Contents

Prejace	1X
VISUAL QUERIES	1
The Apparatus and Process of Seeing	5
The Act of Perception	8
Bottom-Up	10
Top-Down	12
Implications for Design	14
Nested Loops	17
Distributed Cognition	19
Conclusion	20
WHAT WE CAN EASILY SEE	23
The Machinery of Low-Level Feature Analysis	25
What and Where Pathways	26
Eye Movement Planning	26
What Stands Out = What We Can Bias for	27
Lessons for Design	33
Motion	36
Visual Search Strategies and Skills	37
The Detection Field	37
The Visual Search Process	39

Using Multiscale Structure to Design for Search	40
Conclusion	41
STRUCTURING TWO-DIMENSIONAL SPACE	43
2.5D Space	44
The Pattern-Processing Machinery	46
The Binding Problem: Features to Contours	46
The Generalized Contour	49
Texture Regions	50
Interference and Selective Tuning	51
Patterns, Channels, and Attention	52
Intermediate Patterns	53
Pattern Learning	54
Serial Processing	55
Visual Pattern Queries and the Apprehendable Chunk	55
Multi-chunk Queries	56
Spatial Layout	56
Horizontal and Vertical	57
Pattern for Design	58
Examples of Pattern Queries with Common Graphical Artifacts	60
Semantic Pattern Mappings	62
COLOR	65
The Color-Processing Machinery	66
Opponent Process Theory	68
Channel Properties	69
Principles for Design	75
Showing Detail	75
Color-Coding Information	77
Large and Small Areas	77
Emphasis and Highlighting	78
Color Sequences	80
Color on Shaded Surfaces	83
Semantics of Color	84
Conclusion	84
GETTING THE INFORMATION: VISUAL	
SPACE AND TIME	87
Depth Perception and Cue Theory	89
Stereoscopic Depth	94
Structure from Motion	95

2.5D DESIGN	95
How Much of the Third Dimension?	97
Affordances	99
The Where Pathway	100
Artificial Interactive Spaces	102
Space Traversal and Cognitive Costs	103
Conclusion	105
VISUAL OBJECTS, WORDS, AND MEANING	107
The Inferotemporal Cortex and the What Channel	108
Generalized Views from Patterns	109
Structured Objects	110
Gist and Scene Perception	112
Visual and Verbal Working Memory	114
Verbal Working Memory	115
Control of the Attention and the Cognitive Process	115
Long-term Memory	116
Priming	118
Getting into Visual Working Memory	118
Thinking in Action: Receiving a Cup of Coffee	120
Elaborations and Implications for Design	121
Make Objects Easy to Identify	121
Novelty	122
Images as Symbols	123
Meaning and Emotion	124
Imagery and Desire	125
Conclusion	126
VISUAL AND VERBAL NARRATIVE	129
Visual Thinking Versus Language-Based Thinking	130
Learned Symbols	131
Grammar and Logic	132
Comparing and Contrasting the Verbal and Written Modes	133
Linking Words and Images Through Diexis	135
PowerPoint Presentations and Pointing	136
Mirror Neurons: Copycat Cells	137
Visual Narrative: Capturing the Cognitive Thread	138
Q&A Patterns	139
Framing	139
FINSTs and Divided Attention	140
Shot transitions	141

viii

Cartoons and Narrative Diagrams	142
Single-frame Narratives	144
Conclusion	145
CREATIVE META-SEEING	147
Mental Imagery	148
The Magic of the Scribble	152
Diagrams are Ideas Made Concrete	155
Requirements and Early Design	156
Visual Task Analysis	157
The Creative Design Loop	158
Cognitive Economics of Design Sketching	158
The Perceptual Critique	160
Meta-seeing with Design Prototypes	162
Visual Skill Development	163
Conclusion	164
THE DANCE OF MEANING	165
Review	166
Implications	172
Design to Support Pattern Finding	172
Optimizing the Cognitive Process	174
Learning and the Economics of Cognition	177
Attention and the Cognitive Thread	179
What's Next?	181
Index	183