

Changes in Network- Geography: From the Village Community to the Global Village

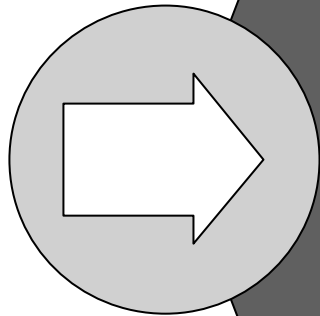


Dissertantenseminar

SECOND DRAFT

Erfurt, October 8 to 11, 2002

Summary



- Interhuman networks follow ubiquitous mathematic and biologic rules
- Network geography has an impact on the value of networks in terms of efficiency (input) and effectiveness (output)
- Social networks were and still are limited by social and technical constraints
- Overcoming these constraints will finally turn the world into a "small world" and help us to leverage the combined creativity and intellectual power of mankind to respond to today's challenges

Agenda

- **Definitions of networks**

- Key characteristics of valuable networks
 - Network evolution in spite of technical, biological and social limitations of social networks
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A network is...

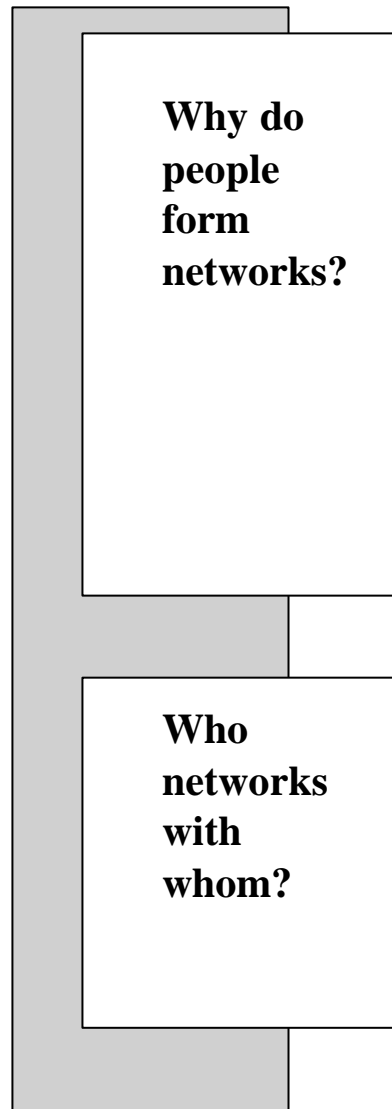
 Focus of this presentation

...everyone the player now knows, everyone the player has ever known, and all the people who know the player even though he or she doesn't know them (Burt; 1992))

...a specific set of linkages among a defined set of persons, with the additional property that the characteristic of these linkages as a whole may be used to interpret the social behavior of the persons involved (Mitchell; 1969)

...a fundamental part of human culture. Distance is a crucial barrier for communication, social traffic and every kind of exchange. A considerable amount of effort of a society's labor is put into overcoming these barriers (Ardelt; 1995)

Networks follow basic rules*



- Assumption: Individuals strive for entrepreneurship for various utilitarian and non-utilitarian reasons
- Networks can help to multiply a person's presence in two ways
 - By serving as a screening device for information and opportunities
 - By directing, concentrating, and legitimating information about a person to others
- Empirical studies show, that larger networks lead to individual benefits like
 - Higher-paying positions
 - Higher life expectancy
- People find similar people attractive and hence develop networks with people like themselves (homophily)
 - Demographics (e.g., age, wealth, education, place of living)
 - Interests (e.g., sports, culture)
- People who develop mutual trust (i.e. interpersonal debt; quid pro quo)

* The concepts laid out here and thereafter are based on professional contacts, personal networks based on friendship or love naturally follow different, less utilitarian rules

Source: Burt (1992), Cohen (2001)

Agenda

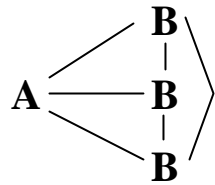
- Definitions of networks

- **Key characteristics of valuable networks**

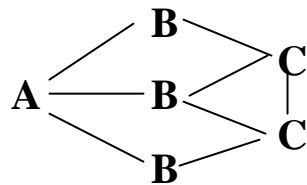
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Evolving human network should be striving for maximum number of non redundant contacts

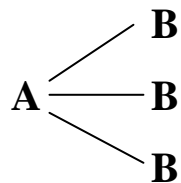
Low



Redundancy by Cohesion: Contacts know each other

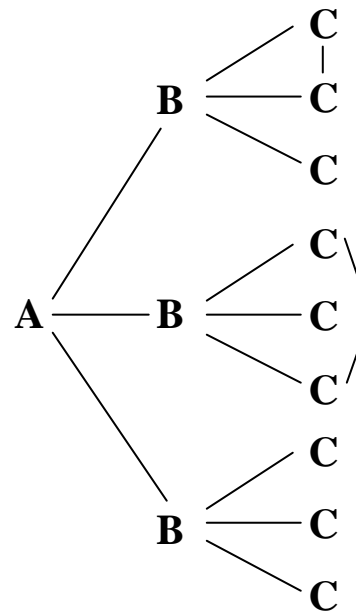


Redundancy by Structural Equivalence: Contacts know the same people



Contacts are "dead ends"

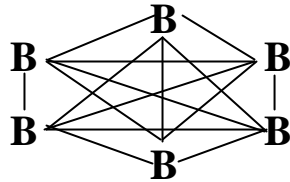
High



- "A" with three independent contacts
- Each contact has independent network, creating three "structural holes"
- Three primary contacts lead to total network size of 12

Centralized and decentralized communication structures with different strengths

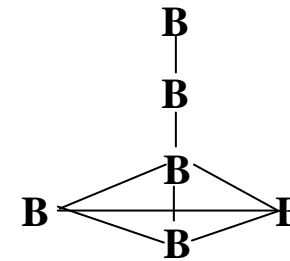
Decentralized



- Every member of the network has similar amount and quality of information
- Relatively high cost of communication and "friction loss"
- Participants feel integrated
- Suitable for complex tasks

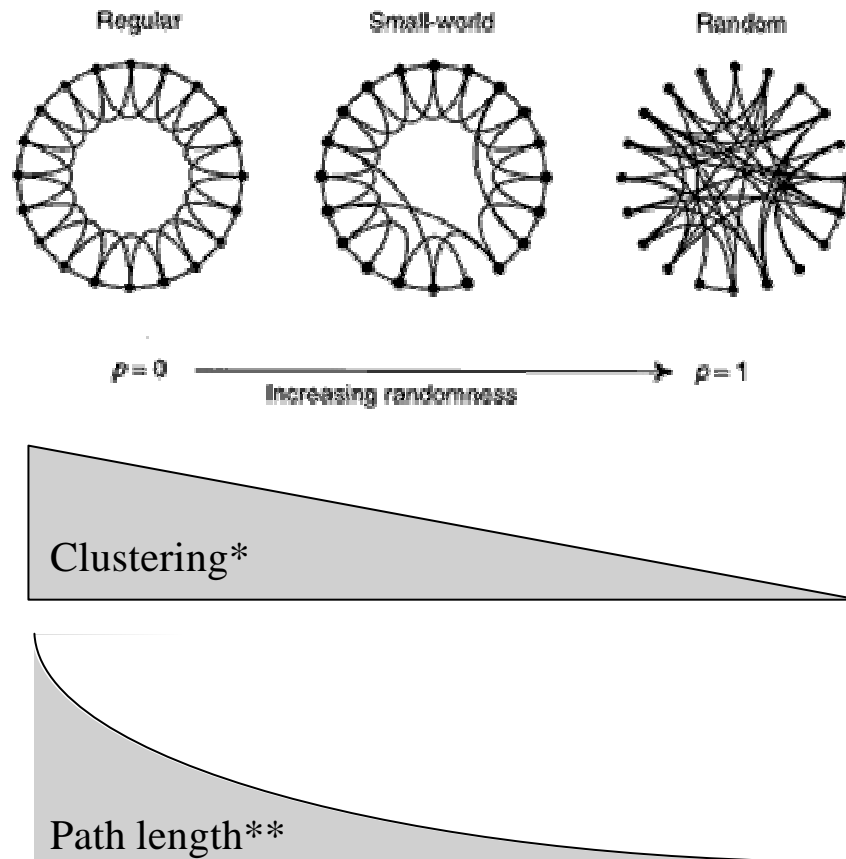
Structure of communication to be adapted to respective requirements

Centralized



- Communication is channeled through few key persons – remainders depend on information carriers, however, information partly does not get to every member
- Very efficient way of communication
- Suitable for simple/urgent tasks

Small-world networks with superior clustering-path length ratio



Description

- Small-world networks have small path lengths, however relatively high clustering coefficient
- Small world effects can be experienced in different kinds of networks
 - Relation of film actors ("Kevin Bacon effect")
 - Power grids
 - Neural network of *C. elegans*
- Small-world effect with huge implications; little changes in network geography with potentially large effects
 - High signal-propagation speed
 - Easily spreading diseases
- Both experience ("Do you know...from my hometown?") and experiments (Milgram; 1967) support small world hypothesis for human society, however evidence is ambiguous

* Interlinkage with close vertices

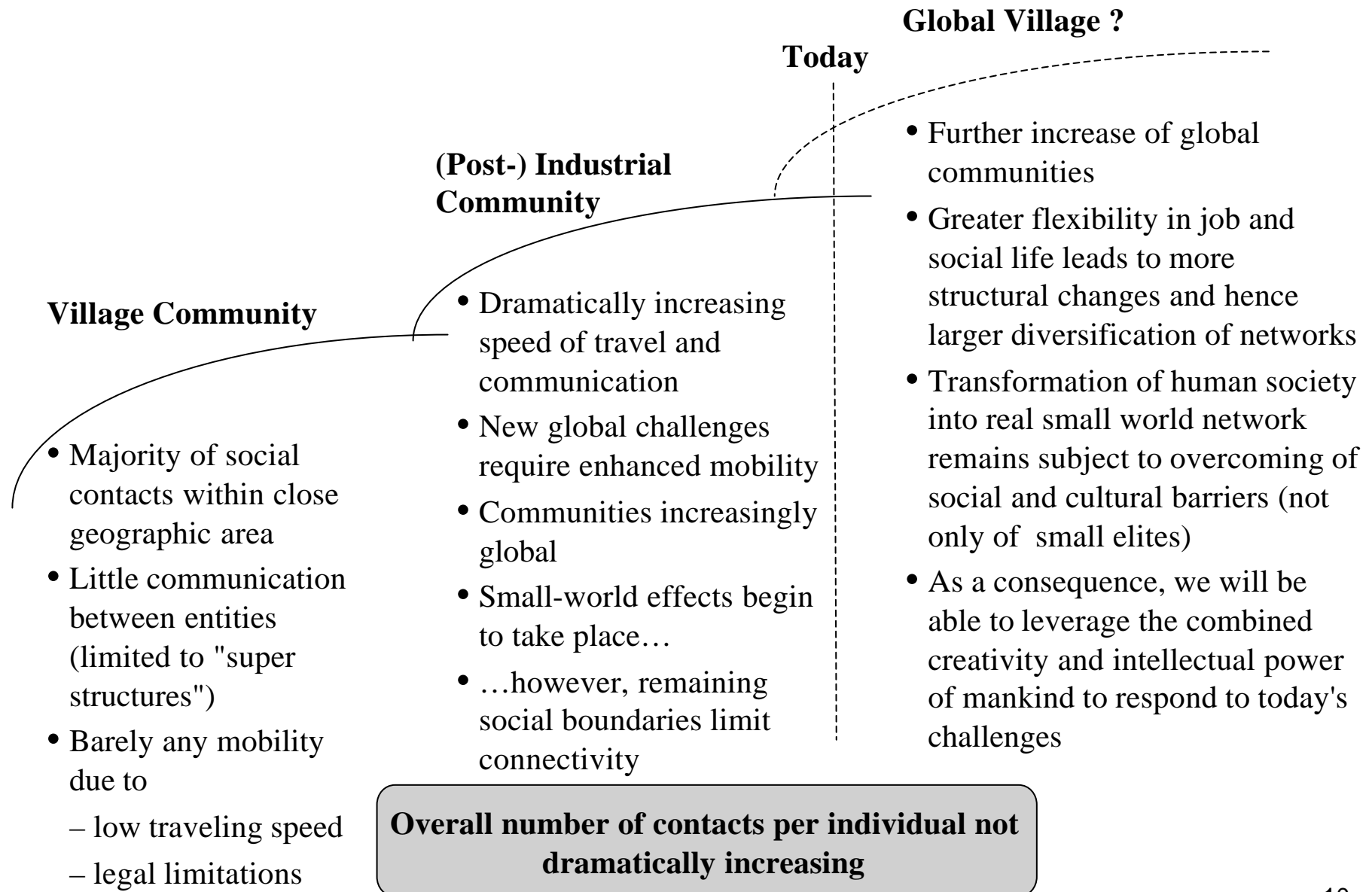
** Average distance from most distant vertex

Source: Anonymous (1999), Watts (1998), Milgram (1967)

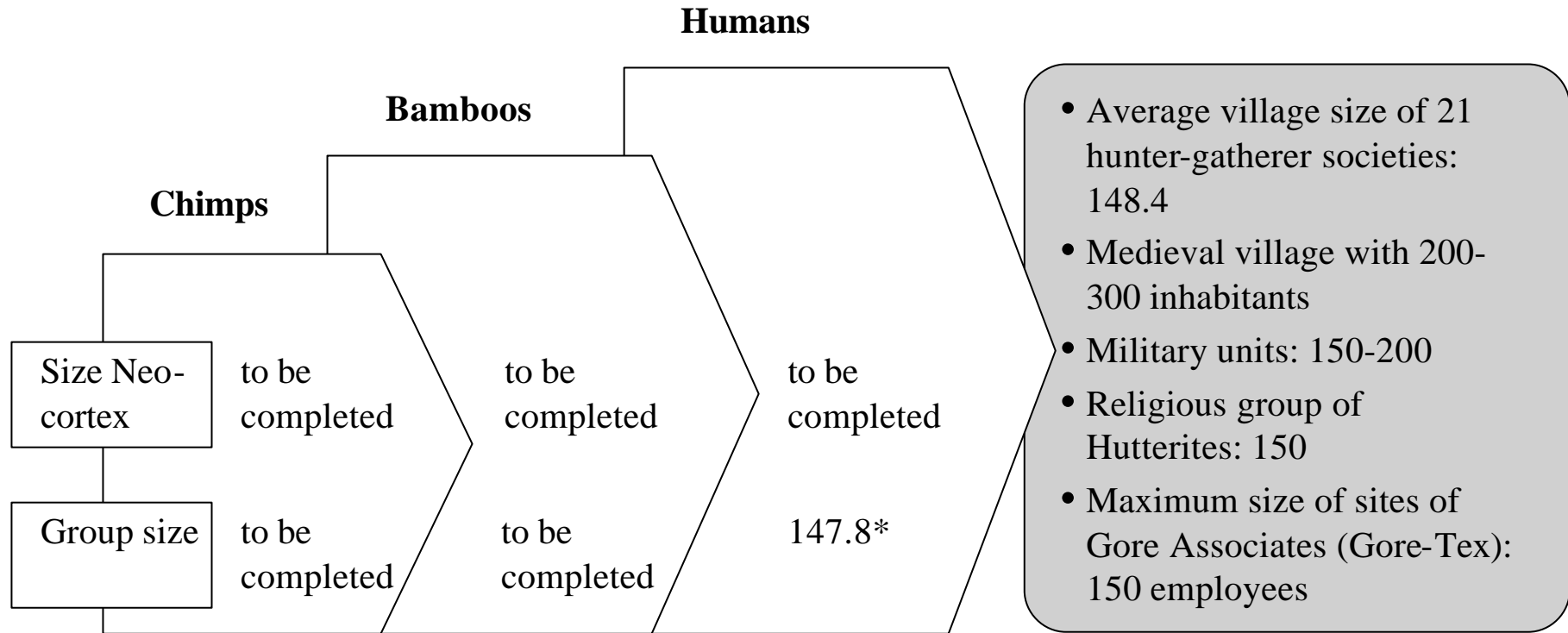
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Social network advances over time



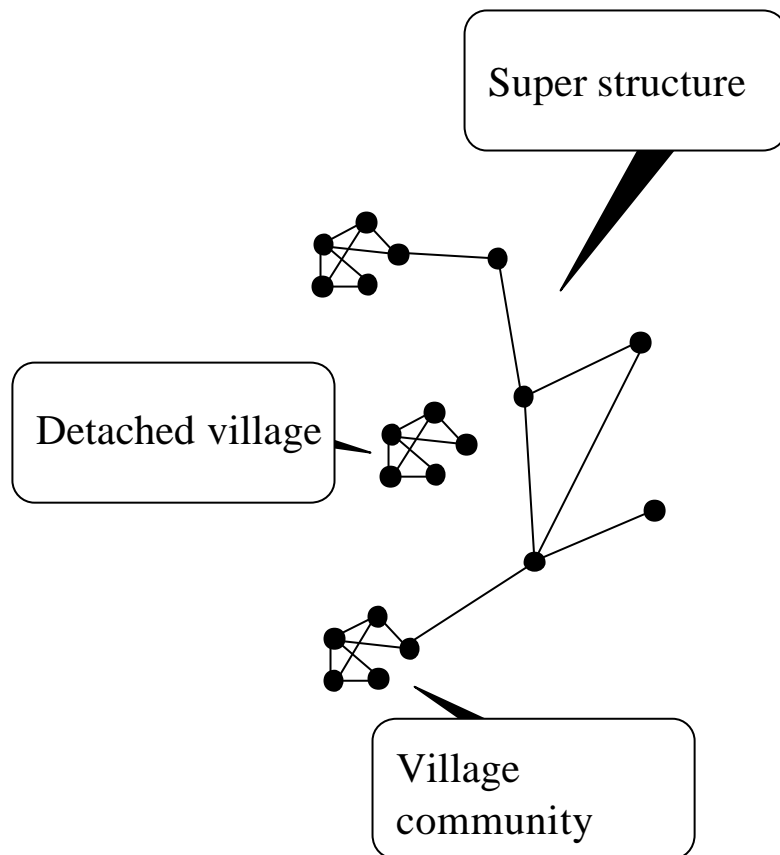
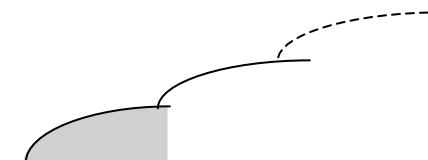
Human networks face biologic boundaries



* Prediction

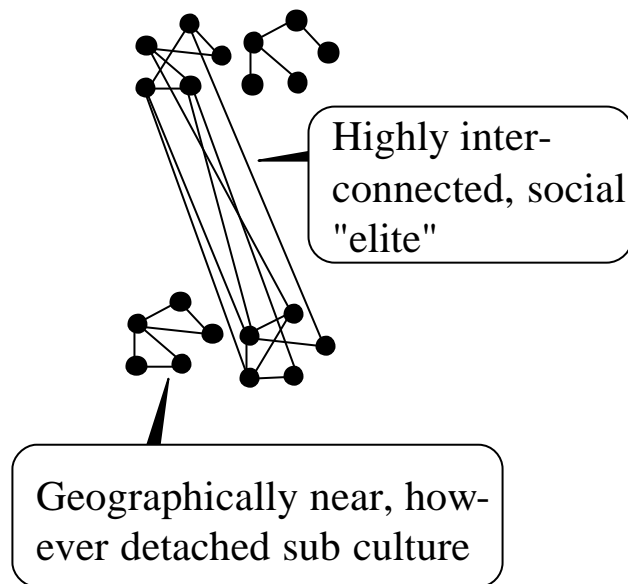
Source: Gladwell (2001), Dunbar (1992), Bryde (2002)

Connectivity in village community limited by technical and social factors



- Average villages consist out of 10 to 30 farms with 200 to 300 inhabitants
- Mobility perceived as dangerous by ruling class – bondman and key craftsman were hindered from moving (e.g., Maria Theresia ordered capital punishment for scythe forgers who left the styrian "Erzberg")
- International trade rudimentarily developed: Total imports of metal to Europe at the end of 16th century ~USD 40 mn (as of today ~ USD 240 bn)
- Traveling speed limited to some 25 to 40 km per day for walkers, 100-150 km for horseback riders and ships; trip from Portugal to India took 6 months in the early 17th century
- Little linkage between different communities, small super structure (e.g., aristocracy, church) largely detached

(Post) industrial community overcomes technical barriers, however, social fences still in place

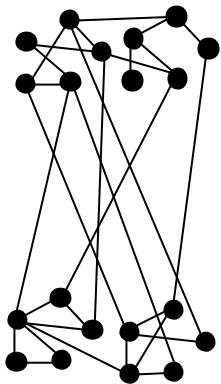


- Since beginning of industrial revolution relevance of distance for traveling and communication deteriorates
- However despite Milgram's famous small world experiment, barriers probably are still in place
 - Small world experiment itself potentially with flaws
 - Results of first attempt not reported
 - Potential bias in selection of test group
 - Parallel empiric work suggests vast majority of links to be homophilious
 - Distinction between white and Afro-American targets, shows significant differences between intra- and interracial chains
 - Distinction along income shows little penetrability from low to high income*
 - On campus experiment shows communication hierarchies and tendencies to stay within genders/subgroups
 - Experiments in literally small worlds (i.e. towns, etc.) are actually successful

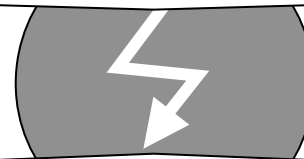
* However, due to low chain completion rate, results are not significant

Source: Kleinfeld (2001), Wilson (2000), Korte (1970), Stevenson (1997), Beck (1968)

Additional socio-economic changes may finally lead to emergence of Global Village



- Importance of social classes and traditions deteriorates as individualization becomes more and more important
- Migration: Contacts of in particular urbanites with higher multiplexity, as freedom of choice of contacts increases
- Higher income frees resources to better govern network development
- Better education increases average network size with more "bridges"
- Emerging of global cultural standards increases homophily between yet separated groups
- Increasing complexity requires global approaches (e.g., science, production)



- Religious fundamentalism far from being defeated (e.g., Northern Ireland, Middle East)
- Nationalism re-emerges (Spain, India-Pakistan)
- More phone lines in greater NY City than in Africa, two thirds of the world's population have no access to a phone, not to mention the internet
- New means of communication, which enable global communication may overstrain users (e.g., "Tara-experiment")

Back-up

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Social network advances over time

