Contents

List of Illustrations ix
Acknowledgments xvii
Introduction xix

Part I: Duchamp and Invisible Reality, 1911–1912

Duchamp's First Quest for the Invisible: X-Rays,
 Transparency, and Internal Views of the Figure,
 1911–1912
 3

X-Rays: History and Popularization 4

Duchamp's Painting and X-Rays, 1911–1912 8

Picabia, Cubism, and X-Rays 13

The Invisible Reality of Matter Itself: Electrons, Radioactivity, and Even Alchemy, Spring and Summer 1912 16

Giving Form to Electrons 18

Munich Works, Summer 1912: Radioactivity,
 Alchemy, and Chemistry 22

Munich Works, Summer 1912: First Borrowings
from the Language of Technology 28

Part II: The Transition from Painter to Artist as Engineer-Scientist, Fall 1912–1914

 From Painter to Engineer, I: Depersonalization of Drawing Style and Adoption of Human-Machine Analogies, Fall 1912–1913
 31

New Approaches to the Drawn Line 32

Duchamp, the Machine, and Human-Machine
Analogies 33

The "Jura-Paris Road" Project 37

The Lure of Science: Imaginative Scientists (Crookes, Tesla) and Scientific Imaginations (Jarry, Roussel) 40

Sir William Crookes (1832–1919): Science and the
Unknown 40
Nikola Tesla (1856–1943): Science as
Spectacle 43

Alfred Jarry (1873–1907): Themes of
Electromagnetism and Electricity in "Docteur
Faustroll" and "Le Surmâle" 47
Raymond Roussel (1877–1933): Scientific
Machines in "Impressions d'Afrique" 51

From Painter to Engineer, II: A Rousselian
 Dialogue with the Equipment of Science and
 Technology Begins, 1913–1914 58

"Painting of Precision": "Chocolate Grinder (No. 1)" and "Chocolate Grinder (No. 2)" 59 "Beauty of Indifference": "Musical Erratum," the "3 Standard Stoppages," and the Early Readymades 60

Part III: "Playful" Science and Technology in The Bride Stripped Bare by Her Bachelors, Even (The Large Glass), 1915–1923

6 Toward the Large Glass: The Box of 1914 and General Introduction to the Glass 71

The "Box of 1914" and the Model of Leonardo's Science 72

New York, 1915: Execution of the "Large Glass" Begins 77

First Conceptions of the Bride and Her Interaction with the Bachelors 86

The Theme of Collision: From Popular Culture to Science and Beyond 86 The Bride as Automobile 89 The Bride as a Modern Automaton Descended from Villiers's "L'Eve future" 93

8 The *Large Glass* as a Painting of Electromagnetic Frequency 98

Hertzian Waves and Wireless Telegraphy in
French Culture and Avant-Garde
Literature 98
Communication via Electromagnetic Waves in the
Art and Theory of Kupka 100

Wireless Telegraphy, Telepathy, and Radio Control in the "Large Glass" 103

"Appareils Enregistreurs" and Other Indexical Signs in the "Large Glass" 115

Other Scientific and Technological Dimensions of the Bride 121

Meteorology and the Eiffel Tower 121
The Bride as an Incandescent Lightbulb 125
Biology and the Bride: J.-H. Fabre and
Remy de Gourmont 126

Other Scientific and Technological Dimensions of the Bachelors, I: The Bachelor Apparatus as Playground of the Would-Be Physical Chemist 130

Old and New Identities in the Bachelor
Apparatus 130
Chemistry, Physical Chemistry, the Liquefaction
of Gases, and Jean Perrin's "Molecular
Reality" 132

Other Scientific and Technological Dimensions of the Bachelors, II: The Unknown Mobile and Desire Dynamo, Playful Mechanics, and Agriculture in the Large Glass 150

Rediscovering the Mobile, the Desire Dynamo, and Aspects of Energy and Power in the Bachelor Apparatus 150 Playful Mechanics in the Chariot and the Juggler/Handler of Gravity 155 The Chariot as the "Plow of Life" in Duchamp's "Machine Agricole" 168

Part IV: Conclusion

Conclusion, I: New Thoughts on Style and Content in Relation to Science and Technology in Duchamp's Large Glass 173 The Musée des Arts et Métiers, Roussel, and
Duchamp's Humorous Invention of a
"Plastically Imaged Mixture of Events" 173
The "Large Glass" as a Scientific-Technological
Allegory of Love and Life: The Virgin,
Persephone, and the Eiffel Tower 179

Conclusion, II: An Overview of Duchamp's Playful Science and Technology in the Large Glass and Related Early Works 185

From Bergsonian Cubism to Science and Invention: A "Continuum of . . . Magnetization or of Repulsion" 185

A Review of Science, Technology, and Self-Fashioning in Duchamp's Early Works, the "Large Glass" Project, and the Readymades 187

The "Large Glass" in the Context of Early Twentieth-Century Modernism 203

14 Coda: Extensions and Echoes of the Large Glass 207

Electricity and Electromagnetism in Duchamp's
Later Works 207
The 1950s Legal Tablet Listings: Thoughts of
Another "Box"? 218

Appendix A: The Collection of Notes Duchamp Contemplated in His 1950s Legal Tablet Listings 225

Appendix B: A Note on the Construction of Duchamp as Alchemist 231

Notes 233

Outline of Bibliography 319

Bibliography 321

Indexes

General Index 349 Large Glass Index 368