

Ch. 8: Affiliations and Overlapping Subgroups

Stanley Wasserman and Katherine
Faust

Important Properties of Affiliation Networks

- Two-mode networks
- Subsets of actors, rather than simply pairs
- Connections among one mode established *through* second mode
- Allow for dual analytical perspectives – actors and events.

Theory

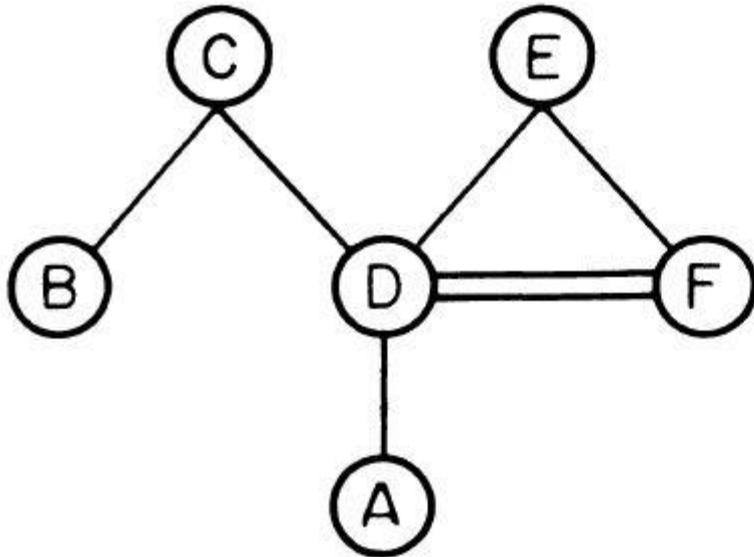
- Based in sociological theories about importance of memberships in collectives
- Actors are brought together through shared memberships, and events through overlapping members.

Using Sociomatrices

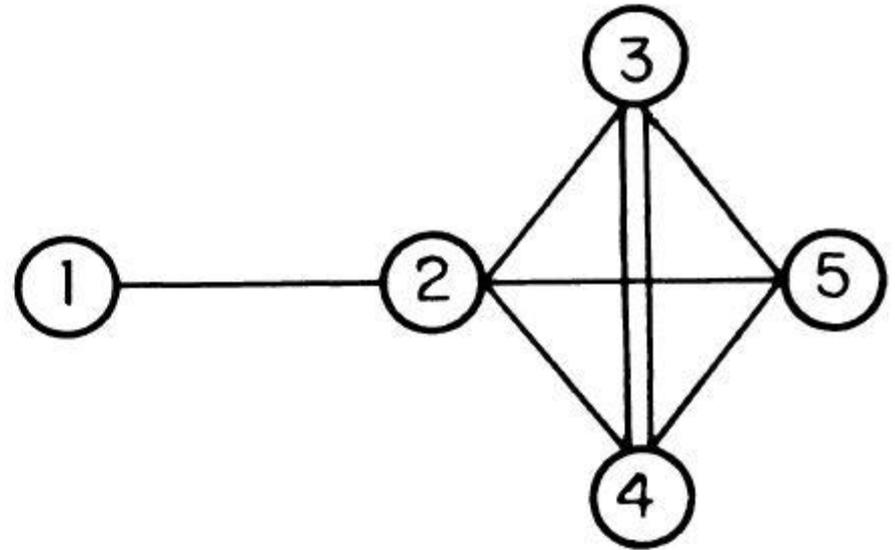
- Representation starts with two-mode matrix:

		1	2	3	4	5
A		0	0	0	0	1
B		1	0	0	0	0
C		1	1	0	0	0
D		0	1	1	1	1
E		0	0	1	0	0
F		0	0	1	1	0

C. The binary adjacency matrix (A) of person-to-group affiliations



A-1. Interpersonal network



A-2. Intergroup network

	A	B	C	D	E	F
A	0	0	0	1	0	0
B	0	0	1	0	0	0
C	0	1	0	1	0	0
D	1	0	1	0	1	2
E	0	0	0	1	0	1
F	0	0	0	2	1	0

B-1. Matrix representation (P) of Figure 1. A-1

	1	2	3	4	5
1	0	1	0	0	0
2	1	0	1	1	1
3	0	1	0	2	1
4	0	1	2	0	1
5	0	1	1	1	0

B-2. Matrix representation (g) of Figure 1. A-2

Visual Representations

- Bipartite Graphs and Hypergraphs

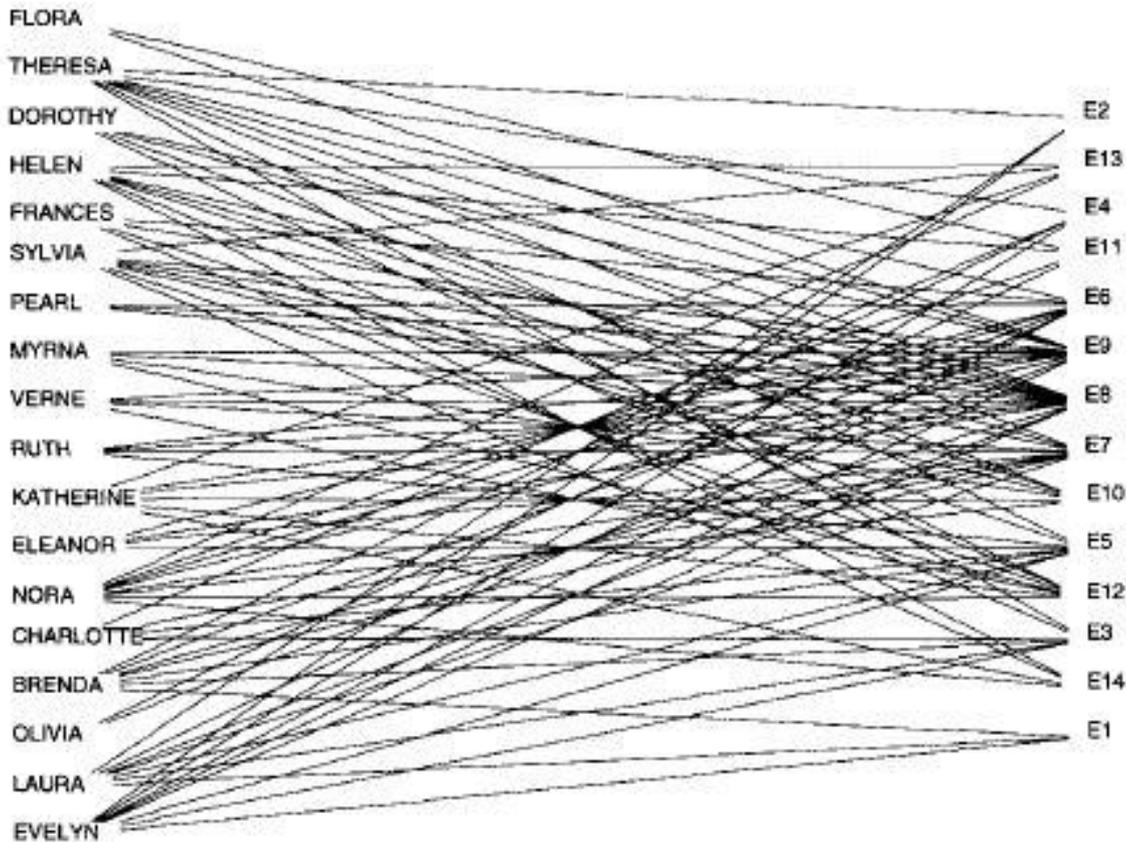


Fig. 3. Simple bipartite graph representation of the DGG dataset.

One-Mode Analysis

- Often, analysis focuses on one mode (actors or events).
- Because connections are made through the second mode, some formulas are modified.
 - With no direct intra-mode connections, there are no intra-mode paths of length 1

Properties of Affiliation Networks

Properties of Actors and Events

- *Rates of Participation*: “number of events with which each actor is affiliated”
- *Size of Events*

Properties of one-mode networks

- Density
 - Number of overlap ties (within one mode) is a function of the number of events per actor, or the number of actors per event.
- Reachability, connectedness, diameter
 - Modified because all connections occur between modes, rather than within them

Cohesive Subgroups

- When groups of events share the same members, or groups of individuals attend the same events.
- Can be valued (at level 3, all subgroup members share 3 affiliations, etc.)

Simultaneous analysis of actors and events

- Galois Lattices

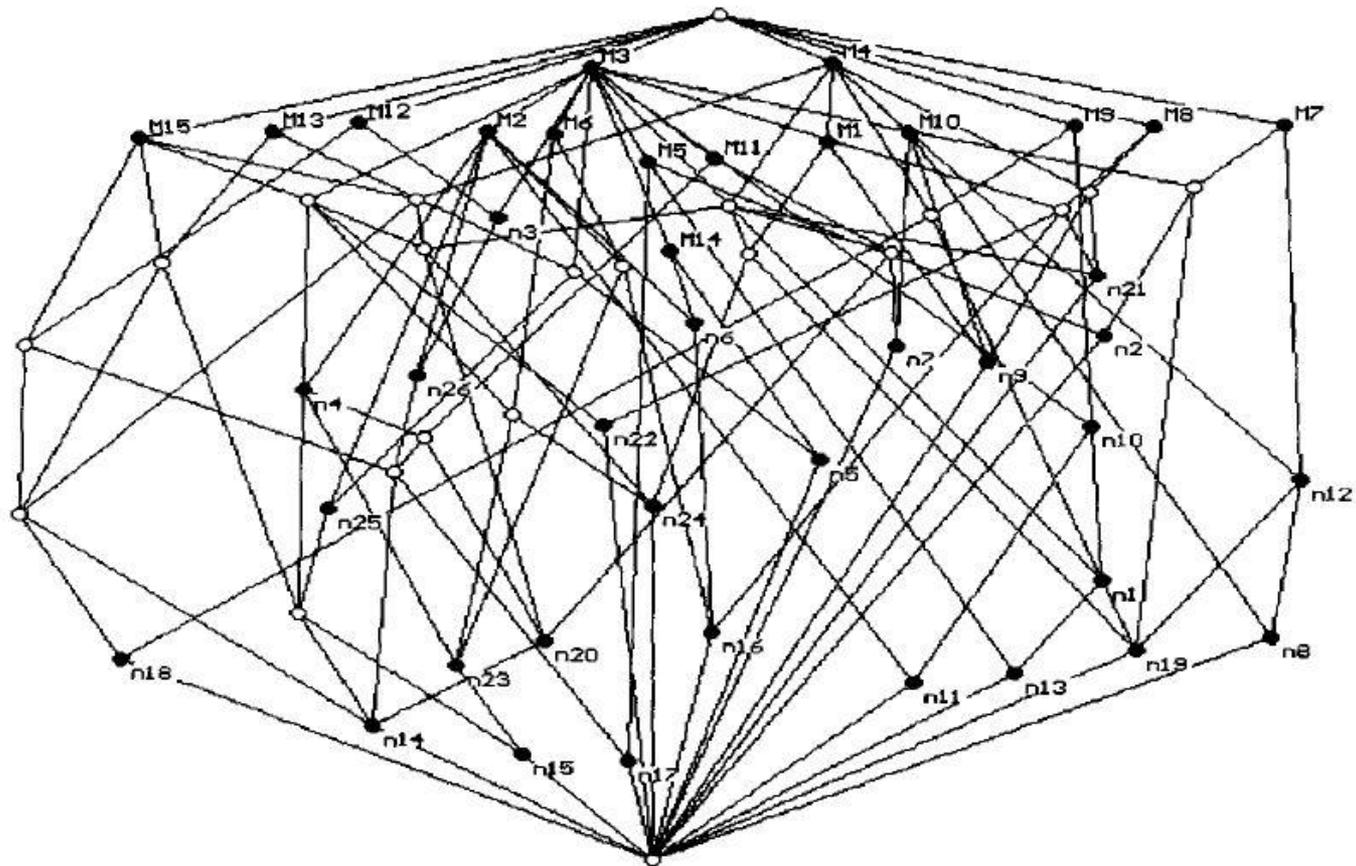


Fig. 4. Galois lattice for CEOs and clubs.

Correspondence Analysis

- Determines mathematical correlation between two modes, then assigns scores to each actor/event.
 - Actor's score is based on the score of events they attend.
 - Scores are used to graph nodes objectively

Network analysis of 2-mode data

Stephen Borgatti and Martin Everett

- Traditional social science analysis studies attributes of individuals, which can be mapped to 2-mode matrices
- Social network analysis looks at dyadic attributes, using 1-mode matrices
- Affiliation networks allow network analysis of non-network data

Studying Non-Network Data

- Example: opinion poll data could be studied as network data.
 - Treat answers as events, and study the relationship between intersecting opinions.

One-mode vs two-mode methods

- If data is intended to study connections within one mode, traditional network techniques may be appropriate.
- To analyze both modes, new methods are required.

Correspondence Analysis Example

- Women are near each other if they attended the same events
- Events are near each other if they were attended by the same women
- Women are near events if they attended those events

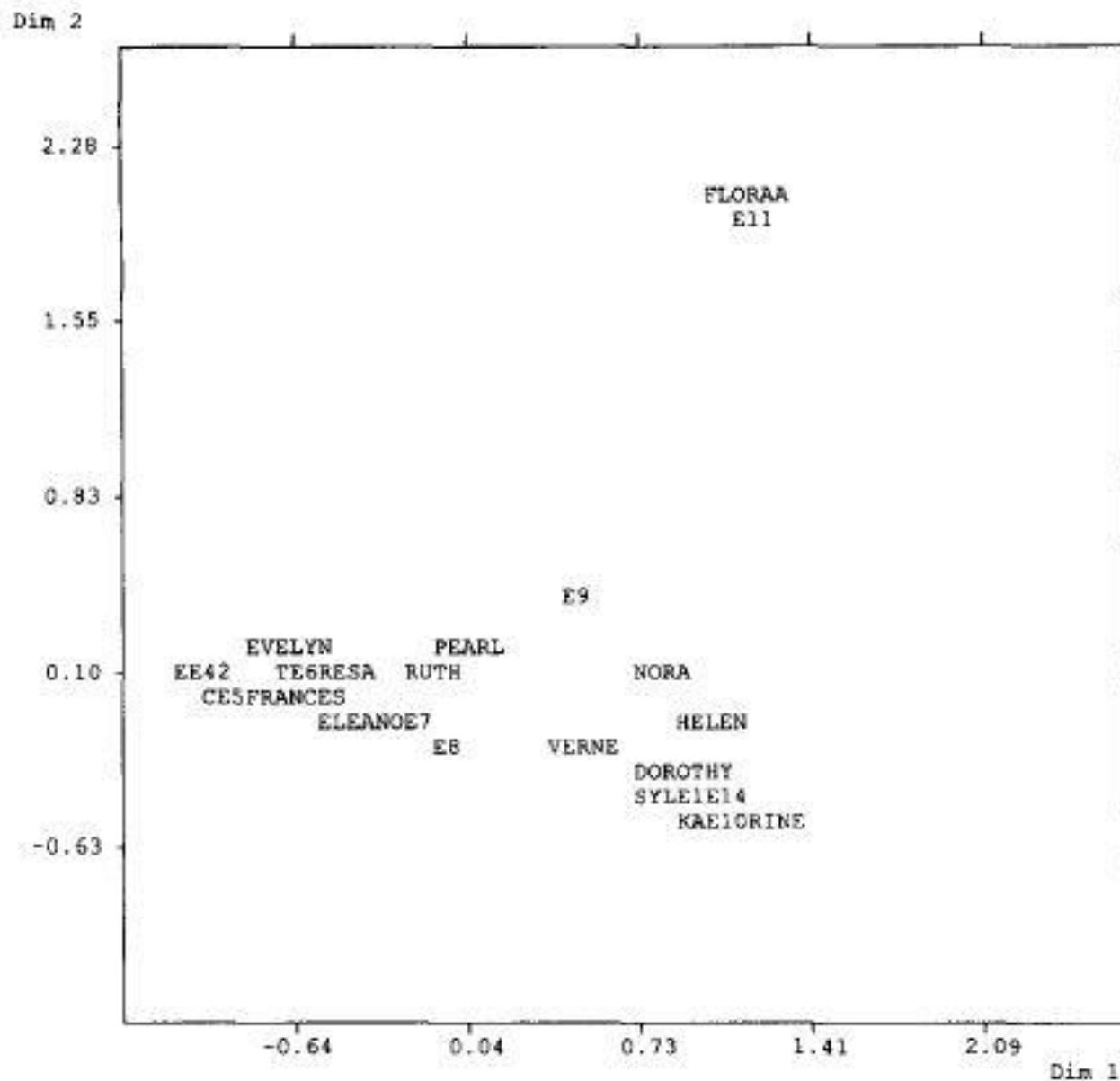


fig. 2. Correspondence analysis of the Davis data. Note: some points are obscured by others.

Network Properties

- As mentioned in Wasserman & Faust, one can still determine density, although the denominator will change
- Also degree, closeness, betweenness, or eigenvector centrality.
- Also centralization – the degree to which a network has a central actor

Cohesive Subgroups

- N-bicliques, n-biclubs, n-biclans
 - Mathematical definitions are altered, because distance between any two actors will be at least 2, rather than 1.

The Duality of Persons and Groups

Ronald Breiger

Sociology Theory

- Breiger starts with theory that individuality is determined by intersection of affiliations.
 - Based on this concept, one can use shared affiliations/membership as an indicator of connections between actors and between events.

Social relationships vs membership

- Memberships connect individuals to collectivities, social relations connect individuals.
 - But Breiger argues that co-membership can also be a connection between individuals, albeit a different kind of connection.

Centrality in Affiliation Networks

Katherine Faust

Introduction

- Centrality has frequently been used to study affiliation networks, but such analyses often ignore key properties such as the presence of two modes, the duality of actors and events, and the non-dyadic affiliation relation.
- Duality: events influence actors, actors influence events
- An affiliation network is non-dyadic because the affiliation relation relates each actor to a subset of events, and relates each event to a subset of actors.

Four Key Ideas

- Centralities exist for both actors and events
 - Should be a clear relationship between them
- Centralities also exist for subsets of actors and/or subsets of events,
 - The centrality of an actor is a function of the events to which it belongs, and the centrality of an event is a function of the centrality of its members
- The importance of linkages created by actors and events,
 - Creates a type of betweenness centrality, as an actor is central if it creates ties between events and an event is central if it creates ties between actors.
- The importance of subset-superset relationships in actors' affiliations and events' memberships,

Degree Centrality

- For actors: determined by their number of events, where actors with a high number of events considered central
- For events: determined by their number of members, with a large number of members marking the event as central

Eigenvector Centrality

- Considers centrality of adjacent nodes
- Actor's centrality is determined by the centralities of the events they belong to, and an event's centrality is a function of the centralities of its members

Other Measures of Centrality

- Closeness centrality
 - For actors, it is a function of the minimum distance to its events, and for events it's a function of minimum distances to its actors.
- Betweenness centrality
 - an event gains betweenness centrality if pairs of its members only belong to that event, and if its members belong to no other events.
- Flow Betweenness Centrality

Galois Lattice

- Lattices showing unions and intersections
- Either for events' members (with respect to subset of actors)or actors' affiliations (with respect to subset of events
- Height of an event or actor in the lattice is related to its relative centrality
 - Actors that are relatively low more central
- Ascending line connects each actor to subset of events, descending line connects event to affiliated actors

Graph Covers

- If an actor is located in such a way that it can see important features of other actors' membership patterns, may be well located to initiate or coordinate actions
- Importance of actor relates to their “view” and access to information

Introductory Overview

Edward Laumann & David Knoke

Introduction

- Uses two mode networks to analyze state/elite decision making
- Relationship between policy actors and decision making events
- State is main unit of analysis

Key Concepts

- National Policy Domain: Set of actors with major concerns about a substantive area, whose preferences and actions need to be taken into account by other participants
 - Includes all consequential organizations with influence over decisions and resources
- Mutual Relevance: actors with trivial capacities are ignored

Key Concepts cont

- Three generic relationships are significant in identifying social structures:
 - Information Transmission
 - Resource Transactions
 - Boundary Penetration
 - Relationships that serve both instrumental and solidarity maintenance functions.
- Event: concrete proposal for authoritative action is placed before a decision making body

Types of Analysis

- Individual Actors-Individual Events
 - Conventional Voting Studies
- Individual Actors-Relational or Systemic Events
 - Monopoly Agenda Settings
- Relational or Systemic Actors-Individual Events
 - Diffusion of Innovation Among Doctors
- Relational/Systemic Actors- Relational/Systemic Events
 - Processes Matching Job Seekers and Positions

Application to Policy

- Framework seeks to connect consequential organizational actors with a set of temporally arrayed policy events
- How actors perceive and respond to structure impacts policy outcomes
 - Structure created by temporal sequence of events

Policy Implications

- Influence of Institutional Structure
 - Links certain events
 - Impact of decision making venue (federal vs. state)
- Influence of Time Order
 - Links Events
 - Historical Context

The Structure of Class Cohesion: The Corporate Network and Its Dual

James Bearden & Beth Mintz

Study Overview

- Purpose: Assess the relationship between class and corporations
- Two analyses
 - One with corporation as unit of analysis
 - What types of individuals important in uniting business world
 - One with network of directors as unit of analysis
 - Role of individuals in creating system unity

Analysis

- Interlockers: directors who sat on more than one board
 - Identified which types of interlocks were overrepresented
- Second analysis focused on structure of person-by-person network
- Points first defined as corporations and relations defined as interlocking directorates
 - Dual (person-by-person graph): individuals as points related by common membership on a corporate board

Results-Corporate Network

- 90% of companies directly tied to at least one other firm
 - 84% share just one director, 64% of interlocked directors only sit on two boards
- Corporations strongly linked through outsiders
 - Individuals affiliated with large, but not the largest corporations
 - Retired executives
- More likely to belong to social clubs, sit on the boards of major commercial banks.

Results-Relations Among Directors

- National grouping, semi-national grouping, and many geographical subsets
- Regional directors maintain strong ties within their region
- Members of the national component unite the regions
- National ruling class vs. important local elites

Component vs. Non-Component

- Elite status and component membership negatively related
- Underrepresentation of policy group members with three or more positions
- Component membership may be alternative means of cohesion forming
- Believe that ties created by shared boardships produce a network of relationships among directors which helps bridge the differences between class and institutional differences