International laboratory for Applied Network Research

Department of Sociology

Moscow 2023

Introduction to Network Analysis: Course description

Elective course at the Department of Sociology (Bachelor's program, 4th year)

Daria Maltseva, Ph.D.

About me

- Head of the International Laboratory for Applied Network Research
- Leading Research Fellow, Visiting Lecturer
- Ph.D. | Candidate of Sciences in Sociology
- Degree in Sociology, Russian State University for the Humanities
- Young Faculty Support Program (Group of Young Academic Professionals), Category "New Researchers" (2018-2019)
- Grant of the Russian Scientific Foundation “Collaboration patterns in the Russian sociological community: the structure of scientific schools and their growth potential” 2021-2023
- Have a 2.5-year-old son

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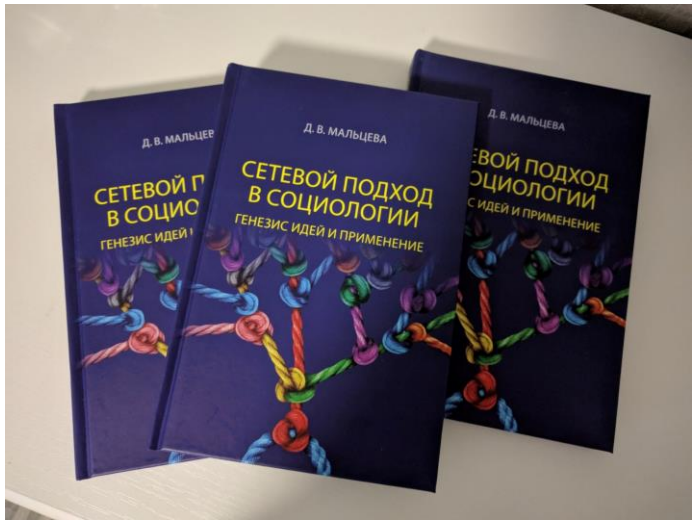
Expertise



Сетевой подход как феномен социологической теории

версия для печати

Мальцева Д. В.
Кандидат социологических наук, зам. заведующего, Международная лаборатория прикладного сетевого анализа НИУ «Высшая школа экономики», Москва, Россия d_malceva@mail.ru

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Рубрика: Методология и методы социологических исследований

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Текст статьи.

Аннотация

Представлен сравнительный анализ трех направлений сетевого подхода в социологии – анализа социальных сетей, реляционной социологии и акторно-сетевой теории. Основаниями для анализа выступают время и контекст появления, основные теоретические положения, методология и методы эмпирических исследований. Делаются выводы о сходстве (до определенной степени) направлений реляционной социологии и акторно-сетевой теории и их отличия от анализа социальных сетей. Каждое из направлений автономно и занимает определенное место в структуре социологического знания. Делается вывод о некорректности представления «сетевого подхода» как единого теоретического блока, объединения его направлений под унифицирующими названиями «сетевая теория», «сетевая парадигма» и др. Подчеркнуто, что это собирательное название для разных теорий и подходов, оперирующих понятием сети в разных смыслах.

Springer Link

Published: 19 April 2022

Collaboration between authors in the field of social network analysis

Daria Maltseva & Vladimir Batagelj

Scientometrics (2022) | Cite this article
267 Accesses | **2** Altmetric | Metrics

Abstract

This paper presents a study of authors writing articles in the field of SNA and groups the
means of bibliographic network analysis. The dataset consists of works from the Web of
Science database obtained by searching for "social network*", works highly cited in the f
works published in the flagship SNA journals, and written by the most prolific authors
(70,000+ publications and 93,000+ authors), up to and including 2018. Using a two-mo
network linking publications with authors, we constructed and analysed different types

Springer Link

Published: 30 August 2019

Social network analysis as a field of invasions: bibliographic approach to study SNA development

Daria Maltseva & Vladimir Batagelj

Scientometrics **121**, 1085–1128 (2019) | Cite this article
994 Accesses | **10** Citations | **1** Altmetric | Metrics

Abstract

In this paper, the results of a study on the development of social network analysis (SNA) and its evolution over time, using the analysis of bibliographic networks are presented. The dataset consists of articles from the Web of Science Clarivate Analytics database obtained by

Springer Link

Published: 25 January 2020

Towards a systematic description of the field using keywords analysis: main topics in social networks

Daria Maltseva & Vladimir Batagelj

Scientometrics **123**, 357–382 (2020) | Cite this article
806 Accesses | **8** Citations | **1** Altmetric | Metrics

Abstract

This paper presents the results of the analysis of keywords used in Social Network Analysis (SNA) articles included in the WoS database and main SNA journals, from 1970 to 2018.

Springer Link

Published: 25 February 2021

Journals publishing social network analysis

Daria Maltseva & Vladimir Batagelj

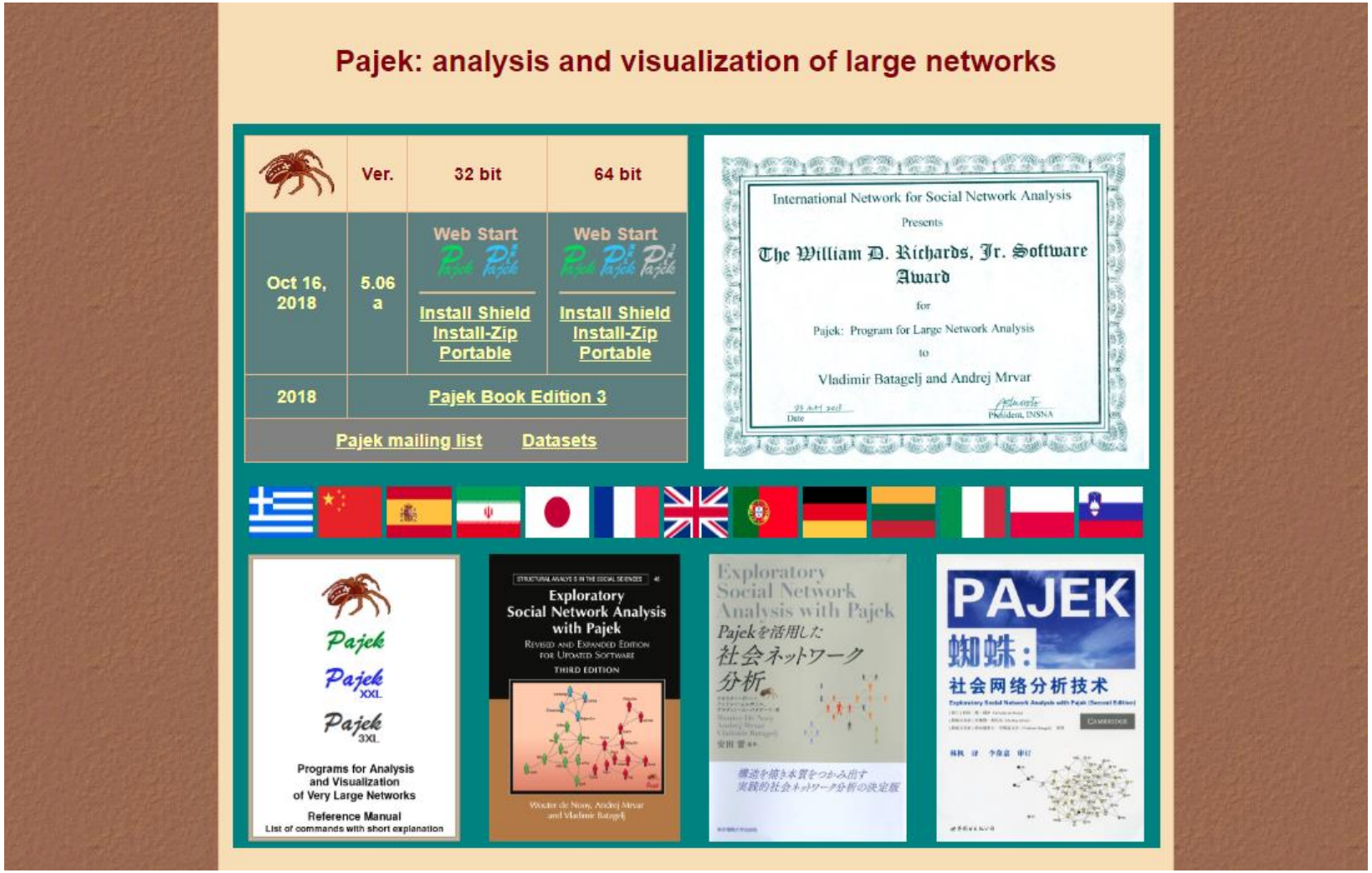
Scientometrics **126**, 3593–3620 (2021) | Cite this article
585 Accesses | **3** Citations | **1** Altmetric | Metrics

Abstract

This paper presents the analysis of journals publishing articles on social network analysis (SNA). The dataset consists of articles from the Web of Science database obtained by searching for "social network*", works intensively cited, written by the most prominent

Expertise

- Series of internships in Center for Methodology and Social Informatics (Faculty of Social Sciences, University of Ljubljana) – 2017, 2018(2), 2019



Tabula Peutingeriana

Figure 1. *Russian trade routes in the 12th - 13th centuries.*

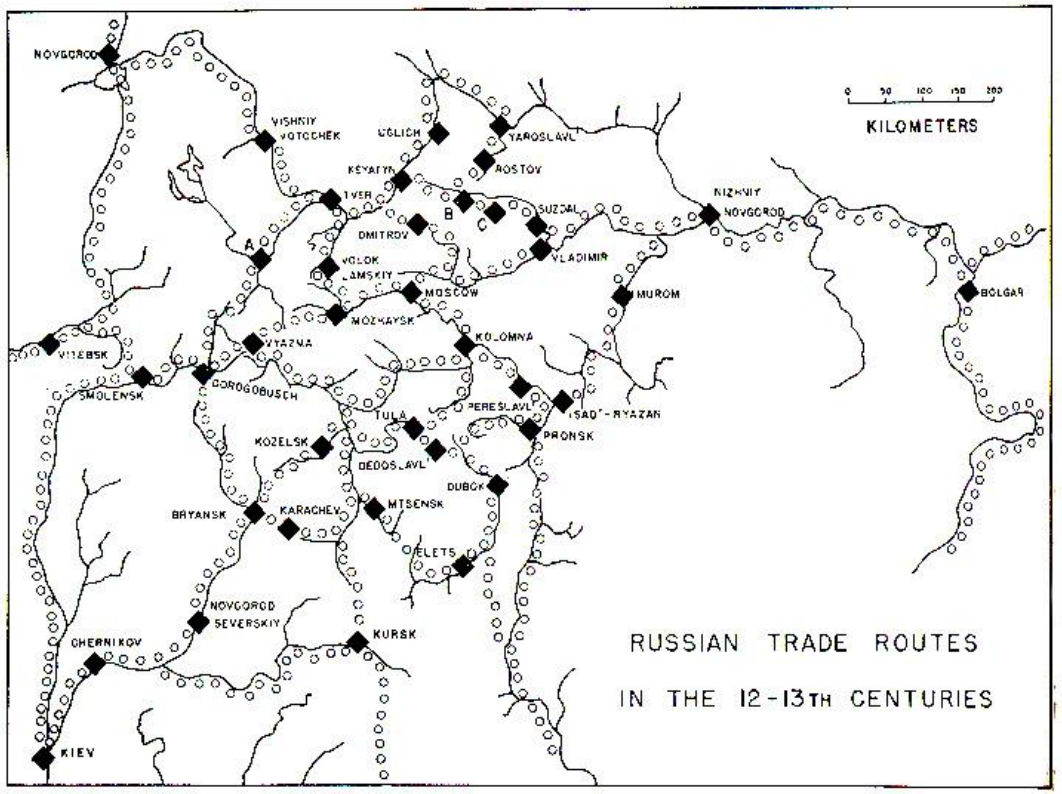
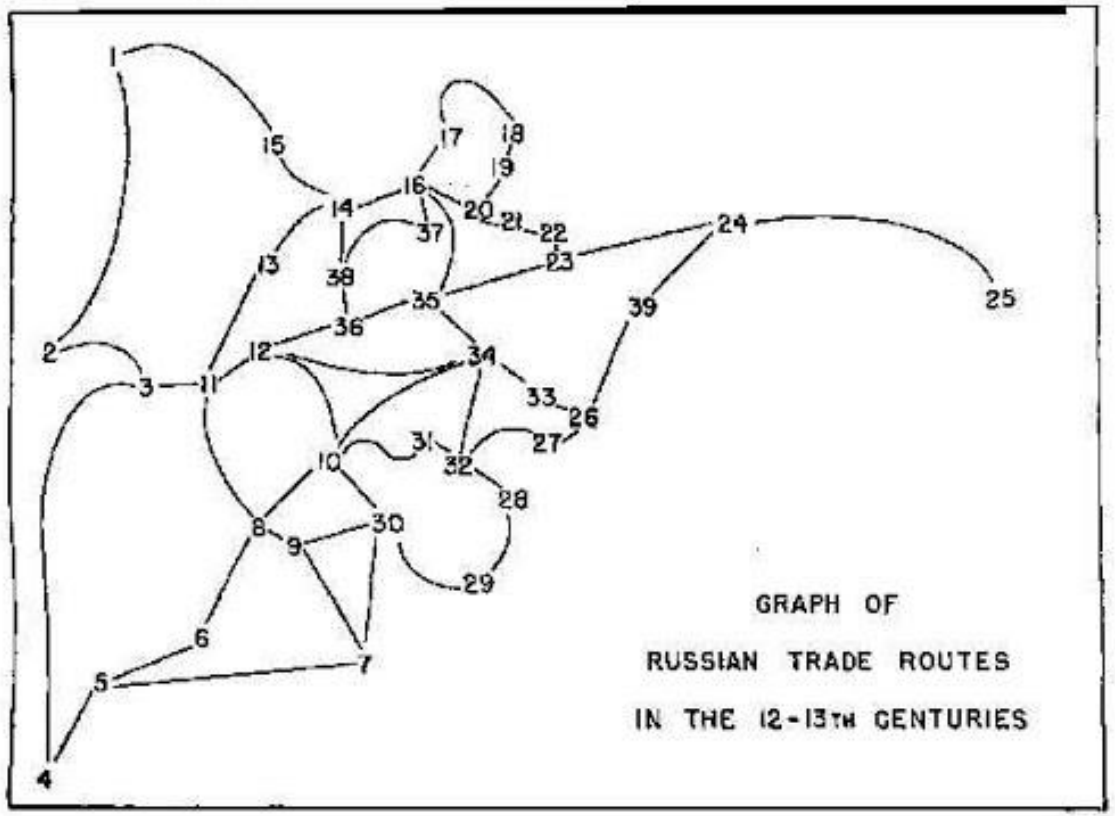
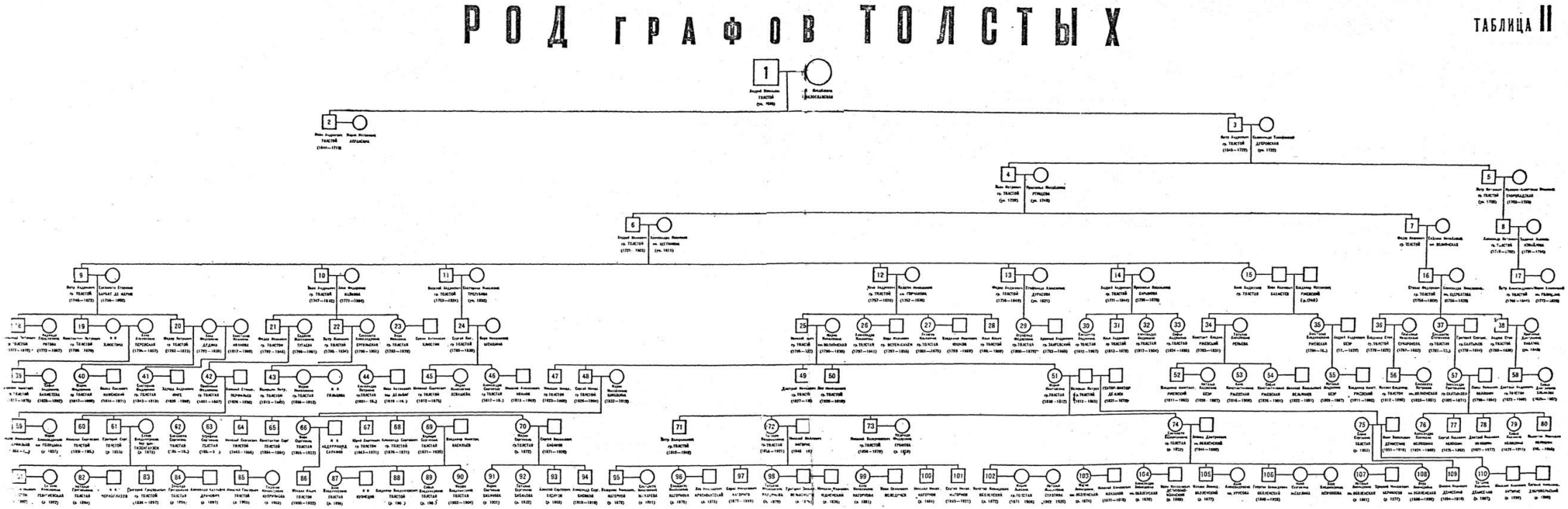


Figure 2. *Graph of Russian trade routes in the 12th - 13th centuries.*

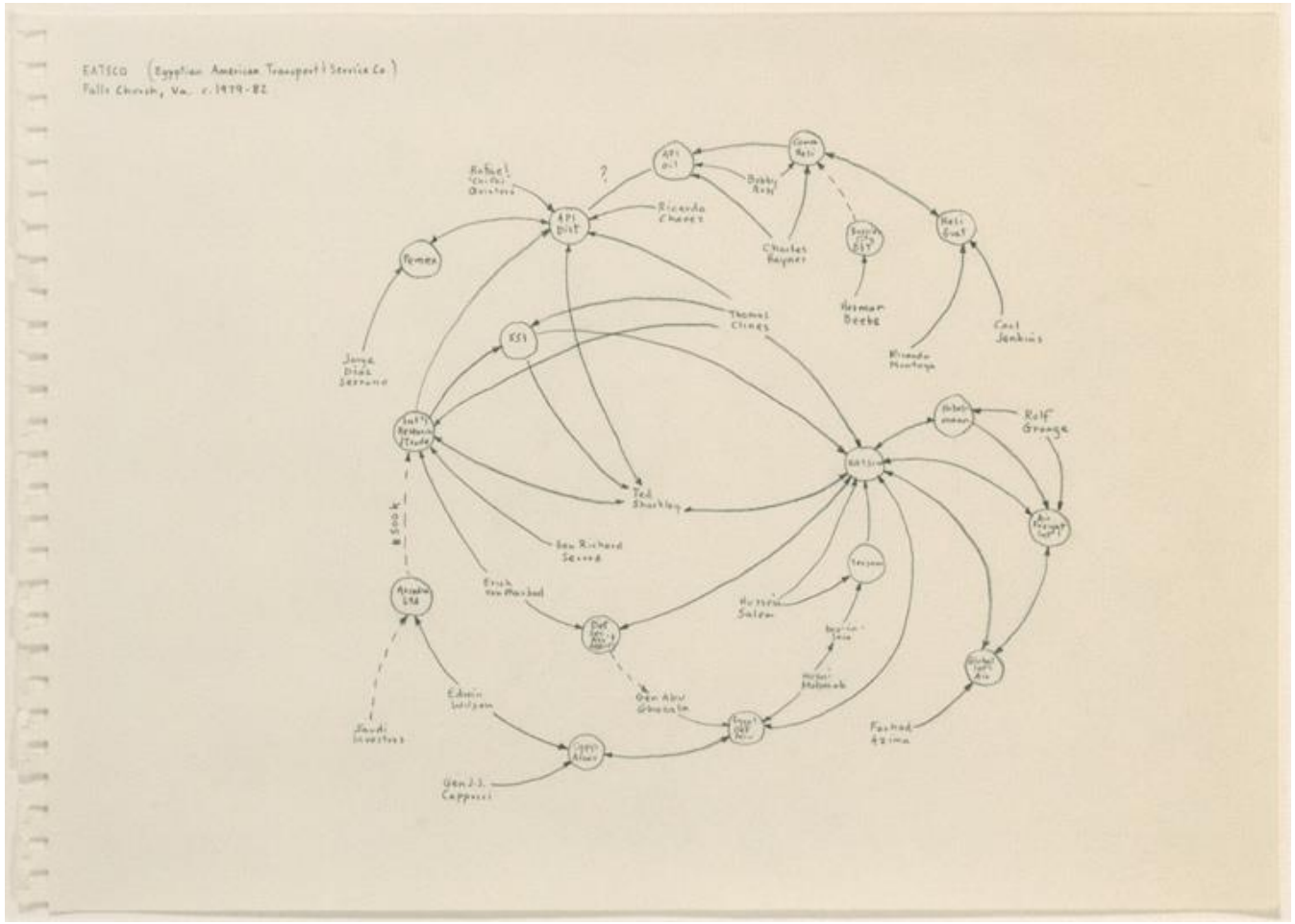


Pitts, F. R. (1978). The medieval river trade network of Russia revisited. Social networks, 1(3), 285-292.



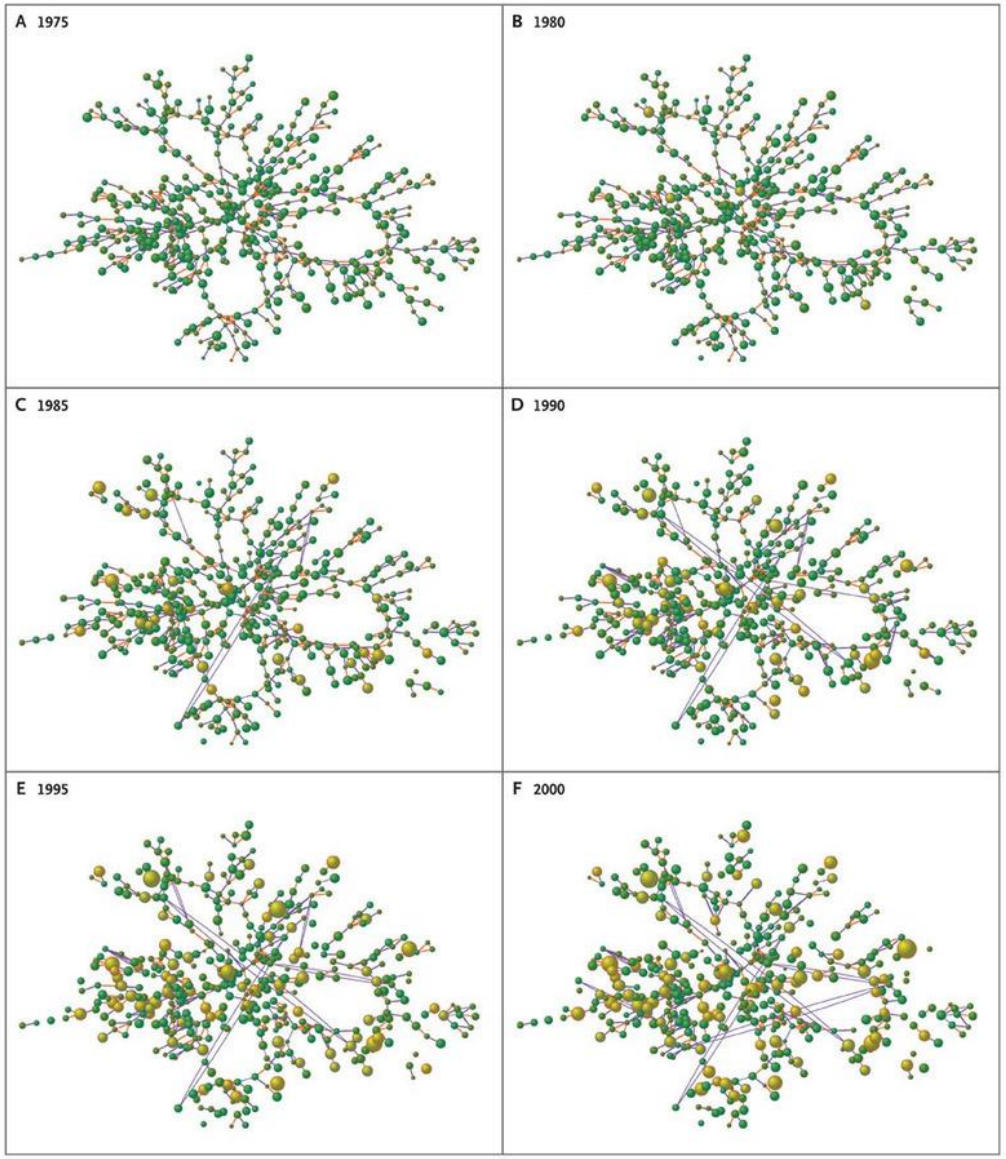
Family of Count Tolstoy

War and Peace: http://voinaimir.com/info/
War and Peace in graphs: https://www.youtube.com/watch?v=MhluxT5oZxM

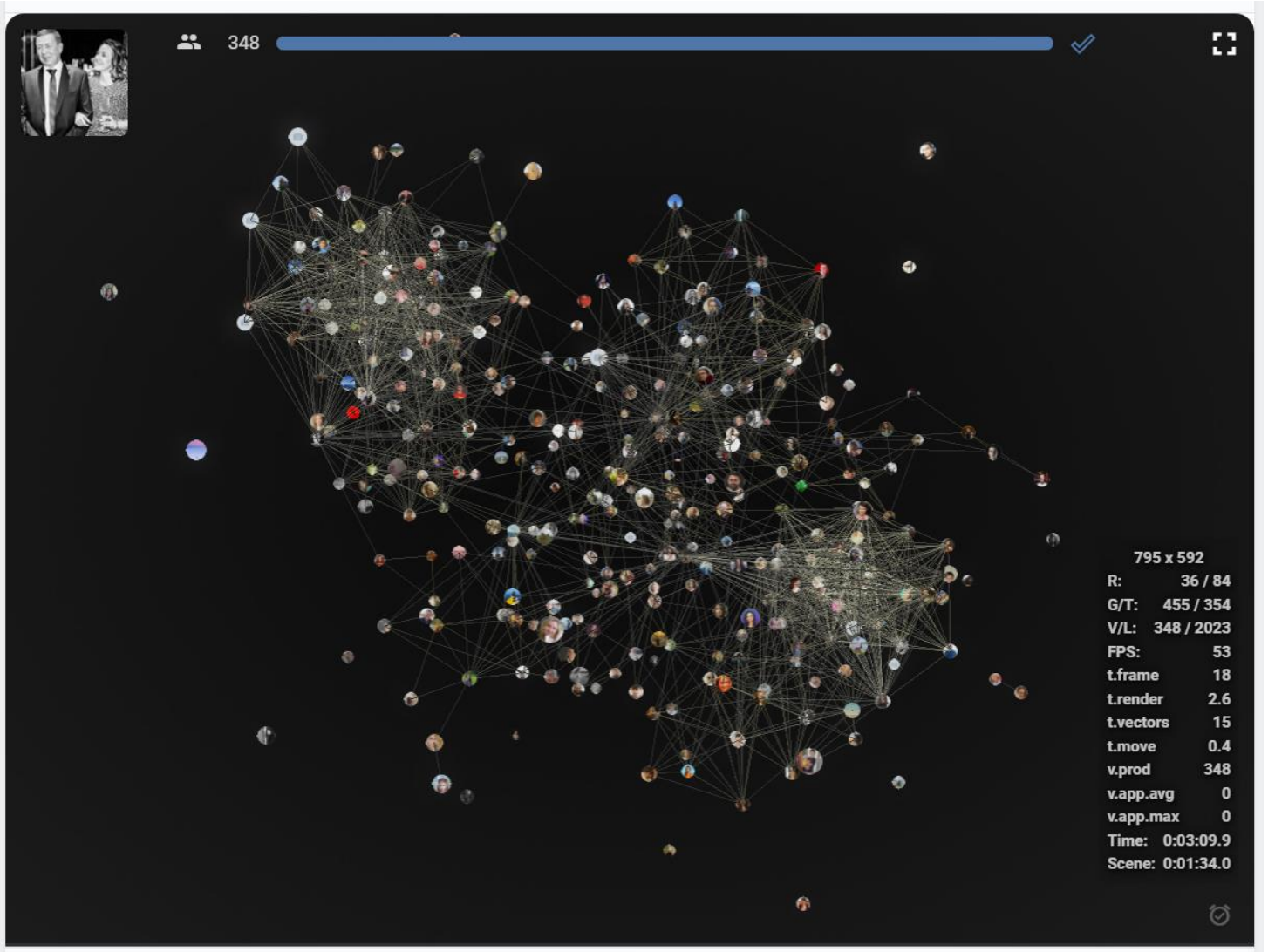


Mark Lombardi Networks

Banco Nazionale del Lavoro, Reagan, Bush, Thatcher, and the Arming of Iraq, c. 1979-1990 (4th version)

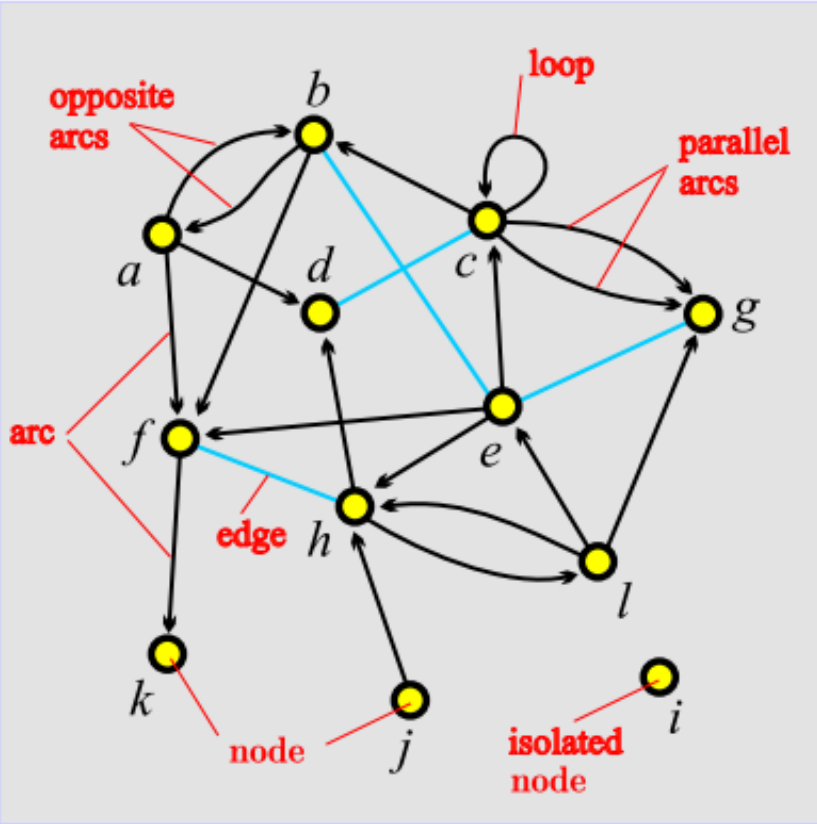


Christakis, N. A., & Fowler, J. H. (2007). The spread of obesity in a large social network over 32 years. New England journal of medicine, 357(4), 370-379.
Видео



Social network VK:
https://vk.com/socialgraph3d

Network Conceptualization



Visualization by: Vladimir Batagelj

The **network** is based on two sets - a set of **nodes** (vertices) representing the selected units of analysis and a set of **lines** (links) representing the connections between the units of analysis, which together form a **graph**.

The line can be directed (**arc**) or undirected (**edge**).

Nodes and lines can contain additional data - characteristics / **attributes** (name, type, value) - that can be measured or calculated.

Network = Graph + Data

Network Analysis: unique specialization

One of the areas in the broader discipline of data analysis/statistics/computational social sciences that develops tools for analyzing relational and related data.

Why is it important?

- Social is relational.

Traditional methods	Network analysis
Most real data are not independent and identically distributed, as is often required for analysis by "traditional" analytical methods, especially parametric statistics	Network analysis overcomes this problem by finding invisible links between the units of analysis
If we represent network data as nodes and links between them, then "traditional" methods allow us to analyze only the "attributes of actors"	Network methods do the same, but also study the presence, strength and influence of connections between actors - the properties and influence of links

SNA application

Social groups:
Social capital
Social support, cohesion, well-being in society
Social inclusion and inequality
Communities, kinship systems, social classes and strata
Social movements and collective action
Migration
Interpersonal and group processes

Economics and finance:
Formal and informal institutions
Labor market and unemployment
Markets for goods and services
Diffusion of innovations
Corporate elites and inter-corporate networks
Achieving status
Embeddedness of economic activity
Financial systems

Policy:
Elites, lobbies, coalitions, networks of influence
Political movements
Business policy

Management:
Organizational efficiency
Knowledge Management
HR

Media and Internet:
Online networks and communities
Information waves and campaigns
Computer and communication networks

Science and education:
Scientific networks
Scientific mapping
Networks of Scientists
Social influence of peers

Culture:
Cultural markets and products
Creativity and success
Identities and contexts
Networks of meanings

Crime:
Gangs
Organized crime
Terrorist and secret networks

Urban planning:
Neighborhood communities
Social space and geography
Epidemiology and public health

NA application

Social sciences

NEWMAN_M{1999}60:7332
VALENTE_T{1996}18:69
FREEMAN_L{1991}13:141
STEPHENS_K{1989}11:1
MIZRUCHI_M{1984}6:193
MARIOLIS_P{1982}27:571
MCPHERSO_J{1982}3:225
BURT_R{1980}45:821
BURT_R{1980}6:79
BURT_R{1979}6:211
BURT_R{1978}7:189
BURT_R{1977}56:551
BURT_R{1977}56:106
ALBA_R{1976}5:77
WHITE_H{1976}81:730
BREIGER_R{1975}12:328
GRANOVET_M{1973}78:1360
HOLLAND_P{1970}76:492
CARTWRIG_D{1956}63:277
HEIDER_F{1946}21:107
HEIDER_F{1944}51:358

Network science (physicists)

LUSSEAU_D{2008}75:1809
NEWMAN_M{2006}74:036104
BOCCALET_S{2006}424:175
CLAUSET_A{2004}70:066111
NEWMAN_M{2004}38:321
NEWMAN_M{2004}69:026113
NEWMAN_M{2003}45:167
NEWMAN_M{2003}67:026126
NEWMAN_M{2002}66:016128
ALBERT_R{2002}74:47
NEWMAN_M{2001}64:025102
STROGATZ_S{2001}410:268
NEWMAN_M{2000}101:819
MOORE_C{2000}62:7059
NEWMAN_M{1999}60:7332
VALENTE_T{1996}18:69

Behavioral biology

MONTIGLI_P{2018}8:1451
FISHER_D{2017}30:2088
SILK_M{2017}132:137
FISHER_D{2017}86:202
CROFT_D{2016}12:52
SPIEGEL_O{2016}7:971
LEU_S{2016}111:23
FARINE_D{2015}84:1144
FARINE_D{2015}2:150057
FARINE_D{2015}28:547
FARINE_D{2015}104:E1
SILK_M{2014}156:701
FARINE_D{2014}89:141
APLIN_L{2013}16:1365
FARINE_D{2012}84:1271
CROFT_D{2011}26:502
SUEUR_C{2011}73:703
=SUEUR_C{2011}73:703
LEHMANN_J{2011}73:775
BRENT_L{2011}73:720
VOELKL_B{2010}64:1449
KASPER_C{2009}50:343
RAMOS-FE_G{2009}63:999
=LUSSEAU_D{2009}63:1067
LUSSEAU_D{2008}75:1809
NEWMAN_M{2006}74:036104

Figure 6: SPC net: Main path by fragments – sociology, physics, biology
(2nd and 3rd parts starts with two works from the previous group)

Aim of the course

4th year: "Introduction to Network Analysis" introduces theory and methods of SNA and their application in the applied projects for the explanation of social phenomena.

3 independent interrelated components:

1. **Theory**: theoretical foundations of network analysis and the integration of theories into the studied networks
2. **Methodology**: methods of analysis and programs used for analysis of network data
3. **Application**: theory and instruments learned in class are then used in individual and group work to develop a research project in the student's area of interest.

We focus on special tool for the analysis and visualization of large networks called **Pajek**.

The main purpose: to use an integrated approach to build theoretically and methodologically grounded research projects with SNA

Course content

Lecture	Seminar
Topic 1. Theoretical foundations and historical development of SNA and main research directions	1. Pajek program for the analysis and visualization of large networks. Data input and basic visualization
Topic 2. Main network statistics **Discussion**	2. Working in Pajek : basic network statistics and advanced visualization. Description of data for the course project
Topic 3. Identification of important nodes and subnetworks **Discussion**	3. Working in Pajek: important nodes and subnetworks
Topic 4. Two-mode networks and fractional approach **Discussion**	4. Working in Pajek: two-mode networks
Topic 5. Blockmodeling **Discussion**	6. Working in Pajek: blockmodeling
Topic 6: Acyclic networks and bibliometric analysis (main path) **Discussion**	7. Working in Pajek: acyclic networks and main path
Topic 7: Co-occurrence networks and bibliometric analysis **Discussion**	8. Working in Pajek: co-occurrence networks
Final project presentation	Final project presentation

Grading

Lectures:

Six 10-min tests on the topics covered in classes previous week

Each lecture

Seminars:

Attendance, one presentation at the discussion and the activity at the discussion

Each seminar

Homework:

Two home assignments implemented individually (in Pajek)

Two HW

Final project

Solving a practical problem (possible to perform in groups of up to 5 people with an indication of the contribution of each participant)

$$0.25 + 0.25 + 0.25 + 0.25 = \text{Grade}$$

Final project

- Large dataset with bibliographic data (1,000's and 1,000,000's of nodes) on publications on the topic of interest or proposed by me;
- Construction of networks from dataset (with my assistance);
- Construction of networks through multiplication and normalization;
- Networks analysis of bibliographic 1-mode and 2-mode networks;
- Work in groups (up to 5 people, with an indication of the contribution of each participant) on the analysis of some subtopic in the dataset;
- Joint presentation of each subtopic and main conclusions

Regard and credit

The content of the lectures is inspired by the lectures of prof. Vladimir Batagelj and prof. Valentina Kuskova

ANR lab

Internship in the ANR-Lab

Bachelor's degree students can have an internship in the Laboratory and work as **trainees-analysts / trainees-researchers:**

- Acquiring new knowledge in advanced data analysis methods
- Work on projects related to your interests and research
  - Participation in research projects
  - Participation in commercial analytical projects
- The opportunity to continue working as an employee after completing the internship

In case you are interested, please write me via mail dmaltseva@hse.ru