GESIS Summer School in Survey Methodology 2022

Syllabus for course:
"Collecting and Analyzing Longitudinal Social Network Data"

Lecturers:	Dr. Lars Leszczensky	Dr. Sebastian Pink
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Date: 22-26 August 2022
Time: Mo: 10:00-17:00 | Tu-Fr: 09:00-17:00
Venue: KOMED, Im Mediapark 7, Cologne.

About the Lecturers:

Lars Leszczensky is a postdoctoral research fellow at the Mannheim Centre for European Social Research at the University of Mannheim. He is experienced in planning and conducting the collection of longitudinal social network data as well as analyzing these data. As a teacher, he regularly gives theoretical, methodological, and thematic seminars. Beyond social network analysis, he is interested in methods of social research and topics such as integration, intergroup relations, and social identity.

Sebastian Pink is a postdoctoral researcher at the Chair of General Sociology at the University of Mannheim. He is experienced in planning and conducting the collection of longitudinal social network data as well as analyzing these data. As a teacher, he regularly gives theoretical, methodological, and thematic seminars. Beyond social network analysis, he is interested in methods of social research and topics such as integration, fertility decision-making, and social inequality.

Selected Publications:

- Leszczensky, L., & Pink, S. (2019): What Drives Ethnic Homophily? A Relational Approach on How Ethnic Identification Moderates Preferences for Same-Ethnic Friends. *American Sociological Review*, 84, 394-419.
- Leszczensky, L., & Pink, S. (2015): Ethnic Segregation of Friendship Networks in School: Testing a Rational-Choice Argument of Differences in Ethnic Homophily between Classroom- and Grade-Level Networks. *Social Networks*, 42, 18-26.
- Pink, S., Kretschmer, D., & Leszczensky, L. (2020): Choice Modelling in Social Networks Using Stochastic Actor-Oriented Models. *Journal of Choice Modelling*, 34, 100202.
- Leszczensky, L., & Pink, S. (2020): Are Birds of a Feather Praying Together? Assessing Friends' Influence on Muslim Youths' Religiosity in Germany. *Social Psychology Quarterly*, 83, 251-271.
- Jugert, P., Leszczensky, L. & Pink, S. (2020): Differential Influence of Same- and Cross-Ethnic Friends on Ethnic-Racial Identity Development in Early Adolescence. *Child Development*, 91, 949-963.

Course Description:

Many social scientists are interested in understanding how social networks emerge and/or how they shape individual behavior. These questions of network formation ("selection") and network effects ("influence") concern both human individuals and organizational units. Examples for selection are the emergence of

friendship between people or cooperation between firms; examples for influence are adolescents start smoking because of their friends or firms copying other firms' strategies. Selection and influence are inherently dynamic processes, but few social scientists have been trained in collecting, processing, and analyzing longitudinal social network data.

This course guides participants who intend to collect and/or analyze longitudinal social network data. For this purpose, we rely on a mix of interactive lectures, guided examples, and practical exercises. We use R for all guided examples and exercises, and we use and provide exemplary school-based friendship network data.

On Day 1, we introduce basic concepts, typical research questions, and longitudinal social network data. Participants can bring forward their own research aims. On Day 2, we cover the design of longitudinal social network studies and the collection of longitudinal social network data, discussing both general challenges and, if applicable, participants' own data collection projects. Participants further learn how to handle and manage network data in R by guided examples and exercises. This includes the visualization of networks and the calculation of descriptive network measures.

On Day 3 and 4, we address how to analyze selection (Day 3) and influence (Day 4) with stochastic actor-oriented models (SAOM). On both days, we first introduce the respective model and show how to specify and estimate it using R. Then we practice how to interpret the model results and graphically communicate findings.

On Day 5, we address several advanced topics that participants likely will encounter when working with SAOM, such as convergence in parameter estimates, goodness of fit, and different means of analyzing multiple networks. We close by giving participants group-based and individual feedback on their own projects.

Keywords:
social networks, data collection, data analysis, computational social science, R

Course Prerequisites:
- Basic knowledge in quantitative data analysis
- Prior knowledge of R is not necessarily required, but we recommend participants without such knowledge to familiarize themselves with R before the course (we provide suggestions in the preparatory reading section)
- Prior knowledge of social network analysis is helpful but not necessarily required

Target Group:
Participants will find the course useful if:
- they (intend or consider to) collect longitudinal social network data
- they (intend or consider to) analyze longitudinal social network data to help them answer substantive research questions
- they already are analyzing social network data and want to discuss their work

Course and Learning Objectives:
By the end of the course participants will:
- know how to design and conduct a longitudinal social network study
- be able to manage and handle longitudinal network data
- know how to exploit the potential of stochastic actor-oriented models for their research aims
- understand how to specify and estimate stochastic actor-oriented models for network dynamics in R
- have learned how to interpret and communicate results of stochastic actor-oriented models

Organizational Structure of the Course:
This is a five-day course with a total amount of 30 hours of class time. Participants can expect a mix of interactive lectures, hands-on exercises, quizzes, and opportunities for group discussions with the instructors and participants with similar interests. Guided exercises in R deepen the understanding of the course material

and may be used as a syntax template for own research. The lecturers will be available for individual consultations on participants' planned or current projects.

Software and Hardware Requirements:

The practical examples and exercises will be done in R. **Participants should bring their own laptop computers to be able to work with R.** They should have a recent R version installed. For working with R in general, we recommend using RStudio.

Before the course, participants should install the following R-packages from CRAN, with dependencies: tidyverse, tidygraph, haven, ggraph, cowplot, reshape2, gridExtra, sna, igraph

Participants also should install the newest version of the R-package "RSiena" from R-Forge, with dependencies. (The version on CRAN tends to be outdated.) The command is: install.packages("RSiena", repos="http://R-Forge.R-project.org")

Day-to-day Schedule and Literature:

Day	Topic(s)
1	**Introduction to Longitudinal Network Analysis** • Introduction, Objectives, Schedule, and Organization • Social networks, research questions and potential of (longitudinal) social network analysis • (Longitudinal) Social network data: specifics and challenges • Discussion of participants' goals and plans for their projects
	Compulsory reading (have to be read before class): ▪ Borgatti, S. P., Mehra, A., Brass, D. J., & Labianca, G. (2009). Network Analysis in the Social Sciences. Science, 323, 892-895. ▪ Wasserman, S. and Faust, K. (1994). Social Network Analysis: Methods and Applications. Chapters 1-3. Cambridge: Cambridge University Press ▪ Robins, G. (2021). Doing Social Network Research: Network-based Research Design for Social Scientists. Chapters 3 and 4. London: SAGE Publications.
2	**Data Collection and Descriptive Analysis** • Data requirements for longitudinal social network analysis and how to design a longitudinal network study • How to collect longitudinal network data • Data processing and network visualization • Calculation of statistical network measures
	Compulsory reading: ▪ Jackson, M. O. (2008). Social and Economic Networks. Chapter 2. Princeton: Princeton University Press. ▪ Robins, G. (2021). Doing Social Network Research: Network-based Research Design for Social Scientists. Chapters 5 and 6. London: SAGE Publications. Suggested reading (suggested, yet do not have to be read before class): ▪ Leszczensky, L. Pink, S., Kretschmer, D. & Kalter, F. (2021). Studying Youth' Group Identities, Intergroup Relations, and Friendship Networks: The Friendship and Identity in School Data. European Sociological Review, jcab052.
3	**Stochastic Actor-Oriented Models for Network Dynamics I: Selection** • Logic of network tie selection in stochastic actor-oriented models • Specification and estimation of selection part of the model • Interpretation of results (based on linear combinations) • (Graphical) Communication of findings

	Compulsory reading:
	▪ Snijders, T. A., Van de Bunt, G. G., & Steglich, C. E. (2010). Introduction to Stochastic Actor-Based Models for Network Dynamics. Social Networks, 32, 44-60.
	▪ Pink, S., Kretschmer, D., & Leszczensky, L. (2020): Choice Modelling in Social Networks Using Stochastic Actor-Oriented Models. Journal of Choice Modelling, 34.
	▪ Ripley, R., Snijders, T. A. B., Boda, Z., Vörös, A., & Preciado, P. (2021). Manual for RSiena. University of Oxford and University of Groningen. Chapter 13.3.
4	**Stochastic Actor-Oriented Models for Network Dynamics II: Influence** • Logic of influence from network ties in stochastic actor-oriented models • Specification and estimation of influence part of the model • Interpretation of results (based on linear combinations) • (Graphical) Communication of findings
	Compulsory reading: ▪ Steglich, C., Snijders, T. A., & Pearson, M. (2010). Dynamic networks and behavior: Separating selection from influence. Sociological Methodology, 40, 329-393. ▪ Ripley, R., Snijders, T. A. B., Boda, Z., Vörös, A., & Preciado, P. (2021). Manual for RSiena. University of Oxford and University of Groningen. Chapter 13.4.
5	**Stochastic Actor-Oriented Models for Network Dynamics III and Project Outlook** • Convergence and goodness of fit • Combining multiple networks: Meta-analysis, multi-group option, and SienaBayes • Missing Data • Group-based and individual feedback on participants' projects
	Compulsory reading: ▪ Lospinoso, J., & Snijders, T. A. B. (2019). Goodness of fit for stochastic actor-oriented models. Methodological Innovations, 12, 1-18. (Example section) ▪ Ripley, R., Snijders, T. A. B., Boda, Z., Vörös, A., & Preciado, P. (2021). Manual for RSiena. University of Oxford and University of Groningen. Chapter 11. Suggested reading: ▪ Gremmen, M. C., Van den Berg, Y. H., Steglich, C., Veenstra, R., & Dijkstra, J. K. (2018). The importance of near-seated peers for elementary students' academic engagement and achievement. Journal of Applied Developmental Psychology, 57, 42-52.

Preparatory Reading:

None. However, we strongly recommend participants who are not used to working with R to familiarize themselves with R prior to the course. There are several resources to learn R that are free of charge. "Intro2R" by Alex Douglas (https://alexd106.github.io/intro2R/) and "R for Data Science" by Hadley Wickham (https://r4ds.had.co.nz/) constitute especially accessible introductions.

Additional Recommended Literature:

Participants who are unfamiliar with social network research may look at the short book by Gary Robins (2021), which provides a nice introduction to social network research and includes further recommendations on various basic topics and research design.
  ▪ Robins, G. (2021). *Doing Social Network Research: Network-based Research Design for Social Scientists*. London: SAGE Publications.

In this course, we treat the basic version of stochastic actor-oriented models. For further information, including on various extensions and related topics, we refer participants to the Siena webpage, which is maintained by Tom Snijders and provides tons of useful materials. This includes RSiena scripts on numerous topics including but not limited to the ones we discuss in this course. The website also lists literature and

teaching materials on various topics, including introductions to SIENA in various languages. The url is: https://www.stats.ox.ac.uk/~snijders/siena/siena.html

Throughout the course, we will work on examples based on the "Friendship and Identity in School" data. Prior knowledge of the data is not required, but participants who want to learn more about the data can find information in Leszczensky et al. (2021).

- Leszczensky, L. Pink, S., Kretschmer, D. & Kalter, F. (2021). Studying Youth' Group Identities, Intergroup Relations, and Friendship Networks: The Friendship and Identity in School Data. *European Sociological Review*, jcab052.