

Contents

1. Introduction	1
1.1 Color Science and Art Before 1920	1
1.2 Some Developments in Color Science Pertinent to Art and Design Since 1920	2
2. The Concept of Color	5
2.1 What Is Color? One Answer	5
2.2 The Visual System: A Brief Sketch	6
2.3 What Is Color? Some Other Answers	8
2.4 What Is Color? A Practical Answer in Technology	9
3. Perceived Colors	11
3.1 Isolated Colors	11
3.2 Hue	12
3.3 Saturation and Colorfulness	13
3.4 Brightness and Lightness	14
3.5 Brilliance: Grayness and Fluorence	14
3.6 Color Terms	16
4. Light and Color	17
4.1 What Is Light?	17
4.2 Wavelength and Light	18
4.3 Spectral and Nonspectral Hues	19
4.4 Light from Lasers	21
4.5 Light from the Sun and from Lamps	21
4.6 Standard Illuminants (CIE)	24
4.7 Eye Brightness Sensitivity	26
5. Colored Materials	28
5.1 Pigments and Dyes	28
5.2 Opaque Materials	29
5.3 Transparent Materials	35
5.4 Fluorescent Materials	37
5.5 Metamerism and Matching Colors	40
5.6 Additive Color Mixture	41

5.7	Subtractive Color Mixture	42
5.8	Color Mixture by Averaging	43
5.9	The Primaries	44
5.10	Color Circles	45
6.	Color Specification (CIE)	47
6.1	Light and Color: Other Definitions	47
6.2	The Chromaticity Diagram: An Introduction	48
6.3	The CIE Chromaticity Diagram	53
6.4	Dominant Wavelength and Purity	58
6.5	An Approximately Uniform CIE Chromaticity Diagram ...	62
6.6	Metamerism and the CIE System	65
7.	Diverse Applications of the CIE Chromaticity Diagram	66
7.1	Color Names for Lights	66
7.2	Additive Complementary Color Pairs	68
7.3	Colors Obtainable by Mixing Light	70
7.4	Light Called "White Light"	72
7.5	The Color Limits for Materials (Paints, Inks, Dyes, etc.) ..	74
7.6	Fluorescent Paints and Dyes	79
7.7	Iridescent Colors: Liquid Crystals	80
7.8	Mixing Paints	83
7.9	Color Images in Television, Pointillism, Four-Color Printing, and Photography	86
7.10	Color Difference	90
7.11	Colors of High Contrast	92
7.12	Metamers	94
7.13	Metameric Illumination	96
7.14	Color Rendering	98
7.15	Color Temperature	100
8.	Color Systems	105
8.1	CIE Color Space, CIE(x, y, Y)	105
8.2	CIELUV and CIELAB Color Spaces	107
8.3	Color-Sample Systems	112
8.4	The Munsell Color System	114
8.5	The Color Harmony Manual and the Ostwald Color System ..	123
8.6	The German Standard Color Chart	129
8.7	The Natural Colour System (NCS) and the Swedish Standards Color Atlas	133
8.8	Chroma Cosmos 5000 and Chromaton 707	138

9. Color Systems (Continued):	
The OSA Uniform Color Scales	142
9.1 Equally Spaced Colors	142
9.2 OSA Color Space	143
9.3 Uniform Color Arrays on the Series of Horizontal Planes Through OSA Color Space	149
9.4 Uniform Color Arrays on the Two Series of Parallel Vertical Planes Through OSA Color Space	151
9.5 OSA Uniform Color Scales (OSA-UCS)	157
9.6 Uniform Color Arrays on the Four Series of Parallel Oblique Planes Through OSA Color Space	158
9.7 The Pastel Color Samples	164
9.8 Comments About the OSA Samples	170
 10. Color Names and Notations and Their Levels of Precision	173
10.1 The ISCC-NBS Color Names of Materials	173
10.2 The ISCC-NBS Centroid Color Charts	178
10.3 The Dictionary of Color Names (ISCC-NBS)	178
10.4 Color Designation: The Levels of Precision	179
 11. Conditions of Viewing and the Colors Seen	181
11.1 Psychological Aspects and Color Systems	181
11.2 Hue Responses	182
11.3 A Psychological Color Specification System	184
11.4 Adaptation to Color; Color Constancy	188
11.5 Adaptation Level	194
11.6 Memory Color	194
11.7 Afterimage Complementary Color Pairs	195
11.8 Simultaneous Contrast	199
11.9 Colored Shadows	203
11.10 Edge Contrast	206
11.11 Assimilation (Reversed Contrast)	208
 12. Appendix	210
12.1 Some Useful Addresses in the Field of Color	210
A) Major Collections of Books on Color	210
B) Color Research	210
C) Color Standards	210
D) Associations	211

12.2	Conversion Table and Charts. CIE(x, y, Y) Notation/ Munsell Notation	212
12.3	Procedure for Determining ISCC-NBS Color Names ...	229
12.4	Notes	239
Color Plates I-XXIII		249
References		269
Name and Subject Index		279