Published under the aegis of

Center for Communication and Information Sciences
(Victoria University; University of Toronto;
University of Helsinki; Universidad Sao Paulo, Brasil; Indiana University;
University of Lugano; University of Ottawa)

Series: Language, Media & Education Studies
Edited by: Marcel Danesi & Leonard G. Sbrocchi

2. M. Angenot, Critique of Semiotic Reason
4. A. Bailin, Metaphor and the Logic of Language Use
6. C. Madott Kosnik, Primary Education: Goals, Processes and Practices
7. F. Nuessel, The Esperanto Language
9. F. Ratto, Hobbes tra scienza della politica e teoria delle passioni
10. S. Battestini, African Writing and Text
11. T. A. Sebeok, Essays in Semiotics I: Life Signs
12. T. A. Sebeok, Essays in Semiotics II: Culture Signs
13. A. Ponzio and S. Petrilli, Philosophy of Language, Art and Answerability in Mikhail Bakhtin
15. F. Merrell, Signs for Everybody, or, Chaos, Quandaries and Communication
16. P. Perron, L.G. Sbrocchi, P. Colilli, M. Danesi (eds.) Semiotics as a Bridge between the Humanities and the Sciences
17. A. Makolkin, Anatomy of Heroism
18. P. Perron, M. Danesi, J. Umiker-Sebeok, A. Watanabe (eds.) Semiotics and Information Sciences
20. M. Danesi (ed.), The Invention of Global Semiotics
21. T. A. Sebeok, Semiotic Prologues
22. R. Dalvesco, Fuller Speak
23. F. Merrell, Learning Living. Living Learning: Signs Between East and West
24. J. Kelly (ed.), Looking Up; Science and Observation in the Early Modern Period
25. A. Valdman, Études sur les variétés du français
27. D. A. Koike, La co-construcción del significado en el español de la Américas: acercamientos discursivos

Cover:
Compugraphics by Pierre Bertrand
28. P. Perron and M. Danesi, *Classical Readings in Semiotics*
29. J. Deely, *Why Semiotics?*
30. S. Petrilli and A. Ponzio, *Views in Literary Semiotics*
31. F. Nuessel and A. Cedeño, *Selected Literary Commentary in the Literature of Spain*
32. A. Ponzio and S. Petrilli, J. Ponzio, *Reasoning with Emmanuel Levinas*
33. M. Solimini, *Anthropology, Otherness, and Existential Enterprise*
34. Maria Grazia Guido, *The Imaging Reader: Visualization and Embodiment of Metaphysical Discourse*
35. J. Deely, S. Petrilli, A. Ponzio, *The Semiotic Animal*
36. R. Iannacito-Provenzano, *Il dialetto molisano di Villa San Michele (Isernia)*
37. A. Ponzio, *The Dialogic Nature of Sign*
38. W. Weiss, *Towards a Mobile Voice*
39. R. Williamson, *La historia verdadera de la conquista de la Nueva España de Bernal Díaz del Castillo. Apuntes para una historia de su lenguaje*
41. F. Merrell, *Processing Cultural Meaning*
42. S. Petrilli and A. Ponzio, *Semiotics Today. From Global Semiotics to Semioethics, a Dialogic Response*
43. G. Marrone, *The Ludovico Cure. On Body and Music in a Clockwork Orange*
44. A. Ponzio, *Emmanuel Levinas, Globalization, and Preventive Peace*
45. R. Longo Lavorato, *De vulgari eloquentia: lingua e dialetti nella cultura italiana*
46. Wang Ning, *Translated Modernities: Literary and Cultural Perspectives on Globalization and China*
47. J. Deely, *Semiotics Seen Synchronously. The View as of 2010*
48. Carolina Travalia, *El concepto de colocación en español: propuesta de una nueva taxonomía y delimitación de sus funciones*
50. Sergej G. Proskurin, *Essays in Contemporary Semiotics*
51. M. Pasquarelli Clivio (ed.) *Lingue in contatto e plurilinguismo nella cultura italiana*
52. Stefania Ventura, *Teaching Languages Through Activities, Games, and Projects* (eds.) *Shaping an Identity. Adapting, Rewriting and Remaking Italian Identity*
55. Frank Nuessel, *Studies in Proverbial Language*
56. Susan Petrilli, ed. *Writing, Voice, Underlaking*
57. Mariana Bockarova and Maecel Danesi, *Semiotic Analysis for Advertisers & Maeketers: An Outline*
58. Maria Grazia Guido, *The Acting Interpreter. Embodied Stylistics in an Experientialist Perspective*
59. Katherine L Morrison, *Loyalism and the Conquest: Historical Roots*
Maria Giulia Dondero
Jacques Fontanille

The Semiotic Challenge of Scientific Images
A Test Case for Visual Meaning

Translation: Julie Tabler

New York Ottawa Toronto
The authors would like to acknowledge the National Research Agency group "Images et dispositifs de visualisation scientifiques" (2008-2010) for hosting a major collective investigation on the topic of this book, as well as program coordinator Anne Beyaert-Geslin, for organizing the workshops and publications associated with it. The authors also extend their appreciation to all the participants in this scholarly investigation for their thoughtful input. A special acknowledgement goes to our friend, Professor Thomas Broden, who gave valuable input on the translation of terminology, including some technical terms never before translated.
# Table of Contents

**FOREWOR**
- A semiotic project 11
- A study of scientific practices 12
- Problematic images 14
- An irreducible structure of experience 17

**PART ONE**
TECHNOLOGIES USED IN THE PRODUCTION OF THE REFERENT

1. Exploring the Visible and the Invisible
   
   1.1. *The Exploration Sequence* 23
   - Exploration and Enunciation 23
   - Energy and Light “Explore” Matter and Bodies 28
   - Exploration Via Scientific and Medical Imaging 31

   1.2. *Exploration, Iconization and Referentialization* 32
   - Modes of Exploration 32
     - X-ray photography 32
     - Computerized tomography scanning 33
     - Scintigraph 33
     - Magnetic resonance imaging 34
     - Ultrasonography 35
     - Optical microscopy 36
     - Scanning tunneling microscopy 36
   - The Tensions Between Iconization and Referentialization 37

2. The Paradoxical “Realism” of Scientific Imaging

   2.1. *Introduction* 41

   2.2. *Realism Derailed* 43
   - The Agents of Everyday Realism 43
   - The Agents of “Positivist” Scientific Realism 44
   - Iconic Drift and “Mythical” Realism 46
   - Practical Realism 49
   - Practical Reduction and Familiarization 50
     - The dual semiotic function 50
     - Familiarization and functional reduction 51

   2.3. *Finishing off ... with energy* 52
3. The Moment of Iconization: Cognitive Tactics and Interpretive Adjustments

3.1. Introduction 55

3.2. Image Instantiation Techniques 56
   Inquiry, Stabilization, Standardization 56
   Iconization and mereology 59

3.3. The Strategic Adjustments Used in the Quest for Figuration 63
   Distal Adjustment and Structural Adjustment 63
     Iconic instability and disabling the point of view 63
     Distal adjustment 65
     Structural adjustment 67
     Subliminal adjustment and imaginal adjustment 67
     Subliminal adjustment 68
     Imaginal adjustment 69
   A Model for Adjusting Cognitive Interactions 71

3.4. Aesthetics and Ethics of Scientific Imaging 74
   Standards, Practices, and Modulations 74
   Aesthetic Contemplation and the Continuity of Physical Worlds 75
   Transformations of the Point of View and Isotopic Conservation 77

3.5. Conclusion 83

Part Two
The Image in the Genres of Scientific Literature

1. From Research Article to Popular Dissemination

1.1. Black Holes in Research Articles 89
   Diagrams and Simulated Photography 90
   From Equation to Visualization 93
   The Manipulable Space of the Diagram 96
   The Diagram as a Visual Experiment 98

1.2. Dissemination Strategies 100
   Simulated Photography:
     Between the Allograph and the Autograph 100
     Simulated Photography and Spirit Photography 102
     Art in Search of the Foundations of Scientific Research 103

1.3. Coda: Art and Mathematics 109
   Cubist Preamble 110
2. Image Series and Scientific Argumentation. Establishing a Montage Type as Part of an Institutional Strategy

2.1. Preamble: Study Objectives and Focus

2.2. The Argumentative Challenges of the Article

Summary of the Argumentation

Stage 1: Macroscopic behavior at very high temperatures
Stage 2: The multi-scalar nature of textured composites
Stage 3: Scale identification and key behaviors

Discussion of the basic line of argumentation

2.3. The Visual Types

The Technical Types
The Semiotic Types
Texture images
Energy images
Concept images
Profile images

2.4. The Rhetorical Organization of the Images

Visual Sequences
Homo-semiotic Sequences
Hetero-semiotic Sequences
Marginal hetero-semiotic sequences
Radical hetero-semiotic sequences

How the Images and Figure Sequences Contribute to the Argumentation

2.5. Conclusion

Part Three
Scientific Images and Schematization

1. The Diagram: Between Mathematics and Visualization

1.1. Preamble: Schemas vs. Diagrams

1.2. The Diagram According to Peirce
The Diagram as an Instrument of Manipulation 144
Photographic Diagrams 149

1.3. Photography as a Tool of Science 150

1.4. The Diagram: Straddling Autography and Allography 154

1.5. From Photography to Geometric Translation 156
The Journey from the Trace to the Type 156
From Photo to Graphic 159
From Drawing to Diagram 163

2. Narrative “problems” and iconic solutions: the semiotic status of mathematical curves

2.1. The Narrative Interpretation of Mathematical Problem Utterances 169

2.2. The Problem at Hand: the Semiotics of Change and the Evolutionary Profile 171

2.3. Why is the Visual Expression of the Solution a Curve? 174

2.4. The Semiotic Analysis of “Profile Types” and Curves 177
The Plane of Expression and the Plane of Content of the Curve 177
The Tug-of-war Between Programs and Counter-programs 181

2.5. A Typology of Curves 182

2.6. Final Remarks: the Composition of Evolving Profiles 187

Conclusions 193

Bibliographic References 197