

# Contents

<i>List of Figures</i>	<i>page</i> x
<i>Acknowledgments</i>	xv
1   Revolutions in Science and Science Studies	1
1.1 The Place of Kuhn's Work in Studies of Science	1
1.2 Revolutions in Science	2
1.3 Theories of Concepts	5
1.3.1 The Classical Theory of Concepts	6
1.3.2 The Roschian Revolution	9
1.3.3 Three Responses to the Roschian Revolution	12
1.4 Nature and Scope of the Present Work	14
2   Kuhn's Theory of Concepts	19
2.1 Exemplars	19
2.2 The Learning Procedure	20
2.3 Similarity, Dissimilarity, and Kind Hierarchies	24
2.4 Knowledge of Ontology and Knowledge of Regularities	27
2.5 Individual Differences and Graded Structures	29
2.6 Generalization to Scientific Concepts	30
2.7 Nomic and Normic Concepts	31
2.8 A Scientific Conceptual Structure: Early Nuclear Physics	33
3   Representing Concepts by Means of Dynamic Frames	42
3.1 Constituents of Dynamic Frames	42
3.2 Frames in Human Cognition	46
3.2.1 Evidence for Attribute-Value Sets	47
3.2.2 Evidence for Intraconceptual Relations	49

3.3	Family Resemblance and Graded Structure in Frames	52
3.4	Frames and Kind Hierarchies	56
3.5	Knowledge of Regularities and Ontological Knowledge	59
3.6	Value Constraints and Causal Theories	60
4	Scientific Change	65
4.1	The Phase Model of Scientific Development	66
4.2	Hierarchical Principles of Stable Conceptual Structures	67
4.2.1	The No-Overlap Principle	67
4.2.2	The Exhaustion Principle	68
4.2.3	The Inclusion Principle	68
4.3	Anomalies as Violations of the Hierarchical Principles	69
4.3.1	Sundevall's Taxonomy: Conceptual Revision in Normal Science	72
4.3.2	Core Concepts of Nuclear Physics in the 1930s	75
4.3.3	Anomalies in Nuclear Physics during the 1930s	78
4.4	Types of Conceptual Change	83
4.5	Revolutionary Change	86
4.5.1	The Gadov Taxonomy: Revolutionary Change without Communication Failure	87
4.5.2	Noddack, Fermi, and Fission: Revolutionary Change with Communication Failure	91
4.6	Conclusion: A Place for the Cognitive History of Science	97
5	Incommensurability	104
5.1	Introduction	104
5.2	The Development of Kuhn's Concept of Incommensurability	105
5.3	Representing Incommensurability in Frames	108
5.4	Galileo's Discoveries and the Conceptual Structure of Astronomy	117
6	The Copernican Revolution	130
6.1	The Conceptual Structure of Ptolemaic Astronomy	130
6.2	The Conceptual Structure of Copernican Astronomy	135
6.3	The Problem of the Equant Point	138
6.4	From Orbs to Orbits	146
6.5	The Conceptual Structure of Kepler's Astronomy	151
6.6	Incommensurability, Incremental Change, and the Copernican Revolution	161
7	Realism, History, and Cognitive Studies of Science	164
7.1	Results	164
7.2	Realism	168

7.2.1 Incommensurability and Realism	169
7.2.2 Entities in a Phenomenal World	170
7.2.3 Anomalies and Restructuring of the Phenomenal World	172
7.2.4 Chain-of-Reasoning Arguments, Conceptual Continuity, and Incommensurability	173
7.3 The Symmetry Thesis	174
<i>References</i>	181
<i>Index</i>	195