

Modeling Social Influence in Large Populations

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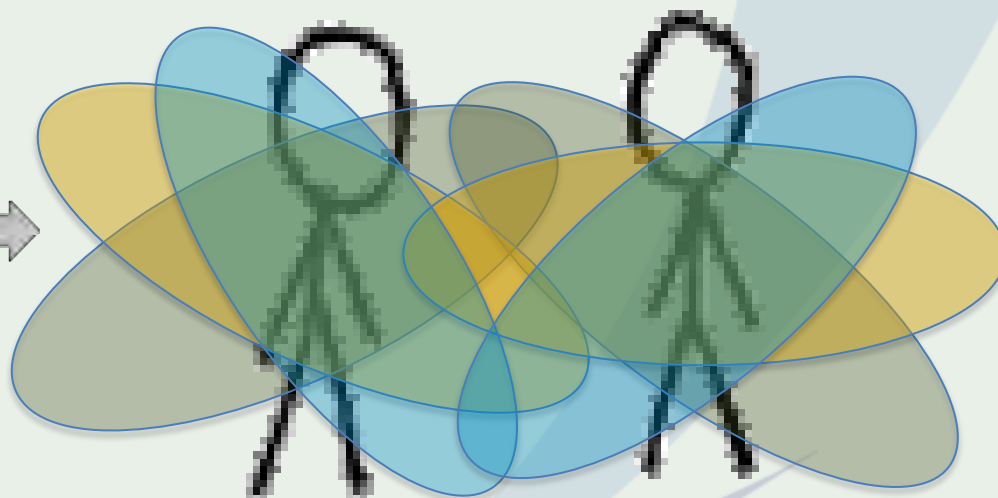
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Theory and Introduction

Theory: human collectivities are composed of individuals with different meaningful identities, and these identities form the basis for meaningful interaction, realized within a model “ecology” of identities.

- Homophily , Ecology of Identity, and Cross-Cutting Social Circles: Peter Blau (1994, 1997, etc...), Miller McPherson (1991, 2001), Lynn Smith-Lovin (2009), *et al.*
- Intersections of identities give rise to meaningful interactions:

Numeric	2	0	How much do you trust your body	15
Numeric	2	0	Trust: Your neighborhood	15
Numeric	2	0	Trust: People you know personally	15
Numeric	2	0	Trust: People you meet for the first time	15
Numeric	2	0	Trust: People of another religion	15
Numeric	2	0	Trust: People of another nationality	15
Numeric	2	0	Trust: People of another race	15
Numeric	2	0	Trust: People in general	15
Numeric	2	0	Trust: S&P	15
Numeric	2	0	Trust: Kids	15
Numeric	2	0	Trust: Christians	15
Numeric	2	0	Trust: Relatives	15
Numeric	2	0	Trust: People in general	15
Numeric	2	0	Confidence: Churches	15
Numeric	2	0	Confidence: Armed Forces	15
Numeric	2	0	Confidence: The Press	15
Numeric	2	0	Confidence: Television	15
Numeric	2	0	Confidence: Labour Unions	15
Numeric	2	0	Confidence: The Police	15
Numeric	2	0	Confidence: Justice System	15
Numeric	2	0	Confidence: The Government	15
Numeric	2	0	Confidence: The Postal Service	15
Numeric	2	0	Confidence: Parliament	15
Numeric	2	0	Confidence: The Civil Service	15



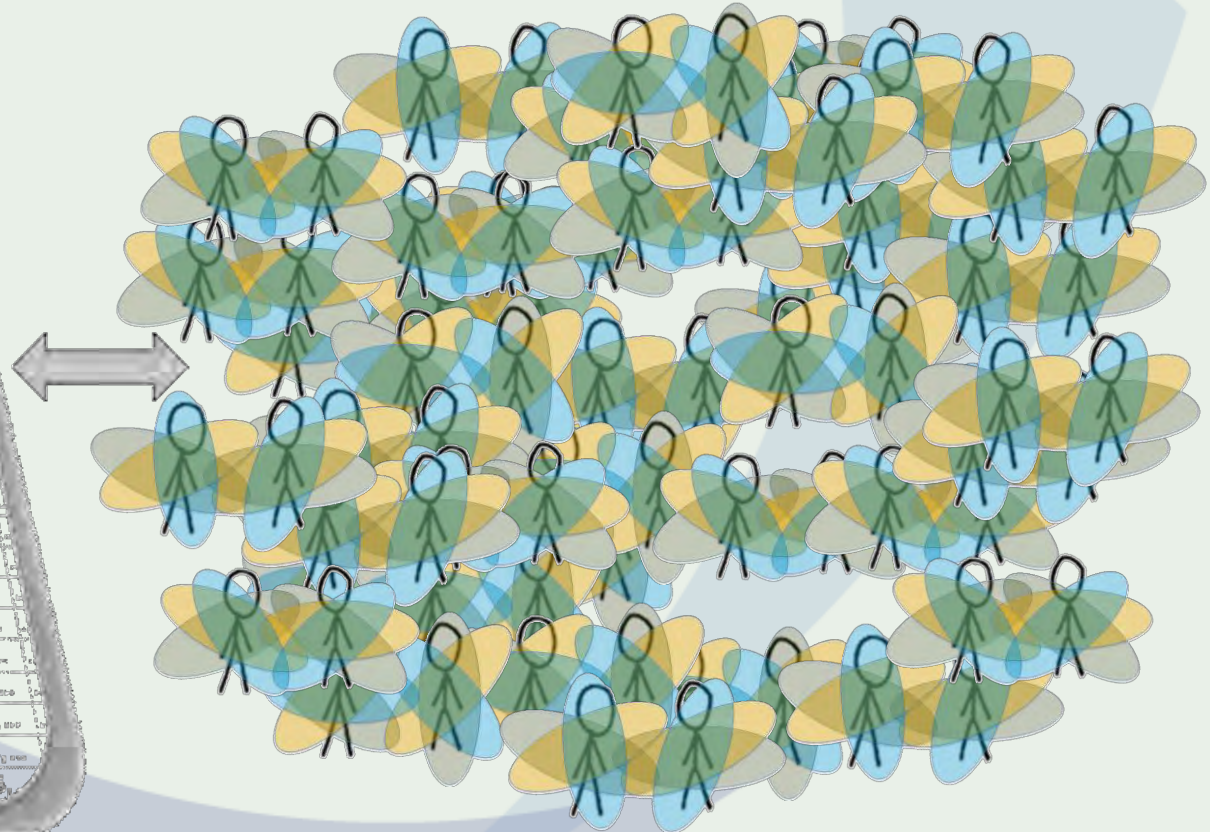
Intersecting dimensions of identity-driven trust and confidence for two individuals (obtained via self-report).

Large Population Structure

Society level structure is calculated by mapping all pair-wise relations on to the distributions of social factors present in the collectivity, accounting for the impact of variance between dimensions.

- Social structure is represented as a social network of probabilistic meaningful interactions:

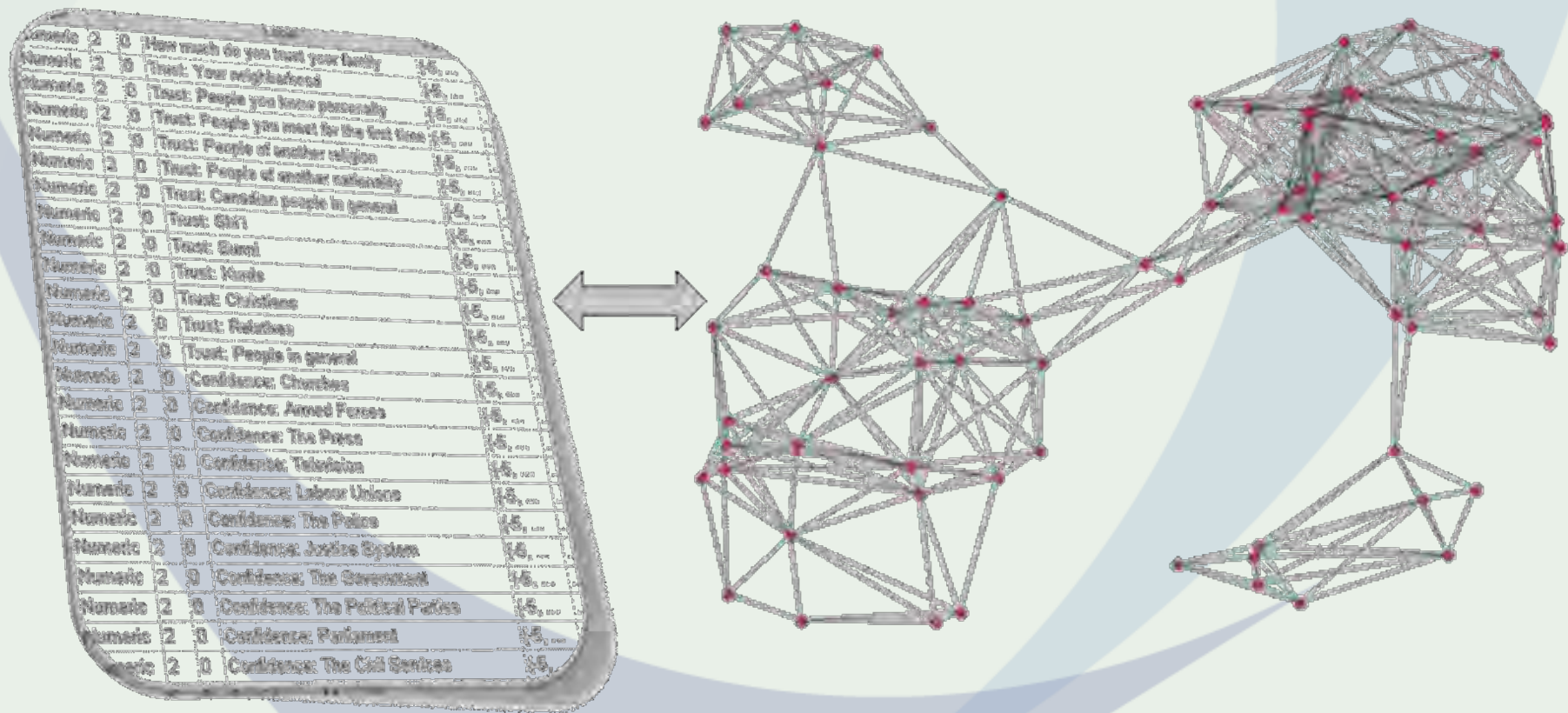
Numeric	2	0	How much do you trust your family	1.5	100%
Numeric	2	0	Trust: Your neighbours	1.5	100%
Numeric	2	0	Trust: People you know personally	1.5	100%
Numeric	2	0	Trust: People you meet for the first time	1.5	100%
Numeric	2	0	Trust: People of another religion	1.5	100%
Numeric	2	0	Trust: Canadian people in general	1.5	100%
Numeric	2	0	Trust: Sikh	1.5	100%
Numeric	2	0	Trust: Sunni	1.5	100%
Numeric	2	0	Trust: Hindu	1.5	100%
Numeric	2	0	Trust: Christians	1.5	100%
Numeric	2	0	Trust: Relations	1.5	100%
Numeric	2	0	Trust: People in general	1.5	100%
Numeric	2	0	Confidence: Churches	1.5	100%
Numeric	2	0	Confidence: Armed Forces	1.5	100%
Numeric	2	0	Confidence: The Press	1.5	100%
Numeric	2	0	Confidence: Television	1.5	100%
Numeric	2	0	Confidence: Labour Unions	1.5	100%
Numeric	2	0	Confidence: The Police	1.5	100%
Numeric	2	0	Confidence: Justice System	1.5	100%
Numeric	2	0	Confidence: The Government	1.5	100%
Numeric	2	0	Confidence: The Political Parties	1.5	100%
Numeric	2	0	Confidence: Parliament	1.5	100%
Numeric	2	0	Confidence: The Civil Service	1.5	100%



Population Network Model

Society level structure is calculated by mapping all pair-wise relations on to the distributions of social factors present in the collectivity, accounting for the impact of variance between dimensions.

- Social structure is represented as a social network of probabilistic meaningful interactions:



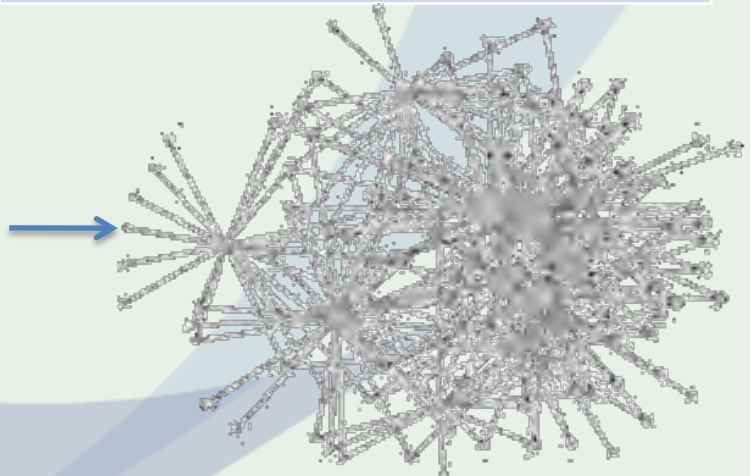
Communication Networks

Communication networks are simulation output that represents the actual communications and influence in a multi-agent system

Population Networks	Communication Networks
Simulation Input	Simulation Output
Instantaneous representation of the distributions of social factors in a populations	Intrinsically represent a window of time (e.g., before, after, or during a simulation event)
Constructed via a theory to model translation of a system based on empirical observations	Ground truth representation of meaningful communications, and inter-agent influences.

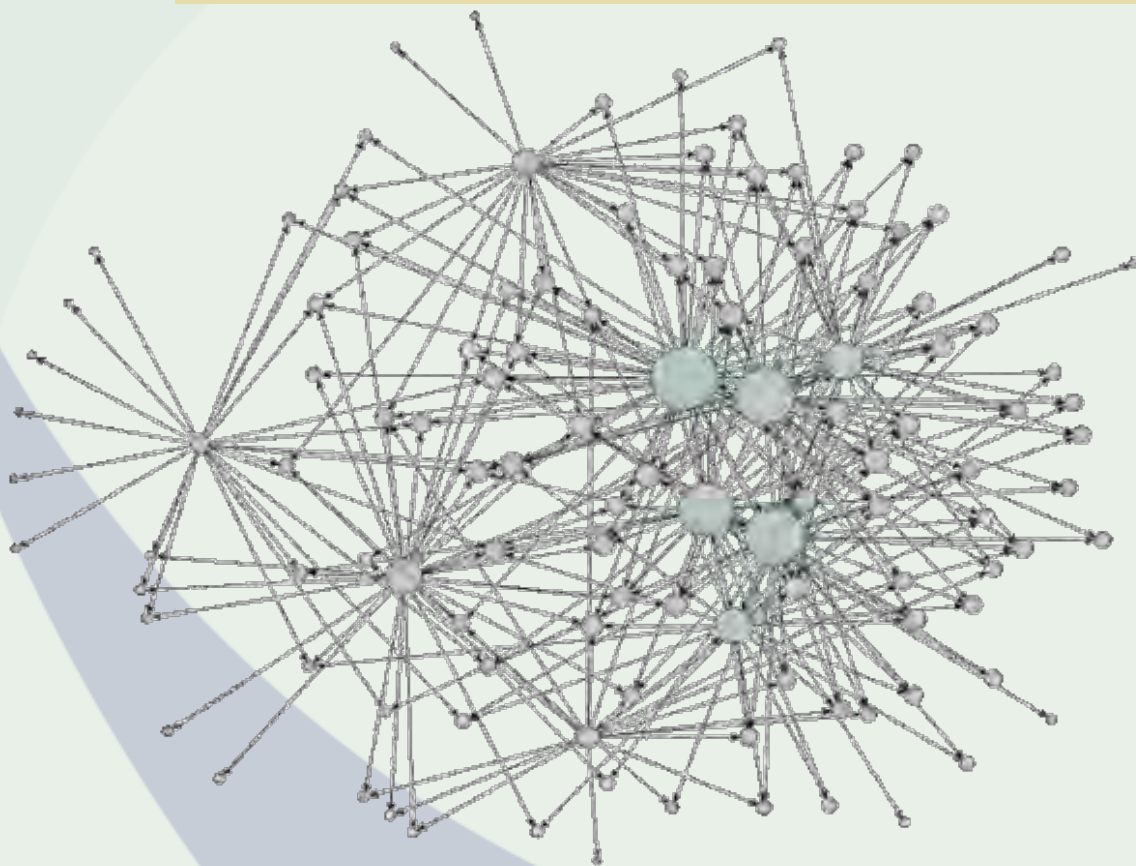
time	logger	entity	agentName	sendingAgent	Value
21.36	Elections	Agent	M_E_ND_A_1	NM_NE_ND_A_4	0.57
24.04	Elections	Agent	M_E_ND_A_1	NM_NE_ND_A_4	0.55
41.26	Elections	Agent	M_E_ND_A_1	M_NE_ND_A_8	0.53
100.5	Elections	Agent	M_E_ND_A_1	M_E_ND_B_1	0.52
363.4	Elections	Agent	M_E_ND_A_1	M_E_S_A_2	0.49

Cultural Geography MAS Output



Mapping Social Influence

Directed (pair-wise) influence, as well as each agent's global influence contribution to the MAS can be visualized and analyzed.



Inter-agent influence network for small time window following an exogenous simulation event, nodes sized by eigenvector centrality

- Communication networks are *directed* (i.e., have a sending agent and a receiving agent).
- Can be *weighted* to represent communication frequency, reciprocity, and combinations of other model parameters.
- Directed and weighted networks allow for much deeper modeling and analysis of influence in large populations.
- Analyzing population networks and communication networks *together*, can address a wide range of important questions related to the dynamics of influence flow and the spread of information (e.g., for information/psyop campaigns).

HSCB Modeling at MOVES

See the full presentation at
Session 4: HSCB Modeling: 0815-0945,
Wednesday, July 14 (Tomorrow Morning!)
Mechanical Engineering Auditorium

See the HSCB demo at
MOVES Demo Night: 1630-1830,
Wednesday, July 14 (Tomorrow Night!)
Watkins Halls, Room WA-275/285

Questions, Comments?



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