

# Contents

<b>1</b>	<b>Introduction</b>	1
1.1	Motivation	1
1.2	Research Goals	4
1.3	Contributions	6
1.4	Dissertation Roadmap	9
	References	12
 <b>Part I Literature Review and State of the Art</b>		
<b>2</b>	<b>Information Visualization</b>	17
2.1	Terminological Distinction	18
2.2	Visual Perception and Processing	23
2.2.1	Preattentive Processing	23
2.2.2	Attentive Processing	27
2.3	Visual Interaction	28
2.3.1	Classifications of Visual Interactions	29
2.3.2	Visual Interaction Techniques	32
2.4	Visualization Tasks	34
2.4.1	Classifications of Visual Tasks	35
2.4.2	High-Level Visual Tasks	39
2.5	Data Foundations	41
2.5.1	Classifications of Data	41
2.5.2	Data Types	43
2.6	Methods and Techniques in Information Visualization	46
2.6.1	Classifications of Visualization Techniques	46
2.6.2	Visualization Techniques	50
2.7	Summary and Findings	60
	References	62
<b>3</b>	<b>Semantics Visualization</b>	69
3.1	Terminological Distinction	70
3.2	The Semantic Web	71

3.2.1	Concept and Architecture of the Semantic Web. . . . .	72
3.2.2	Knowledge Discovery for Semantic Web . . . . .	74
3.3	Semantic Formalisms and Languages . . . . .	76
3.3.1	Classifications of Semantic Formalisms . . . . .	77
3.3.2	Semantic Languages . . . . .	80
3.4	Interaction with Semantics . . . . .	85
3.4.1	Querying Semantics. . . . .	85
3.4.2	Human Interaction with Semantics. . . . .	86
3.5	Visualization of Semantics . . . . .	92
3.5.1	Definition of Semantics in Context of Information Visualization. . . . .	92
3.5.2	Classification of Semantics Visualizations . . . . .	94
3.5.3	Survey of Semantics Visualization Techniques . . . . .	97
3.6	Summary and Findings. . . . .	111
	References . . . . .	115
<b>4</b>	<b>Adaptive Visualization . . . . .</b>	<b>123</b>
4.1	Terminological Distinction . . . . .	124
4.2	Adaptation in Computational Systems . . . . .	127
4.3	Adaptation Process and Methods . . . . .	130
4.3.1	The Adaptation Process . . . . .	130
4.3.2	Predictive Statistical Methods . . . . .	131
4.4	Adaptive Process in Information Visualization. . . . .	135
4.4.1	Influencing Factors . . . . .	136
4.4.2	Knowledge Modeling. . . . .	138
4.4.3	Human Interface Adaptation . . . . .	141
4.5	Adaptive Visualizations . . . . .	144
4.5.1	Definition of Adaptive Visualizations. . . . .	144
4.5.2	Classification of Adaptive Visualizations . . . . .	145
4.5.3	Survey of Adaptive Visualization Techniques and Methods. . . . .	147
4.6	Summary and Findings. . . . .	163
	References . . . . .	164

**Part II Model for Adaptive Semantics Visualization**

<b>5</b>	<b>The Methodological Approach of Adaptive Semantics Visualization . . . . .</b>	<b>173</b>
5.1	Analysis and Derivation of Requirements . . . . .	173
5.2	High-Level Design for Visualization Adaptation . . . . .	179
5.3	Influencing Factors . . . . .	181
5.4	Knowledge Model . . . . .	182
5.5	Process of Adaptation. . . . .	185
5.6	Visual Adaptation . . . . .	187

5.7	Support of Exploratory Search. . . . .	189
5.8	Chapter Summary . . . . .	190
	References . . . . .	191
<b>6</b>	<b>Conceptual Model of Adaptive Semantics Visualization . . . . .</b>	<b>193</b>
6.1	Knowledge Model . . . . .	195
6.1.1	Data Model . . . . .	195
6.1.2	Data Feature Model . . . . .	207
6.1.3	User Model . . . . .	216
6.2	Process of Adaptation. . . . .	237
6.2.1	User Similarity Analysis. . . . .	238
6.2.2	User Deviation Analysis. . . . .	239
6.2.3	Adaptation Process . . . . .	242
6.3	Visual Adaptation . . . . .	251
6.3.1	Layer-Based Reference Model of Adaptation . . . . .	251
6.3.2	Semantics and Content Adaptation. . . . .	259
6.3.3	Visual Layout Adaptation. . . . .	260
6.3.4	Recommending Visual Layouts. . . . .	275
6.3.5	Visual Variables Adaptation . . . . .	277
6.3.6	Visual Interface Adaptation. . . . .	280
6.4	Support of Exploratory Search. . . . .	281
6.4.1	Top-Down Versus Bottom-Up Search . . . . .	282
6.4.2	The Visualization Cockpit Model . . . . .	284
6.5	Chapter Summary . . . . .	290
	References . . . . .	293

**Part III Proof of the Conceptual Model**

<b>7</b>	<b>SemaVis: An Adaptive Semantics Visualization Technology . . . . .</b>	<b>301</b>
7.1	General Architecture of SemaVis. . . . .	302
7.2	User Interface Design of SemaVis . . . . .	306
7.3	Selected Application Scenarios . . . . .	311
7.3.1	SemaVis in Digital Libraries. . . . .	312
7.3.2	SemaVis in Web Search. . . . .	319
7.3.3	SemaVis in Policy Modeling. . . . .	329
7.4	Chapter Summary . . . . .	334
	References . . . . .	335
<b>8</b>	<b>Empirical User Study. . . . .</b>	<b>337</b>
8.1	Foundations of Evaluating Adaptive Visualizations . . . . .	338
8.2	Preliminary Study . . . . .	342
8.2.1	Method . . . . .	343
8.2.2	Collected Data . . . . .	345
8.2.3	Procedure. . . . .	347
8.2.4	Results. . . . .	348
8.2.5	Discussion and Limitations. . . . .	348

8.3	Evaluation of SemaVis . . . . .	349
8.3.1	Hypotheses . . . . .	351
8.3.2	Method . . . . .	354
8.3.3	Collected Data . . . . .	361
8.3.4	Procedure . . . . .	364
8.3.5	Results . . . . .	365
8.3.6	Summary of Results and Discussion . . . . .	380
8.4	Chapter Summary . . . . .	384
	References . . . . .	387
<b>9</b>	<b>Conclusions and Future Work . . . . .</b>	<b>391</b>
9.1	Summary . . . . .	392
9.2	Benefits of the Visual Adaptation Model . . . . .	394
9.3	Prospects for Future Work . . . . .	396
	<b>Appendix A: Publications and Further Readings . . . . .</b>	<b>399</b>
	<b>Appendix B: Supervising Activities . . . . .</b>	<b>407</b>
	<b>Appendix C: Questionnaires of the Evaluation . . . . .</b>	<b>409</b>
	<b>Appendix D: Tasks of the Evaluation . . . . .</b>	<b>415</b>
	<b>Appendix E: Complementary and Detailed Results of the Evaluation . . . . .</b>	<b>419</b>



<http://www.springer.com/978-3-319-30815-9>

Adaptive Semantics Visualization

Nazemi, K.

2016, XVIII, 422 p. 139 illus., 123 illus. in color.,

Hardcover

ISBN: 978-3-319-30815-9