

Understanding Complex Systems

Founding Editor

Prof. Dr. J.A. Scott Kelso
Center for Complex Systems & Brain Sciences
Florida Atlantic University
Boca Raton FL, USA
E-mail: kelso@walt.ccs.fau.edu

Editorial and Programme Advisory Board

Dan Braha
New England Complex Systems, Institute and University of Massachusetts, Dartmouth

Péter Érdi
Center for Complex Systems Studies, Kalamazoo College, USA and Hungarian Academy of Sciences, Budapest, Hungary

Karl Friston
Institute of Cognitive Neuroscience, University College London, London, UK

Hermann Haken
Center of Synergetics, University of Stuttgart, Stuttgart, Germany

Viktor Jirsa
Centre National de la Recherche Scientifique (CNRS), Université de la Méditerranée, Marseille, France

Janusz Kacprzyk
System Research, Polish Academy of Sciences, Warsaw, Poland

Kunihiko Kaneko
Research Center for Complex Systems Biology, The University of Tokyo, Tokyo, Japan

Scott Kelso
Center for Complex Systems and Brain Sciences, Florida Atlantic University, Boca Raton, USA

Markus Kirkilionis
Mathematics Institute and Centre for Complex Systems, University of Warwick, Coventry, UK

Jürgen Kurths
Potsdam Institute for Climate Impact Research (PIK), Potsdam, Germany

Andrzej Nowak
Department of Psychology, Warsaw University, Poland

Linda Reichl
Center for Complex Quantum Systems, University of Texas, Austin, USA

Peter Schuster
Theoretical Chemistry and Structural Biology, University of Vienna, Vienna, Austria

Frank Schweitzer
System Design, ETH Zürich, Zürich, Switzerland

Didier Sornette
Entrepreneurial Risk, ETH Zürich, Zürich, Switzerland

For further volumes:
<http://www.springer.com/series/5394>

Understanding Complex Systems

Future scientific and technological developments in many fields will necessarily depend upon coming to grips with complex systems. Such systems are complex in both their composition - typically many different kinds of components interacting simultaneously and nonlinearly with each other and their environments on multiple levels - and in the rich diversity of behavior of which they are capable.

The Springer Series in Understanding Complex Systems series (UCS) promotes new strategies and paradigms for understanding and realizing applications of complex systems research in a wide variety of fields and endeavors. UCS is explicitly transdisciplinary. It has three main goals: First, to elaborate the concepts, methods and tools of complex systems at all levels of description and in all scientific fields, especially newly emerging areas within the life, social, behavioral, economic, neuroand cognitive sciences (and derivatives thereof); second, to encourage novel applications of these ideas in various fields of engineering and computation such as robotics, nano-technology and informatics; third, to provide a single forum within which commonalities and differences in the workings of complex systems may be discerned, hence leading to deeper insight and understanding.

UCS will publish monographs, lecture notes and selected edited contributions aimed at communicating new findings to a large multidisciplinary audience.

Springer Complexity

Springer Complexity is an interdisciplinary program publishing the best research and academic-level teaching on both fundamental and applied aspects of complex systems - cutting across all traditional disciplines of the natural and life sciences, engineering, economics, medicine, neuroscience, social and computer science.

Complex Systems are systems that comprise many interacting parts with the ability to generate a new quality of macroscopic collective behavior the manifestations of which are the spontaneous formation of distinctive temporal, spatial or functional structures. Models of such systems can be successfully mapped onto quite diverse "real-life" situations like the climate, the coherent emission of light from lasers, chemical reaction-diffusion systems, biological cellular networks, the dynamics of stock markets and of the internet, earthquake statistics and prediction, freeway traffic, the human brain, or the formation of opinions in social systems, to name just some of the popular applications.

Although their scope and methodologies overlap somewhat, one can distinguish the following main concepts and tools: self-organization, nonlinear dynamics, synergetics, turbulence, dynamical systems, catastrophes, instabilities, stochastic processes, chaos, graphs and networks, cellular automata, adaptive systems, genetic algorithms and computational intelligence.

The two major book publication platforms of the Springer Complexity program are the monograph series "Understanding Complex Systems" focusing on the various applications of complexity, and the "Springer Series in Synergetics", which is devoted to the quantitative theoretical and methodological foundations. In addition to the books in these two core series, the program also incorporates individual titles ranging from textbooks to major reference works.

Àngels Massip-Bonet
and Albert Bastardas-Boada (Eds.)

Complexity Perspectives on Language, Communication and Society

 Springer

Editors

Àngels Massip-Bonet
Department of Catalan Philology
Universitat de Barcelona
Barcelona
Spain

Albert Bastardas-Boada
Department of General Linguistics
Universitat de Barcelona
Barcelona
Spain

ISSN 1860-0832

ISBN 978-3-642-32816-9

DOI 10.1007/978-3-642-32817-6

Springer Heidelberg New York Dordrecht London

Library of Congress Control Number: 2012945426

e-ISSN 1860-0840

e-ISBN 978-3-642-32817-6

© Springer-Verlag Berlin Heidelberg 2013

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed. Exempted from this legal reservation are brief excerpts in connection with reviews or scholarly analysis or material supplied specifically for the purpose of being entered and executed on a computer system, for exclusive use by the purchaser of the work. Duplication of this publication or parts thereof is permitted only under the provisions of the Copyright Law of the Publisher's location, in its current version, and permission for use must always be obtained from Springer. Permissions for use may be obtained through RightsLink at the Copyright Clearance Center. Violations are liable to prosecution under the respective Copyright Law.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

While the advice and information in this book are believed to be true and accurate at the date of publication, neither the authors nor the editors nor the publisher can accept any legal responsibility for any errors or omissions that may be made. The publisher makes no warranty, express or implied, with respect to the material contained herein.

Printed on acid-free paper

Springer is part of Springer Science+Business Media (www.springer.com)

Acknowledgments

We are especially grateful to the following individuals, bodies and institutions:

Carme Muñoz, who as Vice-Rector for Scientific Policy at the Universitat de Barcelona allowed us to obtain assistance for a year and to organize the first course on complexity.

Jordi Alberch, Vice-Rector for Research, Universitat de Barcelona, for his support in the organization of the international congress entitled “Language and Complexity”.

The Dean’s office of the Faculty of Philology at the Universitat de Barcelona, for financial support given for the same congress.

The Department of Linguistics and the Department of Catalan Language and Literature at the Universitat de Barcelona for the facilities they have provided.

Jorge Wagensberg, director of the CosmoCaixa museum, and Guillermo Santamaría, CosmoCaixa director of activities, who placed their confidence in our project and made possible the course entitled *Un ésser viu anomenat llenguatge. Complexitat i paraula* (in English, “A Living Being Called Language: Complexity and Word”) held in 2009.

CUSC (Centre Universitari de Sociolingüística i Comunicació), which has always accepted and promoted our projects.

The Ministry of Science and Technology of the Spanish government, which has provided financial support (through project FF2009-12627) for the celebration of the international congress “Language and Complexity”.

And last but not least, the foundation ICREA (Catalan Institution for Research and Advanced Studies), whose contributions have been crucial in the final stages of coordinating and publishing this book.

Contents

1 Introduction	1
<i>Àngels Massip-Bonet, Albert Bastardas-Boada</i>	
2 Facing Complexity: Prediction vs. Adaptation	3
<i>Carlos Gershenson</i>	
1 Introduction	3
2 The Limits of Prediction.....	4
3 Complexity	5
4 Adaptation	9
5 Self-organization.....	9
6 Language	10
7 The Model and the Modeled.....	12
8 Conclusions	12
References	13
3 Sociolinguistics: Towards a Complex Ecological View.....	15
<i>Albert Bastardas-Boada</i>	
1 Introduction	15
2 The Perspective of Complexity.....	16
3 The Main Aspects of an Ecological Complexity: A Proposal	18
4 Sociolinguistic Complexity.....	20
5 The (Bio)ecological Perspective as a Metaphor	23
6 Towards a Socio-emo-cognitive Language Ecology	28
7 Time and Co-evolution in Sociolinguistics.....	32
References	34
4 Language as a Complex Adaptive System: Towards an Integrative Linguistics.....	35
<i>Àngels Massip-Bonet</i>	
1 Shared Assumptions	35
2 Main Vocabulary	36
2.1 Concept.....	36
2.2 Measures of Complexity	37
2.3 Systems.....	39
2.4 Context.....	40
2.5 Organisms	41

3	Change in Complex Systems	41
3.1	Irreversibility, Self-organization and Emergence	41
3.2	Attractors	43
3.3	On the Edge of Chaos	44
3.4	Co-adaptation.....	44
4	Characteristics of the Language System as a CAS (Complex Adaptive System).....	44
4.1	Distributed Control and Collective Emergence	45
4.2	Intrinsic Diversity	45
4.3	Perpetual Dynamics	45
4.4	Adaptation through Factors of Amplification and Competition	46
4.5	Non-linearity and Phase Transitions	46
4.6	Sensitive Dependence on Network Structure.....	46
5	Language Change	46
5.1	Complexity and Change.....	46
5.2	Language Change and Variation.....	47
5.3	Parallels between Biological and Language Systems	48
6	Language Evolution and Language Change	48
7	Language and Thought: Grammar	49
8	Culture	50
9	From Genes to Culture.....	52
10	Brain and Culture.....	53
11	Theories and Time	53
11.1	Linguistic Theories and Complexity.....	53
11.2	Reducing Complexity	54
12	Epistemological Conclusions.....	55
12.1	Brain Activity and Epistemology.....	55
12.2	Neuronal Connections.....	56
13	Conclusions	57
	References	57
5	An Experientially-Based Informationless Communication	61
	<i>Òscar Vilarroya</i>	
1	Introduction	61
2	An Experientially-Based Communication	64
3	Information in Experientially-Based Communication	70
	Reference	73
6	Conversation as Emergent Function.....	75
	<i>Xavier Martorell</i>	
1	Introduction	75
2	Properties of Emergent Functions.....	75
3	Conversation Analysis	76
4	The Analytical Perspective	78
5	The Complex Perspective	79
5.1	Mind-Reading Modules	79

5.2 Social Intelligence80

6 Who Studies Complexity?81

7 How Are Cognitive Functions Generated?82

8 Conclusions83

References84

7 Communication Situations: A Dialogic Quiz?.....85
Enric Puig-Giralt

1 Introduction85

2 Complexity and Informal Speech86

3 From the Historical Discourse to the Art of Advertising87

4 A Whole Music Experience91

References93

8 Education, Emotion, Complexity95
Pere Darder

1 Introduction95

2 References to the Theory of Complexity96

3 The Emotions, Here and Now.....96

4 The Characterization of Emotions97

4.1 Emotional Education.....98

4.2 School Education98

4.3 The Emotional Competence of the Teacher.....99

5 Rethinking Education99

5.1 Integrated Education99

5.2 Learning and Knowledge100

5.3 Participation and Governance in Education.....100

6 A Brief Final Consideration.....101

References101

9 Minds and Screens: Communication and Socialization from a Complexity Perspective103
Magdalena Albero-Andrés

1 Assumptions about the Relationship between Media and Young People103

2 Causes of the Use of the Non-complex Approach106

3 How a Non-complex Approach Misleads Us107

4 Applying a Complexity Perspective to the Use of Media Products and Media Education in Schools110

References114

10 Self-organization in Communicating Groups: The Emergence of Coordination, Shared References and Collective Intelligence117
Francis Heylighen

1 Introduction117

2 Complex Systems118

- 3 Self-organization.....120
- 4 Self-organization as a Problem of Coordination.....122
 - 4.1 Self-organization of Alignment123
 - 4.2 Division of Labor.....126
 - 4.3 Workflow.....127
 - 4.4 Aggregation128
- 5 Collective Intelligence.....129
 - 5.1 Requirements for Collective Intelligence129
 - 5.2 Groupthink and Polarization131
 - 5.3 Avoiding Groupthink.....132
- 6 The Self-organization of Shared References132
 - 6.1 The Origin of Language.....133
 - 6.2 Conversational Alignment135
 - 6.3 Group Alignment136
- 7 An Experiment in Collective Intelligence.....137
 - 7.1 Setting Up an Experiment.....137
 - 7.2 Results of the Experiment.....141
 - 7.3 Interpretation of the Results.....142
- 8 Conclusion.....144
- References146

11 General Linguistics and Communication Sciences: Sociocomplexity as an Integrative Perspective151

Albert Bastardas-Boada

- 1 Introduction: The Need for a Perspective of Complexity151
- 2 Towards a Paradigm of Complexity153
 - 2.1 Constructing a World. The Representation of Reality, and Scientific Activity.....153
 - 2.2 (Re)thinking Reality154
 - 2.3 Wholes and Parts156
 - 2.4 Time.....159
 - 2.5 Human Beings: The Centrality of the Mind/Brain.....161
 - 2.6 Interdisciplinarity.....164
- 3 Linguistics and Complexity166
- References171

12 The Fuzzy Complexity of Language.....175

Frederic Munné

- 1 Fuzziness as a Property of Complex Systems.....175
- 2 Inverting the Laws of Aristotelian Logic.....177
- 3 Language as a Fuzzy System178
- 4 Delimitation: Reducing the Fuzziness180
- 5 Categorization: A Resource for Definition182
- 6 Dichotomization: Glossing over the Fuzziness.....184
- 7 Words as Fuzzy Concepts.....186
- 8 Words and Definitions.....189

9	Indicators of Fuzziness	191
10	Expanding Fuzziness: Hypertext	193
11	Returning to Where We Began	195
	References	195
13	The Emergence of Complexity in Language: An Evolutionary Perspective.....	197
	<i>Salikoko S. Mufwene</i>	
1	Introduction	197
2	Languages as Technologies	201
3	The Phylogenetic Emergence of Complexity	204
3.1	The Nature of Linguistic Complexity	204
3.2	How Did Complexity Emerge Phylogenetically in Language?	208
4	Conclusions	213
	References	215
14	The Ecology of Pressures: Towards a Tool to Analyze the Complex Process of Language Shift and Maintenance.....	219
	<i>Roland Terborg and Laura García-Landa</i>	
1	Introduction	219
2	The Origin of Actions	222
3	The Origin of Pressure	222
4	Interests and Pressures	225
5	The State of the World and Pressures	228
6	Competence and Common Routine	229
7	Classification of Pressures	235
8	As a Conclusion.....	237
	References	238
15	Ethics and Progress in Today's World	241
	<i>Federico Mayor Zaragoza</i>	
	Author Index.....	247
	Subject Index.....	249

List of Editors and Authors

Àngels Massip-Bonet

Department of Catalan Philology
Universitat de Barcelona.
Gran Via de les Corts Catalanes, 585
08007 Barcelona, Spain
E-mail: amassip@ub.edu

Albert Bastardas-Boada

Departament of General Linguistics
Universitat de Barcelona.
Gran Via de les Corts Catalanes, 585
08007 Barcelona, Spain
E-mail: albertbastardas@ub.edu

Magdalena Albero-Andrés

Department of Journalism and Communication Studies
Universitat Autònoma de Barcelona
Edifici I
08193 Bellaterra (Barcelona), Spain
E-mail: magdalena.albero@uab.cat

Pere Darder Vidal

Emeritus professor
Department of Systematic and Social Pedagogy
Universitat Autònoma de Barcelona
Edifici G 6.
08193 Bellaterra, Spain
E-mail: pere.darder@uab.cat

Laura García-Landa

Teaching Centre of Foreign Languages (CELE)
Universidad Autónoma Nacional de México
Circuito interior s/n
Ciudad Universitaria del. Coyoacán
Coyoacán, 04510, México D.F.
E-mail: garlanster@gmail.com

Carlos Gershenson

Computer Science Department
Instituto de Investigaciones en Matemáticas Aplicadas y en Sistemas,
Universidad Nacional Autónoma de México
Circuito Escolar s/n, 4
Ciudad Universitaria
Coyoacán, 04510, México D.F.
E-mail: cgg@unam.mx

Francis Heylighen

Global Brain Institute
Vrije Universiteit Brussel
Krijgskundestraat 33
1160 Brussels, Belgium
E-mail: fheylighen@vub.ac.be

Xavier Martorell

Complexity, Communication, and Sociolinguistics Group
Universitat de Barcelona
Gran Via de les Corts Catalanes, 585
08007 Barcelona, Spain
E-mail: xamafa@telefonica.net

Salikoko S. Mufwene

Department of Linguistics
University of Chicago
1010 E. 59th Street
Chicago, IL 60637, USA
E-mail: s-mufwene@uchicago.edu

Frederic Munné

Emeritus Professor
Department of Social Psychology
Universitat de Barcelona
Campus de Mundet - Edifici Ponent, 4a planta
Passeig de la Vall d'Hebron, 171
E-mail: fmunne@icab.cat

Enric Puig-Giralt

Departament of General Linguistics
Universitat de Barcelona
Gran Via de les Corts Catalanes, 585
08007 Barcelona, Spain
E-mail: puig-giralt@terra.es

Roland Terborg

Teaching Centre of Foreign Languages (CELE)
Universidad Autónoma Nacional de México
Circuito interior s/n
Ciudad Universitaria Del. Coyoacán
Coyoacán, 04510, México D.F.
E-mail: roland.terborg@gmail.com

Òscar Vilarroya

Unitat de Recerca en Neurociència Cognitiva (URNC),
Department of Psychiatry and Legal Medicine,
Universitat Autònoma de Barcelona;
Neuroimaging Research Group (NRG),
Fundació IMIM
Doctor Aiguader, 88
08003 Barcelona, Spain
E-mail: Oscar.Vilarroya@uab.cat