CAMBRIDGE

Cambridge University Press
978-1-107-00238-8 - Exploratory Social Network Analysis with Pajek: Revised and Expanded Second Edition
Wouter De Nooy, Andrej Mrvar and Vladimir Batagelj
Table of Contents
More information

Contents

Figures *page* xv
Tables xxi
Preface to the Second Edition xxiii
Preface to the First Edition xxv

PART I – FUNDAMENTALS

1 Looking for Social Structure 3
1.1 Introduction 3
1.2 Sociometry and Sociogram 3
1.3 Exploratory Social Network Analysis 5
1.3.1 Network Definition 6
1.3.2 Manipulation 12
1.3.3 Calculation 15
1.3.4 Visualization 17
1.4 Assembling a Social Network 25
1.5 Summary 29
1.6 Questions 29
1.7 Assignment 30
1.8 Further Reading 31
1.9 Answers 31

2 Attributes and Relations 34
2.1 Introduction 34
2.2 Example: The World System 34
2.3 Partitions 36
2.4 Reduction of a Network 43
2.4.1 Local View 43
2.4.2 Global View 46
2.4.3 Contextual View 49
2.5 Vectors and Coordinates 50

© in this web service Cambridge University Press www.cambridge.org

CAMBRIDGE

Cambridge University Press
978-1-107-00238-8 - Exploratory Social Network Analysis with Pajek: Revised and Expanded Second Edition
Wouter De Nooy, Andrej Mrvar and Vladimir Batagelj
Table of Contents
More information

2.6 Network Analysis and Statistics 57
2.7 Summary 60
2.8 Questions 61
2.9 Assignment 62
2.10 Further Reading 62
2.11 Answers 63

PART II – COHESION

3 Cohesive Subgroups 71
3.1 Introduction 71
3.2 Example 71
3.3 Density and Degree 73
3.4 Components 77
3.5 Cores 81
3.6 Cliques and Complete Subnetworks 84
3.7 Summary 90
3.8 Questions 92
3.9 Assignment 94
3.10 Further Reading 94
3.11 Answers 94

4 Sentiments and Friendship 97
4.1 Introduction 97
4.2 Balance Theory 97
4.3 Example 100
4.4 Detecting Structural Balance and Clusterability 101
4.5 Development in Time 107
4.6 Summary 110
4.7 Questions 111
4.8 Assignment 112
4.9 Further Reading 113
4.10 Answers 113

5 Affiliations 116
5.1 Introduction 116
5.2 Example 117
5.3 Two-Mode and One-Mode Networks 118
5.4 Islands 124
5.5 The Third Dimension 129
5.6 Summary 133
5.7 Questions 133
5.8 Assignment 134
5.9 Further Reading 135
5.10 Answers 136

© in this web service Cambridge University Press www.cambridge.org

CAMBRIDGE

Cambridge University Press
978-1-107-00238-8 - Exploratory Social Network Analysis with Pajek: Revised and Expanded Second Edition
Wouter De Nooy, Andrej Mrvar and Vladimir Batagelj
Table of Contents
More information

PART III – BROKERAGE

6 Center and Periphery 141
- 6.1 Introduction 141
- 6.2 Example 141
- 6.3 Distance 143
- 6.4 Betweenness 150
- 6.5 Eigenvector Centrality 153
- 6.6 Summary 154
- 6.7 Questions 155
- 6.8 Assignment 155
- 6.9 Further Reading 156
- 6.10 Answers 157

7 Brokers and Bridges 159
- 7.1 Introduction 159
- 7.2 Example 160
- 7.3 Bridges and Bi-Components 161
- 7.4 Ego-Networks and Constraint 166
- 7.5 Affiliations and Brokerage Roles 173
- 7.6 Summary 178
- 7.7 Questions 179
- 7.8 Assignment 180
- 7.9 Further Reading 181
- 7.10 Answers 182

8 Diffusion 186
- 8.1 Example 186
- 8.2 Contagion 189
- 8.3 Exposure and Thresholds 193
- 8.4 Critical Mass 200
- 8.5 Summary 205
- 8.6 Questions 207
- 8.7 Assignment 208
- 8.8 Further Reading 208
- 8.9 Answers 209

PART IV – RANKING

9 Prestige 215
- 9.1 Introduction 215
- 9.2 Example 216
- 9.3 Popularity and Indegree 217
- 9.4 Correlation 219
- 9.5 Domains 221
- 9.6 Proximity Prestige 225

© in this web service Cambridge University Press www.cambridge.org

CAMBRIDGE

Cambridge University Press
978-1-107-00238-8 - Exploratory Social Network Analysis with Pajek: Revised and Expanded Second Edition
Wouter De Nooy, Andrej Mrvar and Vladimir Batagelj
Table of Contents
More information

9.7 Summary 228
9.8 Questions 229
9.9 Assignment 230
9.10 Further Reading 231
9.11 Answers 232

10 Ranking 234
10.1 Introduction 234
10.2 Example 235
10.3 Triadic Analysis 235
10.4 Acyclic Networks 243
10.5 Symmetric-Acyclic Decomposition 246
10.6 Summary 252
10.7 Questions 253
10.8 Assignment 255
10.9 Further Reading 255
10.10 Answers 256

11 Genealogies and Citations 259
11.1 Introduction 259
11.2 Example I: Genealogy of the Ragusan Nobility 259
11.3 Family Trees 260
11.4 Social Research on Genealogies 268
11.5 Example II: Citations Among Papers on Network Centrality 278
11.6 Citations 279
11.7 Summary 288
11.8 Questions 289
11.9 Assignment 1 290
11.10 Assignment 2 290
11.11 Further Reading 290
11.12 Answers 291

PART V – ROLES

12 Blockmodels 299
12.1 Introduction 299
12.2 Matrices and Permutation 300
12.3 Roles and Positions: Equivalence 306
12.4 Blockmodeling 315
12.4.1 Blockmodel 315
12.4.2 Blockmodeling 317
12.4.3 Regular Equivalence 322
12.5 Summary 327
12.6 Questions 328

© in this web service Cambridge University Press www.cambridge.org

CAMBRIDGE

Cambridge University Press
978-1-107-00238-8 - Exploratory Social Network Analysis with Pajek: Revised and Expanded Second Edition
Wouter De Nooy, Andrej Mrvar and Vladimir Batagelj
Table of Contents
More information

12.7 Assignment 330
12.8 Further Reading 331
12.9 Answers 332

13 Random Graph Models 336
13.1 Introduction 336
13.2 Example 338
13.3 Modeling Overall Network Structure 340
13.3.1 Classic Uniform Models 341
13.3.2 Small-World Models 345
13.3.3 Preferential Attachment Models 349
13.4 Monte Carlo Simulation 356
13.5 Summary 360
13.6 Questions 362
13.7 Assignment 364
13.8 Further Reading 364
13.9 Answers 365

Appendix 1 Getting Started with Pajek 369
A1.1 Installation 369
A1.2 Network Data Formats 369
A1.3 Creating Network Files for Pajek 371
A1.3.1 Within Pajek 371
A1.3.2 Helper Software 373
A1.3.3 Word Processor 373
A1.3.4 Relational Database 376
A1.4 Limitations 381
A1.5 Updates of Pajek 382
Appendix 2 Exporting Visualizations 383
A2.1 Export Formats 383
A2.1.1 Bitmap 383
A2.1.2 Encapsulated PostScript 384
A2.1.3 Scalable Vector Graphics 385
A2.1.4 Virtual Reality Modeling Language and X3D 387
A2.1.5 MDL MOL and Kinemages 388
A2.2 Layout Options 389
A2.2.1 Top Frame on the Left – EPS/SVG Vertex Default 390
A2.2.2 Bottom Frame on the Left – EPS/SVG Line Default 392
A2.2.3 Top Frame on the Right 394
A2.2.4 Middle Frame on the Right 394
A2.2.5 Bottom Frame on the Right – EPS Border 395

© in this web service Cambridge University Press www.cambridge.org

CAMBRIDGE

Cambridge University Press
978-1-107-00238-8 - Exploratory Social Network Analysis with Pajek: Revised and Expanded Second Edition
Wouter De Nooy, Andrej Mrvar and Vladimir Batagelj
Table of Contents
More information

Appendix 3 Shortcut Key Combinations 396
A3.1 Main Screen 396
A3.2 Hierarchy Edit Screen 397
A3.3 Draw Screen 397

Glossary 399
Index of Pajek and R Commands 409
Subject Index 414

© in this web service Cambridge University Press www.cambridge.org

CAMBRIDGE

Cambridge University Press
978-1-107-00238-8 - Exploratory Social Network Analysis with Pajek: Revised and Expanded Second Edition
Wouter De Nooy, Andrej Mrvar and Vladimir Batagelj
Table of Contents
More information

Figures

1 Dependencies between the chapters (for the second edition). *page* xxvii
2 Sociogram of dining-table partners. 4
3 Partial listing of a multiple relations network data file for Pajek. 9
4 Pajek Main screen. 11
5 Menu structure in Pajek. 13
6 An information box in Pajek. 13
7 Report screen in Pajek. 16
8 Dialog box of *Info> Network> General* command. 17
9 Draw screen in Pajek. 18
10 Continue dialog box. 20
11 A selected option in the Draw screen. 22
12 *Options* menu of the Draw screen. 23
13 Textual output from *[Draw] Info> All Properties*. 23
14 A 3-D rendering of the dining-table partners network. 25
15 Random network without lines. 27
16 Edit Network screen. 28
17 World trade of manufactures of metal and world system position. 38
18 Edit screen with partition according to world system position. 39
19 Vertex colors according to a partition in Pajek. 41
20 Trade ties within South America. 44
21 The *Partitions* menu. 45
22 World system positions in South America: (2) semiperiphery and (3) periphery. 45
23 Trade in manufactures of metal among continents (imports in thousands of U.S. dollars). 46
24 Trade among continents in the Draw screen. 48

© in this web service Cambridge University Press www.cambridge.org

CAMBRIDGE

Cambridge University Press
978-1-107-00238-8 - Exploratory Social Network Analysis with Pajek: Revised and Expanded Second Edition
Wouter De Nooy, Andrej Mrvar and Vladimir Batagelj
Table of Contents
More information

25	Contextual view of trade in South America.	49
26	Geographical view of world trade in manufactures of metal, ca. 1994.	52
27	*Info>Vector* dialog box.	52
28	Trade, position in the world system, and GDP per capita.	55
29	Aggregate trade in manufactures of metal among world system positions.	64
30	Contextual view of North American trade ties and (mean) GDP per capita.	65
31	Visiting ties in Attiro.	72
32	A simple unconnected directed network.	77
33	Strong components (contours) and family–friendship groupings (vertex colors and numbers) in the network of Attiro.	80
34	*k*-cores in the visiting network at Attiro.	82
35	*k*-cores.	83
36	Stacking or nesting of *k*-cores.	83
37	The complete triad and an example.	85
38	A hierarchy of cliques.	87
39	Viewing a hierarchy in an Edit screen.	88
40	Complete triads and family–friendship groupings (colors and numbers inside vertices).	89
41	Decision tree for the analysis of cohesive subgroups.	91
42	A Person–Other–Object (X) triple.	98
43	P-O-X triple as a signed digraph.	98
44	A balanced network.	100
45	First positive and negative choices between novices at *T*4.	102
46	Output listing of a *Balance* command.	105
47	Three solutions with one error.	106
48	Partial listing of Sampson.net.	108
49	Differences between two solutions with four classes.	114
50	A fragment of the Scottish directorates network.	119
51	One-mode network of firms created from the network in Figure 50.	120
52	One-mode network of directors derived from Figure 50.	121
53	Islands in the network of Scottish firms, 1904–1905 (contours added manually).	125
54	The islands network of Scottish firms (1904–1905) with industrial categories (class numbers) and capital (vertex size).	127
55	Islands in three dimensions.	130
56	Coordinate system of Pajek.	130
57	A landscape of islands in the Scottish firms network.	131
58	Communication ties within a sawmill.	142

© in this web service Cambridge University Press www.cambridge.org

CAMBRIDGE

Cambridge University Press
978-1-107-00238-8 - Exploratory Social Network Analysis with Pajek: Revised and Expanded Second Edition
Wouter De Nooy, Andrej Mrvar and Vladimir Batagelj
Table of Contents
More information

59 Star-networks and line-networks. 144
60 Distances to or from Juan (vertex colors: Default GreyScale 1). 148
61 Geodesics between HP-1 and EM-4. 149
62 Betweenness centrality in the sawmill. 152
63 Communication network of striking employees. 160
64 Cut-vertices (gray) and bi-components (manually circled) in the strike network. 163
65 Hierarchy of bi-components and bridges in the strike network. 166
66 Three connected triads. 167
67 Alejandro's ego-network. 168
68 Proportional strength of ties around Alejandro. 169
69 Constraints on Alejandro. 170
70 Energized constraint network. 172
71 Five brokerage roles of actor *v*. 174
72 Bob's ego-network. 175
73 Constraint inside groups. 176
74 Two overlapping cliques. 181
75 Friendship ties among superintendents and year of adoption. 188
76 Adoption of the modern math method: diffusion curve. 190
77 Diffusion by contacts in a random network ($N = 100$, vertex numbers indicate the distance from the source vertex). 190
78 Diffusion from a central and a marginal vertex. 191
79 Adoption (vertex color) and exposure (in brackets) at the end of 1959. 194
80 Modern math network with arcs pointing toward later adopters. 198
81 Visiting ties and prestige leaders in San Juan Sur. 216
82 *Partitions* menu in Pajek. 221
83 Distances to family 47 (represented by the numbers within the vertices). 223
84 Proximity prestige in a small network. 227
85 Student government discussion network. 235
86 An example of a network with ranks. 237
87 Triad types with their sequential numbers in Pajek. 238
88 Strong components in the student government discussion network. 245
89 Acyclic network with shrunk components. 245
90 Clusters of symmetric ties in the student government network. 247

© in this web service Cambridge University Press www.cambridge.org

CAMBRIDGE

Cambridge University Press
978-1-107-00238-8 - Exploratory Social Network Analysis with Pajek: Revised and Expanded Second Edition
Wouter De Nooy, Andrej Mrvar and Vladimir Batagelj
Table of Contents
More information

91 Discussion network shrunk according to symmetric clusters. 247
92 Symmetric components in the (modified) student government discussion network. 248
93 The order of symmetric clusters according to the depth partition (acyclic). 250
94 Ranks in the student government discussion network. 251
95 Three generations of descendants to Petrus Gondola (years of birth). 261
96 Ore graph. 262
97 Descendants of Petrus Gondola and Ana Goce. 264
98 Shortest paths between Paucho and Margarita Gondola. 265
99 Structural relinking in an Ore graph. 270
100 P-graph. 271
101 Structural relinking in a P-graph. 272
102 Fragment of relinking grandchildren. 275
103 Centrality literature network in layers according to year of publication. 280
104 *k*-cores in the centrality literature network (without isolates). 282
105 Traversal weights in a citation network. 283
106 A main path in the centrality literature network. 286
107 Main path component of the centrality literature network (not all names are shown here). 287
108 Communication lines among striking employees. 300
109 The matrix of the strike network sorted by ethnic and age groups. 302
110 A network and a permutation. 303
111 Partial listing of the strike network as a binary matrix. 304
112 The strike network permuted according to ethnic and age groups. 305
113 Part of the permuted strike network displayed as a binary network. 306
114 Hypothetical ties among two instructors (i) and three students (s). 306
115 A dendrogram of similarities. 308
116 Imports of miscellaneous manufactures of metal and world system position in 1980. 309
117 Hierarchical clustering of the world trade network. 312
118 Hierarchical clustering of countries in the Hierarchy Edit screen. 313
119 An ideal core-periphery structure. 315
120 Image matrix and shrunk network. 316
121 Error in the imperfect core-periphery matrix. 318

© in this web service Cambridge University Press www.cambridge.org

CAMBRIDGE

Cambridge University Press
978-1-107-00238-8 - Exploratory Social Network Analysis with Pajek: Revised and Expanded Second Edition
Wouter De Nooy, Andrej Mrvar and Vladimir Batagelj
Table of Contents
More information

122 *Optimize Partition* dialog box. 319
123 Output of the *Optimize Partition* procedure. 320
124 *Random Start* dialog box. 321
125 Matrix of the student government network. 323
126 Image matrix and error matrix for the student government network. 324
127 Assembling a blockmodel in Pajek. 326
128 Random versions of a small friendship network. 337
129 Political blogosphere, United States, February 8, 2005. 339
130 Small-world random graph generation: ring of local lines (left) and rewired lines (right). 346
131 Log-log degree distributions of the blogs network: absolute frequencies (left) and cumulative proportions (right). 352
132 *Read Network* dialog box. 370
133 A network in Pajek matrix format. 371
134 Editing vertex labels. 372
135 Edit Network screen. 372
136 An empty network in Pajek Arcs/Edges format. 374
137 A network in the Pajek Arcs/Edges format. 375
138 A network in the Pajek matrix format. 375
139 A two-mode network in the Pajek Arcs/Edges format. 376
140 Four tables in the world trade database (MS Access 97). 377
141 Contents of the *Countries* table (partial). 377
142 A lookup to the *Countries* table. 378
143 Export a report to plain text. 379
144 Tables and relations in the database of Scottish companies. 381
145 The *Options* screen. 389
146 Layout of a vertex and its label. 390
147 The *x*/*y* ratio of a vertex. 391
148 The position and orientation of a line label. 393
149 Gradients in SVG export: linear (left) and radial (right). 395

© in this web service Cambridge University Press www.cambridge.org

CAMBRIDGE

Cambridge University Press
978-1-107-00238-8 - Exploratory Social Network Analysis with Pajek: Revised and Expanded Second Edition
Wouter De Nooy, Andrej Mrvar and Vladimir Batagelj
Table of Contents
More information

© in this web service Cambridge University Press www.cambridge.org

CAMBRIDGE

Cambridge University Press
978-1-107-00238-8 - Exploratory Social Network Analysis with Pajek: Revised and Expanded Second Edition
Wouter De Nooy, Andrej Mrvar and Vladimir Batagelj
Table of Contents
More information

Tables

1	Tabular output of the command *Info> Partition*.	*page* 39
2	Distribution of GNP per capita in classes.	53
3	Output of the *Info* command.	59
4	Cross-tabulation of world system positions (rows) and GDP per capita (columns).	66
5	Frequency distribution of degree in the symmetrized network of visits.	76
6	Error score with all choices at different moments ($\alpha = .5$).	109
7	Error score with first choices only ($\alpha = .5$).	115
8	Line multiplicity in the one-mode network of firms.	123
9	Frequency tabulation of coordinator roles in the strike network.	177
10	Adoption in the modern math network.	192
11	Adoption rate and acceleration in the modern math diffusion curve.	201
12	Fragment of Table 11.	204
13	Indegree listing in Pajek.	218
14	Input domain of f47.	224
15	Size of input domains in the visiting relations network.	225
16	Balance-theoretic models.	240
17	Triad census of the example network.	241
18	Triad census of the student government network.	243
19	Number of children of Petrus Gondola and his male descendants.	267
20	Size of sibling groups in 1200–1250 and 1300–1350.	269
21	Birth cohorts among men and women.	277
22	Traversal weights in the centrality literature network.	285
23	Dissimilarity scores in the example network.	308
24	Cross-tabulation of initial (rows) and optimal partition (columns).	321

© in this web service Cambridge University Press www.cambridge.org

CAMBRIDGE

Cambridge University Press
978-1-107-00238-8 - Exploratory Social Network Analysis with Pajek: Revised and Expanded Second Edition
Wouter De Nooy, Andrej Mrvar and Vladimir Batagelj
Table of Contents
More information

25 Final image matrix of the world trade network. 322
26 Monte Carlo simulation results: confidence intervals for the simple undirected blogs network. 357
27 Names of colors in Pajek. 391

© in this web service Cambridge University Press www.cambridge.org