

# Contents

<b>1</b>	<b>Introduction</b>	1
1.1	Various Aspects of Decision Making	2
1.2	Emotion, Logic and Decision Making	13
	References	19
<b>2</b>	<b>Various Approaches to Decision Making</b>	23
2.1	Decision Making (On the Basis of Human Decisions)	25
2.1.1	Canonical Approach and Normative Models	26
2.1.2	The Axiomatic Approach	27
2.1.3	Bayesian Probabilistic Approach	28
2.1.4	Bayesian Statistics	32
2.1.5	Bayes' Rule	32
2.2	Decision Making and Statistical Inference	33
2.2.1	Bayesian Probability and Cognitive Domain	36
2.3	Dempster-Shafer Theory	42
2.3.1	Cognition and Emotion in Human Decision Making	44
	References	47
<b>3</b>	<b>Predictability of Brain and Decision Making</b>	51
3.1	Prediction and Movement	58
3.2	How Does the Brain Predict?	61
3.2.1	Motor Binding in Time and the Centralization on Prediction	61
3.3	How Can a Neuronal Circuit Predict?	64
3.4	Dynamic Geometry and Bayesian Approach to Decision Theory	68
	References	71
<b>4</b>	<b>New Empirical Evidences on Decision Making and Cognition</b>	75
4.1	Disjunction Effect	77
4.2	Categorization-Decision Interaction	81
4.3	Perception of Ambiguous Figures	82

4.4	Conjunction and Disjunction Fallacies . . . . .	83
4.5	Over Extension of Category Membership . . . . .	84
4.6	Over-Distribution Effect in Memory Recognition . . . . .	85
4.7	Failures of Commutativity in Decision Making . . . . .	86
4.7.1	Non-commutativity and the Uncertainty Principle Underlying the Functional Architecture of the V1 Cortical Area. . . . .	87
4.7.2	Architecture of VI Area . . . . .	89
4.8	Uncertainty Relation and Ambiguity in Perception . . . . .	91
4.9	Uncertainty Relations for Unsharp Observables . . . . .	92
4.10	Wave-Particle Dualism and Double Slit Experiment. . . . .	94
	References. . . . .	97
<b>5</b>	<b>Fundamental Concepts of Mathematics and Quantum Formalism . . . . .</b>	<b>101</b>
5.1	Postulates . . . . .	102
5.2	Mathematical Preliminaries . . . . .	106
5.2.1	Vector Space . . . . .	106
5.2.2	Subspaces . . . . .	107
5.2.3	Norms . . . . .	107
5.2.4	Scalar Product . . . . .	107
5.3	Hilbert Space . . . . .	108
5.3.1	Hermitian Operator . . . . .	109
5.3.2	Unitary Operator . . . . .	109
5.4	Commutative Properties . . . . .	109
5.4.1	Projection Operator . . . . .	110
5.5	Projection Postulate (PP) . . . . .	111
5.5.1	Statement of Projection Postulate (PP) . . . . .	112
5.6	Unsharp Observable and Operational Quantum Theory . . . . .	113
5.7	Stern–Gerlach Experiment . . . . .	114
5.8	POVM for Spin-Half Particles . . . . .	115
	References. . . . .	116
<b>6</b>	<b>The Complementary Principle, Concept of Filter and Cognition Process. . . . .</b>	<b>117</b>
6.1	Spatiotemporal Representation of Image. . . . .	118
6.2	The Response–Percept Domain and Observation Process . . . . .	119
6.3	The Complementarity Principle, Percepts and Concept. . . . .	121
	References. . . . .	129
<b>7</b>	<b>Quantum Probability Theory and Non-Boolean Logic . . . . .</b>	<b>131</b>
7.1	Logic and Cognition. . . . .	132
7.2	Logic and Decision Making . . . . .	132
7.3	Boolean Algebra. . . . .	133

7.4	Quantum Logic and Non-Boolean Algebra . . . . .	136
7.4.1	Propositional Logic . . . . .	138
7.4.2	Lattices . . . . .	138
	References. . . . .	139
<b>8</b>	<b>Quantum Ontology and Context Dependence . . . . .</b>	<b>141</b>
8.1	Newton and Metaphysics . . . . .	144
8.2	Quantum Ontology . . . . .	145
	References. . . . .	151
<b>9</b>	<b>Modern Neuroscience and Quantum Logic . . . . .</b>	<b>153</b>
	References. . . . .	158
<b>10</b>	<b>Future Directions of Modelling the Uncertainty in the Cognitive Domain . . . . .</b>	<b>159</b>
10.1	Remarks on Affective Computing and Quantum Probability. . . . .	160
10.2	Epistemological Issues . . . . .	161
	References. . . . .	165



<http://www.springer.com/978-81-322-3620-7>

Decision Making and Modelling in Cognitive Science

Roy, S.

2016, XV, 165 p. 2 illus. in color., Hardcover

ISBN: 978-81-322-3620-7