

Statistical models for social network structures, individual beliefs and perceived social norms

NetSci 2006

Garry Robins & Dean Lusher

School of Behavioural Science
University of Melbourne
Australia

Overview

- **AIM:**
 - To translate a well-known macrostructural theory into specific network based hypotheses
 - To examine these hypotheses using exponential random graph (p^*) models
 - In particular, to examine the effects of perceptions of group opinions on the emergence of social ties.
- **REASONING:**
 - Social structures, individual attributes AND cultural factors are interrelated in human social relations.
- **RESULTS:**
 - Social partners are selected not just based on individual attributes, but also on perceived group opinions.
 - Norms provide unique information about social structure but are interdependent with structural & individual factors.

Tie formation in social networks

1. Endogenous structural effects:

Social ties emerge from the presence of other social ties

e.g. Reciprocity

Transitivity (triadic closure, clustering)

2. Node-level social selection effects:

Social ties emerge based on qualities of the nodes

e.g. Homophily

Social selection: Homophily

People with similarities are more likely to form ties.

But what are the bases of similarity?

Demographics?

Shared interests?

Shared attitudes?

Shared capacities?

Social selection: Heterophily

Homophily cannot explain the formation of hierarchical relations.

Hierarchy implies difference

What are the bases of difference?

Demographics?

Different interests?

Different attitudes?

Different capacities?

Tie formation in social networks

3. Node-level selection based on norms??

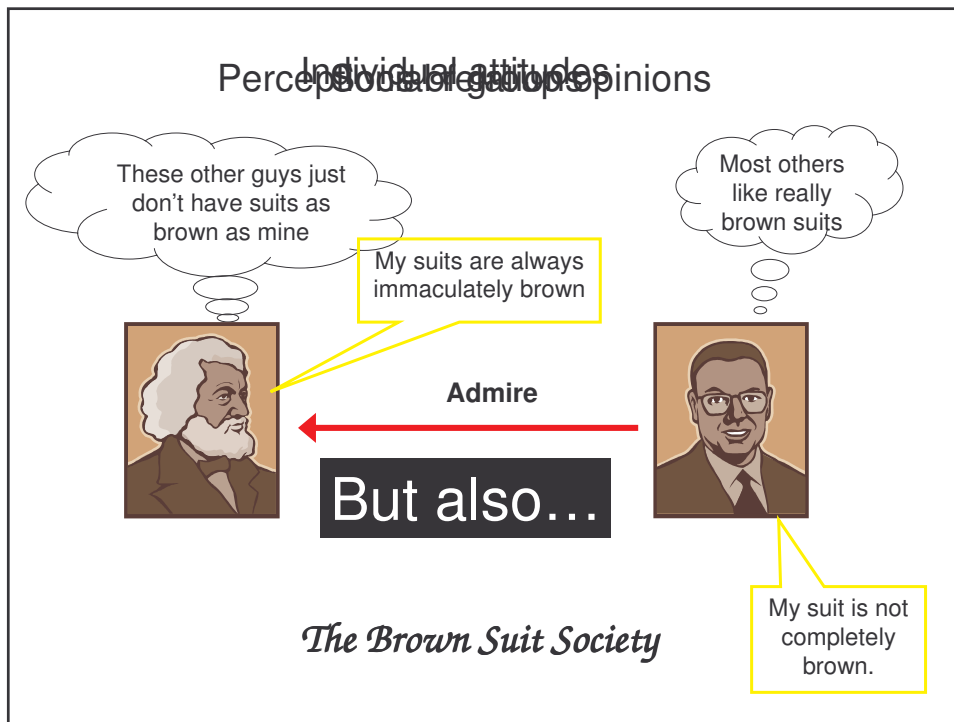
A person may select a target because the target best exemplifies certain standards or norms.

- Actual behaviour can be altered by an individual's *perceptions* of the global ideals, cultural standards or group norms (Lyons & Kashima, 2003).
- *Social identity theory*: Prototypical people in a group are the most powerful.
- *Relational discrepancy theory* (Robins & Boldero, 2003): Relationship formation explicable in terms of two dimensions – (1) personal attributes, (2) shared standards and motivations.

Need to distinguish between:

A person's personal attitudes

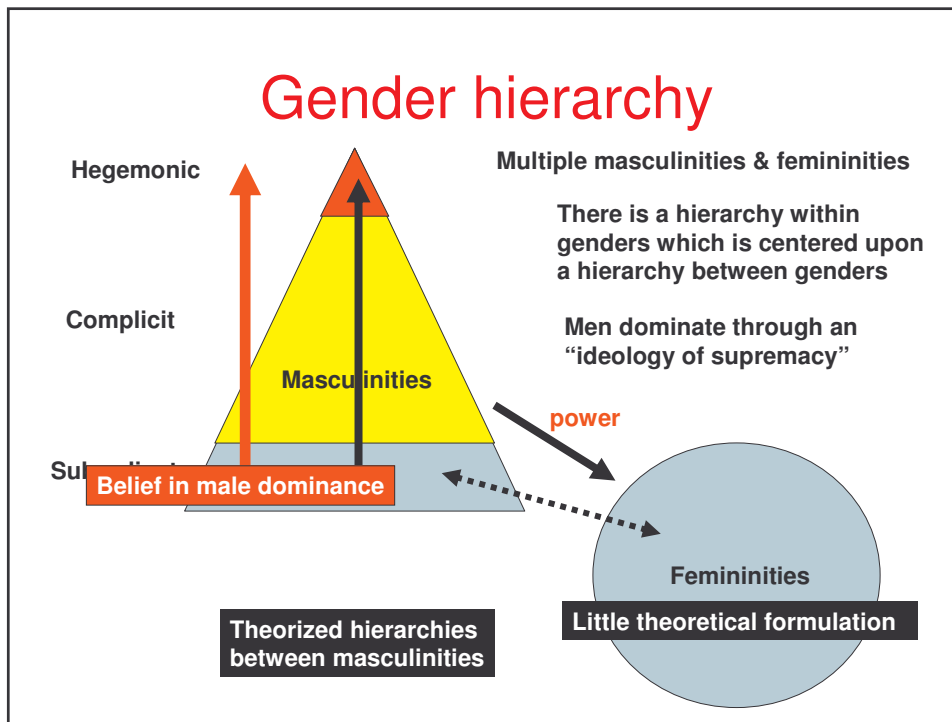
A person's perception of attitudes generally held by a reference group



Social theory of gender

Connell (1995, 2002, 2005)

- Gender is hierarchical relations of power
 - Men dominate women
 - Certain men dominate other men
- Relations between genders are explained by the relations within genders

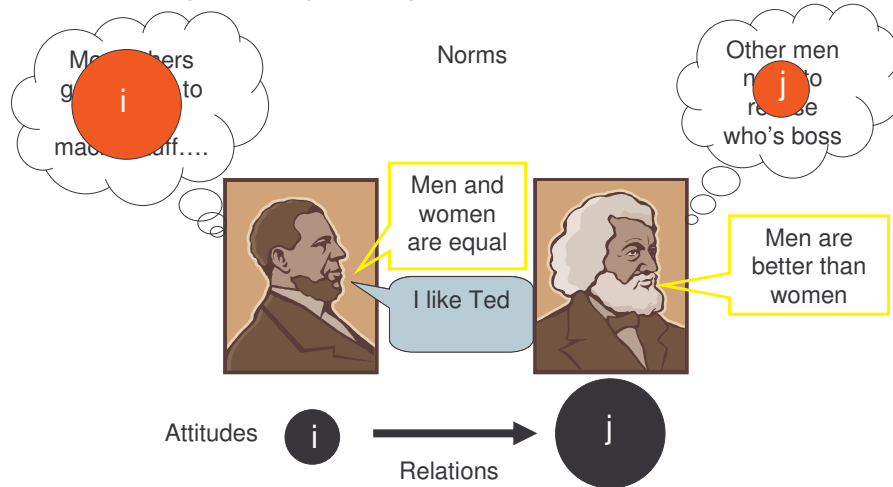


Summary of Connell’s theory

- Gender is relations of power
- Men’s dominance is underpinned by “an ideology of supremacy”
- Beliefs will vary with a structural position of power
- Gender “effects” do not just occur when men and women are present together
 - Gender is still pervasive in single-sex environments (e.g. army, all-male sports team)
- Norms are important as a reference point in people’s gender “performance”
 - Constrain and enable oneself and others

Structural Relations

Larger node represents greater belief in male dominance



Measuring Attitudes

Research literature and psychological inventories examining masculinity stress the following elements and their interrelatedness

**Masculine
Attitudes
Index**

Anti-femininity
Violence
Gay-male homophobia

Masculinity is relational to femininity

Examples

- It is OK for a man to cry in public
- Physical violence never solves an issue
- It is OK for a woman to be the major provider in her family
- Gay males sicken me because they are not real men
- It's natural for men to get into fights

Individual Attitudes & Group opinions

- Individual Attitudes
 - What do *you* think?
- Perceptions of group opinions
 - What do *your friends* think?

(For simplicity in what follows, we will simply label these as attitudes and norms, respectively.)

13-item inventory

Structural Equation Modeling (SEM)

Fit indices for a 13-item structural model for adolescent boys

Participant group	N	χ^2	df	p	RMSEA	TLI	CFA	SRMR
Boys	376	58.43	61	.570	0.000	1.004	1.000	.0347

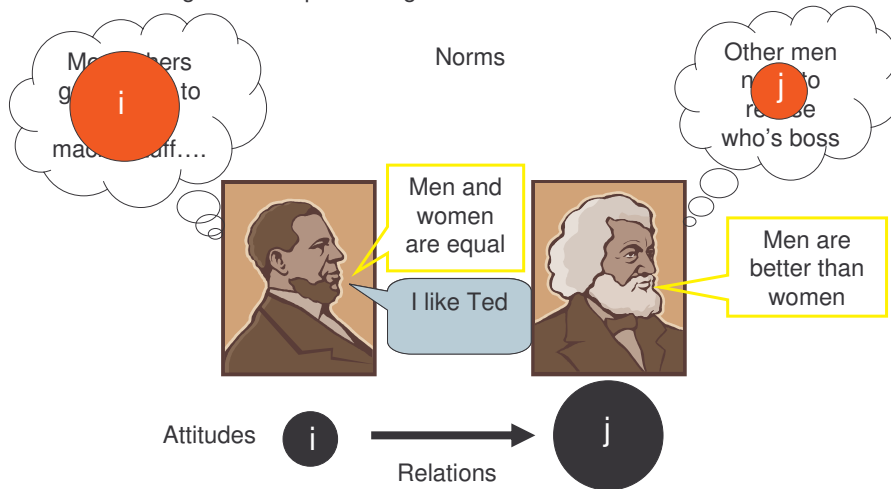
A very good fitting model for the data

Anti-femininity, Violence & Gay-Male Homophobia are independent but interrelated factors for masculinity

MAI Attitudes & MAI Norms

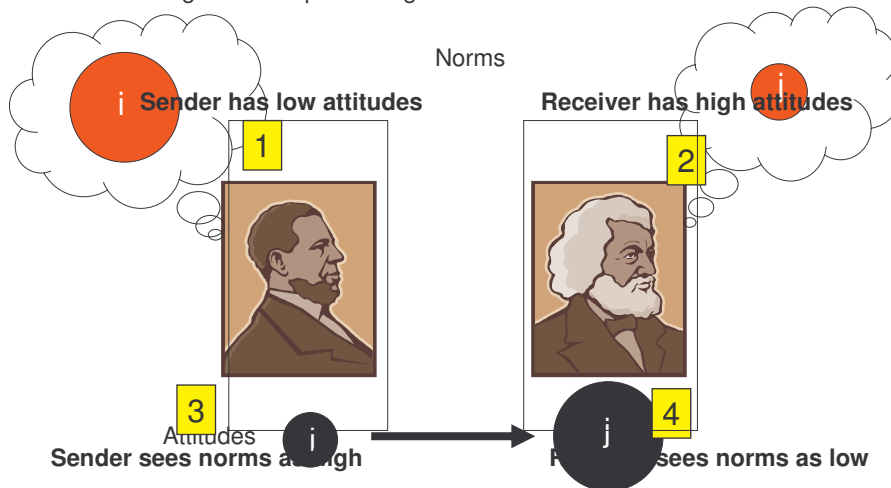
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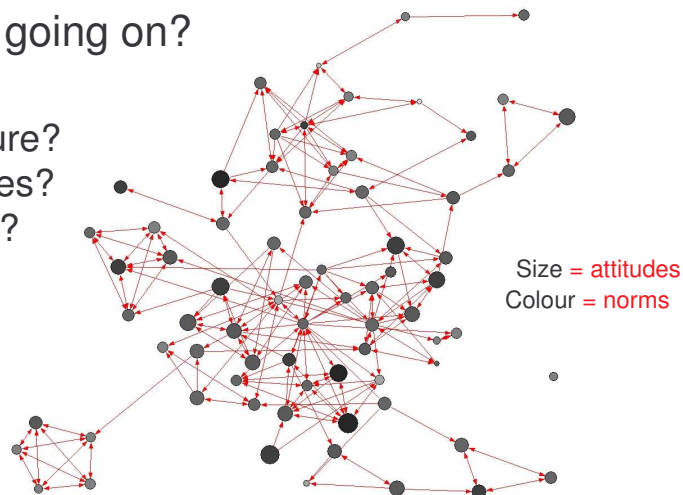


Participants

- N=72 male students
- Mean Age = 15.5 (.53) years
- Year 10 level (not single classes)
- Boys only, religious, private school
- 40-minute survey
 - Social networks (positive affect)
 - Attitudes
 - Norms
 - Ethno-cultural background & SES

What is going on?

Structure?
Attitudes?
Norms?



Exponential random graph models

$$P(\mathbf{X} = \mathbf{x}) = (1/c) \exp\{\sum_Q \gamma_Q z_Q(\mathbf{x})\}$$

normalizing quantity *parameter* *network statistic*

The summation is over all network configurations Q in the model

Network statistic $z_Q(\mathbf{x})$ is a count of the relevant configuration in the observed network.

A large positive parameter estimate indicates more configurations observed than expected by chance.

Exponential random graph model: Structural effects in the model

Edge



Reciprocity



Expansiveness
k-out-stars



Popularity
k-in-stars

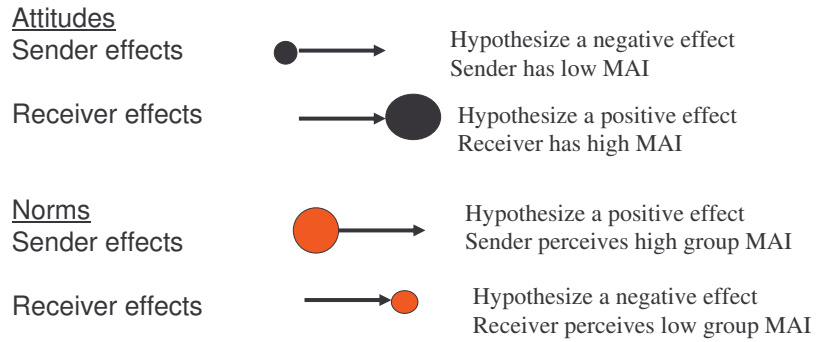


Multiple triangles
k-triangles



Snijders, Pattison, Robins & Hancock, 2006

Exponential random graph model: Node-level effects in the model



Also control for ethnic background, SES

p^* Model estimates

Positive affect relations

* PARAMETER		Estimate	SD	Convergence Statistic	
Arc		-1.8843	1.22862	-0.00856	
Reciprocity		2.4109	0.28728	0.02878	*
K-In-Star	Structural	-0.9423	0.26747	-0.02353	*
K-Out-Star		-0.7831	0.25136	-0.02384	*
TK-Triangle		1.3679	0.10424	0.01470	*
TK-2-Paths		-0.0861	0.03416	-0.07174	*
Rb for Ethno-culture	Ethno-culture	0.4222	0.13837	-0.03037	*
Rs for Ethno-culture		-0.0318	0.16467	-0.02187	
Rr for Ethno-culture		-0.2822	0.17012	0.01071	
Sender Attitudes	Attitudes	-0.2606	0.11795	0.00473	*
Receiver Attitudes		0.3615	0.14624	-0.01032	*
Sender Norms	Norms	0.3804	0.11894	-0.00036	*
Receiver Norms		-0.4290	0.15466	-0.00262	*
Sender SES (postcode)	SES	-0.0034	0.00145	-0.00983	*
Receiver SES (postcode)		0.0038	0.00152	-0.00902	*
Absolute Difference SES (postcode)		-0.0015	0.00106	-0.09328	
Sender Dad's occupation status		0.0001	0.00338	0.02367	
Receiver Dad's occupation status		-0.0026	0.00350	0.02142	
Absolute Difference Dad's occupation status		-0.0022	0.00221	-0.02503	
Sender Mum's occupation status		0.0026	0.00261	-0.04999	
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Attitudes

Norms

p^* Model estimates

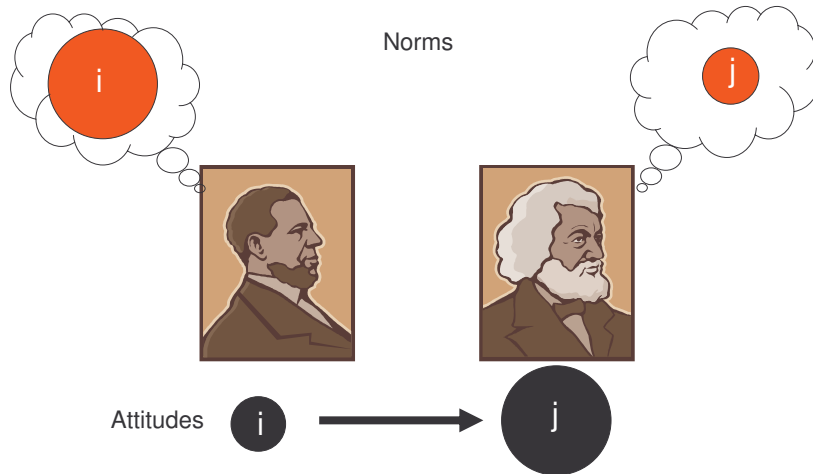
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Attitudes

Norms

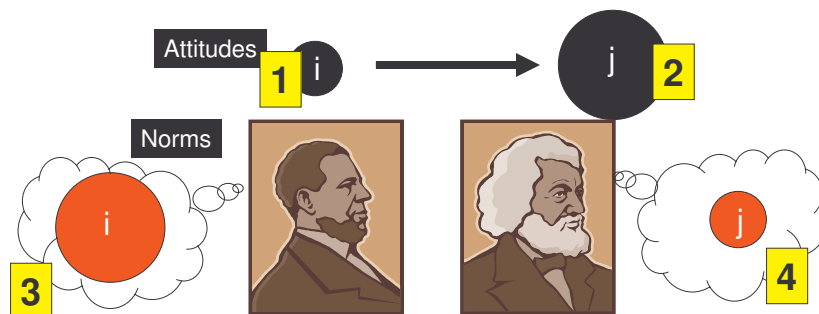
Connell's theory



p^* Model estimates

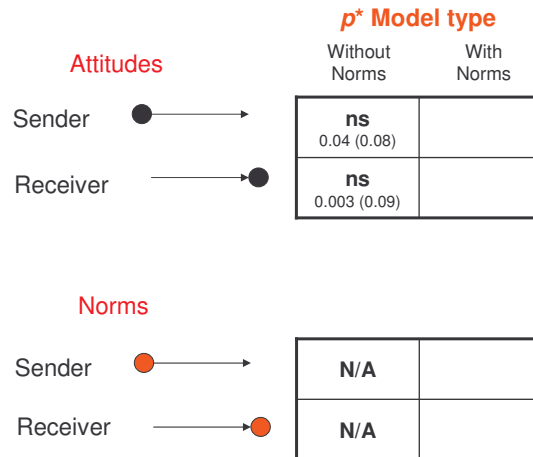
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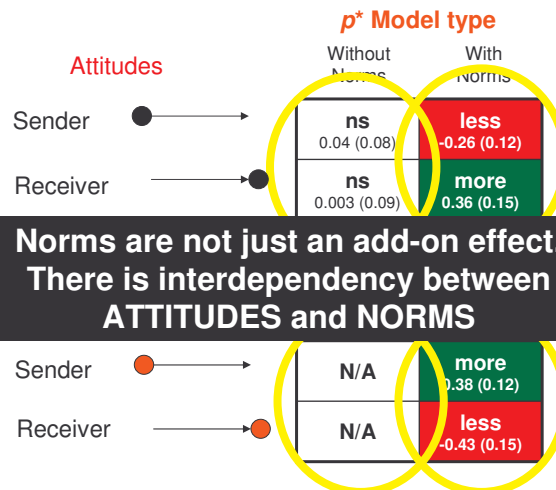
Masculine Attitudes

Positive affect relations



Masculine Attitudes

Positive affect relations

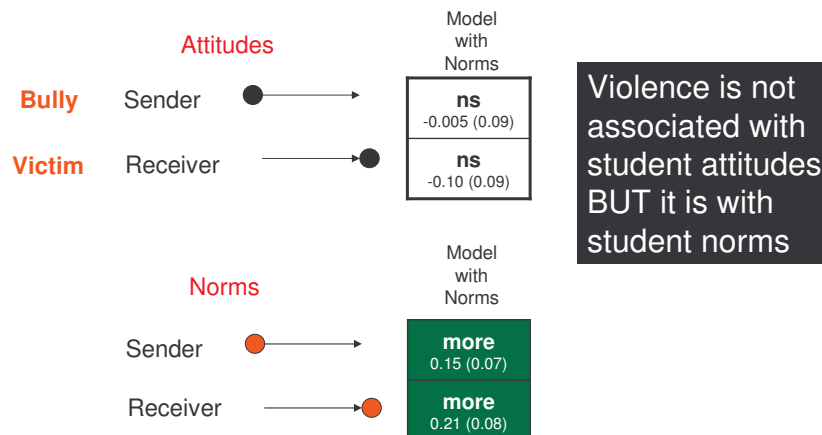


Violence

- A secondary mechanism of dominance is through violence
 - Connell (1995); Sidanius & Pratto (1999)

Masculine Attitudes

Violence relations



Future directions

- Defining a norm
 - What most people do?
 - What influential people do?
- Longitudinal data more informative
 - What creates a tie?
 - Role of norms vs attitudes?
 - Social structures
- Dyadic selection effects
 - Triadic or higher order theorising with attributes?

Conclusions

- Norms may be important in the formation of social ties
 - Social partners are selected not just based on individual attributes, but also on perceived group opinions.
 - Perceptions of group opinions may provide unique information about social structure but are interdependent with structural & individual factors.
- The importance of what we measure
 - In some network research contexts, it may be important to collect information on shared perceptions and other cultural aspects