# Contents

## Part I New Approaches in Map and Atlas Making

<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aspects of the Thematic Atlas Compilation</td>
<td>3</td>
</tr>
<tr>
<td>Vit Vozenilek</td>
<td></td>
</tr>
<tr>
<td>Introduction</td>
<td>3</td>
</tr>
<tr>
<td>Books Called Atlases</td>
<td>4</td>
</tr>
<tr>
<td>Prerequisites for the Compilation of Thematic Atlas</td>
<td>5</td>
</tr>
<tr>
<td>Thematic, Territorial and Temporal Aspects</td>
<td>7</td>
</tr>
<tr>
<td>Relationships in the Atlas</td>
<td>8</td>
</tr>
<tr>
<td>Conclusions</td>
<td>10</td>
</tr>
<tr>
<td>References</td>
<td>11</td>
</tr>
<tr>
<td><strong>Mapping Disorder: An Exploratory Study</strong></td>
<td>13</td>
</tr>
<tr>
<td>David Fairbairn</td>
<td></td>
</tr>
<tr>
<td>Introduction</td>
<td>13</td>
</tr>
<tr>
<td>Handling Disorder in Landscapes</td>
<td>14</td>
</tr>
<tr>
<td>Archaeological Disturbance in the Landscape</td>
<td>15</td>
</tr>
<tr>
<td>Data Preparation</td>
<td>16</td>
</tr>
<tr>
<td>Data Processing</td>
<td>18</td>
</tr>
<tr>
<td>Representation</td>
<td>19</td>
</tr>
<tr>
<td>Conclusions</td>
<td>22</td>
</tr>
<tr>
<td>References</td>
<td>22</td>
</tr>
<tr>
<td><strong>The Next Generation of Atlas User Interfaces: A User Study with “Digital Natives”</strong></td>
<td>23</td>
</tr>
<tr>
<td>Raimund Schnürer, René Sieber, and Arzu Çöltekin</td>
<td></td>
</tr>
<tr>
<td>Introduction</td>
<td>23</td>
</tr>
<tr>
<td>Related Work</td>
<td>24</td>
</tr>
<tr>
<td>Experiment</td>
<td>26</td>
</tr>
<tr>
<td>Materials</td>
<td>26</td>
</tr>
<tr>
<td>Participants and Procedure</td>
<td>27</td>
</tr>
</tbody>
</table>
Results ................................................................. 28
Discussion ......................................................... 32
Conclusion and Outlook ........................................ 33
References ......................................................... 34

The State of Official Statistical Mapping in Switzerland (and Other European Countries) ................................................................. 37
Thomas Schulz
Statistical Mapping ................................................. 37
Official Statistical Mapping in Switzerland ......................... 39
Products and Institutions ......................................... 39
Users ................................................................. 41
Contents ............................................................. 43
Cartographic Representations .................................... 44
Reference Areas .................................................. 45
Statistical Atlases .................................................. 46
General Development Trends ................................... 46
Statistical Atlases of Switzerland ................................ 46
Statistical Atlases of Other European Countries ............... 48
Technologies and the Role of the Cartographer ................. 50
Technologies for Statistical Mapping ........................... 50
The (New) Role of the Cartographer ............................ 51
Current Technological Trends and Developments .............. 52
Conclusions ......................................................... 54
References .......................................................... 55

Online Cartographic Atlas Products: Learning from the Past ................................................................. 57
Alexander Pucher
Introduction ......................................................... 57
What’s So Special About Online Cartography? .................. 58
Considerations on Testing Methods for Cartographic Information Systems ......................................................... 61
Lessons Learned from Previous Developments ................. 63
Usefulness ............................................................ 63
Efficiency ............................................................ 63
Effectiveness ......................................................... 64
Learnability .......................................................... 64
Satisfaction .......................................................... 64
Conclusion .......................................................... 65
References .......................................................... 65

Non-technological Aspects in Atlas Cartography Based on the Czech Approach ................................................................. 67
Alena Vondrakova
Introduction ......................................................... 67
Atlas Cartography in the Czech Republic ......................... 68
General Aspects of Map Production ................................ 70
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-technical Aspects of Map Production</td>
<td>72</td>
</tr>
<tr>
<td>Definition and Properties of Individual Non-technical Aspects</td>
<td>72</td>
</tr>
<tr>
<td>Conclusion</td>
<td>79</td>
</tr>
<tr>
<td>References</td>
<td>80</td>
</tr>
<tr>
<td>The Evolution of Digital Cartographic Databases (State Topographic Maps) from the Beginnings to Cartography 2.0: The Hungarian Experience</td>
<td>81</td>
</tr>
<tr>
<td>László Zentai</td>
<td>81</td>
</tr>
<tr>
<td>Introduction</td>
<td>81</td>
</tr>
<tr>
<td>State Topographic Maps of Hungary</td>
<td>82</td>
</tr>
<tr>
<td>The First Cartographic Database</td>
<td>82</td>
</tr>
<tr>
<td>The First Digital Map Production</td>
<td>83</td>
</tr>
<tr>
<td>The Beginning of GIS in Hungary</td>
<td>85</td>
</tr>
<tr>
<td>Digital State Topographic Maps</td>
<td>85</td>
</tr>
<tr>
<td>Cadastral Maps</td>
<td>87</td>
</tr>
<tr>
<td>Other Digital Databases</td>
<td>88</td>
</tr>
<tr>
<td>Legal Issues</td>
<td>88</td>
</tr>
<tr>
<td>Cartography 2.0: Global Cartographic Services</td>
<td>89</td>
</tr>
<tr>
<td>Conclusion</td>
<td>90</td>
</tr>
<tr>
<td>References</td>
<td>91</td>
</tr>
<tr>
<td>Creation of the Accurate Raster Driven Polygonal Environment for the 3D Surface Models Based on the LIDAR Technology</td>
<td>93</td>
</tr>
<tr>
<td>Jan Hovad and Jitka Komarkova</td>
<td>93</td>
</tr>
<tr>
<td>Introduction</td>
<td>93</td>
</tr>
<tr>
<td>Used Data, Software and Hardware</td>
<td>94</td>
</tr>
<tr>
<td>Methods and Procedures</td>
<td>95</td>
</tr>
<tr>
<td>Creation of the 3D Terrain Model</td>
<td>95</td>
</tr>
<tr>
<td>Data Filtering and the Tree Recognition</td>
<td>96</td>
</tr>
<tr>
<td>Raster Transformations</td>
<td>99</td>
</tr>
<tr>
<td>Raster Driven Digital Cloud Model</td>
<td>100</td>
</tr>
<tr>
<td>Final Composition and Outputs</td>
<td>100</td>
</tr>
<tr>
<td>Discussion and Conclusion</td>
<td>101</td>
</tr>
<tr>
<td>References</td>
<td>101</td>
</tr>
<tr>
<td>A Framework for Color Design of Digital Maps: An Example of Noise Maps</td>
<td>103</td>
</tr>
<tr>
<td>Beate Weninger</td>
<td>103</td>
</tr>
<tr>
<td>Introduction</td>
<td>103</td>
</tr>
<tr>
<td>Fundamentals of Color Design</td>
<td>104</td>
</tr>
<tr>
<td>Color Perception</td>
<td>104</td>
</tr>
<tr>
<td>Scheme Types</td>
<td>108</td>
</tr>
<tr>
<td>Color Design Aspects for Digital Maps</td>
<td>109</td>
</tr>
</tbody>
</table>
Utilization of the Campus Map of the Faculty of Science .............. 138
Visualization of BIM Through Web and Printed Maps .............. 138
3D Visualization ............................................. 139
Future Development ............................................. 139
Conclusions ............................................. 141
References ............................................. 142

Part II Progress in Web Cartography

Integrating User and Usability Research in Web-Mapping Application Design .................................................. 147
David Schobesberger
Introduction ............................................... 147
User-Centred Design ............................................. 148
Meta-Analysis of User Studies ............................................. 149
A Framework for User-Centred Web-Map Design and Evaluation ............................................. 151
Requirements Stage ............................................. 153
Prototype Stage ............................................. 154
Post-Release Stage ............................................. 154
Common Usability Problems ............................................. 155
Conclusion ............................................. 155
References ............................................. 156

Interlinking Opensource Geo-Spatial Datasets for Optimal Utility in Ranking ............................................... 159
D. Bhattacharya, P. Pasquali, J. Komarkova, P. Sedlak, A. Saha, and P. Boccardo
Introduction ............................................... 159
Background ............................................. 161
Methodology ............................................. 164
Test Results for the Above Approach for Czech Republic ............................................. 167
Conclusions, Limitations & Future Scope ............................................. 168
References ............................................. 169

Exploring Class Discussions from a Massive Open Online Course (MOOC) on Cartography ..................................... 173
Anthony C. Robinson
Introduction ............................................... 173
Background ............................................. 174
Phrase Nets ............................................. 175
Topic Modeling ............................................. 177
Geo-Parsing Forum Posts ............................................. 179
Conclusions ............................................. 181
References ............................................. 182
Evaluating Mapping APIs ........................................ 183
Michael P. Peterson

Introduction ..................................................... 183
Comparison of Application Programmer Interfaces for Mapping .... 184
  Google Maps API ........................................... 184
  Bing Maps API .............................................. 185
  Nokia HERE API ........................................... 186
  MapQuest API .............................................. 187
  OpenStreetMap API ....................................... 187
  Leaflet API ................................................. 189
  Baidu Map API ............................................. 189
  Mapstraction .............................................. 190
Evaluation of Mapping APIs .................................... 193
Summary ...................................................... 196

References .................................................... 196

Demography of Twitter Users in the City of London: An Exploratory
Spatial Data Analysis Approach ................................ 199
Barbara Hofer, Thomas J. Lampoltshammer, and Mariana Belgiu

Introduction ..................................................... 199
Twitter Data Analyses ......................................... 200
Data and Methods ............................................ 201
Results and Discussion ....................................... 203
Conclusions ................................................... 209

References .................................................... 210

Visualization Problems in Worldwide Map Portals ................. 213
Jana Stehliková, Helena Řezníková, Hana Kočová, and Zdeněk Stachoň

Introduction ..................................................... 213
Previous Studies .............................................. 214
Methods ........................................................ 215
  Visual Interpretation ....................................... 215
  Null-Hypotheses and Pre-test ................................ 216
  User Test .................................................... 217
Results ........................................................ 220
  Participants in User Test ................................... 220
  Qualitative Data/Research ................................ 220
  Quantitative Data/Research ............................... 221
Discussion ..................................................... 222
Conclusion ..................................................... 223

References .................................................... 224

Geovisualising Unequal Spatial Distribution of Online Social Network
Connections: A Hungarian Example .............................. 227
Ákos Jakobi and Balázs Lengyel

Introduction ..................................................... 227
Database Characteristics: The Case of iWiW ..................... 229
Geovisualisation of Connections and the Analysis of Spatial Connectivity .......................... 232
Derived Maps and Geospatial Aggregation of Data ......................................................... 236
Conclusions ...................................................................................................................... 239
References ......................................................................................................................... 239

**The Competitive Analysis Method for Evaluating Water Level Visualization Tools**
Robert E. Roth, Chloë Quinn, and David Hart

Introduction ...................................................................................................................... 241
Method Description ......................................................................................................... 244
Results .............................................................................................................................. 246
  - Representation of the Waterline/Flood Extent .............................................................. 246
  - Representation of the Certainty of the Waterline/Flood Extent Prediction ..................... 247
  - Basemap and Overlay Context Information .................................................................. 249
  - Supported Interaction Operators ............................................................................... 250
  - Web Mapping Technologies ....................................................................................... 253
Conclusion and Outlook ................................................................................................... 254
References ......................................................................................................................... 255

**Part III Advanced Methods in Map Use**

**Models and Methods to Represent and Explore Phenomena on GIS**
Anne Ruas

Mapping Phenomena at the District Level: Needs and Diagnostics ............................... 259
Improving the Data Flow to Take Advantage of the Existing Models ............................. 261
Data Models to Map Pollution Data in 2D ........................................................................ 262
Statistics and 3D Visual Grids to Map Phenomena Such As Pollution ............................ 265
Conclusion ......................................................................................................................... 266
References ......................................................................................................................... 267

**Assessing Cartographic Products for Visual Usability**
William Cartwright

Introduction ....................................................................................................................... 269
Considering the Colour-Blind ......................................................................................... 270
Design Strategies ............................................................................................................ 270
Guidelines and Tools ....................................................................................................... 273
Map Evaluations .............................................................................................................. 274
General Findings ............................................................................................................. 276
Conclusion ......................................................................................................................... 278
References ......................................................................................................................... 278
Part IV  Cartography in Practice and Research

On Shape Metrics in Cartographic Generalization: A Case Study of the Building Footprint Geometry ........................................... 397
Vít Pászto, Alžběta Brychtová, and Lukáš Marek
Introduction .................................................. 397
Data and Methods .......................................... 399
Results: Case Study ...................................... 402
Discussion .................................................. 405
Conclusions ............................................... 405
References ................................................ 406

Analysis of Basic Relations Within Insights of Spatio-Temporal Analysis ................................................. 409
Andreas Hall and Paula Ahonen-Rainio
Introduction .................................................. 409
Theoretical Background .................................... 411
Case Study .................................................. 414
Results ..................................................... 415
  The Framework of Spatio-Temporal Cognitive Concepts .... 416
  Insights .................................................. 416
Discussion and Conclusions ............................ 420
References ................................................ 421

3D Cartography as a Platform for Reminding Important Historical Events: The Example of the Terezín Memorial .................. 425
Pavel Hájek, Karel Jedlička, Michal Kepka, Radek Fiala, Martina Vichrová, Karel Janečka, and Václav Čada
Creation of 3D Maps ....................................... 425
Modeling of 3D Objects of Terezín ....................... 426
  Modeling of Buildings of Terezín Fortresses .......... 427
  Modeling of Terezín’s Fortification .................... 432
Data Storage and Interactivity of the 3D Model .......... 434
Summary .................................................. 436
References ................................................ 437

Changes in Urban Area Discovered by Analysis of Chosen Places in Old Maps of Liberec .......................... 439
Vojtěch Blažek, Vojtěch Hájek, Ladislav Ličík, Branislav Nižnanský, and Klára Popková
Introduction .................................................. 439
Methodology ............................................... 440
  The Locality of Vítězná and Masarykova Crossroads... 440
  Locality of TUL Area .................................... 444
  Locality Králův Háj 1 .................................... 448
Conclusion ................................................................. 453
Source Materials ....................................................... 453
References ................................................................. 454

Altering of Graphical Part of Local Flood Management Plans Using Geoinformatics: Scottish and Czech Approaches .................. 455
Petr Vahalík and Přemysl Janata

Introduction ............................................................. 455
Methods and Data .......................................................... 457
Characterization of the Locality in Question ...................... 458
Creation of the Local Flood Management Plan in the Village Hostašovice ............................................................. 458

Results ................................................................. 460
Structure of Administration and Creation of the Flood Management Documentation in the CR ................................................. 460
Structure of Administration and Creation of Flood Management Documentation in Scotland ................................................. 461
GIS Implementation in the Case Study of a Local Flood Management Plan ................................................................. 462

Conclusion ................................................................. 463
References ................................................................. 464

Mapping a Local Budget Plan: Why and How? ................. 467
Anja Reinermann-Matatko

Mapping a Local Budget Plan: Why? ..................................... 467
Georeferencing a Local Budget Plan ........................................ 469
Mapping a Local Budget Plan ................................................... 470
Methods ................................................................. 470
Results ................................................................. 472
  Online Survey ........................................................ 472
  Eye-Tracking Study .................................................. 473

Conclusion ................................................................. 474
References ................................................................. 475

Historical Data Processing, Modelling, Reconstruction, Analysis and Visualization of Historical Landscape in the Region of North-West Bohemia ................................................................. 477
Jan Pacina and Jiří Cajthaml

Introduction ................................................................. 477
The Area of Interest ............................................................ 478
Data and Methods ............................................................ 479
  Old Maps ............................................................ 479
  Aerial Photographs .................................................... 480
  Digital Terrain Modelling .......................................... 480
  Field Data Collection ................................................ 481
Information System Front-End ............................................. 484

Conclusions ................................................................. 486
References ................................................................. 487
Bayesian Mapping of Medical Data .................................................. 489
Lukáš Marek, Vít Pászto, and Pavel Tuček
Introduction .................................................................................. 489
Disease Mapping and Basic Terms in Epidemiology ................. 490
Bayesian Mapping and Smoothing ............................................. 491
Identification of Spatial Clusters ............................................... 492
Case Study ................................................................................. 494
  Data ....................................................................................... 494
  Choropleth Maps of Smoothed Prevalence and Relative Risk .... 494
  Identification of Clusters ....................................................... 501
Discussion and Conclusions .................................................... 504
References ................................................................................. 504

Spatial-Temporal Evolution of the Unique Preserved Meandering System in Central Europe ........................................ 507
Jakub Miřijovský and Monika Šule-Michalková
Introduction .................................................................................. 507
Study Area .................................................................................. 508
  Case Study Site ....................................................................... 508
Material and Methods .............................................................. 510
  UAV Photogrammetry ............................................................ 510
  Ground Control Points ........................................................... 511
Results and Discussion ............................................................ 513
  Analysis of the Historical Development of the Morava River Near the Kenický Meander PLA ........................................ 513
  Woody Debris in the River Basin ............................................. 513
  The Kenická Accumulation and Woody Debris ....................... 514
  Further Development of the Locality ..................................... 515
Conclusions ................................................................................. 516
References ................................................................................. 517

Terrain Analysis for Armed Forces .............................................. 519
Vaclav Talhofer, Vladimir Kovarik, Marian Rybansky, Alois Hofmann, Martin Hubacek, and Sarka Hoskova-Mayerova
Introduction .................................................................................. 519
Analysis of Potential Helicopter Landing Sites ...................... 520
  Crisp Set Analysis of Potential HLS ....................................... 521
  Fuzzy Set Analysis of Potential HLS ..................................... 522
Results and Discussion ............................................................ 524
Analysis of Cross Country Movement ..................................... 525
  Crisp Set Analysis of CCM ..................................................... 528
  Fuzzy Set Analysis of CCM ..................................................... 528
Results and Discussion ............................................................ 530
Conclusion ................................................................................. 532
References ................................................................................. 532

Index ............................................................................................ 533
Modern Trends in Cartography
Selected Papers of CARTOCON 2014
Brus, J.; Vondrakova, A.; Vozenilek, V. (Eds.)
2015, XXIII, 534 p. 116 illus., 79 illus. in color.,
Hardcover
ISBN: 978-3-319-07925-7