

SIMULATING THE EVOLUTION OF LANGUAGE



Edited by
Angelo Cangelosi & Domenico Parisi

Summary

This volume provides a comprehensive survey of computational models and methodologies used for studying the origin and evolution of language and communication. With contributions from the most influential figures in the field, *Simulating the Evolution of Language* presents and summarises current computational approaches to language evolution and highlights new lines of development. Among the main discussion points are:

- Analysis of emerging linguistic behaviours and structures
- Demonstration of the strict interaction and interdependence between language and other non-linguistic abilities
- Direct comparisons between simulation studies and empirical research

Essential reading for researchers and students in the areas of evolutionary and adaptive systems, language evolution, modelling and linguistics, it will also be of particular interest to computer scientists working on multi-agent systems, robotics and internet agents.



Springer-Verlag (London) Ltd

Table of Contents

Aknowledgements	ix
List of Contributors	xi
PART I INTRODUCTION	1
1 Computer Simulation: A New Scientific Approach to the Study of Language Evolution <i>Angelo Cangelosi and Domenico Parisi</i>	3
2 An Introduction to Methods for Simulating the Evolution of Language <i>Huck Turner</i>	29
PART II EVOLUTION OF SIGNALING SYSTEMS	51
3 Adaptive Factors in the Evolution of Signaling Systems <i>Jason Noble, Ezequiel A. Di Paolo and Seth Bullock</i>	53
4 Evolving Sound Systems <i>Bart de Boer</i>	79
5 The Evolution of Dialect Diversity <i>Daniel Livingstone</i>	99
PART III EVOLUTION OF SYNTAX	119
6 The Emergence of Linguistic Structure: An Overview of the Iterated Learning Model <i>Simon Kirby and James R. Hurford</i>	121
7 Population Dynamics of Grammar Acquisition <i>Natalia L. Komarova and Martin A. Nowak</i>	149
8 The Role of Sequential Learning in Language Evolution: Computational and Experimental Studies <i>Morten H. Christiansen, Rick A.C. Dale, Michelle R. Ellefson and Christopher M. Conway</i>	165

PART IV GROUNDING OF LANGUAGE	189
9 Symbol Grounding and the Symbolic Theft Hypothesis <i>Angelo Cangelosi, Alberto Greco and Stevan Harnad</i>	191
10 Grounding Symbols through Evolutionary Language Games <i>Luc Steels</i>	211
PART V BEHAVIORAL AND NEURAL FACTORS	227
11 Grounding the Mirror System Hypothesis for the Evolution of the Language-ready Brain <i>Michael A. Arbib</i>	229
12 A Unified Simulation Scenario for Language Development, Evolution, and Historical Change <i>Domenico Parisi and Angelo Cangelosi</i>	255
PART VI AUTO-ORGANIZATION AND DYNAMIC FACTORS	277
13 Auto-organization and Emergence of Shared Language Structure <i>Edwin Hutchins and Brian Hazlehurst</i>	279
14 The Constructive Approach to the Dynamic View of Language <i>Takashi Hashimoto</i>	307
PART VII CONCLUSION	325
15 Some Facts about Primate (including Human) Communication and Social Learning <i>Michael Tomasello</i>	327
Author Index	341
Subject Index	347