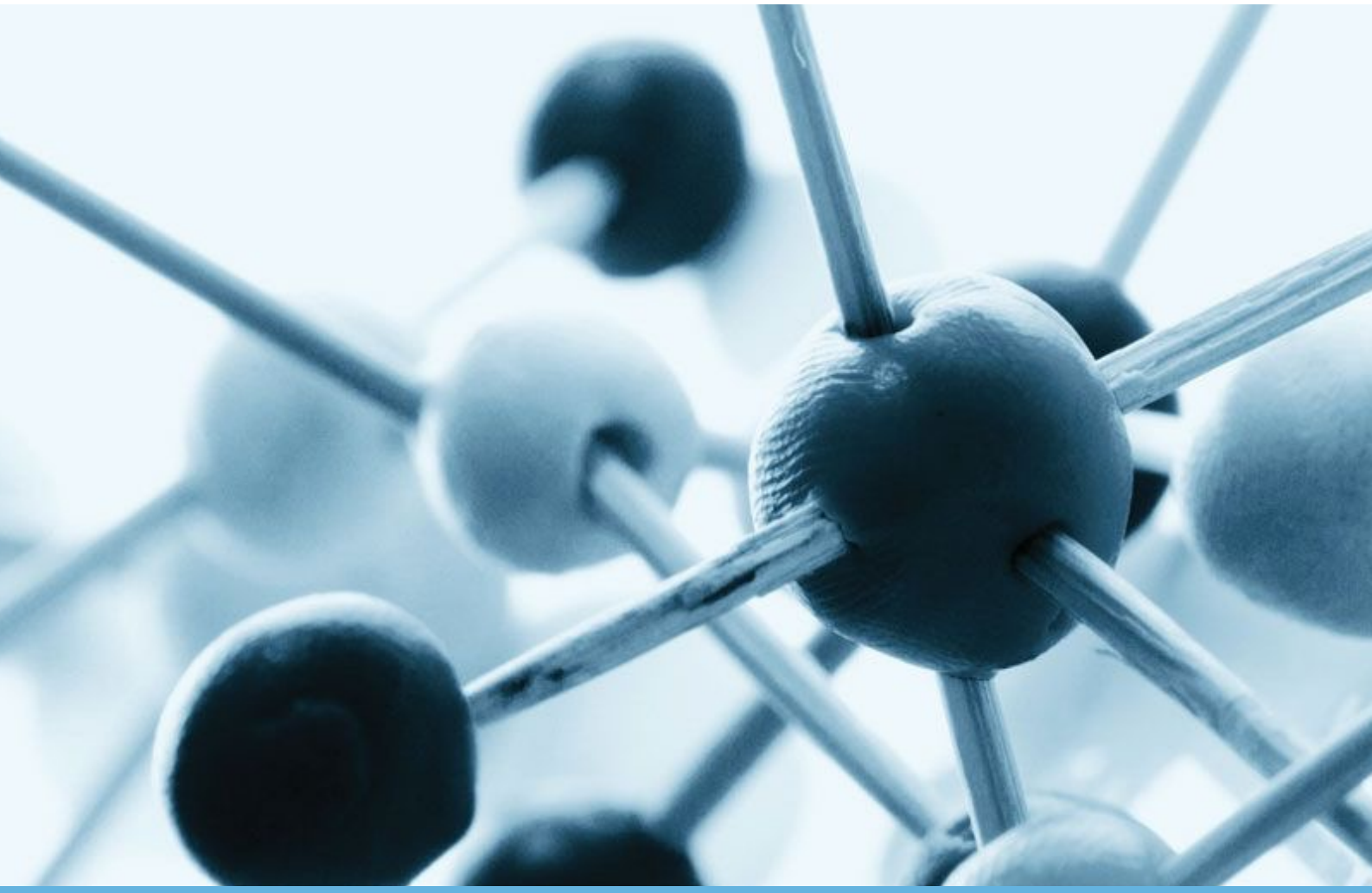
1st Annual Australian Social Network Analysis Conference



16-17 NOVEMBER 2016

SWINBURNE UNIVERSITY OF TECHNOLOGY

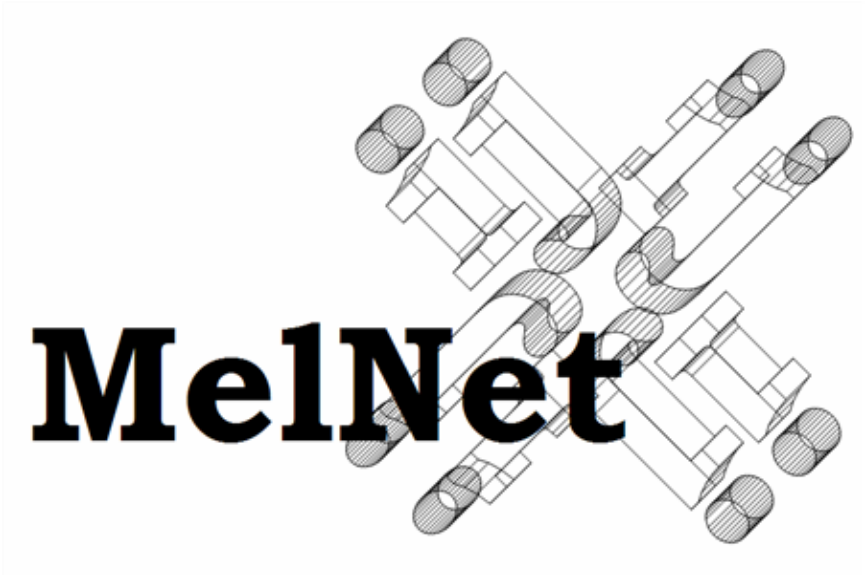
CTI SWINBURNE Centre for Transformative Innovation

INSNA INTERNATIONAL NETWORK FOR SOCIAL NETWORK ANALYSIS

MelNet

ASNAC 2016 is proudly supported by:

The scope and aims of the 1st Australian Social Network Analysis Conference are endorsed by INSNA (International Network for Social Network Analysis) and we are pleased to offer our support of the conference. We invite all participants to join INSNA and to participate in our signature Sunbelt Conferences (XXXVII in 30 May 2017 – 4 June 2017 in Beijing, CN)



Contents

Welcome to ASNAC 2016

It is our pleasure to welcome you to the 1st Australian Social Network Analysis Conference (ASNAC 2016) at Swinburne University of Technology.

This conference marks the first national meeting for researchers and practitioners in Australia who are working with social network analysis (SNA).

The conference intends to build greater coordination and collaboration among social network researchers and practitioners in Australia, and raise the profile of SNA nationally. The conference brings together academics and doctoral students from key universities and research institutes in Australia, as well as industrial partners

The conference will explore the breadth of theory, method and application of social network analysis in the Australian context.

We are very pleased you can join us for what will be an informative two days dedicated to SNA.

All the best.

Associate Professor Dean Lusher
Dr Peng Wang
Professor Garry Robins

Organising Committee ASNAC 2016

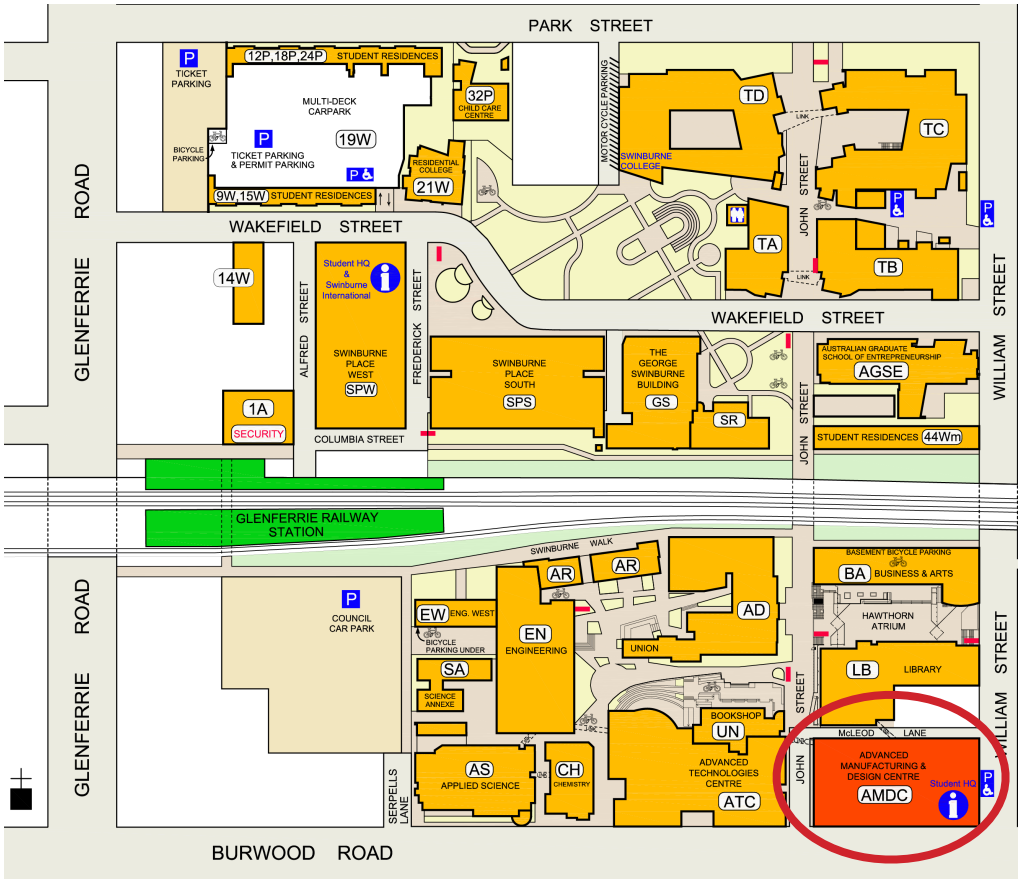
CTI SWINBURNE Centre for Transformative Innovation

Introductory Information

Dear ASNAC Delegate,

We welcome you to the inaugural ASNAC Conference. We hope that you have had a chance to look at the conference website at www.asnac2016.org.au where we have included lots of information to facilitate your attendance at the conference.

Map



Registration and Welcome

Registrations will be from 8:30 AM on Wednesday 16th November in the AMDC Level 3 Foyer. Registration will then be followed by a welcoming address and the first keynote presentation in the AMDC 301 Lecture Theatre.

Conference Program

A digital copy of the program can be found at www.asnac2016.org.au/program

ASNAC 2016 will be held solely within Swinburne University of Technology, Hawthorn Campus. Prominent signposting will be placed around the AMDC Building. We advise delegates to make their way promptly to subsequent sessions during the conference.

Wireless Internet

Wireless internet coverage across Swinburne University is very good. The details on how to access the WiFi network for the conference can be found below. The Wi-Fi details are also reproduced on the back of your identification lanyard. Eduroam is also available on the campus.

WiFi Network name: Events@Swin
Password: swin0099

Social Media

Please use the hashtag **#ASNAC2016** in your social media posts, updates and tweets.

ASNAC 2016 Contact

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Tel: (+61) 3 9214 5934
Website: www.swin.edu.au/cti

Traveling Around Hawthorn

The Advanced Manufacturing and Design Centre (AMDC) Building is located on the Hawthorn Campus of Swinburne University and is just off Burwood Road (see the map above). Visitors planning to arrive by car should plan to use the undercover parking station on Wakefield Street. The operating hours for the multi-deck carpark is 7:00 AM to 10:30 PM.

Swinburne's Hawthorn Campus is a 10-minute train ride from Flinders Street Station (Melbourne's main station) to Glenferrie Station (stop 74). You can catch the Alamein, Belgrave or Lilydale line trains which are usually Platforms 2 or 3 at Flinders Street Station (but be sure to check that the train stops at Glenferrie Station). You will need to purchase a Myki card for travel (www.myki.com.au). The AMDC Building is located about 5 minutes walk from the Glenferrie train station.

If coming from interstate, you can catch a SkyBus from the Melbourne Airport to Southern Cross Station, and then catch an Alamein, Belgrave or Lilydale line train from Southern Cross Station to Glenferrie. Tickets for the SkyBus are $19 one-way. Taxis from Melbourne Airport to Hawthorn are likely to cost $60+.

Accommodation

It is recommended if travelling from interstate that you stay in the city and catch the train from Flinders Street Station to Glenferrie Station. There are not many accommodation options in Hawthorn.

Centre for Transformative Innovation

SWINBURNE UNIVERSITY OF TECHNOLOGY

Global Prosperity Through Knowledge and Innovation

Overview

The Centre for Transformative Innovation at Swinburne University of Technology is part of a world-wide movement to improve societies' understanding of how ideas and inventions enhance productivity.

As the largest interdisciplinary academic research body on innovation in Australia, the Centre for Transformative Innovation is uniquely placed to provide the robust and objective evidence needed to guide public and enterprise policy through change.

The Centre is known for the high calibre of its researchers, analysts and PhD candidates; the depth and quality of its empirical analysis; its evidence-based public policy recommendations; and its outstanding infrastructure for large-scale data analytics.

PhD Education

The PhD in Innovation Studies is designed to provide the education needed to conduct independent, advanced research in the economics of innovation and/or networked innovation. On completion, the candidate should be capable of conducting a complex research program without supervision and have a thorough knowledge of the relevant literature.

Contract Research

The Centre undertakes applied economic; social; network; management and accounting research on a contract basis.

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swinburne.edu.au/cti

Full Conference Schedule

Wednesday 16th November 2016		Location
08:30 - 09:15	Registration	**AMDC Level 3 Foyer**
09:15 - 09:30	**Welcome with Professor Michael Gilding and Associate Professor Dean Lusher**	**AMDC 301**
09:30 - 10:30	**Opening Plenary with Professor Garry Robins** ***"Collapse of networked social systems"***	**AMDC 301**
10:30 - 11:00	Morning Tea	**AMDC Level 3 Foyer**
11:00 - 12:30	**Session 2: Ecological Systems and Communities**	**AMDC 301**
	Angela Guerrero, Örjan Bodin, Ryan McAllister, Kerrie Wilson & Courtney Morgans, *"Assessing the effectiveness of collaborative approaches to conservation and natural resource management"* Örjan Bodin & Daniel Nohrstedt, *"Formation and performance of collaborative disaster management networks: Evidence from a Swedish wildfire response"* Michele Barnes, Örjan Bodin, Angela M Guerrero, Ryan RJ McAllister, Steven M. Alexander, Garry Robins, *"Theorizing the social structural foundations of adaptation and transformation in social-ecological systems"* Petr Matous & Peng Wang, *"Strengthening networks of remote rural communities from outside"* Jane Farmer, Christopher Mason, Karen Carlisle & Virginia Dickson-Swift, *"Social Network Analysis and changes to health literacy from community participation"* Halley McCann, Maedeh Aboutalebi Karkavandi & Hartmut Fuenfgeld, *"Inter-organisational collaboration for disaster resilience: a case study of a Victorian health care network"*	
12:30 - 13:30	Lunch	**AMDC Level 3 Foyer**
13:30 - 15:00	**Session 3: Health**	**AMDC 301**
	Richard Bryant et al., *"Mental Health Outcomes in the Context of Social Networks Following the Victorian Black Saturday Fires"* Dan Chamberlain et al., *"Social network analysis of patient referral patterns: Considerations for continuity of care and the co-location of services"* Fabian Held, Quinn Grundy & Lisa Bero, *"API networks of mobile health apps – tracing the flow of data"* Tim Slade et al., *"Friendship networks and the interplay between alcohol use and depression during adolescence"* Nick Scott et al., *"Eliminating hepatitis C virus among HIV-positive men who have sex with men: a multi-modelling approach of sexual risk behaviour"* Suku Sukunesan & James Watts, *"Tweeting the body away: An exploratory study of Eating disorder communities on Twitter"*	
15:00 - 15:30	Afternoon Tea	**AMDC Level 3 Foyer**

15:30 - 17:00	**Session 4: Social Media and Politics**	**AMDC 301**
	Robert Ackland, "*Measuring and Explaining Political Homophily in the Australian Twittersphere*" Haris Memic & Robert Ackland, "*Dynamic Network Analysis of Australian Politicians on Twitter*" Mathieu O'Neil & Robert Ackland, *"Towards a theory of field/force in online activist networks"* Miguel Wood, Graeme Shanks, Simon Milton & John Power, *"Do Personality Traits Drive Commitment to Vote in Online Social Networks?"* Timothy Graham, Paul Henman & Robert Ackland, *"Online networks of government: mapping and analysing Australian governments' hyperlink networks"* Ryan McAllister, Bruce Taylor & Ben Hamrn, *"Unpacking the mix of 'cooperation' and 'coordination in policy networks"*	
17:30 - 19:00	Poster Session and Cocktail Reception	**AMDC Level 3 Foyer**

Thursday 17th November 2016		**Location**
09:00-10:30	**Session 5: Theory and Methods**	**AMDC 301**
	Malcolm Alexander, *"Where is the social structure? Investigating systems of overlapping memberships"* Peng Wang, Johan Koskinen, Dean Lusher & Garry Robins, *"Duality of Social Selection and Social Influence"* Tasuku Igarashi & Taro Hirashima, *"Does emotional intelligence work beyond dyads? From a multiple community perspective"* Pavel N. Krivitsky, *"Estimation of Exponential-Family Random Graph Mixed Models with Dyadic Dependence: Combining MCMC with Analytic Approximation"* Nicholas Harrigan, TAN Bing Yang, Janice YAP & TAN Yu Xun, *"The Cost of Ties: Explaining balance and status in everyday signed tie formation"* Murray Aitkin, Duy Vu & Brian Francis, *"The effect of time-samping of events attended by actors on the analysis of a terrorist network"*	
10:30 - 11:00	Morning Tea	**AMDC Level 3 Foyer**

11:00 - 12:30	**Session 6: Education and Innovation**	**AMDC 301**
	Geoff Woolcott, Amanda Scott, Robyn Keast & Dan Chamberlain, *"Social network approaches to collaborative sustainability in a higher education research project"* Giovanni Radhitio Putra Sadewo, Emiko S. Kashima, Yoshihisa Kashima & Colin Gallagher, *"The Contribution of Friendship Network to International Students' Psychological Adjustment"* Maedeh Aboutalebi Karkavandi, Heidi Gazelle, Garry Robins & Vicki Mckenzie, *"Effects of Teaching Practice on Classroom Friendship Networks"* Andrew Terhorst, Dean Lusher, Dianne Bolton & Ian Elsum, *"Knowledge Sharing Behaviour in Three Open Innovation Initiatives"* John Fitzgerald & Adam Simmons, *"Performativity and music performance network maps"* Till Klein, Michael Gilding, Noordin Shehabuddeen, Greg Simpson & Dean Lusher, *"The emergence of industry-research collaborations: a longitudinal network analysis"*	
12:30 - 13:30	Lunch	**AMDC Level 3 Foyer**
13:30 - 15:15	**Session 7: Organisations, Innovation, Crime and Twitter**	**AMDC 301**
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15:15 - 15:45	Afternoon Tea	**AMDC Level 3 Foyer**
15:45 - 17:00	**Session 8: Closing Plenary**	**AMDC 301**
	Applications of Social Network Analysis **Chair: Dean Lusher** Jenny Lewis (*The University of Melbourne*) Lucia Falzon (*Defence Science & Technology Group and The University of Melbourne*) Galina Daraganova (*Australian Institute of Family Studies*) Michael Gilding (*Swinburne University of Technology*)	
17:00 - 17:05	**Closing of ASNAC 2016 with Associate Professor Dean Lusher**	

Poster Session

During ASNAC 2016 we will have on display research posters in the AMDC Level 3 Foyer. A list of those posters on display can be found below. Be sure to check them out and discuss with the authors the research on display.

Author(s)	Title
Alia Bihrajihant Raya	Farmer Group Members Knowledge Exchange of Chili Farming on Coastal Sandy Land Indonesia
Amanda Scott, Geoff Woolcott , Robyn Keast & Daniel Chamberlain	Collaborative sustainability in a higher education research project: Proactive and reactive responses in a complex adaptive system approach
Andrew Pitts	Polinode: A Web Application for the Collection and Analysis of Network Data
Arif Khan	Predicting the risk of chronic disease - a framework based on graph theory and social network analysis
Caitlin McCurrie, Lucia Falzon & Garry Robins	Understanding the Twitter Bird: How studying the individual may reveal insights into information spread across the Twittersphere
David Green	Evolution of Social Networks
Ekaterina Anichenko, Kon Shing Kenneth Chung & Lynn Crawford	Social Network Analysis: Towards a network perspective of project team performance
Michelle Barnes & Emmanuel Mbaru	Key players in conservation diffusion: using social network analysis to identify critical injection points
Fatima Bilkis Seeme, David Green, Julian Garcia & Carlo Kopp	The emperor's new clothes - modelling pluralistic ignorance in social networks
Francesco Bailo	Political stability and the fragmentation of online publics in multilingual states
Jonathan Rhodes, Iadine Chadés, Angela Guerrero, & Örjan Bodin	Quantifying the Importance of Social Networks for Biodiversity Conservation Planning
Amin Rigi, Irene Moser & Chengfei Lui	Finding community around a seed node in networks inspired by machine vision
Marc Cheong, Joanne Byrne, Sid Ray & David Green	The Power of Metadata: The role of statistical pattern recognition and inference algorithms in Twitter studies
Ming-Yi Chang, Yang-Chih Fu & Chih-Ya Shen	Dynamics of College Students' Facebook Interactions and Class Activity Participations

Nazim Ahmed Choudhury & Shahadat Uddin	Time-Aware Network Structural Similarity Measures for Link Prediction in Longitudinal Networks
Oleksandra Poquet	Social Processes in MOOCs
Penelope Hawe, Lisa Wood & Sarah French	A Two-Mode Social Network Analysis of a Community Neighbourhood House Highlights the Value of Activities that traditional Evaluations Might Miss
Rachel Friedman, Angela Guerrero-Gonzalez & Kerrie Wilson	Social Networks for Social Equity in Conservation
Rachel Sacks-Davis, Megan SC Lim, Judy Gold, Anna Bowring & Margaret Hellard	Short gap length, concurrent sexual partnerships, and sexual mixing in a sample of young people attending a music festival
Rennta Chrisdiana	The Effects of Mother's Personal Communication Networks on Mother's Nutrition Knowledge in Kabupaten Soleman
Yaghoob Foroutan	Multiculturalism, Religion, Gender Dynamics: Australasia Perspective

Session Abstracts

Angela Guerrero, Örjan Bodin, Ryan McAllister, Kerrie Wilson & Courtney Morgans, *"Assessing the effectiveness of collaborative approaches to conservation and natural resource management"*

When it comes to addressing biodiversity conservation and natural resource management problems it seems like 'collaboration' is a prerequisite for success. This is especially true for large-scale problems where multiple actors are involved, multiple objectives are on the table, multiple plans need to be negotiated and multiple solutions are required to be implemented at different scales. But establishing and maintaining collaborative arrangements takes time, effort and resources, all of which are very limited. To minimize inefficient or ineffective efforts we need to be strategic about how we approach collaboration, focusing on developing relationships where it matters most. For example when pursuing large-scale conservation objectives it's crucial that the partnerships involved facilitate the coordination of actions across multiple management scales. It is also important that collaborations align with the ways ecological resources are interconnected across the landscape. In this context, it is important to ensure that interactions between collaborating actors can enhance the formulation, refinement, and coordination of actions that are locally implemented but have consequence beyond the domain of a managing actor due to the interconnected nature of the ecological system.

Örjan Bodin & Daniel Nohrstedt, *"Formation and performance of collaborative disaster management networks: Evidence from a Swedish wildfire response"*

Large-scale natural disasters, such as wildfires, present challenges across scales and contexts that no single entity or person has the capacity to address. Collaboration and coordination are thus critical for effective responses. Understanding how collaborative networks are formed and how they function in situations of response to large-scale natural disasters is an urgent research need and will draw lessons relevant for policy and practice. Moreover, natural disasters typically present a multitude of entangled challenges that often needs to be addressed together. Prior research rarely investigate if patterns of collaboration are aligned ('fit') with how different challenges (tasks) are interdependent, or how levels of fit influence disaster response performance. We develop formal models to explicate what presumingly constitutes a good fit between collaboration networks and task interdependency and how levels of fit condition crisis response performance. These assumptions are tested using empirical data from the response to a major wildfire in Sweden. Using multilevel exponential random graph models (ERGM), we show that patterns of actor and task interdependency have a significant effect on the formation of collaborative networks, and that actors only partially select actor-task configurations conducive to performance. We receive indicative support that a good fit is associated with more effective responses. Our results also suggest that a good fit is more important for performance than actors' prior experience and level of professionalization.

Michele Barnes, Örjan Bodin, Angela M Guerrero, Ryan RJ McAllister, Steven M. Alexander, Garry Robins, *"Theorizing the social structural foundations of adaptation and transformation in social-ecological systems"*

Social networks are frequently cited as vital for facilitating successful adaptation and transformation in linked social-ecological systems to overcome pressing resource management challenges. Yet confusion remains over the precise nature of adaptation versus transformation and the specific types of social networks that set the stage for these processes to occur. Here we adopt a network perspective to theorize a continuum of capacities in social-ecological systems that set the stage for effective adaptation and transformation. We begin by drawing on social theories of change, the resilience literature, and Kiser and Ostrom's multilayered action situation to develop tentative hypotheses about seven specific social-ecological network configurations that lay the structural foundation necessary for facilitating adaptation versus transformation. A key contribution is the identification of configurations that specifically account for the manner in which social networks relate to the resource context and specific environmental problem at hand. Of the seven configurations, two are solely linked to adaptation and three to transformation, while the remaining two are hypothesized to be important for facilitating both processes. As a first step, we draw on two empirical examples from marine fisheries to help to illustrate our arguments, yet more

cases will be needed to statistically show these effects. Further development of our hypotheses, particularly as more data becomes available, can ultimately help guide the design of institutional arrangements more effective at dealing with change.

Petr Matous & Peng Wang, *"Strengthening networks of remote rural communities from outside"*

Rural communities need both local links and long-distance links for sustainable development. Long-distance links are vital for rural communities to gain access to new information and local links are necessary to share, adapt, and implement the new knowledge within the community. The question is what can be done about that? Can outsiders reinforce communal networks in a controlled manner? We invited 117 randomly selected members of 16 randomly selected Sumatran communities to three three-day networking events outside of their villages. One event was held in the same district, one in a different district but on the same island, and one was held on a different island. Eighteen months later, we surveyed 371 member of these 16 communities regarding their information-sharing networks. Controlling for endogenous network tendencies by Exponential Random Graph Models, a meta-analysis of the 16 networks shows that the randomly selected participants in the furthest networking event have overall become significantly more central across the 16 local social networks. Specifically, they have become more sought for advice by other community members. The overall meta-analysis also reveals that individuals with more external contacts outside of their communities (whether created through the intervention or otherwise) are preferred as sources of information inside their communities in general. Separate analyses of the 16 networks shows that the number of communities which were measurably impacted by each intervention increases with the distance of the networking event from the homes of the participants (two, four, and five respectively). The findings highlight the importance of external long-distance links (which are typically ignored in "whole network" studies) for structuring internal networks and the potential of simple interventions that stimulate the creation of such external links to trigger significant long-term changes inside the structures of remote rural communities.

Jane Farmer, Christopher Mason, Karen Carlisle & Virginia Dickson-Swift, *"Social Network Analysis and changes to health literacy from community participation"*

This paper suggests the potential of using social network analysis (SNA) to evaluate changes to community health literacy, from community participation processes, and to understand how this occurs. It uses data from a NHMRC funded community participation project – Rural ECOH (Engaging Communities in Oral Health).

Health services increasingly use community participation in local service design decision-making. Reasons given include production of innovative locally-relevant services and health literacy improvements. Health literacy is knowledge and familiarity with institutional structures and language that allows people to make effective and efficient use of services and other health resources. A challenge for community participation exercises is that they attract confident, affluent people, rather than diverse people who could benefit from increased health literacy. Affluent people are already more health literate, thus participation can be derided as merely reinforcing health literacy inequity.

From qualitative data gathered in Rural ECOH, we noticed community members passing on health information, learned from their participation, to others. We explored a data subset to: a) investigate if and how health literacy diffused further than Rural ECOH workshop participants; b) experiment with SNA for assessing health literacy changes.

We used 6 in-depth stakeholder interviews from one case study rural Australian community in Rural ECOH. To explore the data, we deployed post-hoc coding and analysis, using NVivo 11. Firstly, based on a reading of the interview data, a series of case nodes and relationship types were created in NVivo. Second, the case nodes were coded-up by linking them with the identified relationships, leading to creation of a network sociogram. Third, researchers discussed the data in more detail. Since the data analyst was not involved in data collection, this input provided context about, eg. acronyms used to identify organisaitons and job roles. This helped to refine case node descriptions. The process also helped to reduce the number of relationships applicable to case nodes. We remain mindful of the limitations of post-hoc analysis, but the resultant sociogram raised novel insights.

Analysis provided rich descriptions of the processes and relationships involved in diffusing health literacy in a

community. In particular, the post-hoc analysis shows links between how health knowledge is deployed, and formal (occupational) and informal (familial) networks. Participants identify how they pass on information to family and friends, knowing that their connectedness with specific community sub-groups (e.g. local Indigenous or older-people communities) expedites information diffusion. The findings also show which institutions are deemed less effective in information diffusion, thus not included in health professionals' networks. Analysis reveals that the multiple formal and informal networks are strategically co-ordinated by local health-care professionals. Analysis reveals the significance of high-level local embeddedness that provides the 'know-who' as well as the 'know-how' to diffuse health knowledge. This is strongly represented in the qualitative data, offering complementary insights alongside the relationships identified in the sociogram.

SNA could have potential for assessing health literacy changes as the result of community participation and for understanding who should be targeted for inclusion in community participation to 'seed' health literacy change.

Halley McCann, Maedeh Aboutalebi Karkavandi & Hartmut Fuenfgeld, *"Inter-organisational collaboration for disaster resilience: a case study of a Victorian health care network"*

Siloed, top-down governance approaches have long been recognised for their limits in addressing complex socio-ecological issues. Responding to climate change and disasters requires new approaches that promote collaboration between diverse actors and organisations. Concepts like network governance and adaptive management incorporate vertical and horizontal integration between actors thus supporting the development of adaptive capacity via learning. Collaborative governance approaches are better equipped to respond to the dynamic interaction of social, economic and environmental variables that drive actor and system vulnerability.

However diagnosing and operationalising collaborative governance approaches remain a challenge. This research uses social network analysis to investigate the collaborative ties between 20 healthcare agencies in a formal network in the Southern Grampian and Glenelg shires of Victoria. It investigates which attributes and ties may be precursors to collaborating for disaster preparedness.

The research undertook a mixed method approach beginning with semi-structured interviews with each organisation. The interviews informed which attributes and ties to include in the quantitative analysis to ensure meaningful and relevant outcomes to participants. A survey was undertaken with a 100% response rate. Various hypotheses were of interest, however this study focused on: do organisations that informally network together and experience applied learning together, predict collaborating on disaster preparedness? Exponential random graph models (ERGMs) were applied to the predictors of preparedness collaboration where networking and applied learning were included in the models as dyadic covariates. Also included were the number of staff, core business, tenure, and location of the organization as actor-relation attributes in the models, however no organisational attributes predicted collaborating on preparedness.

The results showed that both networking and applied learning networks were significant predictors of collaboration ties for disaster preparedness in that those who network and learn from each other tend to collaborate on disaster preparedness. This supports the notion that adaptive capacity is characterised by networks that self-organise to learn from each other in order to respond to uncertainty and change. Understanding the precursors for applied learning would further support similar networks to create enabling conditions for disaster preparedness activity and thus in an important direction for future research.

Richard Bryant et al., *"Mental Health Outcomes in the Context of Social Networks Following the Victorian Black Saturday Fires"*

Although disasters are a major cause of mental health problems and typically affect large numbers of people and communities, there is poor understanding of how social structures impact on mental health outcomes. This study tested the extent to which mental health outcomes following disaster are associated with social network structures.

Participants were survivors of the Black Saturday fires (N = 558), who were assessed for probable posttraumatic stress disorder (PTSD) and depression. To assess social networks, participants were asked to nominate up to 10 people with whom they felt personally close.

Depression risk was higher with participants who reported fewer social connections, were connected to other depressed people, or were connected to people who had left their community. PTSD risk was higher if fewer people reported being connected with the participant, if those who felt close to the participant had higher levels of property loss, or if the participant was linked to others who were themselves not interconnected. Interestingly, being connected to other people who in turn were reciprocally close to each other was associated with reduced risk of PTSD. Data will also be presented on psychological resilience of the cohort, which found that being nominated by others as a close emotional tie is associated with a reduced likelihood of resilience, unless the person nominating you is resilient themselves. These findings provide initial evidence of disorder-specific patterns in relation to one's social connections following disaster.

Dan Chamberlain, Susan Nancarrow, Cathy Avila, Robyn Keast, Jo Bradbury, Frances Doran, Peter Hill & Kegan Barlow, *"Social network analysis of patient referral patterns: Considerations for continuity of care and the co-location of services"*

Background: Continuity of care has a strong association with better patient outcomes, particularly for those with chronic conditions. Increasingly patients are less likely to have a single GP providing interpersonal continuity of care, and are more likely to attend practices with multiple practitioners, who are tasked with managing patient continuity through other means, such as information management systems.

Methods: We conducted an audit of randomly selected patients on chronic disease management plans, collecting referral data for 204 patients at a regional clinic with 8 GPs, which had co-located primary health care services. We used social network analysis to map the network of 213 specialists to whom GPs made referrals directly, and mapped the specialists they were indirectly connected to, through sharing a patient with another GP who then provided a referral. We mapped the pathways of patients through the primary health care system, by connecting specialists who were involved in a patient's care.

Results: 188 patients received a total of 737 referrals to specialists to 213 practitioners and businesses. The 8 GPs in the clinic had mean rates of referral for patients between 1.1 and 3.4. 33.8% of referrals were for patients who had seen more than one GP. We examined the effect that attending multiple GPs had on patients' access to specialists and the pathways taken to receive care. Each GP referred patients to a network of specialists, 117 of whom were only referred to directly by a single GP. When indirect referrals were included GPs connected to 22 additional specialists on average, and increased the percentage of the network reached by 8.84%.

Five of the co-located services were among the highest numbers of direct referrals, and were referred to by 4-6 of the GPs. The most referred to practitioner, a co-located dietitian, accounted for 70 referrals (9.5% of all referrals) and was involved in 37.23% of patient cases. The degree distribution of the referral network exhibited scale free properties, with the five co-located services at the upper end of the scale. The average degree of practitioners in the network was 8.571, the co-located dietitian had a degree of 126.,

A breakdown of the primary health care practitioners and businesses into 31 medical specialisations and 22 allied health professions and nursing specialties, showed that co-located services had the greatest number of referrals to practitioners per specialty. For example, 65 referrals to exercise physiologists went to 5 practitioners, including co-located practitioners, compared with 19 referrals to gynaecologists/obstetricians across 7 practitioners.

Conclusion: We argue that patients on chronic disease management plans have greater access to specialists when their primary health care is shared between physicians, potentially improving their quality of care and offsetting the loss of interpersonal continuity of care.

The co-location of GPs and primary health care services have produced strong connections and pronounced preference for those services, indicative of good working relationships, with concomitant benefits for patient's quality of care and improved informational and management continuity.

Fabian Held, Quinn Grundy & Lisa Bero, *"API networks of mobile health apps – tracing the flow of data"*

Background - The number of mobile health apps has more than doubled in only 2.5 years, reaching over 100,000 apps with market revenues projected to grow to $36bn by 2017. However, mobile health apps are largely unregulated. In particular, researchers have highlighted risks to consumer privacy such as the lack of privacy policies, the collection of user health data without permission and sharing of unencrypted data over the internet. Apps have the ability communicate with each other as well as other services on the internet through so-called APIs (application programming interfaces). We investigate the network of API relations between mobile health apps to better understand the potential for user data distribution throughout this network.

Methods - We generated a sample of 212 prominent apps that explicitly pertained to health and fitness and provided guidance, tracked personal data, or made a health claim. We used two sampling strategies: 1) a crawling program sampled the 100 top-ranked apps from the iTunes and Google Play app stores in the United States, Canada and Australia and 2) purposive sampling of new high-profile apps.

Two researchers then independently extracted data on app characteristics, financial backing, shared APIs and privacy features from each app's store description and websites. The analysis presented here focusses on the network of shared APIs. We used structural equivalence analysis and various centrality indices to identify and characterise the positions of particularly relevant apps. Random walk community detection was used to identify clusters of interrelated apps.

Findings - The sampling strategy led to a network of 395 app-nodes, with one connected component of 265 apps (67%). Of these, 75 apps (35%) were top health apps in our initial sample, with another 135 other apps with which they share an API. The connected component has a diameter of 6, density of 0.01, and average path length of 3.24. Structural equivalence analysis revealed that the majority of apps (97.5%) are indistinguishable regarding their positions in the network: they are either isolates or peripheral parts of the central component. At the same time, the analysis identified ten apps that assume more notable network positions, 7 of which were in our original sample. These included mobile health start-ups, manufacturers of wearables and sports apparels, and major technology companies. All these apps showed high levels of betweenness and closeness centrality and often they were surrounded by a distinct community of related apps.

Conclusions - The market of mobile health apps displays a remarkable dichotomy: many apps are stand-alone offerings that do not integrate with the rest of the market. There is also a core group of apps that are sparsely connected and may be exchanging user data through their APIs. Ten apps were found to hold crucial positions that may enable them to act as gatekeepers in the flow of data, or to gather user information from a diverse range of sources. Notably, the types of organisations behind these apps are surprisingly diverse, including hardware manufacturers and social media platforms that are not traditionally involved in the health or fitness market.

Tim Slade, Cath Chapman, Brad Shaw, Nicola Newton, Louise Birrell, Louise Mewton, Gavin Andrews, Steve Allsop, Leanne Hides, Nyanda McBride, Nina Te Pas, Nina Pocuca, Simone Fermin-Sarra, Zoe Tonks & Maree Teesson, *"Friendship networks and the interplay between alcohol use and depression during adolescence"*

Background: Friends play an influential role in the health behaviour choices of adolescents. Adolescents whose peers drink alcohol report higher levels of alcohol consumption themselves. Yet how this relationship originates and how friendship and alcohol use behaviours co-evolve over time is less well understood. A separate but related body of research is emerging to show that social networks also act as powerful conduits for the spread of emotional problems such as depression. However, to date there is little research on the interplay between alcohol use and depression within the context of friendship networks.

Aim: The current study will map friendship networks together with reported measures of alcohol use and depression among a sample of Australian adolescents recruited as part of the Climate Schools Combined study. Social network indices (e.g. centrality, bridging and isolation) will also be calculated and correlated with alcohol use and depression.

Methods: Information was collected on friendship networks from adolescents (mean age 13.1 at baseline) in 22 schools in Australia. We also collected information on perceptions of peer alcohol use, actual self-reported alcohol use, binge drinking and symptoms of depression. Network visualisation and analysis tools will be used to map friendship networks and overlay information about alcohol use and depression.

Results: Data are currently being analysed.

Conclusions: Uncovering the mechanisms by which the onset of drinking behaviours as well as the experience of depressive symptoms diffuse through peer networks holds great promise for not only understanding the etiology/causality of peer impacts on alcohol use and depression but also for identifying individuals strategically positioned in a friendship network, so-called "key players", who hold greater sway over their peers' behaviour. It is likely that these key players will exist in different locations in the network depending on whether we are considering alcohol use or depression but once identified these key players could form the basis of targeted prevention programs that capitalise on the social influence model to alter alcohol use attitudes/ behaviours or emotional regulation strategies at a population level.

Nick Scott, David Wilson, Olivia Keiser, Mark Stoove, Carol El-Hayek, Joseph Doyle & Margaret Hellard, *"Eliminating hepatitis C virus among HIV-positive men who have sex with men: a multi-modelling approach of sexual risk behaviour"*

Introduction: Outbreaks of hepatitis C virus (HCV) infections among HIV-positive men who have sex with men (MSM) have been observed globally. We estimate the time and treatment numbers required to achieve an 80% reduction in HCV prevalence among HIV-positive MSM in the state of Victoria, Australia, and determine the importance of risk behaviour heterogeneity for epidemic dynamics and policy.

Methods: We compare HCV prevalence outcomes between a dynamic compartmental model and agent-based models (ABMs) of HCV transmission, testing and treatment among MSM. By increasing heterogeneity in the ABM , we measure the effects of including very high risk MSM, and use the ABM to determine the most important behavioural characteristics for epidemic dynamics.

Results: Among approximately 5000 HIV-positive MSM in Victoria, 10% are co-infected with HCV. Both types of epidemiological modelling approaches consistently estimated an 80% reduction in HCV prevalence could be achieved in approximately 123 (inter-quartile range (IQR) from multiple simulations 112–134) weeks with approximately 539 (IQR 485–582) treatments. That is, more people would need to complete treatment than the number of people living with HCV in this population, due to reinfection, for the overall population prevalence to decline by 80%. However, the same prevalence reduction could be achieved in 84 (IQR 72–111) weeks if the average time between HCV diagnosis and treatment commencement was reduced from six months to 16 weeks. If risk behaviours were more heterogeneous , this reduction in prevalence took a shorter time with fewer incident HCV cases. Risk reduction post-HCV diagnosis and interactions with casual partners outside existing sexual networks were the behavioural factors that were least known and most likely to influence the sexual transmission of HCV among MSM.

Conclusions: Major reductions in HCV prevalence can be achieved among HIV-positive MSM within two years. Uncertainties surrounding the distribution of risk behaviours within this population are likely to make resource requirement estimates conservative, as treatment-as-prevention may be more effective in highly heterogeneous MSM populations. Future epidemiological studies should focus on measuring risk reduction post HCV diagnosis and interactions with casual partners outside existing sexual networks.

Suku Sukunesan & James Watts, *"Tweeting the body away: An exploratory study of Eating disorder communities on Twitter"*

More than two million Australians are estimated to be experiencing a form of eating disorder (ED) and the rate of development amongst the Australian population is increasing. What is less understood is the emergence of Pro-Eating disorder websites and online communities on social networks. Pro-Eating Disorder (Pro-ED) communities are a controversial subculture that promote and provide positive attitudes toward eating disorders, namely anorexia nervosa (pro-anorexia/pro-ana) and bulimia nervosa (pro-bulimia/pro-mia). These communities share content to promote thinness, provide advice to other members, and glorify low body weight as ideal. The effect of this community towards the Australian wider economy is undeniable. The total social and economic cost of ED is calculated at AUD 69.7 billion in 2012. The unprecedented growing uptake of mobile devices and the fleet of social media applications has further facilitated these communities. ED is the third most common illness in young females. Despite the aforementioned issues ED hasn't been totally understood and limited research has been done involving the social network of ED communities.

Robert Ackland, "*Measuring and Explaining Political Homophily in the Australian Twittersphere*"

Ackland and Shorish (2009) develop an economic model of network formation which maps the underlying population distribution of political types ('liberal' or 'conservative') to the linking behaviour between political bloggers. The model predicts that if a blogger's political preference is in the minority of the population as a whole, then they will exhibit a higher degree of political homophily, leading to the formation of smaller, more homogenous networks. By contrast, those with the majority preference will form more attachments with bloggers from the other side of the political spectrum, leading to larger and more heterogeneous networks.

We test the predictions of Ackland and Shorish's model using dynamic network data constructed from politically-oriented conversations on Twitter. Specifically, we collected all the Tweets authored by Australian federal politicians and the Tweets that mention, reply to or retweet these politicians, for a year commencing in September 2015 (our data collection thus covered the federal election held in July 2016). We then construct a dynamic network where the nodes are politicians and other actors clearly aligned with particular parties, and the ties are retweets/replies/mentions. Finally, we then use exponential random graph models (ERGM) to estimate the extent of political homophily at different time points over the year of data collection, and assess how this correlates with political preferences in the general population of voters, based on voter intention polling data.

This research makes a contribution to research on politically motivated network behaviour and also methods for constructing large-scale dynamic networks from Twitter and analysing these networks using statistical techniques.

Haris Memic & Robert Ackland, "*Dynamic Network Analysis of Australian Advocacy* Groups on Twitter"

Until relatively recently, most social network data has been collected by obtrusive data collection approaches such as surveys. For reasons of expense, respondent burden and recall error, time-stamps on edge creation events would typically not be included in these datasets, and most social network analysis measures were developed for analysis of cross-sectional networks. In contrast, virtually all social networks are dynamic and not static in their very nature, highlighting the fundamental question of what kind and type of processes are shaping the evolution of these networks. Recent popular advances in this field based on cross-sectional (e.g. ERGM) and panel (e.g. SIENA) simulation approaches of modeling processes that agglomerate to create the observed social networks are suboptimal for the reasons of computational efficiency, limited ability to recognise which links are truly dependent on which other links, as well as their inability to take into account the exact sequence and timings of individual link creation and link dissolution, and are thus consequentially prone for distortion of the actual/estimated network effects.

Mathieu O'Neil & Robert Ackland, *"Towards a theory of field/force in online activist networks"*

Though the Internet is widely recognised as a privileged site for the emergence of social change, there is no clear answer to the question: why do some activists choose to connect to new issues, whilst others do not? In this paper, we operationalise field theory using social network analysis (SNA) to account for the emergence of innovations amongst online activists. SNA measures the properties of nodes, ties, and clusters statistically (Carrington et al. 2005) whilst field theory holds that people act in certain ways because of social positions and shared values (Bourdieu 1985, Fligstein & McAdam 2012).

We draw some elements from Actor-Network Theory (ANT), such as incorporating non-human actors, but answering our question about actor choices requires us to establish distinctions between the agency of categories of actors: hashtags are essential to defining an online activist field on Twitter, but hashtags do not have agency as they cannot choose whether to make a connection with another actor, or not. We contend that ANT's objections about researchers arbitrarily imposing boundaries onto reality (Latour 2005) do not apply here, as actors in online activist fields have a common purpose that is both overtly expressed and physically circumscribed by socio-technical affordances (such as hashtags) which do not extend forever.

We consider the goals of actors in choosing to connect to issues, and define 'capital' as the number of connections accrued by actors in the course of their trajectories across online activist fields. We introduce the concept of 'field/force', the capacity of human or organisational actors to attract capital in social space or the capacity of issue actors to attract capital in semantic space. We argue that field/force, capital and goals are mutually constitutive.

We illustrate this conceptual exploration by drawing on empirical studies of Web 1.0 and 2.0 online activist fields. Using the Internet Archive, we collect historical data (2002-2012) on how websites of environmental groups react to the introduction of new risk issues such as nanotechnology and neocotinoids; using a custom analytical suite, we also collect network and semantic data (2011-2012) about how people who used OWS-related Twitter hashtags react to the introduction of new calls for mobilisation. We find that field effects are stronger in Web 2.0, and suggest that this may be a function of the composition of Web 2.0 fields: they comprise more participants and are more flexible than Web 1.0 fields, but also more at risk of disaggregation into an unstructured crowd. There is hence more opportunity for autonomous action by new entrants, and participants recursively seek to produce connections and community. Other factors, such as algorithmic filtering, may also play a role.

Miguel Wood, Graeme Shanks, Simon Milton & John Power, *"Do Personality Traits Drive Commitment to Vote in Online Social Networks?"*

This study examines social network effects in an annual University student election and actor attributes effects in fostering commitment to vote behaviour.

Across Western societies political participation is in decline posing major challenges for democracy. Since 2000 political advocacy has undergone a rapid transformation led by a disruptive wave of IT led innovation in infrastructure, predictive analytics and online social networks. Political campaigns have harnessed these advances to target, influence and mobilise partisan voters.

Yet is political participation uniform across voters? Network interventions using online social networks and behavioural science are found to increase voting and reveal individual differences in political behaviour (Bond et al, 2012; Bakshy et al, 2015). In particular, extroverted individuals relative to other users may play an enhanced role (Messing et al, 2015). Our current picture of personality traits and political behaviour is largely offline. Few studies relate to online behaviour (Jordan et al, 2015). Studies examine individual responses to general/ targeted information against two-step flow communication models (Lazarfeld et al, 1944). Yet opinion leaders and social networks still shape individual attitudes and behaviours (Contractor et al, 2014). How personality traits guide social interactions and social influence online during an election is unclear.

In this research-in-progress article we examine the interaction of personality traits, internal political efficacy and human social motives to enact social influence during a University student election. Our research model investigates whether personality traits drive commitment to vote behaviour by eliciting implementation intentions using an online vote plan. We utilise context based push notifications to signal actor based actions across the network. Attributes of age and gender, often ignored, are incorporated to determine selection processes operating within the network.

Prior online political network analysis has relied on data collected from third-party platforms intended for other purposes. We overcome this limitation using a novel, mobile-first, social media app operating as a social network to better connect University students to political information, increase engagement and improve transparency. The app enables unobtrusive data collection based on voluntary user interaction with online information. The app is supported by scalable graph-database architecture for behaviour tracking, real-time analytics, and increased granularity.

All attribute validated measurement instruments for personality traits, internal political efficacy, commitment to vote, and push notifications are integrated into the app with only single responses recorded for each user. To address our research questions on how individual attributes and the relationships with others effects commitment to vote we adopt an auto-logistic actor attribute model (ALAAM) to understand the behaviour of ego and their position in the network and behaviour of other actors in the network.

With political disengagement endemic among young adults in Western democracies new interventions that mitigate or turnaround current trends are highly valued. Beyond political network analysis, social network research opportunities in national and international economic, institutional, and community settings exist. By deepening our understanding of small world interactions we hope to respond to the collective challenge of restoring the link between the meaning and purpose of voting and help reinvigorate democracy.

Timothy Graham, Paul Henman & Robert Ackland, *"Online networks of government: mapping and analysing Australian governments' hyperlink networks"*

Governments' web estate has grown rapidly over the twenty years since the popularisation of the internet, resulting in a vast and complex new infrastructure of government. Little is known, however, about this infrastructure and how it relates to the offline networks of government, and the effects of jurisdictional boundaries in shaping them. Moreover, in a period of the 'hollowing out' of the state, whereby increasingly governments outsource public service delivery to external profit and not-for-profit organisations, the role of these in online networks with government has hardly been investigated. Significantly, the connections between government's online presence in new digital

infrastructure companies, such as Google, FaceBook and YouTube, has scarcely been investigated and considered. This paper draws on a large hyperlink network of Federal, State and local government agencies and their hyperlink neighbours. The paper uses a range of social network metrics to examine the makeup of the network, the role of government sites within it, and the communities within the network. Such empirical findings point to new ways of thinking about the twenty-first digital state as evidenced by its online web presence.

Ryan McAllister, Bruce Taylor & Ben Hamrn, *"Unpacking the mix of of 'cooperation' and 'coordination in policy networks"*

We show a novel application of EGRM to two urban partnership networks which unpacks the distribution of 'cooperation' and 'coordination'. Governments worldwide increasingly partner with diverse sets of stakeholders in delivering public policy. This spreads commercial risk, but also, particularly where agendas diverge, introduces new risks related to trust in relationships. Urban development is an example of a sector where partnerships are used to spread risk. Urban development is also a domain where already divergent agendas are spread further by requirements to build for climate change. The 'risk hypothesis' distinguishes between networks for 'cooperation problems', where partners have high individual payoffs for uncooperative behaviours, and 'coordination problems', where partners subscribe to a common goal and uncooperative behaviours are less rewarding. Using mixed-methods to study networks of local and state government, developers, and consultants that centre on joint-venture partnerships for developing new urban, residential projects. Our quantitative indicators show how state government interactions are most exposed to risky relationships. In contrast to the state governments' apparent exposure to risk, qualitative data showed they are not only well trusted, but overall the partnership networks reported very low levels of conflict. By exploring the distribution of 'cooperation' and 'coordination', we identified which stakeholders perceived the most risk. And more generally, the demonstrated approach is part of collaborative research efforts aimed at better linking network methods to social science theory.

Malcolm Alexander, *"Where is the social structure? Investigating systems of overlapping memberships"*

From its 'Renaissance' in the 1970s Social Network Analysis (SNA) was closely involved with corporate power structure research and networks of interlocking directorships. This aspect of SNA fostered specialised techniques for handling '2-mode', membership data which have been a feature of SNA since that time. A common substantive research question animating the study of 2-mode membership data are attempts to identify structures of centralized power or schisms and potential bifurcation operating behind the details of visible group organization.

Further examples of 2-mode investigations are analyses of school yearbooks and section (thematic group) memberships within professional associations. SNA offers investigators 1-mode reductions of 2-mode data, an array of customised 2-mode network measures and ERGM procedures customised for bipartite graphs (2-mode data). This paper will draw on the 2-mode membership datasets in UCINET's standard datasets (Davis Southern Women; AOM memberships) and the author's investigation of thematic group memberships in The Australian Sociological Association (TASA).

This paper argues that the process of moving from essentially dyadic network data to claims about an overarching, group based social structure are contentious and fraught with difficulty. It considers the way that animal ethology and socio-cognitive mapping use observed 2-mode data to build 1-mode dyadic association matrices from which they undertake this task using subgroup detection procedures and similar methods used also in SNA. Systems of overlapping group memberships are distinctive in that memberships are public and visible and do not need to be reduced to dyadic associations. They offer a significant opportunity for different approaches to this task that retain information about the size (memberships) of the subgroups.

This paper starts with some basic descriptive measures for systems of overlapping membership derived from set theory rather than SNA. It then looks at the SNA procedure that normalizes of the reductions of 2-mode to 1-mode data to allow for disparities in the size of

groups/events (Bonacich 1972). Animal ethologists, by contrast, favour the use of dyadic association indices that work on the valued, co-membership reductions of 2-mode data but take account of the different gregariousness of the individuals in the dyad. The paper considers the pros and cons of these contrasting methods for the example datasets it uses. Both approaches produce valued (weighted) datasets however so an investigator requires appropriate network measures and subgroup detection procedures.

PNet's ERGM modelling of bipartite graphs works directly on the 2-mode dataset. As such it retains awareness of differentials in group size. The paper concludes with an assessment of the contribution of this ERGM modelling in the investigation of social systems of overlapping memberships.

Peng Wang, Johan Koskinen, Dean Lusher & Garry Robins, *"Duality of Social Selection and Social Influence"*

Built on the interdependent nature of network activities and individual outcomes, we combine and extend the features Exponential Random Graph Models and Autologistic Actor Attribute Models into a modelling framework where both network structure and individual outcomes are modelled together. The proposed models eliminate presumptions of whether social selection or influence processes dominates a given social context by combining social selection and social influence processes into a unified model. A generalizable data structure representing both networks and nodal attributes is presented. The proposed model specifications are demonstrated with simulation studies, including higher-order configurations beyond dyadic effects that may alleviate model degeneracy. The empirical modelling examples illustrate the power and flexibility of the modelling framework and its empirical and theoretical implications.

Tasuku Igarashi & Taro Hirashima, *"Does emotional intelligence work beyond dyads? From a multiple community perspective"*

In this study, we report our initial attempts of how emotional intelligence is related to the structure of personal communities (Wellman, 1979) online, including dyads and social groups formed and maintained via instant messaging services on smartphones.

There has been scientific debate for decades on the maximum size of human social networks. In evolutionary anthropology, it is posited that human network size has been limited to 150 (a.k.a. "Dunbar's number") since the ancient hunter-gatherer societies due to biological restrictions of the size of neocortex, a human brain region for social information processing in interpersonal communication (Dunbar, 1993). In particular, emotional intelligence, the capacity to understand other's feelings and intentions, is supposed to be a unique and core ability of humans to form and maintain strong dyadic personal ties with close others in a single tightly-knitted community (Stiller & Dunbar, 2007).

On the other hand, sociology theorists (Rainie & Welman, 2012) argue that Dunbar's number is too small in the 21st century. They claim that modernization promotes mobility of egos and diversity of alters in a large-scale social network at the societal level, resulting in the recent expansion of the size of weak ties and the number of communities (polyadic networks) to which egos belong. Belonging to multiple and diverse communities gives a significant advantage to egos in that they can increase the opportunity to make use of various resources from networks. Thinking about a web of relationships beyond a single community is thus very important to understand the nature of contemporary social networks. However, no previous study has focused on emotional intelligence as a crucial factor that allows us to belong to multiple and diverse communities in modernized society.

A total of 175 first-year undergraduates at a university in central Japan completed a questionnaire about emotional intelligence, Big Five personality traits, and personal community indices (i.e. number and diversity of dyadic and polyadic networks) calculated by self-report statistics of LINE use (the most popular instant messaging application in Japan). Multiple regression

analyses revealed that emotional intelligence was positively related with the number of dyadic networks, but not with the number of polyadic networks and the diversity of dyadic and polyadic networks. Extroversion was positively related with the numbers of dyadic and polyadic networks and the diversity of dyadic networks, but not with the diversity of polyadic networks.

These results suggest that emotional intelligence may be useful in the promotion of personal communication in dyadic interaction, but not in the management of multiple communities in one's social network. Extroversion may increase both the quality and quantity of dyads, but neither emotional intelligence nor extroversion would contribute to the enhancement of belonging to multiple and diverse communities. Future research should examine what psychological factors make it possible for egos to maintain multiple communities in their immediate social surroundings.

Pavel N. Krivitsky, *"Estimation of Exponential-Family Random Graph Mixed Models with Dyadic Dependence: Combining MCMC with Analytic Approximation"*

As the p2 model extended the p1 model, mixed effects are a natural extension to ERGMs to produce "p2*" Exponential-family Random Graph Mixed Models (ERGMMs). This class of models offers many possibilities; in particular, it can model triadic and other higher-order effects, while parsimoniously and interpretably controlling for individual actor heterogeneity, as well as allowing a more parsimonious specification for multi-level models. However, adding random effects to an ERGM with dyadic dependence creates a so-called doubly-intractable problem: the marginal likelihood of the model (a function of fixed effects and variance parameters) requires evaluating an integral over the conditional likelihood (a function of fixed and random effects), which is itself intractable. This is currently done using Bayesian exchange algorithms. These techniques, while flexible, are very computationally demanding, requiring "MCMC within MCMC": every MCMC update of the model parameters requires an independent draw from the network model, itself requiring an MCMC run, which, in turn, requires a burning-in period that must be repeated every time.

In this work, we propose a hybrid approach, combining the Importance Sampling MCMC MLE with analytic approximation and quadrature to fit ERGMMs in a frequentist framework, allowing MLE to be found with only one "level" of MCMC and without requiring prior specification and provide some further approximations to further reduce computational cost. We also describe some techniques to make the estimation more stable. We demonstrate how this approach can be used to avoid spurious detection of transitivity and apply it to data.

Nicholas Harrigan, TAN Bing Yang, Janice YAP & TAN Yu Xun, *"The Cost of Ties: Explaining balance and status in everyday signed tie formation"*

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 everyday longitudinal networks – friendship, esteem, dislike, and disdain – of 115 undergraduates. We find that how balance and/or status operates is a product of the cost of ties. Balance only plays a major role in the friendship network because friendship ties are costly: they require mutual investment, and tend to have a norm of loyalty. Status manifests as popularity in low-cost tie (esteem, dislike, disdain) networks and as transitivity in costly-tie (friendship) networks.

Murray Aitkin, Duy Vu & Brian Francis, *"The effect of time-samping of events attended by actors on the analysis of a terorrist network"*

The Noordin Top terrorist network was analysed by Aitkin, Vu and Francis in a paper to appear in the Journal of the Royal Statistical Society Series A. The network analysed comprised 74 actors attending 45 events; the analysis used a latent class model to group actors into classes based on their event attendance. The leaders clearly fell into one class; the other actors were not clearly classified.. This analysis assumed that all actors could have attended all events. However some events were time stamped, and this talk describes the effect of using the time stamping to define the actors' periods of engagement when they could attend events.

Geoff Woolcott, Amanda Scott, Robyn Keast & Dan Chamberlain, *"Social network approaches to collaborative sustainability in a higher education research project"*

Research projects obtain considerable benefit from the social networks that support collaboration during project implementation, but the post-project sustainability of such networks has proved problematic. This presentation outlines a preliminary investigation of the potential of reframing the sustainability of a collaborative project networks in terms of a complex adaptive system. It is posited that complexity theory, therefore, may provide a useful lens through which to examine network sustainability, with social network analysis providing the necessary measurement capability. Such an examination may be a potentially productive response to a growing demand from funders for evaluative models that deal with the examination of dynamic change and complexity in collaborative projects.

Case study data from a government-funded educational project suggest that this, and other similar projects, may be considered as complex adaptive systems. Initial analysis within the case study has suggested that social network analysis may provide measurement of collaborative networks within such projects and provide insights into collaborative project sustainability. This means that complexity thinking may be useful in setting up sustainability structures and processes from project outset, as well ways of building sustainability measures into project evaluation frameworks. This would offer new set of variables and methods for their measurement to support sustainability in collaborative projects, removing the current reliance on more linear measures.

An important finding from this initial investigation is that measures need to be developed to consider both adaptability and flexibility and that these measures might be based in use of social network analysis. The approach suggests that future research would benefit from identifying sustainability variables in projects that prove to be complex adaptive systems, in particular, those variables that examine sustainability of collaborative project networks.

Giovanni Radhitio Putra Sadewo, Emiko S. Kashima, Yoshihisa Kashima & Colin Gallagher, *"The Contribution of Friendship Network to International Students' Psychological Adjustment"*

To settle in a new country requires people to form new social networks (e.g., friendship). Two studies were designed to investigate how features of friendship networks among international students relate to different aspects of their psychological adjustment, namely, life satisfaction, the presence of positive affect, the absences of psychological strain and negative affect. The first two aspects suggest thriving whereas the latter two suggest surviving. Study 1 examined the ego networks of 302 students enrolled at a university. Study 2 examined the whole network of 54 students enrolled in a postgraduate coursework degree to test whether social selection and social influence processes (convergence and contagion) can explain the dynamics of psychological adjustment in the classroom. Data were analysed by using Stochastic Actor Oriented Models (SAOM). Results indicated that students with similar levels of psychological strain tend to befriend one another and those with high levels of positive affect tend to attract more friends (social selection). No evidence was found for social influence processes in psychological adjustment. Interpretations of these findings will be offered.

Maedeh Aboutalebi Karkavandi, Heidi Gazelle, Garry Robins & Vicki Mckenzie, *"Effects of Teaching Practice on Classroom Friendship Networks"*

Friendship ties among children at school may arise through network self-organization processes, individual attributes, and exogenous factors. In this study, we investigate the contribution of the teacher as an exogenous factor on the students' friendship network over a school year. Teachers may affect social relations in the classroom through providing or limiting students' social interactions, a general affective tone of the classroom, and management of extreme status (e.g. isolated students).

Research participants were 688 third grade and 714 fourth grade students (48.5% boys) in 46 classrooms. Teaching practice – which can affect classroom climate – was measured at the commencement of the school year

before the classroom networks were established, and friendship ties were measured at the year's end. Observers rated the quality of classroom climate using the Classroom Assessment Scoring System (CLASS; Pianta et al., 2008). CLASS has three domains: emotional support, instructional support, and classroom organization. Classroom climate is measured as the average of these three domains. Emotional support refers to the global affective tone of a classroom; instructional support focuses on the way the teacher delivers teaching content; and classroom organization refers to teacher management of time, classroom resources, and children's behaviour. We expected that positive classroom climate would encourage friendship formation, and that emotional support would be the strongest predictor of friendship network density at year's end.

To test these hypotheses, we used Exponential Random Graph Models, controlling for network self-organizing structural process and taking into the account dependency among network ties. We ran ERGMs simultaneously across all classrooms, with models where classroom climate, emotional support, instructional support and classroom organization were used as covariates for each class. Emotional support was a significant predictor of friendship ties for third-grade classes (overall classroom climate was close to significant). However, the different measures of teaching practice were not significant predictors for fourth grade.

Results for third-grade classrooms were in line with our predictions. Emotional support was significantly associated with the formation of friendship ties. However, the absence of significant results for fourth grade suggests third grade may be a critical age for the influence of teachers on student classroom relationships.

Andrew Terhorst, Dean Lusher, Dianne Bolton & Ian Elsum, *"Knowledge Sharing Behaviour in Three Open Innovation Initiatives"*

This study reports on a mixed method social network study of three open innovation case studies. Many firms are embracing open innovation to remain competitive in an increasingly globalised economy disrupted by new technological advances. Open innovation may be defined as a distributed innovation process based on purposefully managed knowledge flows across firm boundaries in line with the firm's business strategy. Managing open innovation processes can be very challenging for firms. The flow of knowledge across firm boundaries is heavily influenced by the nature of the innovation challenge, type of knowledge being exchanged, and personal and work-place attitudes towards learning and knowledge sharing.

Purposeful management of knowledge flows across firm boundaries requires a deeper understanding of environmental and psychosocial factors that shape knowledge sharing behaviour. Prior research suggests more complex innovation challenges require higher levels of social interaction to enable tacit knowledge exchange. Positive attitudes towards learning and knowledge sharing enhance the likelihood of open innovation success whereas negative attitudes are more likely to result in agency issues leading to less favourable outcomes. Motivating people to seek out new external knowledge and to willingly share their knowledge with external partners is critical for the emergence of collaborative social structures that deliver open innovation success.

The configuration of knowledge sharing and idea generation networks reveals telling information about personal and work-place attitudes towards new external knowledge. We argue using mixed method social network analysis to assess knowledge sharing behaviour provides a contextualised and nuanced view of knowledge brokers and their agency. The mixed method social network analysis employs statistical modelling to expose patterns of social interaction and assess how individual traits affect the emergence of social structures in terms of self-determination, social exchange, social identity and social cognition theories. The modelling is complemented by semi-structured interviews that capture the environmental context regulating emergent collaborative social structures.

Mixed method social network analysis was used to assess knowledge sharing behaviour in three open innovation initiatives from the food and agriculture industry. The analysis considered patterns of knowledge brokerage across each initiative. Knowledge sharing appears to be strongly motivated by social pressure. People are also more likely to share knowledge with others they deem competent. Patterns of knowledge

sharing are influenced by the amount of tacit knowledge being exchanged with tacit knowledge playing a key role in social learning processes. Though tacit knowledge does feature more strongly in one particularly complex innovation challenge, this initiative is also at an advanced stage. Positive attitudes towards learning and knowledge sharing were more evident in those collaborations with a clear sense of purpose and direction.

Mixed method social network analysis does enables a better understanding of the psychosocial factors that affect knowledge flows across firm boundaries. Such understanding should contribute to more effective management of knowledge flows in open innovation collaborations, leading to more successful outcomes.

Julien Brailly, Julia Brennecke, Dean Lusher & Tom Spurling, *"Public research business models: between institutional constraints, researchers' careers and social networks"*

This study investigates how institutional context shapes scientific collaborations and so the innovation process in a multilevel framework. Technological innovation is defined as inventing a product and taking it to market. The commercialisation of public research requires the coming together of two very different communities of practice – public research organisations and private firms – each with their own values, measures of worth, language and hierarchy.

Interaction between both communities is partly defined at the local scale (i.e., within laboratories or universities) and partly at the national scale. Those scales correspond to the institutional context which shapes formal interdependencies and power relationships between both communities, for instance in terms of contract clauses, added value, ownership rights and public research funding. From that top-down perspective, institutions shape public research and predefine informal interactions between public research organisations and private firms. Consequently, they also shape networks between scientists; for example, we find that the higher the proportion of PhD students funded by the private sector, the lower are the social exchanges between them. Institutional context shapes scientific collaborations and so the innovation process.

At the opposite, from a bottom-up perspective, researchers' careers lead them to experience different institutional contexts, for instance in terms of universities or country. These experiences constitute a specific knowledge allowing them to make institutional constraints more flexible. In addition, laboratories' networks are emergent and result of the particular history of the laboratory. Researchers' experiences and their social networks shape research hub's business model and so the innovation process.

Combining qualitative interviews and quantitative data, we explore interdependencies between institutional contexts, public research organisations business models and intra- and inter-organisational networks in France, Germany, United Kingdom, Australia, Japan, China, United States. Data was collected across 14 sites around the world that involve the development of a platform technology that, in contrast to a single use technology, has a much larger potential innovation and economic impact because it can be applied in multiple ways and multiple domains.

Till Klein, Michael Gilding, Noordin Shehabuddeen, Greg Simpson & Dean Lusher, *"The emergence of industry-research collaborations: a longitudinal network analysis"*

Industry-research collaborations are important for technology transfer, but only a few studies explore the emergence of such collaboration ties from an evolutionary perspective. Building on theories of Evolutionary Economic Geography, this research adopts a case study approach to explore the dynamic effects of different proximity dimensions (e.g., geographic proximity, social proximity) on network emergence. To elicit the drivers for tie formation three dissimilar cases are selected and reviewed with the Method for Business Ecosystem Network Analysis: an industry case, a research case, and a mixed case. Patent data is used for constructing co-inventor networks, which are complemented by qualitative data. The empirical setting is an original dataset on the Technology for Controlled Radical Polymerisation (a novel technique for making 'better polymers') covering the global patenting activities from 1995 to 2013. The RSiena analyses reveal interesting differences and similarities between the various proximity dimensions. Emerging themes are discussed along with suggestions for further research for understanding industry-research collaborations.

Marissa Takahashi, Marta Induska & John Steen, *"The Role of Network Characteristics in Facilitating Research Impact"*

Companies invest in research and development (R&D) with the expectation of boosting their innovation pipeline, which drives product innovation and growth. However, the trajectory from research to development of new, commercially viable, products is not straightforward. There are many research endeavours and investments that fail to deliver the expected returns. This paper aims to understand the challenges of coordinating R&D project teams in their quest to create research impact. In particular, we focus on the relationship of R&D project teams' network characteristics with their subsequent performance.

To achieve this aim, we examine the social network of several corporate R&D project teams within a global software company. These R&D teams have the specific task of conducting research projects that advance the state of the art in a specific domain, as well as the mandate to commercially explore their results. To achieve these tasks, the R&D teams collaborate, both face-to-face and electronically, with a network of diverse participants within their global ecosystem - a complex mesh of interconnected stakeholders dispersed geographically and across time zones.

Based on this data, and drawing on network theory, we examine how network characteristics influence the knowledge transfer processes that facilitate research impact. In this paper, we posit that knowledge transfer among the network stakeholders is a facilitating mechanism in generating research impact. Our study further posits that the structural and relational characteristics of the network influence knowledge transfer. We present the results of two analyses of R&D networks (one in Australia and one in Europe) to explore how specific knowledge transfer processes drive the creation of research impact within the respective R&D networks. Specifically, we used MRQAP to investigate the relationship between the structural characteristics such as centrality and relational characteristics such as tie strength along with other covariates on knowledge transfer. We then used meta-analysis on the MRQAP results to derive our conclusion. We expect that insights from this unique dataset will contribute to a deeper understanding of the dynamic interplay between network characteristics and knowledge transfer that ultimately results in research impact.

Andrew Rixon, Kathy Overton & Stephanie Carr, *"Use your networks .. But how?!"*

In today's complex web of interactions within and between organisations, as well as the blurring of boundaries resulting from collaborative networks and relationships established with stakeholders and communities ,the old saying of "It's not what you know, but who" is certainly true. It has been suggested that "Organizations (and the individuals that make them up) are much like "bramble bushes in a thicket". The reality of the complexity and constant changes in an apparent tangled web of interactions can bring a manager or leader to a standstill around the common advice of "use existing networks".

Social Network Analysis appears to provide an opportunity to start to map a way through the chaos and help managers, leaders and change makers gain a bird's eye view on the tangled web, and more importantly, begin to make sense of the landscape they are playing in. From this sense-making, hopefully some grounded informed action can result. For the practitioner there is however, a number of challenges and barriers to realising the promise that Social Network Analysis puts forward.

Such challenges and barriers include:

• What are the ethical impacts on scope and viability of Social Network Analysis projects in Industry?

• What are the most effective ways of facilitating conversations, sense-making and action planning about the resulting network maps that are productive within and across organisational environments given the complexities?

By way of sharing some industry applications and case-study examples, this interactive presentation will seek to invite and involve those attending in an exploration of these questions in order to develop a common understanding of the challenges and barriers, as well as gaining insights into practices that are useful ways forward.

Amanda Dennett, Cecile Paris, Surya Nepal, Robert Power & Bella Robinson, *"Understand the Impact of Your Tweets to Your Audience"*

Today's social media monitoring tools are typically focused on understanding the topics being discussed by processing the message text. Though topic analysis provides a better understanding on what has been discussed in social media, they have inherent limitations on understanding the impact of an individual message. For example, how messages propagate on social media, what is the reach and coverage of messages, who are the different audience cohorts and who are the 'key influencers' for a particular message. To answer these questions, we need to understand another important aspect of social media, i.e., the network or relationships formed by the flow of messages.

André F. Gygax, Matthew Hazledine & J. Spencer Martin, *"Are Fat Cats Copycats?"*

Why is there so much similarity in executive compensation packages of firms? Prior literature identifies clear patterns in firms sharing directors, in firms sharing compensation consultants, or in firms simply belonging to the same industry. We introduce recently developed dynamic stochastic network techniques to analyze all three channels simultaneously for the first time. The dynamic technology has a further benefit in investigating board relationship evolution, rather than simple imitation, as a possible reason for package design similarities. The dynamic approach brings us several new findings. First, we find little evidence that having the same compensation consultant is the primary determinant of similarity. Instead, we show that sharing directors leads firms to imitate compensation package features. Second, our results suggest that firms are less likely to form ties with other firms with a higher proportion of fixed versus variable compensation. Finally, we document that boards with fewer females are more likely to include higher proportions of options compensation in their packages.

David Bright, Aili Malm & Johan Koskinen, *"Criminal network dynamics: The formation and evolution of a drug trafficking network"*

Objectives: The project aims to: (1) investigate structural and functional changes in criminal networks across time to determine ways in which criminal networks form and evolve. To meet this aim, the project will answer the following research questions: (1) What social structural changes occur in criminal networks across time?; (2) How are these structural changes related to roles/tasks performed by network members?; and (3) What social processes (e.g., degree, brokerage, or transitivity) can account for the growth and change over time in criminal networks?

Methods: The relational data on the network was divided into four time periods each of two years duration. Actors were allocated to specific roles. We applied a Stochastic Actor-Oriented Model (SAOM) to explain the dynamics of an Australian drug trafficking network across time. Using RSiena we estimated a number of models with the key objectives of investigating: (1) the effect of roles only; (2) the endogenous effect of preferential attachment; (3) the endogenous effect of brokerage (as captured by a preference for being indirectly connected to many others); (4) how preferential attachment is moderated by brokerage.

Results: Preferential attachment is completely moderated by brokerage, meaning that there is no centralization as a result of actors connecting to hubs but there is centralization as a result of actors preferring not to be directly connected to many others. Locally, actors seek cohesive relationships through triadic closure.

Conclusions: Actors do not seek to create an efficient network that is highly centralized at the expense of security. Actors strive to optimize security through triadic closure, requiring trust, and to protect their local neighborhood through being connected to the rest of the network via brokers.

Giles Hirst, *"Looking up influences down below: How middle managers ties to executives influences middle manager behaviour and employee creativity"*

John Fitzgerald & Adam Simmons, *"Performativity and music performance network maps"*

Ethnographic literature suggests that in improvised music scenes at least, collaborative music performance is not just entertainment, it is constitutive of social, cultural and professional identity. The literature suggests that performances engage musicians and audiences in a collaborative project of bringing into existence an ideal society, and a set of ideal social relationships. There is an ongoing process of community building through improvisational musical performance. These "performative presentational strategies" are found in the selection of artists and the programming of musical events. They are performative because the events create the communities of which they speak.

Maps also have the potential to not only make social and network relations visible but to construct new lived social realities. Drawing on the literatures' ethnographic and theoretical concerns about how music performance can "make" musical communities, this paper will explore how making the "Melbourne Music Map" can make or perform a musical community.

A network of 101 musicians was assembled from musicians performing in the "100:25:1" performance series held in Melbourne in November 2015. The ego network was constructed by the ego - multi-instrumentalist Adam Simmons - using a quota sampling strategy based on five musical genre to stratify the network. Only those who had previously played with the ego were invited to perform in the concert series and subsequently be included in the network.

Artists self-completed their network information on a questionnaire. Performers were asked to nominate those musicians from the list of 100 that they had performed with publicly in the last 12 months. Performers were also asked to nominate the genre in which they work. The quota sampling strategy approximated a maximum variation sampling strategy to provide a balanced account of the range of genre performing with him in the Melbourne music scene. A physical network map was also created on the wall of the performance space over the 25 days that the performance series ran (http://www.abc.net.au/radionational/programs/lifematters/communities-in-tune/6945986).

The performance network was visualised and descriptively analysed using Gephi. Five genre were identified (jazz, experimental, new music, folk/world and mainstream pop). Genre showed distinct differences across; components, density, diameter, average degree, and clustering coefficients. Analysis of the network explored the degree to which performers connected with other performers in/out of their genre. Importantly, there were discrepancies between the distributions of musicians according to the stratifications designed by the ego (the quota sampling strategy) and the genre self-nominated by each artist. This has implications for how we conceptualise genre, the movement of musicians across genre and the capacity of some musicians to build musical communities based on genre identity. As funding to the music industry is often based on genre, the articulation of who is in/out of genre is critical to the social, cultural and economic identity of those in the music industry. This is a unique descriptive network account of a musician performance network in Australia. The findings also have implications for the best methods of sampling when the performance of community is intimately linked to network mapping.

Poster Session Abstracts

Alia Bihrajihant Raya, *"Farmer Group Members Knowledge Exchange of Chili Farming on Coastal Sandy Land Indonesia"*

It attempts to focus on two pioneering farmer groups based on chili farming located on coastal sandy land, the Bugel Farmer Group (BFG) and the Garongan Farmer Group (GFG). Farmer group as a united group of farmers are founded based on similar needs, similar socioeconomic condition, and solidarity among them in order to obtain a better life and better economic condition. Being a member of farmer group, farmers could have a wider opportunity to exchange the knowledge regarding their commodities. These two farmer groups are reputed as advanced farmer groups and have been successfully conducting activity of chili farming. The activities are embedded in the process of diffusion of chili farming innovation since the innovations are the prominent aspect of increasing chili productivity on coastal sandy land. In order to mapping the pattern of knowledge exchange between each member of farmer group, social network analysis was applied to understand how the social structure of relationships around a farmer and farmer group affects diffusion of innovation.

The research was conducted in September 2015 to collect data about knowledge exchange of chili farming on coastal sandy land. All members and board of the BFG (95 farmers) and GFG (86 farmers) were interviewed while the roster method was used. Then, the network was drawn by Pajek 3.15 and analyzed by ERGM using MPNet software. The result showed that the BFG network's density is 0.02 while the GFG network's density is 0.11. On the BFG has only one clique appeared while on the GFG's network produced 329 cliques. In addition, in the GFG the reciprocal ties are dominant; 81.17% from a total of 818 ties, while in the BFG the reciprocal ties are only 19.51% of a total of 205 ties. It showed that knowledge exchange among GFG's member is more likely appeared than in the BFG. The knowledge exchange of GFG is based on the structural homophily. The members of GFG diffuse their knowledge to other members while other members also reciprocally inform their views about innovation of chili farming. Meanwhile, in the BFG there are some popular farmers who are knowledgeable and most of the members of BFG accessing the new information from them. Those farmers are BFG board member who has a role as an information broker to any other farmers. Among members of BFG tend to less practically exchange the knowledge while in the GFG, the information is not centralized only to particular farmers-all farmers tend to share choice and share network activity together. GFG has a rule to conducting chili farming based on the collective action so that the exchange knowledge among them has probably influenced by the collective norm. These findings suggest that exchange knowledge among farmers could enhance the spread of innovation diffusion and speed timing of innovation adoption.

Amanda Scott, Geoff Woolcott , Robyn Keast & Daniel Chamberlain, *"Collaborative sustainability in a higher education research project: Proactive and reactive responses in a complex adaptive system approach"*

This poster outlines an exploration of typologies of responses as part of a new view of collaborative project sustainability seen in terms of a complex adaptive system, one that responds to funders needs for evaluation of dynamic change across and beyond project lifetimes. Preliminary analysis of data from a government-funded educational research project, It's part of my life: Engaging university and community to enhance science and mathematics education, suggests that complexity thinking may be useful in setting up sustainability processes from project outset. This would open new measures to support sustainability that would remove the current reliance on linear models.

The characteristics of flexibility and adaptability are necessary for responses that enable system action or response to their environment. Such actions and responses can be considered as either proactive or reactive, where both can be related to the capacity to explore and exploit the environment in order to improve system fitness and support collaborative project sustainability. This poster outlines how sustainable collaborative networks must be able to foresee and act (proactive) or withstand and respond (reactive) optimally to ever-new and changing contexts in ways that mean they can continue to create and command value for stakeholders across contexts. The poster presents evidence that adaptability and flexibility, therefore, could be considered the necessary foundational backbone for

an evaluative framework supporting optimal collaborative project sustainability.

Fundamentally, the ability of a collaborative network to be proactive and reactive in order to respond and evolve for sustainability is its capacity to transfer knowledge for learning and subsequent action. This knowledge transfer is made possible through the complex relationships and interactions between actors, facilitated by the associated mechanisms, processes and infrastructure that support these relationships, and interactions. Thus relationships are considered central to the success of collaborative initiatives. Viewing collaborative sustainability as acting within a complex adaptive system enables us to better understand how the process of knowledge transfer occurs in a collaborative process; this process including feedback loops and non liner interactions leading to emergence, and the continual creation of new wholes. Social network analysis, used as an exploration tool, provides the means to assess relationship development and associated interactions across the macro and micro levels at particular moments in time; the macro level focusing on the outcomes of interactions across the system and the micro level understanding how relationship and position within a network influence resources acquisition and transfer. Social networks analysis offers a way forward to a new view of sustainable collaborative networks, in particular by looking at proactive and reactive responses.

Andrew Pitts, *"Polinode: A Web Application for the Collection and Analysis of Network Data"*

In this poster we will summarise some of the functionality and core features of Polinode, an online tool for performing network analysis. Polinode is aimed at commercial and non-commercial users alike and supports both research-related use cases as well as teaching network analysis to students.One of its primary advantages is that it is web-based. It therefore doesn't require any software downloads and opens up new avenues for collaboration and the incorporation of online content into network analysis. With Polinode you can upload arbitrary network data for online visualisation and analysis and you can also use the built-in relationship-based survey functionality to collect network data from respondents. The poster will emphasise some of the non-commercial use cases for Polinode (e.g. it has recently been used at UNSW and UTS to introduce students to network analysis and is being used at Yale for some fairly advanced data collection).

Arif Khan, *"Predicting the risk of chronic disease - a framework based on graph theory and social network analysis"*

A significant proportion of potentially preventable hospital admissions is due to the chronic disease. Furthermore, when patients are admitted to the hospitals, they are often unaware of their chronic conditions and it is discovered as secondary diagnosis. This results in further complicacy, longer length of stay and a huge burden on limited healthcare resources. Had they been diagnosed as chronic patients before, these complications could be averted. However, traditional way of clinical diagnoses and regular monitoring for a large population is often resource intensive. One potential alternative can be from healthcare data mining perspective, more specifically – from hospital admission data. Therefore, in this research we propose a framework to - i) understand the progression of a particular chronic disease and ii) predict future risk based on the understanding. We utilised graph theory and social network analysis for both of these parts. For the first part, we proposed the concept of 'baseline network' that can effectively model the comorbidities and their transition patterns, thereby representing the chronic disease progression. We further take the attribution effect of the comorbidities into account while generating the baseline network, that is - we do not only look at the diseases in the chronic disease patients but also compares them with that of non-chronic patients to understand which comorbidities are more responsible for leading to chronic disease pathway. For the second part, we used this 'baseline network' to match with the individual health trajectory of non-chronic patients. For matching the networks, we proposed several graph theory and social network based methods. These methods look at multiple parameters such as - the prevalence of the comorbidities, transition pattern and frequencies, clustering membership as well as demographic and behavioural factors. Individual risk scores against each of these parameters are then merged to generate the single prediction score that can dictate the risk of chronic disease for non-chronic patients in future.

We implemented the framework is applied to the administrative data within the Australian healthcare context and chose type 2 diabetes as the chronic disease to predict the risk for. The overall dataset contained approximately 1.4 million admission records from which we filtered and sampled the records of 2300 diabetic and 2300 non-diabetic patients. We followed an exploratory approach during the implementation to understand the contribution of different types of parameters in the prediction. The result gave the highest ranking to the graph theory based 'comorbidity prevalence' and 'transition pattern match' scores. This proves the effectiveness of our proposed network theory based measures. Overall, the framework shows prediction accuracy within 90% to 95% in identifying the future risk of type-2 diabetes. This is a significant improvement than the other similar prediction methods.
The proposed framework can potentially be useful for stakeholders like the governments, health insurers etc. to identify the high-risk cohort of chronic disease patients. By adopting a rigorous early intervention and prevention policy targeted at those patients can potentially divert them from chronic disease pathway and reduce healthcare cost from both provider and consumer perspective.

Caitlin McCurrie, Lucia Falzon & Garry Robins,
"Understanding the Twitter Bird: How studying the individual may reveal insights into information spread across the Twittersphere"

Twitter represents an idealised platform for individuals to rapidly and widely share information with others. A plethora of research has assessed what information is most widely propagated through the 'Twittersphere' network and why. Although these studies provide some initial insight as to what factors contribute to the success of information propagation on Twitter, the research methods utilised have a number of limitations. The vast majority of studies use only digital trace data. Compared to digital trace data, traditional research methods (e.g. survey) can communicate a particular richness and nuance at the level of the individual. In response to this shortcoming, we take a different approach and conduct a synthesis of survey and social network methodology, using these two forms of data. It is our view that when these methods are used in combination, we gain new insights into how and why information is spread on Twitter.

First, a model of Twitter information sharing was produced in accordance with prior literature. This model then informed a comprehensive survey that was designed to assess relevant perception and behaviour at all stages of Twitter information sharing. 150 active and registered Twitter users (85% USA, 14% United Kingdom, 1% Australia & Canada) answered questions relating to their: (1) motivations for information sharing, (2) their imagined audience, (3) strategies used for facilitating information propagation, (3) choice of Tweet content, and (4) motivations for following others. The survey also assessed the role of message reception on the actor's attitudes and consequent information spreading. Specifically, participants were asked whether reading messages on Twitter led to any attitude change and/or sharing of the message across non-Twitter media (i.e. Facebook or offline). It is difficult with digital trace data alone to assess the effect of message reception on a user who passively receives the information (i.e. does not retweet or respond on Twitter). As a result of the over-reliance on digital trace data within the field, it is not clear if reading tweets tends to lead to attitude changes, attitude escalation or further sharing of the message across other media. This aspect of the study was designed to provide a preliminary investigation into this issue. Finally, participants provided their Twitter handle as part of the survey and digital trace data was then captured using the RAPID data collection and analytics software over an approximately 2-week period .

We intend to use this data to generate ego-centred networks for each participant and use social network analysis to explore three types of networks: discussion (Twitter replies), broadcasting (retweeting or tweeting) and follower-followee. We then plan to analyse network features using the results of the participant survey responses to enrich the interpretation of the results. There is also scope to compare the results of the survey analysis with network analysis in a number of ways, such as by classifying participants using the survey data and testing differences in metrics between groups.

David Green, *"Evolution of Social Networks"*

Social attitudes and organization emerge out of interactions between people. These interactions and relationships can have profound effects on society. In a series of simulation and statistical studies, this research has investigated the effects of interactions between individuals on opinions and behavior with social groups, and on the structures formed by networks of inter-personal relationships.

Most models of social influence have adopted a game theory approach. However, our models are premised on the assumption that influence is a greater determinant of behaviour. Our models consist of agents, who have a number of attributes (states, opinions). They interact with others via a network (static or dynamic) of social relationships.

In our early studies, my colleagues and I confirmed Dunbar's hypothesis that there is a "natural" group size for humans. Our subsequent studies have explored a wide range of social issues including influence of media on public opinion, break-down of law and order, pluralistic ignorance (Seeme and Green 2016) and formation of topological patterns in social networks.

Many social activities are limited by the range of interactions. People spend most of their time in a "local phase" during which they interact only with their existing social contacts. Occasionally they enter a "global phase" in which their activity (e.g. trip, party) leads them to interact with people outside their normal circle and forge new social contacts. Remaining in just one phase leads to degenerate networks of contacts. However switching between phases leads to the process of Dual-Phase Evolution, which can form a rich variety of network topologies.

Our studies showed that Dual-Phase Evolution is responsible for the formation of small worlds, but can also form many different network topologies, depending on the way social links are formed and broken. Links formed on the basis of a single attribute lead to cliques. Links formed on a range of shared attributes lead to networks with topologies similar to those observed in studies of real social networks.

Ekaterina Anichenko, Kon Shing Kenneth Chung & Lynn Crawfor, *"Social Network Analysis: Towards a network perspective of project team performance"*

A long-standing concern in most literature on teamwork centres on how individuals actually work together. Teams that are able to work together effectively allow organisations to prosper in the turbulent and increasingly unpredictable environment. Such an environment calls for flexible structures and project teams are becoming the instrument that, when managed well, is equipped to deal with the tasks and adversities that organisations face.

Yet, project teams often become a source of frustration when they bring about ineffective solutions or fail to deliver results altogether. One of the contributing factors to such performance could reside in the limitation imposed by the traditional assessment tools that are often short term, outcome-based and external to the team. Although measures for the project team's internal state are available, they are limited in their ability to determine whether project team structures are efficient or effectively optimised for enhanced team performance.

Effective teams display distinctive attributes in internal team health: team members support, respect and trust towards each other; team goals are placed above personal interests and communication is frequent; information flows freely and team-building occurs in harmony with the team environment. The internal state of a project team can significantly predict the project team's potential performance. However, it remains problematic to measure and visualise the team's internal health partially because of the limited tools available for assessing all of the attributes linked to effective teams. Social Network Analysis (SNA) provides a theoretical framework and distinct quantitative measures capable of accurately assessing internal team health and, thereby, potential project team performance. SNA focuses on identifying structural relations of project team members; mapping out the networks formed by those relations and using quantitative measures to evaluate the network structures.

This paper identifies three networks that are central to internal team health: communication, information and trust. It further evaluates the relevant attributes of networks - centralisation, centrality and density – and

identifies their potential to predict effective project team performance.

Emmanuel Mbaru & Michele Barnes, *"Key players in conservation diffusion: using social network analysis to identify critical injection points"*

Coastal social-ecological systems are comprised of multiple stakeholders and identifying the right stakeholders to engage with is fundamental to ensuring conservation information and initiatives diffuse through target populations. Yet this process can be challenging, particularly as practitioners and policy makers grapple with different conservation objectives and a diversifying landscape of relevant stakeholders. We draw on social network theory and methods to present guidelines for selecting key players better positioned to successfully implement four distinct conservation objectives: (1) rapid diffusion, (2) widespread diffusion, (3) diffusion between disconnected groups, and (4) spreading complex knowledge or initiatives that specifically target behaviour change. Using complete network data among coastal fishers from six villages in Kenya, we apply this approach to select key players to facilitate each type of conservation objective. We then draw on key informant interviews from seven resource management and conservation organizations working along the Kenyan coast to investigate whether the socio-economic attributes of the key players we identified match the ones typically selected to facilitate conservation diffusion. Our findings show clear discrepancies between the current strategies applied and the ideal strategy identified here for selecting individuals to engage with, highlighting missed opportunities for progressing more effective conservation diffusion. We conclude with specific criteria for selecting stakeholders to facilitate each distinct conservation objective, thereby helping to mitigate the problem of stakeholder identification in ways that avoid blueprint approaches or panacea.

Fatima Bilkis Seeme, David Green, Julian Garcia & Carlo Kopp, *"The emperor's new clothes - modelling pluralistic ignorance in social networks"*

Pluralistic ignorance (PI) arises when people publicly express what they subjectively perceive as the public sentiment, rather than stating their actual opinions. It is a type of cognitive bias, prevalent across a range of different social settings, and relevant to social networks, political science, social psychology and other fields. We employ a multi-agent simulation model to investigate how and why PI arises. Agents have private opinions, which may differ from the opinions they express in public. Interactions between agents, in turn, lead to changes in opinions. Our model explores the effect of network structure on pluralistic ignorance. We test a number of well-known network structures and their effect in promoting or discouraging pluralistic ignorance. Experimental results indicate that the network structure alone can reduce the effects of pluralistic ignorance in multi-agent systems. Our results resonate with the existing literature on opinion dynamics, in which network structure turns out to be a critical factor.

Francesco Bailo, *"Political stability and the fragmentation of online publics in multilingual states"*

In this paper, I compare users' interactions on Facebook pages of parties and politicians in four different European multilingual countries: Switzerland, Belgium, Bosnia-Herzegovina and Ukraine. The focus is on measuring the political and linguistic divide of online publics and their association with measures of political stability of the respective countries. The research question motivating this paper is whether more politically stable countries have more politically and ethnolinguistically integrated online publics.

The data (and metadata) for the analysis - that is Facebook posts, comments and likes - were collected through the Facebook API and were all published in the year of the last general election organised in each country (2015 for Switzerland and 2014 for Belgium, Bosnia and Ukraine). In total 1433 Facebook pages linked to parties competing in the four elections were parsed. After being collected each post and comment was processed to estimate its language with a N-Gram-Based text categorisation algorithm (Cavnar, Trenkle, & others, 1994). The political collocation of each party and politician was categorised on a five-point scale - left, centre-left, centre, centre-right and right - based when available on the coding of the Manifesto Project (Volkens et al., 2016) or on the English version of Wikipedia.

This paper maps relations among Facebook pages of party organisations or politicians and among Facebook users. Relations are drawn by comments and likes left by

users. Users are labelled on two dimensions: the linguistic dimension and the political dimension. The language of each user is estimated based on the language of posts liked or comments directly published. The political label from a five points scale is assigned solely based on the liking behaviour of users since it is reasonable to assume that a user is more likely to comment than to like across the political spectrum. If a user liked posts on pages expressing different political views, the label is assigned based on the average political orientation of all likes.

Two networks are built from the interactions of Facebook users. The first type of network maps the relations among political pages of the same country. Undirected relations among each pair of pages are described by edges weighted according to the number of users commenting on both pages. The second type of network maps the relations among users with each direct edge from user A to user B describing a comment posted by user A in reply to a posting of user B.

The significance the political and linguistic dimensions in determining the frequency of connections among pages and users is estimated with exponential random graph models (Snijders, Pattison, Robins, & Handcock, 2006). In the case of the first network, connecting Facebook pages of party and politicians, the model will measure the effect of political homophily (nodematch) on the formation of weighted edges (Krivitsky, 2012). In the case of the second type of network, mapping the relations among users, the model will measure the effect of language homophily (nodematch) in determining the probability of observing a direct reply among users.

Jonathan Rhodes, Iadine Chadés, Angela Guerrero, & Örjan Bodin, *"Quantifying the Importance of Social Networks for Biodiversity Conservation Planning"*

Interest in integrating social networks into biodiversity conservation planning has grown considerably over the past few years. However, there have been few attempts to evaluate how much and in what situations the integration of social networks provides the greatest benefits for conservation planning. Here we use a model system to address this question. We first develop a decision framework to identify priority conservation actions to conserve species distributed across a network of planning units where the managers of those planning units are linked through a social network. More specifically, we assume that the social network allows managers to influence each other so that managers who are connected to each other behave more similarly than those that are not connected. We then quantify the extent to which the strength of network influence, the structure of the network, and species distributions determines the importance of accounting for the social network. We show that network importance depends strongly on influence strength, followed by network structure. However, there are strong interactions with the distribution of species even to the extent that, when the distribution of species is highly nested across planning units, accounting for the social network matters little.

M Amin Rigi, Irene Moser & Chengfei Lui, *"Finding community around a seed node in networks inspired by machine vision"*

Many complex systems such as the Internet, social networks, World Wide Web, and protein interaction networks can be represented with networks. Detecting and analysing communities are one of the most important studies in networks. Community detection methods based on their need of the information of networks can be divided into two groups: global and local. In global community detection, information from all of the network must be present. Since many information and social networks such as WWW or Facebook have billions of nodes, it is impossible to use global methods. On the other hand, local community detection methods do not need information from the entire network. They can detect communities in an area of the network with locally available information which makes them more efficient. In this research, active contours, a very well-known derivative based machine vision method for object detection, has been adopted to networks to find local communities. This requires mapping concepts of derivatives from Euclidean space into network space. The results show the proposed method is competitive with other local community detection methods and in some cases outperforms them.

Marc Cheong, Joanne Byrne, Sid Ray & David Green, *"The Power of Metadata: The role of statistical pattern recognition and inference algorithms in Twitter studies"*

The literature on Twitter in academia has mushroomed over the past 7 years, with many research areas opening up periodically. Hot topics nowadays focus on extrinsic properties of Twitter such as issue mapping, social network analysis, text mining, and 'big data' visualisation and analysis - powerful standalone techniques in their own right. However, one area which has remained somewhat a niche is the usage of raw metadata for inference generation and as the basis for various statistical pattern recognition techniques.

Analyses of metadata from users and messages on Twitter can be more beneficial (and can strengthen) 'surface level' analyses of tweets and the user network. This is evident in a simple yet pertinent example: how a single metadata attribute, the "Twitter client" can be used to distinguish between US Presidential Candidate Donald Trump's personal tweets and his campaign staffers' (Robinson, 2016).

In this presentation, we will draw from Twitter metadata-based research in Cheong (2013)'s PhD thesis as well as related work (conducted from 2009-2013) to provide examples of the relatively cost-effective, simple, yet powerful techniques that can be employed on Twitter metadata to generate meaningful inferences. These were based on large-scale empirical studies, experimental metadata-collation techniques, bespoke Twitter API harvesting scripts, and eclectic studies of the Twitter ecosystem; which pre-dates most large-scale data collection and analysis platforms such as TCAT (Borra & Rieder, 2014).

We will also cover how these niche computer-science based techniques are still relevant to more contemporary studies and popular analysis techniques. We believe that they can augment findings from current analysis methods found in popular studies, especially in line with the recent surge in popularity of 'big data' and increased awareness of machine learning techniques. Examples include proofs-of-concept of how statistical correlation and clustering on Twitter metadata - staples of data mining techniques - can be used to reveal latent patterns in day-to-day happenings as reported by Twitter users. As an analogy, this is not dissimilar to how hidden neural network patterns are discovered by Google DeepDream.

Also, in the interest of multidisciplinary research, this presentation will review existing (and propose new) applications of our metadata-based techniques in several other disciplines: including but not limited to marketing (Aleti Watne et al, 2014), political science (Ghazarian & Cheong, 2016) and social anthropology (Byrne & Cheong, 2016).

Ultimately we believe than by combining the best of multiple disciplines, our niche techniques will provide valuable understanding of human phenomena - resulting from cross-disciplinary research that is greater than the sum of its constituent parts.

Ming-Yi Chang, Yang-Chih Fu & Chih-Ya Shen, *"Dynamics of College Students' Facebook Interactions and Class Activity Participations"*

Positive outcomes of extracurricular activities were documented, including high school graduation, development of critical life skills, development of individual's identity, and so on. Extracurricular activities are also documented to be the settings that help to maintain current friendships and promote new friendships. However, very little work has directly examined why some students participate these school activities, some don't. Will friends in school participate these activities influence their participation? The goal of the current investigation is to examine the selection and influence process of friendship network and college students' class activity participation. We already collected one wave of online survey data and their Facebook activity data of 1,800 college seniors nested in 50 college departments from a national sample. Facebook interaction data, such as tagging in the same posts or commenting the same posts, will be used to construct students' friendship network structures. Being tagged in group photos of school departments will be used to construct the measurement of students' class activity participation. RSiena will be used to answer the research questions and further discussions will be provided about the complex relations between friendship and class activity participation.

Nazim Ahmed Choudhury & Shahadat Uddin, *"Time-Aware Network Structural Similarity Measures for Link Prediction in Longitudinal Networks"*

Longitudinal social networks evolve through simultaneous arrivals and/or departure of actor as well as creation and/or deletion of links among these actors. Increased availability of real-world longitudinal network datasets has prompted longitudinal network analysis to gain considerable research interests to better understand the underlying mechanisms of its evolutionary dynamics. In relation to evolutionary network analysis, different link prediction methods in network science support the prediction of future links and modelling of their dynamics. The most potential limitation of these link prediction methods is their static nature of observation and failure to taking into account the network evolution. Link prediction mechanisms predict future links in a network by observing only its immediate previous state rather than considering temporal events occurring in the network. However, longitudinal networks cater information of more than one network states that can be beneficial to understand the future link formation. Therefore, it is worthwhile to consider the temporal information of structural changes occur in longitudinal networks in order to measure the possibility of future link formation. Instead of considering the topological similarity metrics, which is widely used in existing link prediction methods, similarity between temporal sequences of structural changes associated with individual actors can be utilised to predict future links in longitudinal networks. In this research, we aim to define time series of simple network structural information (i.e., different centrality measures, connectivity) of non-connected node pairs that changes over time in longitudinal network, define new temporal similarity of these time-variant structural properties of node pairs and utilize supervised learning methods to successfully predict future links among them in longitudinal network.

Oleksandra Poquet, *"Social Processes in MOOCs"*

People benefit from learning with others. Talking to a peer can result to better understanding, but learning can also be enriched indirectly as one works alongside a group, or through one's sense of belonging and trust. For these reasons developing community in an educational setting is highly valued. As educational settings evolve to new modalities, forming communities may become a challenge. For instance, in open online environments (such as massive open online courses), anonymity, volume of interactions and shifting boundaries of the cohort cast doubt as to whether social processes can lead to community formation. Although communities could be defined by the presence of affective interpersonal dyadic relations based on trust, they also can be defined by commitment and attachment to a common identity or cause (see Ren et al., 2007 for review). Defining community via common-identity approach has previously been applied to informal online groups. MOOCs are yet to be examined from such a perspective where attachment to the group is a result of self-identification with group's purpose not a group's member, e.g. as in topic-based groups such as sports team or a school newspaper. Thus, this study focused on the social processes that unfold at scale and interpreted them from the perspective of identity-based communities. For this purpose, I analysed networks of learners from 4 MOOCs with differing facilitation strategies and varying degree of social negotiation. Directed networks have been constructed from the logs of interactions of a sub-group of individuals with higher commitment to learning socially, i.e. through participation in any three or more weeks of the course. Hypotheses of the social processes taking place within these networks have been based on the prior research on online identity-based communities. Through the application of ERGM, the network structure has been examined in relation to the hypothesized social processes of reciprocity, social validation, generalized exchange and propensity to reply to individuals who project higher effort. Results largely confirm that networks of committed learners develop a structure similar to online identity-based communities. The differences in network structures across four cases suggest that various external conditions of forum facilitation may have different impact on the social processes within the forum.

Penelope Hawe, Lisa Wood & Sarah French, *"A two-mode social network analysis of a community neighbourhood house highlights the value of activities that traditional evaluations might miss"*

A neighbourhood house is a multifunction community agency providing health, vocational, recreational and social services. Traditional evaluations make judgements about the benefit or value of a neighbourhood house by aggregating factors like service usage and client satisfaction and health/well-being. We set out to investigate if data from these same surveys could capture the underlying social interaction structure created among the client user group and to determine if new or valuable insights resulted. The neighbourhood house is in a low socio-economic status suburb of a large state capital city.

All neighbourhood house attendees over an 8 week period were invited to complete a survey of reasons for attending, the types of activities engaged in, service satisfaction, self-rated health and an eight item measure of mental and social well-being. We focused on two research questions; (1) do the activities, programs and events create a social structure at the neighbourhood house; and (2) is this social structure associated with health and well-being? Social network analytic methods (using UCINET) enabled us to construct visualisations and metrics about the social ties created among people by virtue of their attending the same events and/or activities. This two-mode affiliation network was then converted into two one-mode networks, one for the people and one for the events/activities. It was once thought that this method entailed loss of data, however this concern has now been discounted (Everett & Borgatti, 2012). Categorical core-periphery analysis was performed on each one mode network. We also calculated Freeman degree centrality and betweeness centrality. We compared the characteristics of people in the core of the social network relative to those in the periphery in terms of demographics, length of time as a neighbourhood house user, self-rated health and well-being using SPSS. Differences between the two groups were tested using chi-squared tests or Fisher exact test, where one or more cell sizes were less than five.

Fifty eight people took part (response rate of 78%) and 32 activities, services and events were identified. Based on the small number of people attending, some of the events might be considered unimportant (e.g, the German Playgoup), however their high betweeness centrality scores identified them as vital for connecting people who might otherwise not be connected. There were 21 people in the core (concentration of 0.895) and 37 on the periphery. Compared to those on the periphery, people in the core were significantly more likely to be longer users, to attend more often, to be Aboriginal, and to rate their mental and social well-being more highly. To our knowledge this is the first time opportunity has been taken to do a two-mode network analysis of a neighbourhood house using information routinely collected for service evaluation. The technique yielded new information of strategic value for service planning; particularly to identify the value of less well attended activities and the many informal activities that were scored in the "core" and might otherwise be vulnerable to funding cuts.

Rachel Friedman, Angela Guerrero-Gonzalez & Kerrie Wilson, *"Social Networks for Social Equity in Conservation"*

Social relations and interactions underlie decision-making processes, and 'power' and 'participation' are important concepts in trying to understand these relationships. Consequently, these are themes in the literature analysing social networks. A growing line of research inquiry in this area is how the structure and functioning of networks are tied to environmental outcomes. Researchers are also recognizing that themes of power and stakeholder involvement are influential within the decision-making processes for environmental management.

Community forest management (CFM) is one form of environmental management proposed as a means to protect forested habitat and biodiversity, while also addressing the needs and values of local people. Although literature suggests that devolving control over decision-making and management to local communities can result in beneficial conservation outcomes, the determinants of success and the social consequences are still topics open to discussion. Communities are often idealized as harmonious units. However, they are in reality heterogeneous in their socio-cultural, political, environmental, and economic characteristics, and so inequities persist in terms of stakeholder participation and control over resources.

While the application of social network analysis in socio-ecological systems is still in its infancy, it offers a mechanism to address the concerns increasingly raised over social equity in conservation: by characterising relationships in a community and demonstrating how network structure influences the decision-making process. The research will apply SNA to a case study of CFM in Borneo, using a mix of data from surveys and stakeholder interviews related to information sharing and decision-making power/influence of individuals (or groups). It will test claims that CFM is a socially unified and inclusive governance mechanism by examining the structure of the community network and characteristics of actors within it. The following questions will be addressed:

1. What network characteristics - structural (e.g. cross-scale interactions, position in network, etc); attribute-based (e.g. types or traits of actors connected to) - are most prevalent? Which influence local community acceptance and successful implementation of forest management?
2. What groups are marginalized in the sphere of decision-making? What knowledge, and/or values might not be recognized as a consequence?
3. How does the flow of information and ideas through a network affect which priorities are incorporated into management activities?

With a history of inadequate or even counter-productive approaches to forest management and conservation, it is clear that more emphasis must be placed on the social variables of the systems in question. Applying social network analysis principles and techniques to these complex environmental challenges has the potential to lead us toward more viable conservation solutions.

Rachel Sacks-Davis, Megan SC Lim, Judy Gold, Anna Bowring & Margaret Hellard, *"Short gap length, concurrent sexual partnerships, and sexual mixing in a sample of young people attending a music festival"*

Concurrent and consecutive sexual partnerships separated by short gaps, and sexual mixing between partners with discordant characteristics (e.g. large age differences) can increase rates of STI transmission We aimed to identify participants with concurrent partnerships and short gap-times between relationships, and investigate STI-related risk behaviours in this group, and sexual-mixing related correlates.

Rennta chrisdiana, *"The Effects of Mother's Personal Communication Network on Mother's Nutrition Knowledge in Kabupaten Sleman"*

This study aims to describe the mother's personal communication network structure and examine its effect on nutrition knowledge. It is conducted by a combination of qualitative and quantitative approach. The quantitative approach is used to describe the structure of personal communication network mothers using EGONET. Meanwhile, the qualitative approach is undertaken to map the mother's nutrition knowledge and explain personal communication network influences on nutrition knowledge. Struktur Lege Technic used by the dialogue-consensus method to test the effect of mother's personal communication network on nutrition knowledge. The result shows that the structure of mother's personal communication network can be identified using degree centrality, closeness centrality and betweenness centrality, and managed to find the key people on the network that affect mother's nutritional knowledge such as husband, mother/mother in law, and other network members. Family members occupy the closest position and influence the most on nutritional knowledge. Mother's and alter's activity through employment and social organization distinguishes the level of breadth and depth of mother's nutritional knowledge.

Yaghoob Foroutan, *"Multiculturalism, Religion, Gender Dynamics: Australasia Perspective"*

This paper presents research-based evidence to explore the place of religion and gender in the multicultural workplace. In terms of the issue of workplace, this study focuses on both employment status (i.e. whether employed or not employed) and occupational levels (i.e. the types of occupations). The fields of this study are the multicultural settings of Australasia (that is, Australia and New Zealand). Holding a wide range of cultural and ethno-religious groups from throughout the world, these multicultural contexts serve as a unique human and cultural laboratory to approach properly the key research objectives of this analysis. The discussion is mainly based on the customized data of population census and employs the method of logistic regression analysis. Accordingly, the multivariate results of this analysis will shed further lights on the place of religion and gender in the multicultural workplace.

Thank you

for attending the 2016 Australian Social Network Analysis Conference