Contents

Preface	vii
List of Figures	ix
Introduction: the 'picture theory of science'	I
Part I. Representation	
1. Representation of, Representation As	11
The value of distortion	12
How does a representation represent?	15
What's in a photo?	20
What is a representation then?	22
Appearance to the intellect: illumination as embedding	29
In conclusion	30
2. Imaging, Picturing, and Scaling	33
Modes of representation	33
What distinguishes a picture?	36
Mathematical imagery, distortion through abstraction	39
Scale models and virtuous distortion	49
Conclusion about imaging and scaling	56
3. Pictorial Perspective and the Indexical	59
Pictorial perspective and the Art of Measuring	60
Perspective versus Descartes's frames of reference	66
Mapping and perspectival self-location	75
What is in a map?	82
Visual perspective and the metaphor	84
Concluding empiricist postscript	86

Part II. Windows, Engines, and Measurement

4.	A Window on the Invisible World (?)	93
	Instrumentation's diversity of roles	94
	Engines of creation: engendering new phenomena	100
	The microscope's public hallucinations	101
	Objections to this view of 'observation by instruments'	105
	Experimentation's diversity of roles	111
5.	The Problem of Coordination	115
	Coordination: a historical context	116
	The problem of coordination reconceived	121
	Mach on the history of the thermometer	125
	Poincaré's analysis of time measurement	130
	Observables coordinated: two morals	137
6.	Measurement as Representation: 1. The Physical Correlate	141
	Physical conditions of possibility for measurement	141
	General theory of measurement	147
	What is not measurement	156
7.	Measurement as Representation: 2. Information	157
	What is measurement—number-assigning?	158
	The scale as logical space	164
	Data models and surface models	166
	The over-arching concept for measurement	172
	What is a measurement outcome?	179
	Relating the views 'from above' and 'from within'	184
Part	III. Structure and Perspective	
8.	From the Bildtheorie of Science to Paradox	191
	The Bildtheorie controversy	191
	Representation: the problem for structuralism	204

	CONTENTS	xiii
9.	The Longest Journey: Bertrand Russell	213
	Prolegomena to Russell's conversion to structuralism	213
	Russell's structuralist turn	217
	Conclusion	223
10.	Carnap's Lost World and Putnam's Paradox	225
	Carnap: Der Logische Aufbau der Welt	225
	Putnam's Paradox	229
	Staying with Putnam: the Paradox dissolved	232
II.	An Empiricist Structuralism	237
	What could be an empiricist structuralism?	237
	The fundamental remaining problem for a structuralist view of science	
		239
	The two main dangers for an empiricist The problem in concrete setting revisited and dissolved	244
	Return to our epistemological question	253 261
Part	IV. Appearance and Reality	
12.	Appearance vs. Reality in the Sciences	269
	Appearance and reality: the real and unreal problem	270
	Appearance versus reality at the birth of modern science	270
	Three putative completeness criteria	276
	Appearance vs. reality: A deeper Criterion	280
	Phenomena versus appearances	283
	Three-faceted representation	288
13.	Rejecting the Appearance from Reality Criterion	291
	The supervenience of mind challenge	292
	The Great Leibnizian Escape move	296
	The quantum mechanics challenge	297
	Exploring the case of quantum mechanics	300
	Supervenience?	304
	An empiricist view	304

xiv CONTENTS

APPENDICES

Appendix to CH 1. Models and theories as representations	309
Appendix to CH 6. Quantum peculiarities: fuzzy observables	312
Appendix to CH 7. Surface models and their embeddings	315
Appendix to CH 13. Retreat (?) from The Scientific Image	317
Notes to Appendices	320
Bibliography	322
Notes	345
Index	399