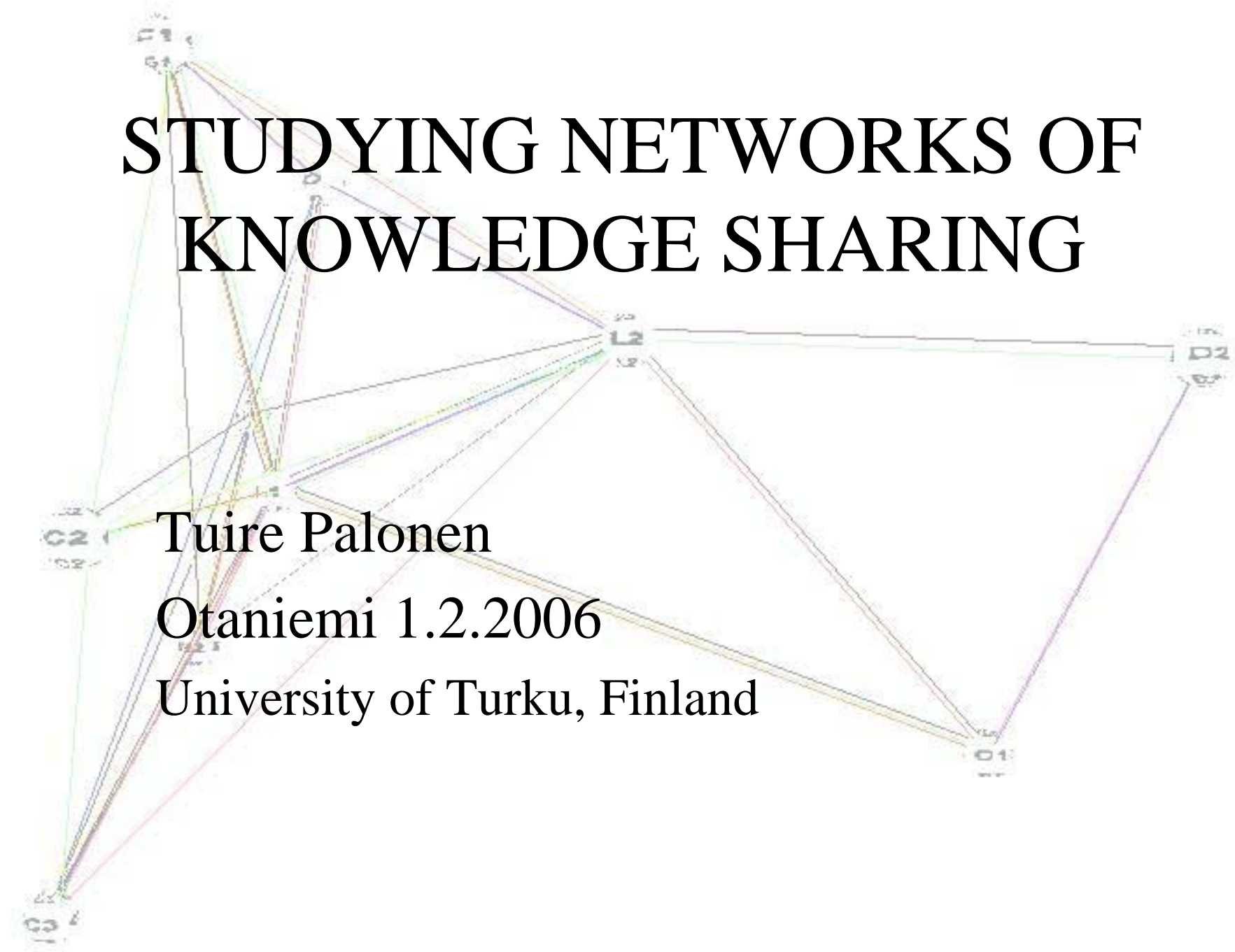


STUDYING NETWORKS OF KNOWLEDGE SHARING

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Social network analysis

A complex network graph with multiple nodes and edges, representing social interactions. The nodes are small circles, some labeled with letters like 'C1', 'C2', 'D1', 'D2'. The edges are lines of various colors (red, green, blue, purple) connecting the nodes. The graph is dense, with many connections between nodes.

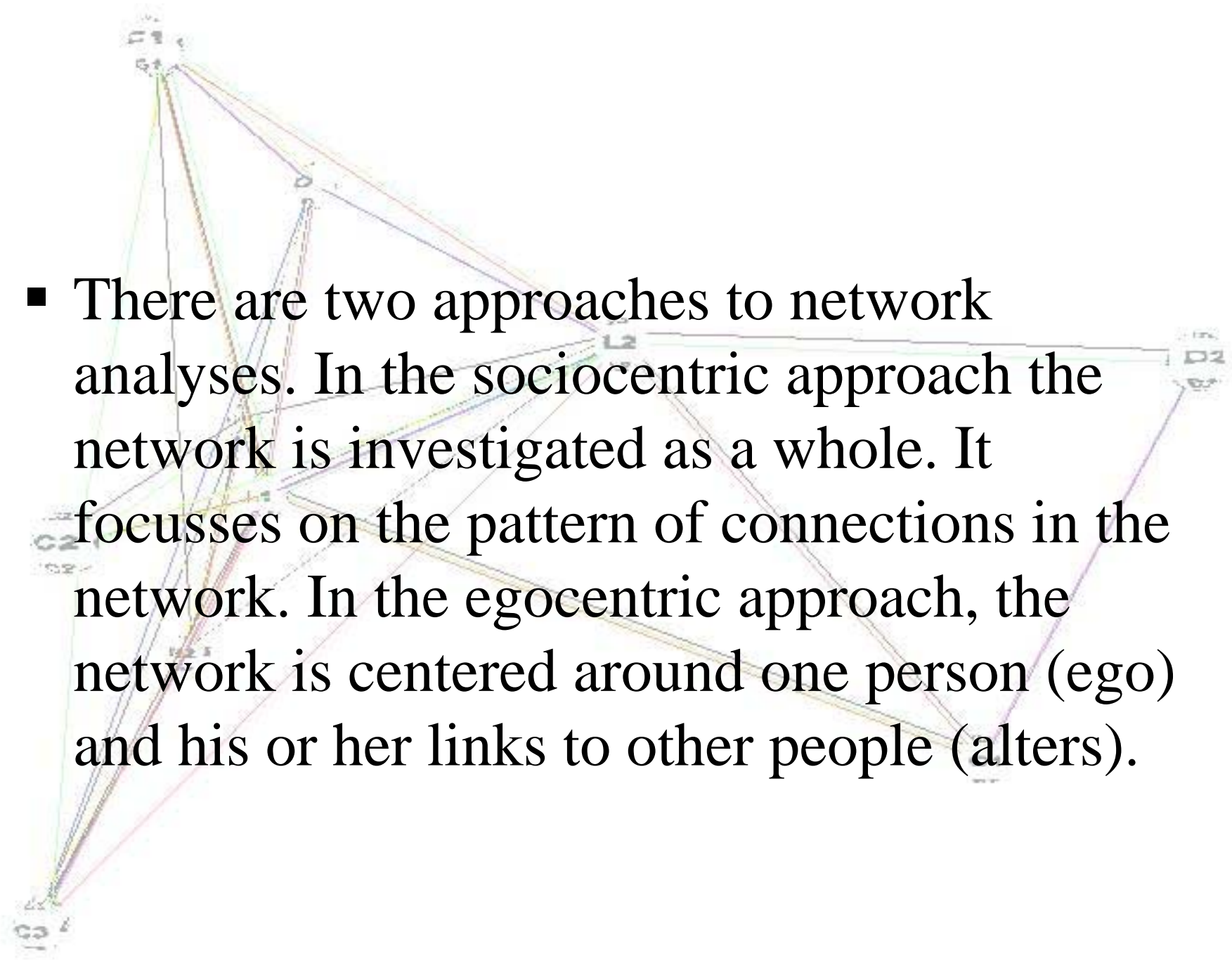
- A structural approach to understanding social interaction.
- Networks consist of **Actors** and the **Ties** between them.
- Social networks can be presented as **graphs** whose **vertices** are the **actors** and whose **edges** are the **ties**.
- Edges are usually weighted to show the strength of the tie.
- Usually an actor is an individual person.
- A tie might be “asks advice”. Or it might represent the amount of email exchanged between persons A and B.



A social network

(Marsden & Cambel, 1984)

- ”A social network is a set of actors and the relations that hold them together. Actors can be individual people, or they can be aggregate units such as departments, organizations, or families. The key is that the actors exchange resources which then connect them in a social network.”

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- There are two approaches to network analyses. In the sociocentric approach the network is investigated as a whole. It focusses on the pattern of connections in the network. In the egocentric approach, the network is centered around one person (ego) and his or her links to other people (alters).

History

- “Sociograms” were invented in 1933 by Moreno.
- In a sociogram, the actors are represented as points in a two-dimensional space. The **location** of each actor is significant. E.g. a “central actor” is plotted in the center, and others are placed in concentric rings according to “distance” from this actor.
- Actors are joined with lines representing ties, as in a social network.
- Methods like MDS (Multi-Dimensional Scaling) can be used to lay out actors, given a vector of attributes about them.

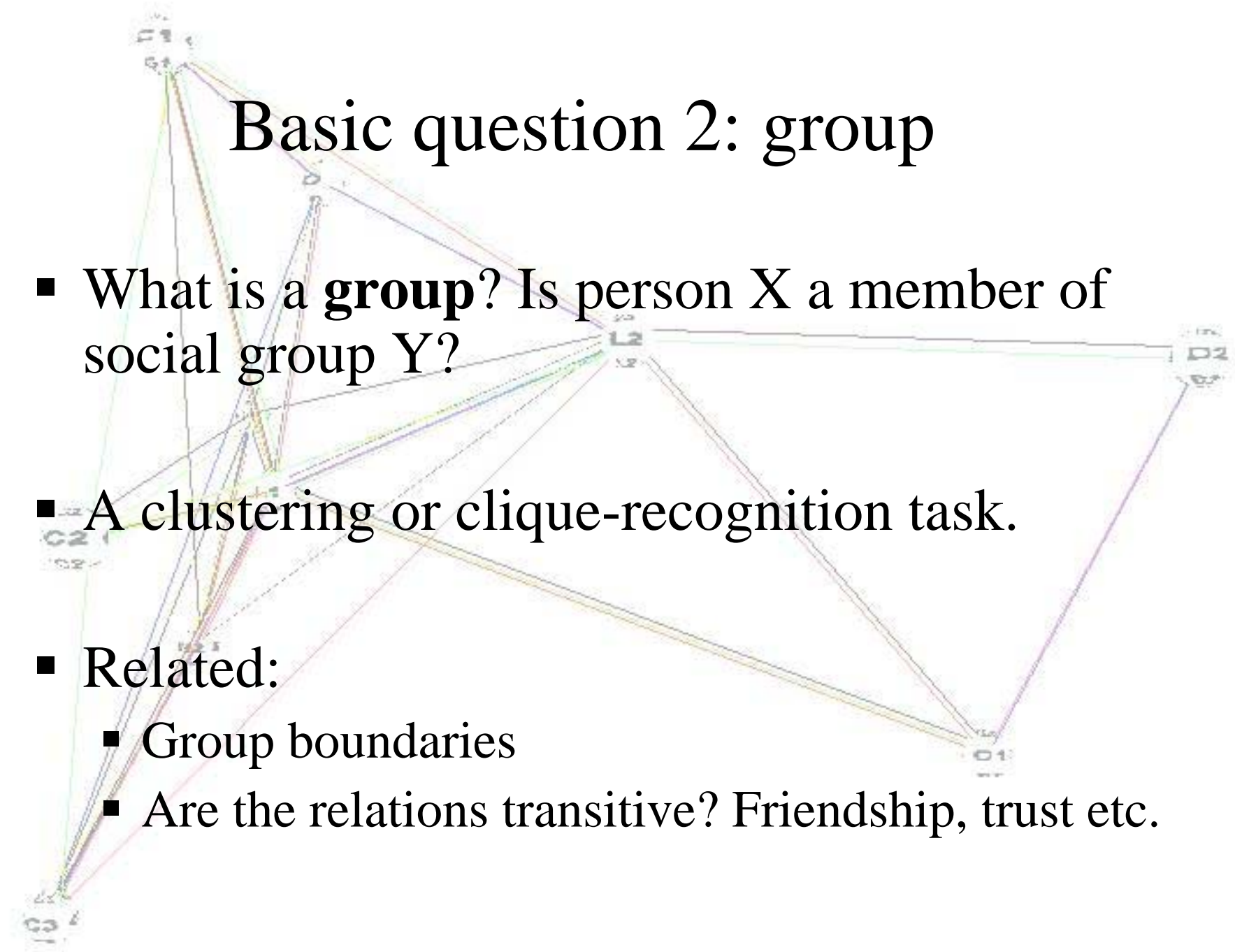


Basic question I: cohesion

- **Prestige and popularity:** How important is the actor in the network?
- Related notions are **status** and **centrality**.
- Centrality reifies e.g. the notion of “peripheral vs. central participation”.
- Key notions of centrality were developed in the 1970’s, e.g. Freeman’s degree and betweenness values and “eigenvalue centrality” by Bonacich.

Basic question 2: group

- What is a **group**? Is person X a member of social group Y?
- A clustering or clique-recognition task.
- Related:
 - Group boundaries
 - Are the relations transitive? Friendship, trust etc.



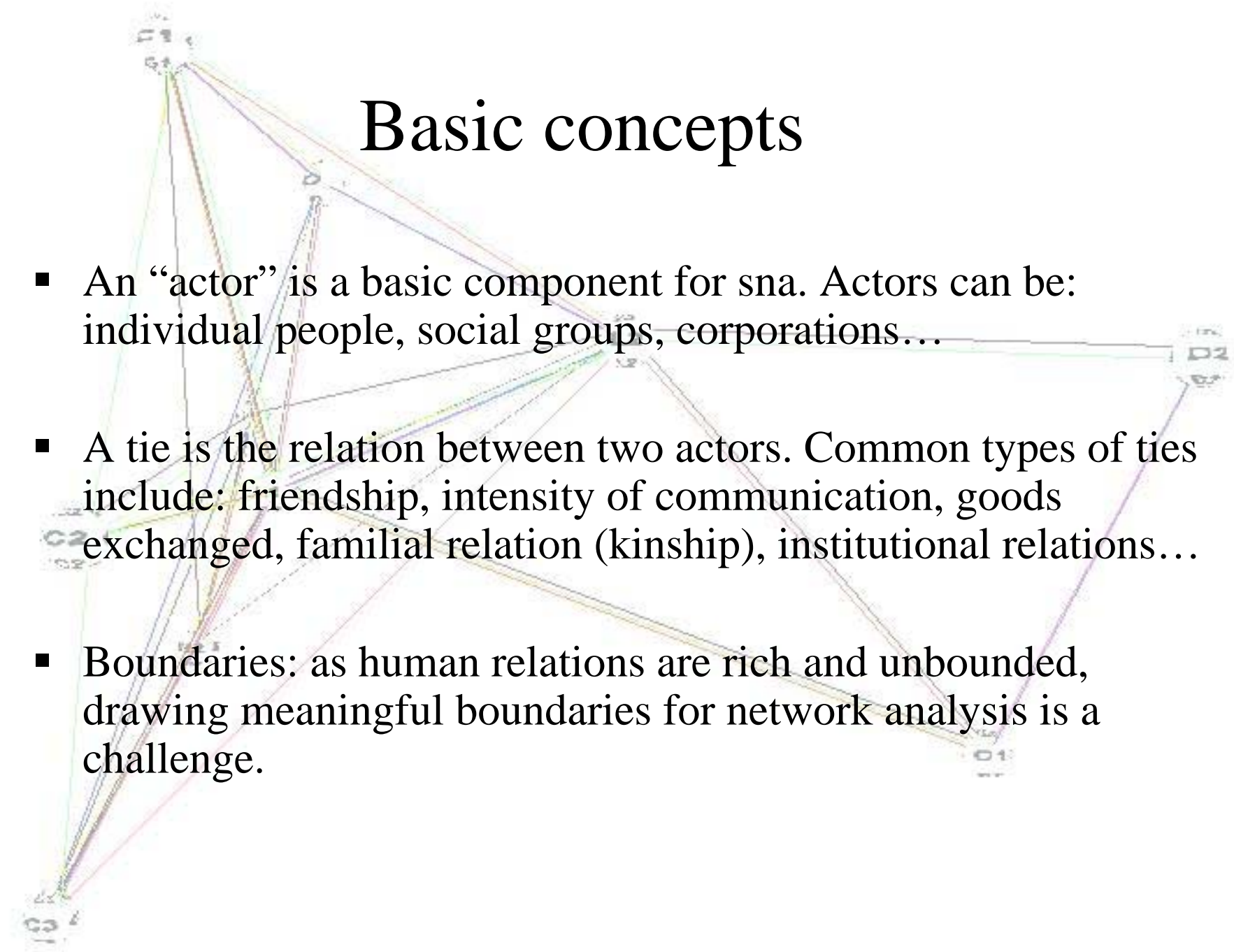


Basic question 3: Role

- **Role:** what role does the actor perform in the network?
- Role is defined in terms of actors' neighborhoods.
- The neighborhood is the set of ties and actors connected directly to the current actor.
- Actors with similar or identical neighborhoods are assigned the same role.
- **Paradigm:** interchangeability. Actors with the same role are interchangeable in the network. They have the same third parties.

Basic concepts

- An “actor” is a basic component for sna. Actors can be: individual people, social groups, corporations...
- A tie is the relation between two actors. Common types of ties include: friendship, intensity of communication, goods exchanged, familial relation (kinship), institutional relations...
- Boundaries: as human relations are rich and unbounded, drawing meaningful boundaries for network analysis is a challenge.



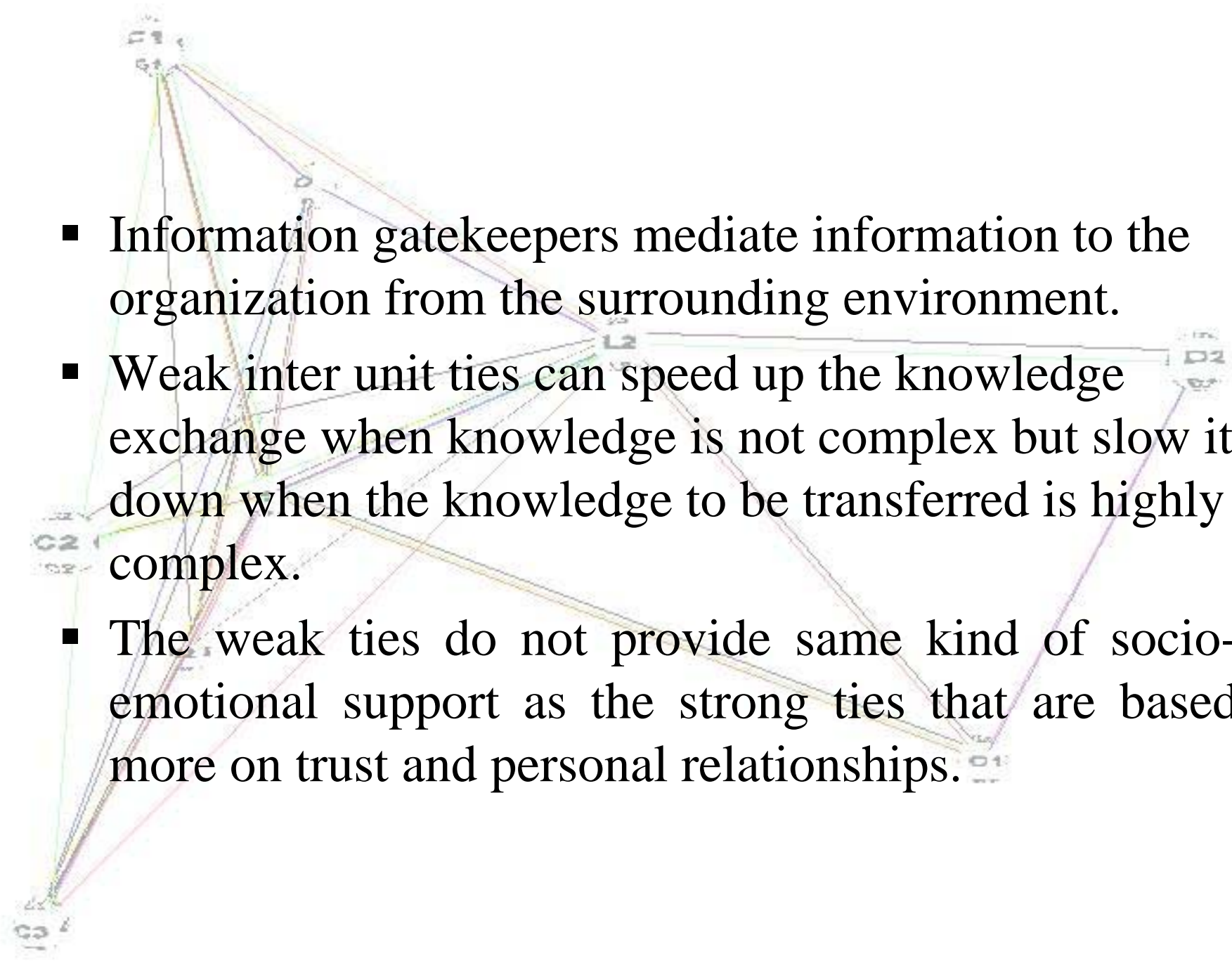


Sna and knowledge sharing

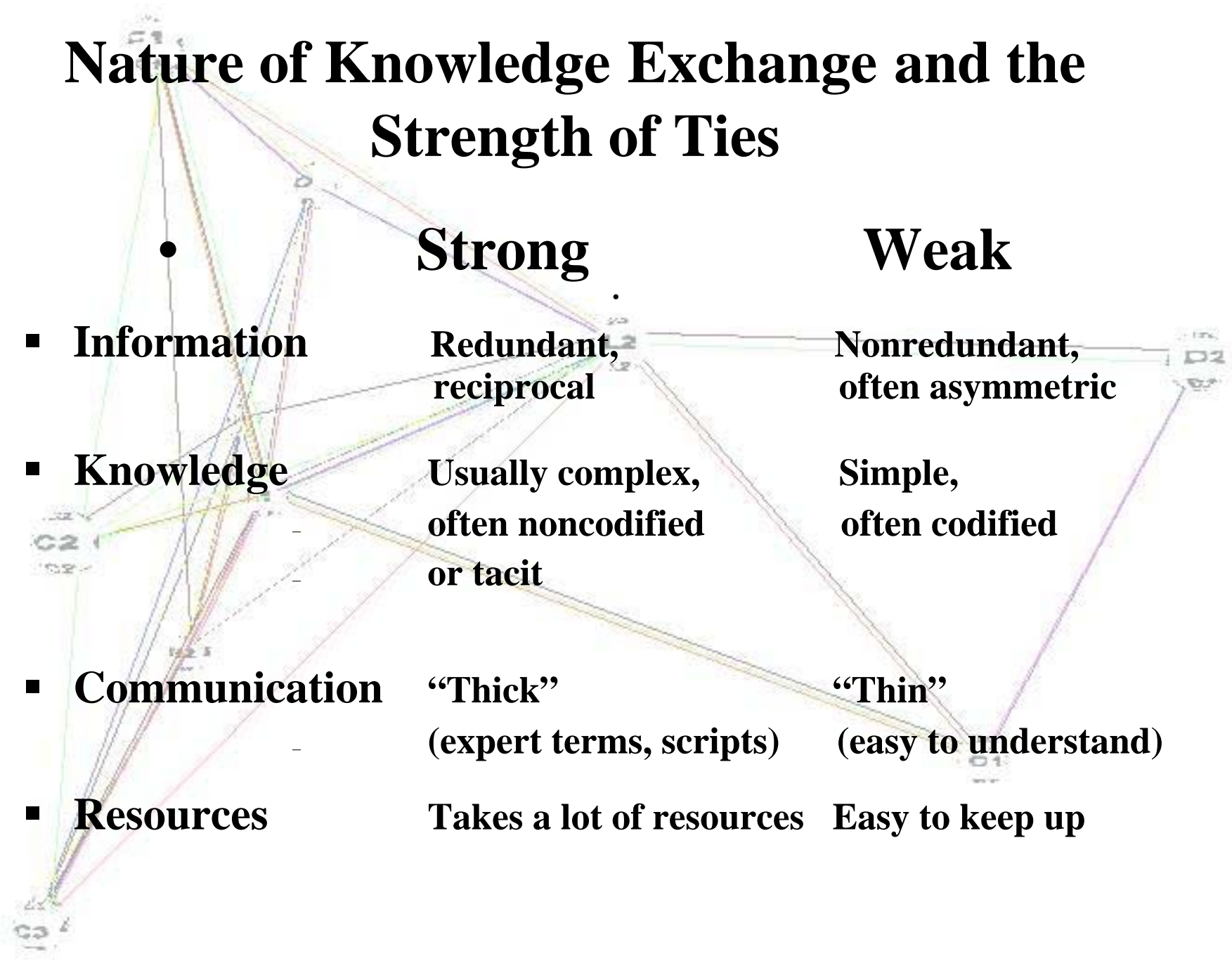
- Uncovering the patterns of networking activity by applying methods of social network analysis
- Statistical tools for examining relational data rather than examining attributes of individual actors.
- Describing patterns of relationships among actors, and analyzing the structure of these patterns.
- Organizational (community) level, dyad level (tie properties) and individual attributes can be combined.

Dyad properties, e.g. tie strength and reciprocity

- Strong ties tend to mediate redundant information among small groups of actors in which everyone knows what the others know (sharing of in-depth expertise)
- New information is often received through weak links.
- Strong links are needed because the recipient may need multiple opportunities to assimilate complex information.
- The strong ties that start as nonredundant contacts are likely to become redundant over time.
- Information gatekeepers mediate information between communities

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- Information gatekeepers mediate information to the organization from the surrounding environment.
 - Weak inter unit ties can speed up the knowledge exchange when knowledge is not complex but slow it down when the knowledge to be transferred is highly complex.
 - The weak ties do not provide same kind of socio-emotional support as the strong ties that are based more on trust and personal relationships.

Nature of Knowledge Exchange and the Strength of Ties



	Strong	Weak
•		
▪ Information	Redundant, reciprocal	Nonredundant, often asymmetric
▪ Knowledge	Usually complex, often noncodified or tacit	Simple, often codified
▪ Communication	“Thick” (expert terms, scripts)	“Thin” (easy to understand)
▪ Resources	Takes a lot of resources	Easy to keep up

Examples of the analysis and levels of analysis

- Organizational level: e.g. studying different types of network dimensions (advice, new information, collaboration, informal interaction) among network members;
- Team/community level: analyzing the intensity of interaction among participants within and between teams (cohesion, patterns of interaction as regarding density and centrality).
- Individual level: The extent of each member's participation (centrality: popularity versus activity)
- Tie level: e.g. exploring the role of **strong** and **weak links** among the network actors.



Egocentric networks, personal networks and “intentional networks”

- The concept of intentional (Nardi, Whittaker & Schwarz, 2000, 2002) or egocentric (Mc Carty, 2002) network is used when describing the creation, maintenance, cultivation and activation of personal social networks, which are seen as an important resource in the information age.
- Intentional networks are “egocentric “ networks that arise from individuals and their communication and workplace activity.
- Two approaches to egocentric networks: attribute-based analyses and structural analyses



Attribute based analyses:

- data can be gathered e.g. in interviews; free-listing network members. People tend to classify network members into groups.
- In attribute-based analyses the data are often summaries of attributes of network members that are then compared to the same or other attributes of respondents.
- Other typical question asked concerns the type or content of the relation with each network member.



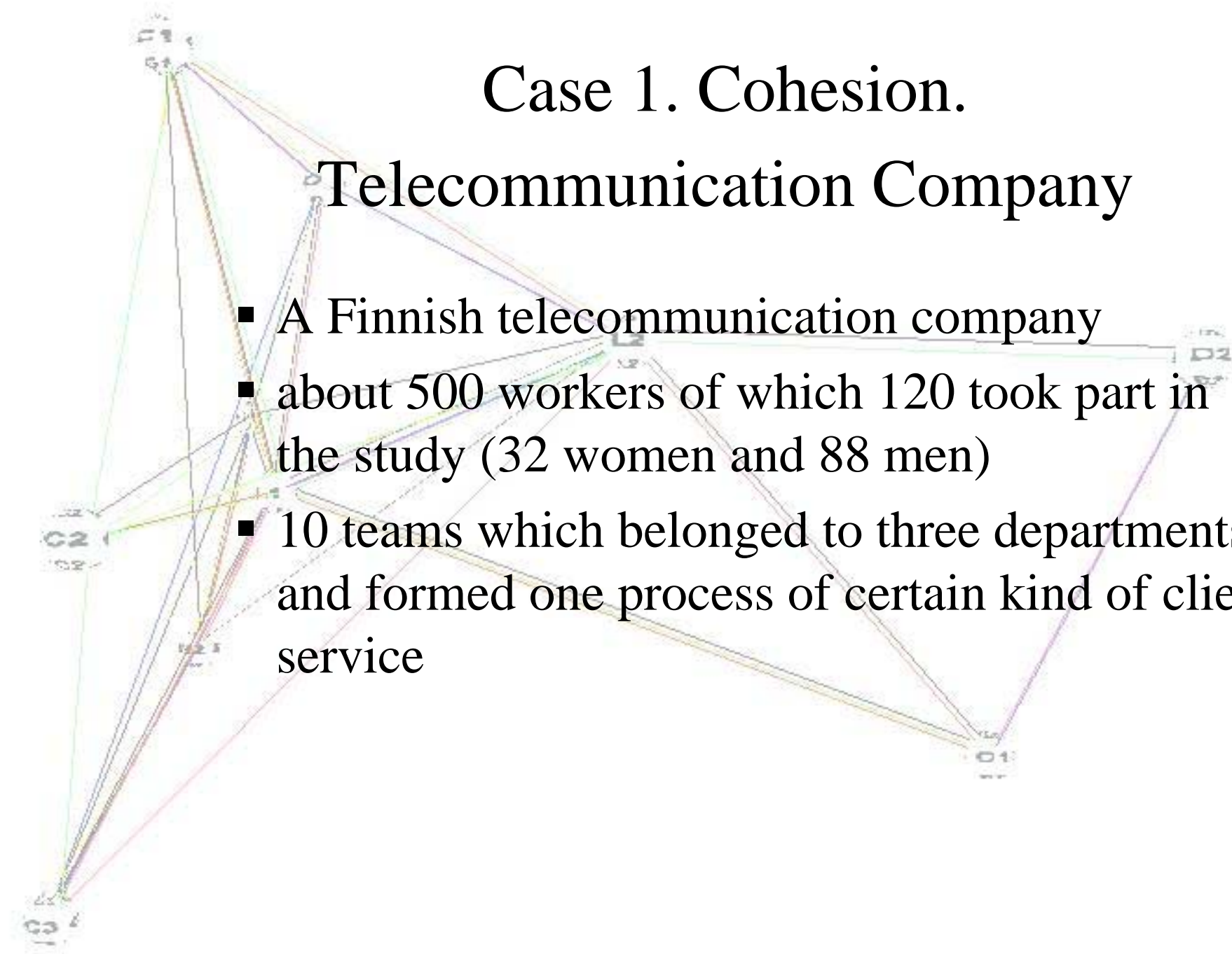
Structural analyses

- Can be gathered e.g. as lists of the names in which respondents mark with whom they are having a relationship (such as advice seeking, collaboration, social support).
- Gathering whole network data is a time-consuming task if the network is large!
- Usually, ego is removed from the matrix. This makes the figures more clear and otherways structural measures such as centrality or density, will demonstrate very high cohesiveness because ego, by definition, connects everybody

Case 1. Cohesion.

Telecommunication Company

- A Finnish telecommunication company
- about 500 workers of which 120 took part in the study (32 women and 88 men)
- 10 teams which belonged to three departments and formed one process of certain kind of client service

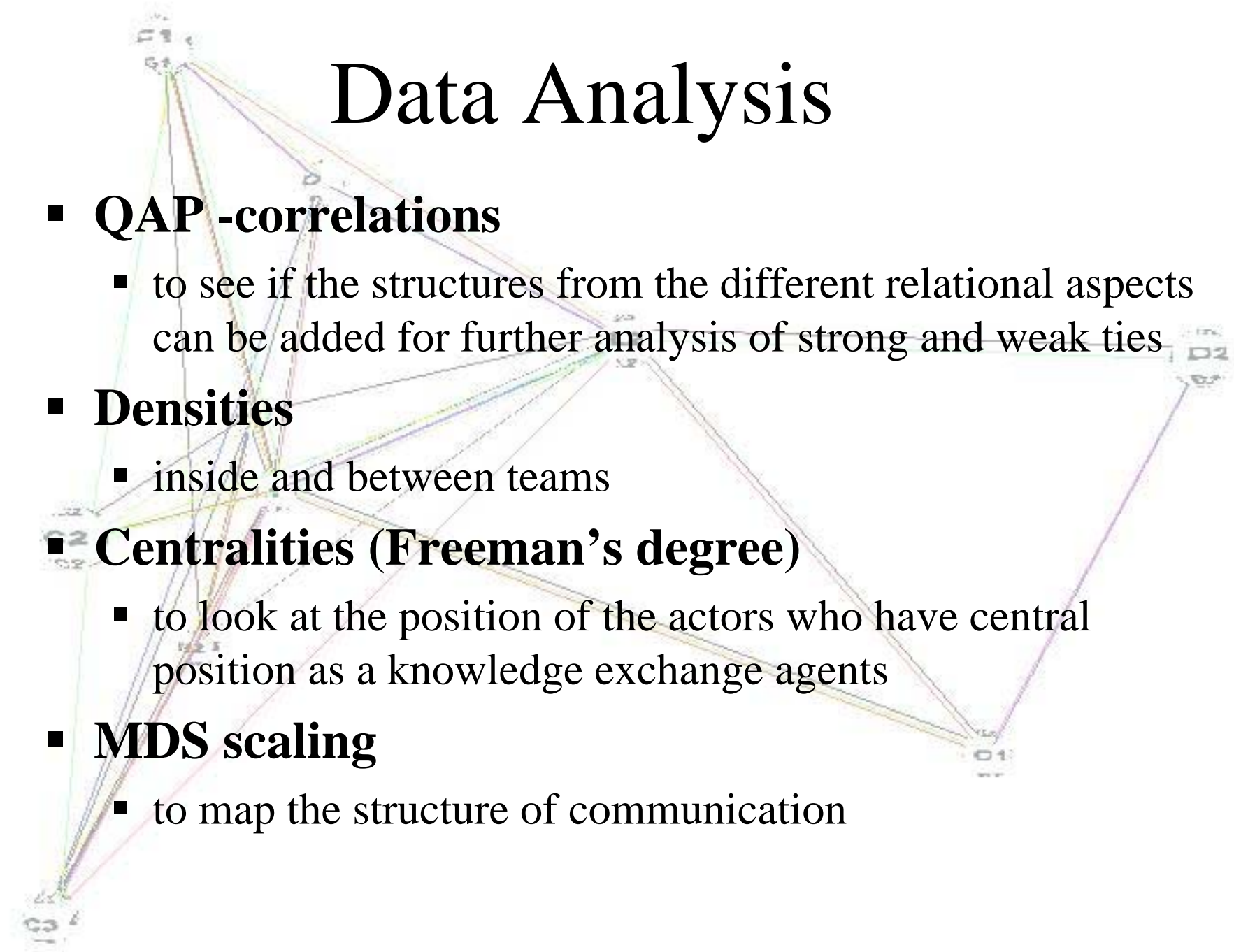


Method of Data Collection

- A questionnaire was constructed for analyzing practices of interaction and knowledge exchange within the organization.
- Interviews (10 team leaders and 10 central workers frequently providing advice to other workers)
- The questionnaire addressed:
 - to whom the workers go for advice?
 - to whom they go for new information?
 - with whom they collaborate?
 - with whom they have informal discussions?

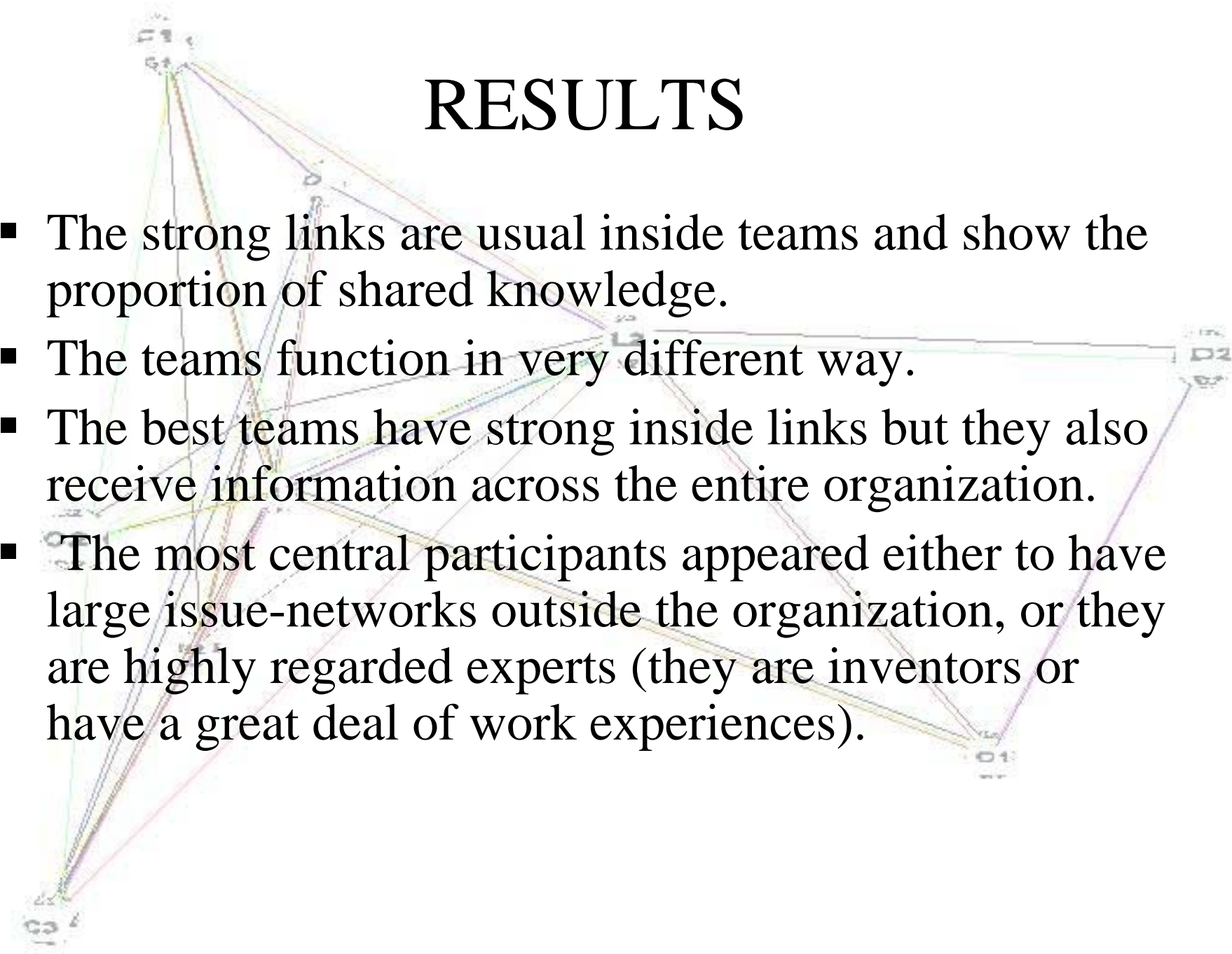
Data Analysis

- **QAP -correlations**
 - to see if the structures from the different relational aspects can be added for further analysis of strong and weak ties
- **Densities**
 - inside and between teams
- **Centralities (Freeman's degree)**
 - to look at the position of the actors who have central position as a knowledge exchange agents
- **MDS scaling**
 - to map the structure of communication



RESULTS

- The strong links are usual inside teams and show the proportion of shared knowledge.
- The teams function in very different way.
- The best teams have strong inside links but they also receive information across the entire organization.
- The most central participants appeared either to have large issue-networks outside the organization, or they are highly regarded experts (they are inventors or have a great deal of work experiences).



ALL LINKS, Densities between and inside teams

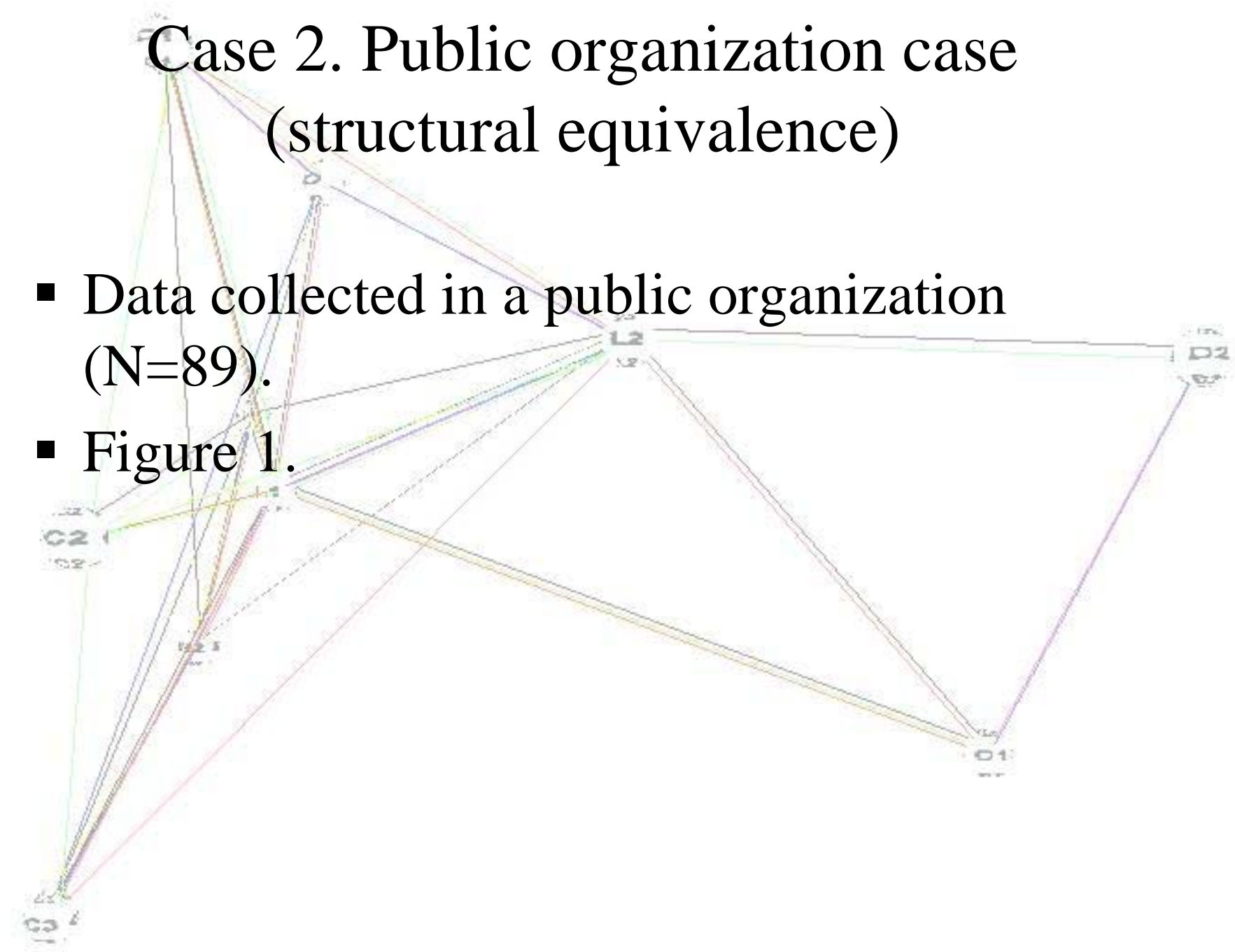
	1	2	3	4	5	6	7	8	9	10
Team1	.90	.18	.13	.28	.21	.33	.05	.03	.03	.53
Team2	.19	.89	.30	.48	.39	.46	.06	.17	.03	.56
Team3	.10	.32	.96	.38	.20	.18	.04	.32	.44	.21
Team4	.12	.57	.42	.80	.14	.33	.03	.36	.50	.33
Team5	.27	.40	.21	.26	.88	.29	.90	.31	.24	.08
Team6	.41	.52	.34	.61	.37	.97	.17	.59	.35	.23
Team7	.13	.08	.06	.05	.79	.07	.83	.30	.06	.13
Team8	.02	.08	.14	.22	.21	.50	.14	1.00	.21	.00
Team9	.11	.09	.38	.48	.27	.22	.05	.38	1.00	.08
Team10	.41	.45	.19	.50	.16	.19	.06	.04	.17	.94

STRONG LINKS, Densities between and inside teams

	1	2	3	4	5	6	7	8	9	10
Team1	.64	.04	.02	.05	.03	.11	.00	.00	.02	.19
Team2	.03	.58	.08	.22	.18	.15	.01	.01	.01	.19
Team3	.03	.14	.67	.17	.04	.06	.00	.08	.10	.19
Team4	.03	.14	.67	.17	.04	.06	.00	.08	.10	.06
Team5	.06	.05	.01	.07	.52	.03	.19	.02	.04	.02
Team6	.24	.29	.15	.44	.13	.86	.03	.35	.17	.10
Team7	.01	.00	.00	.00	.40	.00	.45	.08	.00	.02
Team8	.00	.00	.00	.00	.00	.07	.00	.67	.00	.00
Team9	.02	.02	.08	.12	.02	.03	.00	.02	.79	.00
Team10	.06	.05	.02	.06	.00	.00	.00	.00	.03	.69

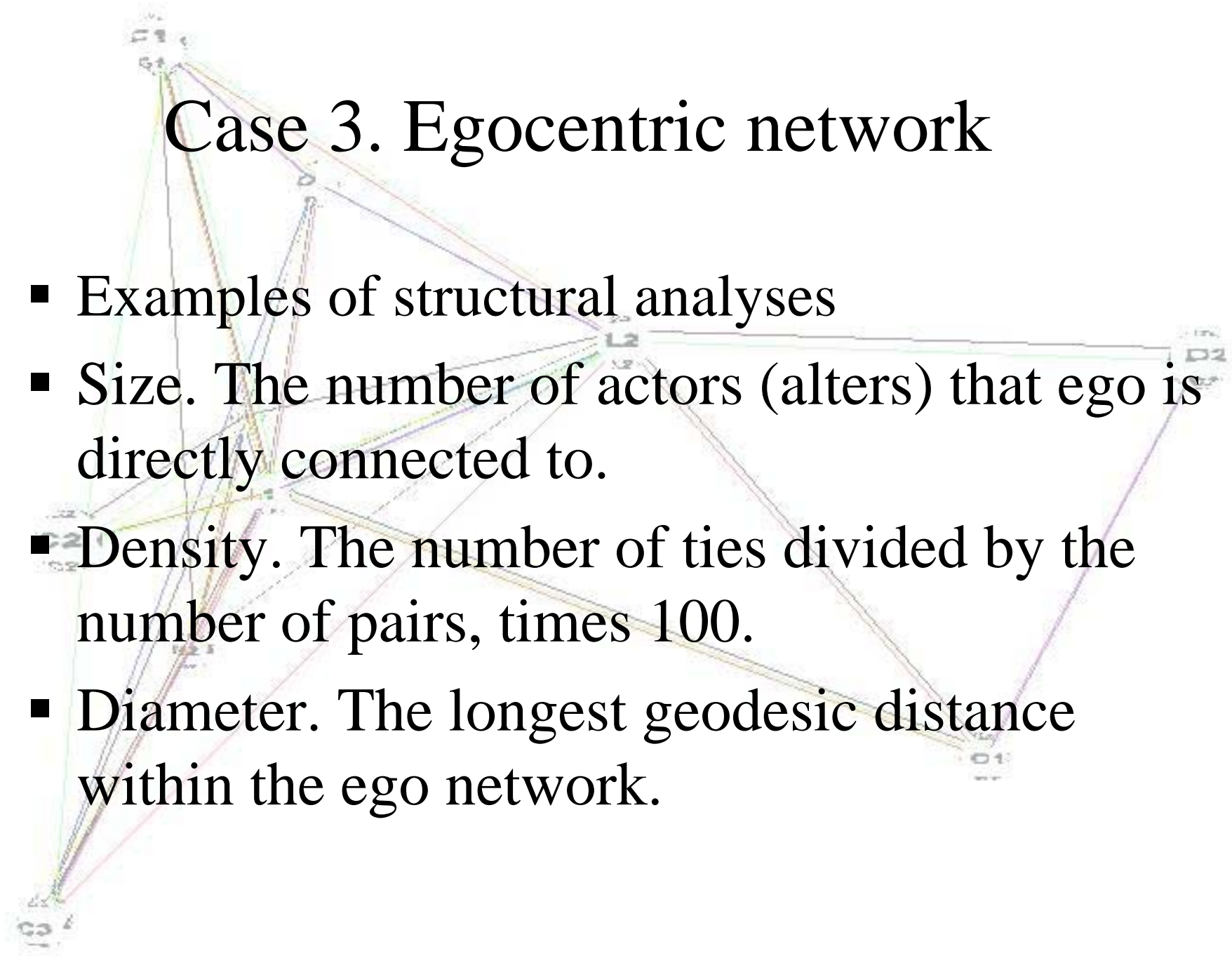
Case 2. Public organization case (structural equivalence)

- Data collected in a public organization (N=89).
- Figure 1.



Case 3. Egocentric network

- Examples of structural analyses
- Size. The number of actors (alters) that ego is directly connected to.
- Density. The number of ties divided by the number of pairs, times 100.
- Diameter. The longest geodesic distance within the ego network.

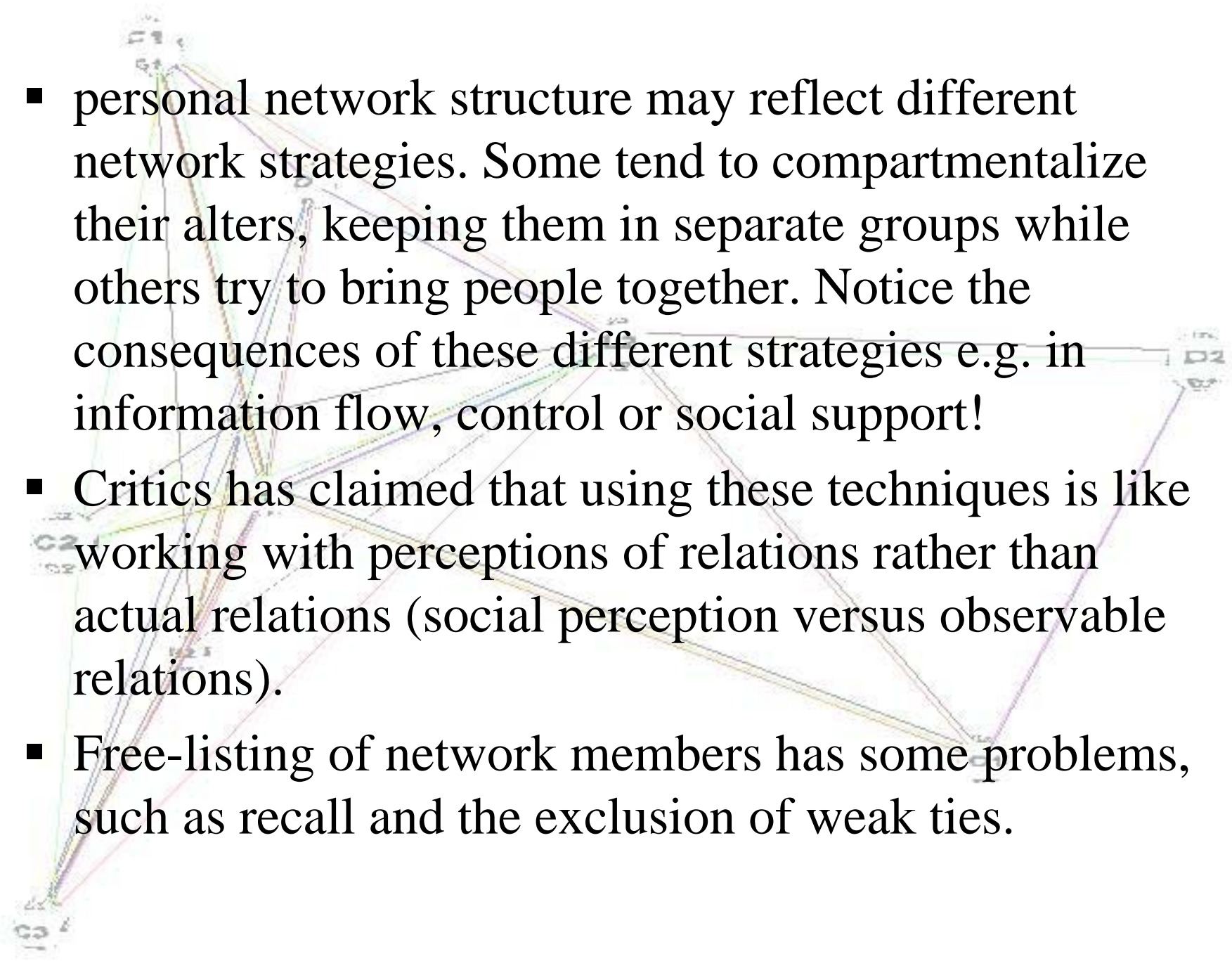


Whole network (N=89)			Egocentric network					
Code	Advice in	Advice out	Bet w.	Size	Ties	Pairs	Dens	Diam.
3	42	16	188	53	746	2756	27,1	53
10	38	10	88	39	527	1482	35,4	3
14	36	6	155	37	428	1332	32,1	37
17	41	4	28	42	501	1722	29,1	42
34	46	28	450	48	666	2256	29,5	5
42	35	41	483	53	814	2756	30,0	53
68	37	13	143	41	454	1640	27,7	4



Some Methodological Implication

- The methods of social network analysis appear to supply useful tools for assessing networking relations between the participants.
- Sna provides a new kind of relational information of participation; i.e., patterned sets of connections that linked the persons to each other.
- Studying the relations among participants appears to help better understanding and explaining collaborative processes that affect the individual participants.

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- personal network structure may reflect different network strategies. Some tend to compartmentalize their alters, keeping them in separate groups while others try to bring people together. Notice the consequences of these different strategies e.g. in information flow, control or social support!
 - Critics has claimed that using these techniques is like working with perceptions of relations rather than actual relations (social perception versus observable relations).
 - Free-listing of network members has some problems, such as recall and the exclusion of weak ties.

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