

Conceptual Systems

Harold I. Brown, London: Routledge 2007

www.niu.edu/~hbrown

hibrown@niu.edu

It is argued that the introduction of new concepts and the abandonment of older concepts are persistent features of human thought as we discover new phenomena and re-examine familiar phenomena in the light of developments in science, technology and society. In recent years conceptual change and any consequent incommensurability have become important topics in philosophy and the philosophy of science. *Conceptual Systems* seeks to understand how radically new concepts are introduced into our thinking while maintaining sufficient continuity with older concepts to ensure intelligibility.

The book provides a unified account of the nature of concepts, with particular emphasis on the development of scientific concepts. Harold I. Brown establishes a database of examples of conceptual change in science, mathematics, society, and philosophy, and critically examines the influential theories of concepts in modern philosophy, documenting the way in which different theories of concepts provide different criteria for a successful conceptual analysis. The author then constructs a new theory of concepts that builds on the work of Wilfrid Sellars. The theory is applied to two types of problems: rethinking the nature and purpose of conceptual analysis, and studying conceptual change in the history of science - a task that requires analysis of the concepts being examined. *Conceptual Systems* then presents two new studies of conceptual change in physics, developments in the seventeenth century from Galileo to Descartes to Newton and the conceptual framework of the 'standard model' in late twentieth-century high-energy physics. These studies illustrate how the theory of concepts developed here can guide historical studies while providing further tests of the adequacy of the theory.

This book will be welcomed by philosophers, philosophers of science and cognitive scientists interested in concepts.

Contents

Preface ix

Acknowledgments xi

Abbreviations xii

Notation xiv

1 Studying Concepts 1

1.1 *Orientation* 1

1.2 *Conceptual Variation* 4

1.3 *Conceptual Analysis* 7

1.4 *Concepts and Language I* 10

1.5 *Biology, Psychology, and Abstract Descriptions* 12

1.6 *Naturalism* 16

1.7 *Incommensurability and Relativism* 17

2 Conceptual Journeys 20

2.1 *Physical Science* 21

2.2 *Mathematics* 34

2.2.1 *Numbers* 34

2.2.2 *Exponents* 41

2.2.3 *The Gamma Function* 44

2.2.4 *Calculus* 45

2.3	<i>Biology, Technology, and Society</i>	52
2.4	<i>Philosophical Concepts</i>	69
2.5	<i>Some Forms and Generators of Conceptual Change</i>	77
2.6	<i>Some Philosophical Issues</i>	84
3	<i>Some Theories of Concepts</i>	88
3.1	<i>Locke</i>	88
3.2	<i>Berkeley</i>	97
3.3	<i>Hume</i>	104
3.4	<i>Early Twentieth Century Empiricism</i>	111
3.5	<i>Theoretical Terms</i>	122
3.6	<i>C. I. Lewis</i>	130
3.7	<i>The Analytic-Synthetic Distinction I</i>	138
3.8	<i>Conclusion</i>	142
4	<i>Sellars: Exposition, Interpretation, and Critique</i>	144
4.1	<i>Conceptual Status</i>	145
4.2	<i>Descriptive Concepts I</i>	149
4.2.1	<i>Material Rules of Inference</i>	152
4.2.2	<i>Implicit Definitions</i>	157
4.2.3	<i>Entry Transitions</i>	158
4.2.4	<i>Individual Concepts</i>	170
4.3	<i>Formal Concepts</i>	171
4.4	<i>Prescriptive Concepts I</i>	173
4.5	<i>Models, Analogies, and Conceptual Change I</i>	178
4.5.1	<i>Theoretical Entities</i>	178
4.5.2	<i>Modifying Formal Concepts</i>	189
4.6	<i>Conclusion and Preview</i>	190
5	<i>Reconstruction</i>	192
5.1	<i>Concepts and Language II</i>	192
5.2	<i>Commentaries</i>	195
5.3	<i>Descriptive Concepts II</i>	198
5.4	<i>Systemic Role</i>	202
5.5	<i>Prescriptive Concepts II</i>	206
5.6	<i>Models, Analogies, and Conceptual Change II</i>	209
5.7	<i>Conceptual Systems and Theories</i>	211
5.7.1	<i>Descriptive Theories</i>	211
5.7.2	<i>Prescriptive Theories</i>	213
5.8	<i>Individuating Conceptual Systems</i>	215
5.9	<i>Self-reference, Circularity, and Reflexive Consistency</i>	219
5.10	<i>The Concept of a Concept</i>	221
5.10.1	<i>Systemic Role</i>	221
5.10.2	<i>Intra-systemic Relations</i>	223
5.10.3	<i>Extra-systemic Relations</i>	224
5.11	<i>Summary and Conclusion</i>	230
6	<i>Clarifications, Responses, and Refinements</i>	233
6.1	<i>Natural Kinds</i>	233
6.2	<i>Social Content</i>	237

6.3	<i>Informational Atomism</i>	242
6.4	<i>Cognitive-Historical Analysis</i>	246
6.5	<i>The Fine-Structure of Conceptual Content</i>	256
6.6	<i>Conclusion</i>	258
7	<i>Conceptual Analysis I: Causation</i>	259
7.1	<i>Conceptual Analysis</i>	259
7.2	<i>The Causal Relation</i>	262
7.2.1	<i>Implications</i>	262
7.2.2	<i>Extra-systemic Relations</i>	279
7.2.3	<i>Systemic Role</i>	281
7.3	<i>Is Causation a Kind of Necessary Connection?</i>	284
7.4	<i>Conclusion</i>	286
8	<i>Conceptual Analysis II: Epistemic Concepts</i>	290
8.1	<i>The Analytic-Synthetic Distinction II</i>	290
8.2	<i>Propositional Knowledge</i>	295
8.3	<i>Justification</i>	299
8.4	<i>Truth</i>	305
8.4.1	<i>Systemic Role</i>	305
8.4.2	<i>Extra-systemic Relations</i>	311
8.4.3	<i>Implications</i>	315
8.5	<i>Non-Propositional Knowledge</i>	316
8.6	<i>Social Epistemology</i>	318
8.7	<i>Conclusion: The Status of Conceptual Analysis</i>	320
9	<i>Historical Studies I: Seventeenth-Century Physics</i>	326
9.1	<i>Aristotle</i>	326
9.2	<i>Galileo</i>	330
9.3	<i>Descartes</i>	344
9.4	<i>Newton</i>	369
9.5	<i>Conclusion</i>	394
10	<i>Historical Studies II: Interactions</i>	396
10.1	<i>Qualitative Picture</i>	397
10.2	<i>Mathematical Framework</i>	403
10.2.1	<i>Electromagnetic Interaction</i>	405
10.2.2	<i>Weak Interaction</i>	406
10.2.3	<i>Strong Interaction</i>	409
10.3	<i>From Angular Momentum to Isospin</i>	412
10.3.1	<i>Angular Momentum</i>	412
10.3.2	<i>Bohr's Theory of the Atom</i>	413
10.3.3	<i>Quantum Theory</i>	414
10.3.4	<i>Spin</i>	417
10.3.5	<i>Isospin</i>	419
10.4	<i>Forces and Interactions</i>	421
10.5	<i>Unification</i>	422
10.6	<i>Conclusion</i>	427
	<i>Appendix: Some Mathematical Concepts</i>	427
	<i>A1 Operators</i>	427

A2 Operators in Quantum Mechanics 429

A3 Invariance 431

A4 Symmetry 432

A5 Groups 433

A6 Representations 434

A7 Generators 435

11 Conceptual Change, Incommensurability, and Progress 437

Notes 455

References 485