

## TABLE OF CONTENTS

PREFACE . . . . .	v
ACKNOWLEDGMENTS . . . . .	xi
<b>1. THE EMPIRICAL CYCLE IN SCIENCE . . . . .</b>	<b>1</b>
1; 1 <i>The acquisition of experience</i> . . . . .	1
1; 1; 1 The empirical cycle; without reflection . . . . .	1
1; 1; 2 The empirical cycle; as reflected . . . . .	5
1; 1; 3 The shift from end to means; problem solving .	6
1; 1; 4 The empirical cycle in thought processes . . . . .	7
1; 2 <i>Higher experiential processes: thinking, creation, interpretation</i> . . . . .	9
1; 2; 1 The universal cycle of end and means . . . . .	9
1; 2; 2 The creative and the hermeneutic cycle . . . . .	12
1; 2; 3 Multiplicity of cyclic forms . . . . .	14
1; 2; 4 Indispensability of the cycle . . . . .	16
1; 2; 5 The empirical cycle; the reporting of experience .	17
1; 3 <i>Aims and standards of empirical science</i> . . . . .	18
1; 3; 1 The aims of science . . . . .	18
1; 3; 2 Selection of problems; degrees of certainty . . .	21
1; 3; 3 Standards and techniques; logic and methodology	23
1; 3; 4 Unwritten rules . . . . .	25
1; 3; 5 The forum . . . . .	26
1; 4 <i>The cycle of empirical scientific inquiry</i> . . . . .	27
1; 4; 1 The empirical cycle; in science . . . . .	27
1; 4; 2 Observation . . . . .	28

## TABLE OF CONTENTS

1; 4; 3	Induction . . . . .	29
1; 4; 4	Deduction . . . . .	29
1; 4; 5	Testing . . . . .	30
1; 4; 6	Evaluation . . . . .	31
<b>2.</b>	<b>DESIGNING THEORIES AND HYPOTHESES . . . . .</b>	<b>33</b>
2; 1	<i>Characteristics of hypothesis formation . . . . .</i>	33
2; 1; 1	The process of hypothesis formation . . . . .	33
2; 1; 2	Freedom of design . . . . .	35
2; 1; 3	Freedom of concept formation . . . . .	37
2; 1; 4	Factual underpinnings . . . . .	39
2; 1; 5	Theoretical framework . . . . .	40
2; 1; 6	Interpretation of the facts . . . . .	42
2; 2	<i>Means and methods of hypothesis formation . . . . .</i>	45
2; 2; 1	Facts and ideas – two approaches . . . . .	45
2; 2; 2	Inspiration through the literature . . . . .	48
2; 2; 3	Empirical exploration . . . . .	51
2; 2; 4	Explorations of sample materials . . . . .	53
2; 2; 5	Methods of interpretation: 'Verstehen'; empathy	55
2; 3	<i>Formalization: problems of choice . . . . .</i>	58
2; 3; 1	Language; verbal or mathematical. . . . .	58
2; 3; 2	Selection within one language . . . . .	61
2; 3; 3	Tentative or definitive . . . . .	62
2; 3; 4	General or specific . . . . .	63
2; 3; 5	Complex or simple . . . . .	64
2; 3; 6	Hypothetical constructs . . . . .	65
<b>3.</b>	<b>FORMULATION OF THEORIES AND HYPOTHESES: A. THE DEDUCTIVE PROCESS . . . . .</b>	<b>69</b>
3; 1	<i>Normative standards for formulation . . . . .</i>	69
3; 1; 1	Antecedent formulation . . . . .	69
3; 1; 2	Logical consistency . . . . .	69
3; 1; 3	Principle of economy . . . . .	71
3; 1; 4	Testability. . . . .	72
3; 1; 5	Stated empirical reference . . . . .	73

TABLE OF CONTENTS

<b>3; 2 Deduction and specification . . . . .</b>	<b>74</b>
3; 2; 1 From general to particular . . . . .	74
3; 2; 2 Theory, hypothesis, prediction: distinctions . . . . .	77
3; 2; 3 From hypothesis to prediction . . . . .	78
<b>3; 3 Explication of a theory or hypothesis . . . . .</b>	<b>80</b>
3; 3; 1 Explication: ramifications . . . . .	80
3; 3; 2 Nomological network . . . . .	82
3; 3; 3 Three types of relations . . . . .	82
3; 3; 4 Operational definitions of constructs . . . . .	84
3; 3; 5 Relation between construct and variable . . . . .	86
<b>3; 4 The scientific prediction . . . . .</b>	<b>89</b>
3; 4; 1 Function, content, characteristics . . . . .	89
3; 4; 2 Verifiability conditions and verification criteria . . . . .	93
3; 4; 3 Lack of falsifiability and other shortcomings . . . . .	95
 <b>4. FORMULATION OF THEORIES AND HYPOTHESES:</b>	
<b>B. CONFIRMATION . . . . .</b>	<b>99</b>
<b>4; 1 Confirmation of hypotheses . . . . .</b>	<b>99</b>
4; 1; 1 Deterministic hypotheses . . . . .	99
4; 1; 2 Probabilistic confirmation and probabilistic hypotheses . . . . .	101
4; 1; 3 Relevance of predictions . . . . .	105
<b>4; 2 Acceptance and rejection of theories . . . . .</b>	<b>107</b>
4; 2; 1 Refutation of theories . . . . .	107
4; 2; 2 Relative rejection and acceptance of theories . . . . .	111
4; 2; 3 Theory development . . . . .	114
4; 2; 4 Development of theoretical constructs . . . . .	115
<b>4; 3 Normative standards for the publication of theories and hypotheses . . . . .</b>	<b>119</b>
4; 3; 1 'Testability' necessary and sufficient . . . . .	119
4; 3; 2 Different forum conventions . . . . .	121
4; 3; 3 In quest of minimum requirements . . . . .	124
4; 3; 4 Explication essential . . . . .	125
4; 3; 5 Falsifiability . . . . .	126

## TABLE OF CONTENTS

<b>5. FROM FORMULATION TO TESTING AND EVALUATION . . . . .</b>	<b>128</b>
<i>5; 1 Design of hypothesis testing investigations . . . . .</i>	128
5; 1; 1 Freedom of choice . . . . .	128
5; 1; 2 Considerations pertaining to confirmation . . . . .	130
5; 1; 3 Practical considerations . . . . .	133
5; 1; 4 The importance of advance analysis . . . . .	135
<i>5; 2 From formulation to test: an example . . . . .</i>	139
5; 2; 1 Psychosomatic specificity . . . . .	139
5; 2; 2 Step by step specification of the problem . . . . .	141
5; 2; 3 Empirical specification of concepts . . . . .	142
5; 2; 4 Experimental design; further specifications . . . . .	145
5; 2; 5 Statistical testing: final decisions . . . . .	148
<i>5; 3 Testing and evaluation . . . . .</i>	150
5; 3; 1 Execution of the testing procedure . . . . .	150
5; 3; 2 Disturbing factors . . . . .	152
5; 3; 3 Problems of generalization . . . . .	155
5; 3; 4 Cause or effect? . . . . .	160
<b>6. OBJECTIVITY: A. THROUGH THE EMPIRICAL CYCLE . . . . .</b>	<b>162</b>
<i>6; 1 The principle of objectivity . . . . .</i>	162
6; 1; 1 What is objective? . . . . .	162
6; 1; 2 Objectivity a basic requirement . . . . .	163
6; 1; 3 Objectivity in research design . . . . .	167
<i>6; 2 From construct to objective variable . . . . .</i>	169
6; 2; 1 Instrumental realization; definitions . . . . .	169
6; 2; 2 The evaluation problem as an example; goal, effect, measure . . . . .	172
6; 2; 3 'Insight gained': an objective instrument . . . . .	175
6; 2; 4 Objectivity and relevance . . . . .	176
6; 2; 5 Development of instruments . . . . .	180
<i>6; 3 Objective selection of experimental (testing) materials . . . . .</i>	182
6; 3; 1 Universe and sample . . . . .	182
6; 3; 2 Diversity of universes . . . . .	185
6; 3; 3 Objective sample selection . . . . .	188
6; 3; 4 Objective elimination . . . . .	193

## TABLE OF CONTENTS

<b>7. OBJECTIVITY: B. DATA COLLECTION AND ANALYSIS . . . . .</b>	<b>198</b>
<b>7; 1 Objective questions and answers . . . . .</b>	<b>198</b>
7; 1; 1 The art of asking questions: precoding . . . . .	198
7; 1; 2 The art of getting answers: coding . . . . .	203
7; 1; 3 Ad hoc coding . . . . .	206
<b>7; 2 Question form and processing techniques . . . . .</b>	<b>210</b>
7; 2; 1 Relationships between collection and processing .	210
7; 2; 2 Measurement and measurement scales . . . . .	211
7; 2; 3 Scale construction and measurement as analogue representation . . . . .	214
7; 2; 4 Problems of isomorphism . . . . .	218
<b>7; 3 Judgmental procedures: intersubjectivity . . . . .</b>	<b>221</b>
7; 3; 1 Judges as measuring instruments . . . . .	221
7; 3; 2 Specific problems in judging . . . . .	224
7; 3; 3 Controls and precautions . . . . .	228
7; 3; 4 'Disinterested' judges . . . . .	232
7; 3; 5 The judge a subject; paired comparisons . . . . .	234
7; 3; 6 From expert to formula . . . . .	237
<b>8. CRITERIA FOR EMPIRICAL VARIABLES AND INSTRUMENTS . . . . .</b>	<b>239</b>
<b>8; 1 Instrumental utility of a variable . . . . .</b>	<b>239</b>
8; 1; 1 Relations among basis concepts: a recapitulation	239
8; 1; 2 Instrumental utility: definition . . . . .	242
8; 1; 3 Three construction requirements; three criteria .	245
<b>8; 2 Validity . . . . .</b>	<b>248</b>
8; 2; 1 Criterion validity as a simple operational concept	248
8; 2; 2 Criterion problems . . . . .	249
8; 2; 3 Construct validity: measurement versus prediction	254
8; 2; 4 Contributions to construct validity . . . . .	257
8; 2; 5 How to assess construct validity: a theoretical problem . . . . .	259
<b>8; 3 Accuracy and stability; reliability . . . . .</b>	<b>262</b>
8; 3; 1 Differentiation of the measurement scale . . . . .	262
8; 3; 2 True value and chance error . . . . .	265
8; 3; 3 Measures for the reliability of an instrument . . . . .	269
8; 3; 4 The stability problem . . . . .	273

## TABLE OF CONTENTS

8; 3; 5 Significance and uses of reliability measures . . . . .	278
8; 3; 6 From measurement outcome to conclusion . . . . .	281
<b>8; 4 Internal efficiency and scoring . . . . .</b>	<b>283</b>
8; 4; 1 Internal efficiency . . . . .	283
8; 4; 2 Internal consistency . . . . .	284
8; 4; 3 Problems of scoring and scale construction . . . . .	290
<b>9. DIVERSITY AND UNITY IN SCIENTIFIC RESEARCH . . . . .</b>	<b>298</b>
<b>9; 1 Different types of investigations . . . . .</b>	<b>298</b>
9; 1; 1 Limitations of this study . . . . .	298
9; 1; 2 Five types of investigation: 1. hypothesis testing	301
9; 1; 3 2. Instrumental-nomological investigations . . . . .	302
9; 1; 4 3. Descriptive investigations . . . . .	303
9; 1; 5 4. Exploratory investigations . . . . .	306
9; 1; 6 5. Interpretative and theoretical studies . . . . .	309
<b>9; 2 Methodology of interpretation . . . . .</b>	<b>310</b>
9; 2; 1 The interpretation problem: an illustration . . . . .	310
9; 2; 2 Interpretation as an extension of explanation . . . . .	313
9; 2; 3 Testing through extrapolation . . . . .	319
9; 2; 4 Convergence within the universe . . . . .	320
9; 2; 5 Testing by partitioning the universe . . . . .	324
<b>9; 3 Complex problems and devices . . . . .</b>	<b>327</b>
9; 3; 1 Multiplicity of variables . . . . .	327
9; 3; 2 Complex procedures . . . . .	333
9; 3; 3 Mathematical models . . . . .	335
9; 3; 4 Machine models: simulation of behavior . . . . .	338
<b>9; 4 Unity of science . . . . .</b>	<b>343</b>
9; 4; 1 Idiographic-nomothetic: a difference in method?	343
9; 4; 2 Misconceptions concerning 'uniqueness' . . . . .	345
9; 4; 3 Relative differences . . . . .	348
9; 4; 4 Objectivity and other values . . . . .	353
9; 4; 5 Unity chosen . . . . .	356
<b>BIBLIOGRAPHY . . . . .</b>	<b>357</b>
<b>INDEX OF NAMES . . . . .</b>	<b>373</b>
<b>INDEX OF SUBJECTS . . . . .</b>	<b>379</b>