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Weaving the Rainbow: Visions of Color in World History

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LUDWIG WITTGENSTEIN wrote his last work, *Remarks on Colour*, during a visit to Vienna in 1950 and while dying of cancer in Cambridge the following year. The slim book represented a return to a theme of his earliest writings, for he had dealt with the thorny problem of the logical structure of color concepts in *Tractatus Philosophico-Mathematicus* (1908).¹ *Remarks on Colour* sets forth a broad range of what Wittgenstein called “puzzle questions”: Why is white not considered a color? What makes bright colors bright? Are “pure” colors mere abstractions, never found in reality? What is the relationship between the world of objects and the world of consciousness? Is there such a thing as a “natural history of color”? Faced with more conundrums than answers, Wittgenstein despaired that the logic of color perceptions could be clarified: “there is merely an inability to bring the concepts into some kind of order. We stand there like the ox in front of the newly-painted stall door.”²

Wittgenstein’s reflections on color took place upon a fault line dividing the followers of Isaac Newton (1642–1727) from those of Johann Wolfgang von Goethe (1749–1832). Wittgenstein remarked that he found Newtonian questions interesting but not gripping, and although

¹ Ray Monk, *Ludwig Wittgenstein: The Duty of Genius* (New York: Free Press, 1990), pp. 561–568; J. Westphal, *Colour: Some Philosophical Problems from Wittgenstein* (Oxford: Basil Blackwell, 1984), pp. 6–7, 11.

² Ludwig Wittgenstein, *Remarks on Colour*, ed. G. E. M. Anscombe and trans. Linda L. McAlister and Margarete Schättle (Berkeley: University of California Press, 1978), p. 16e.

he was sympathetic toward the intentions of Goethe, he regarded his *Theory of Colours* (1810) as no more than a makeshift outline: "it isn't really a theory at all. Nothing can be predicted with it. . . . Nor is there any *experimentum crucis* which could decide for or against the theory."³ In Newton's renowned *experimentum crucis* of 1666, described in his *Optiks* (1704), the scientist used glass prisms to demonstrate that sunlight (or white light) comprised a mixture of rays of different colors, not a uniform, pure substance, as previously thought. A stunning revelation, it provoked wonder and controversy well into the nineteenth century.⁴ Newton recognized that his findings about the composite nature of light ran counter to age-old, commonsense assumptions: "I perswade my selfe that this assertion above the rest appears *Paradoxicall*, & it is with most difficulty admitted."⁵

Newton adopted the term "spectrum" (from Latin *specere*, "to look") to characterize his rainbow image of seven colors. His analysis moved color theory from the realms of philosophy and painting to those of mathematics and optics: he showed that color is not an inherent property of objects, as everyone since Aristotle (384–322 B.C.E.) had maintained, but instead is an illusion arising from the response of human visual apparatus to emissions of light.⁶ "For the Rays to speak properly are not coloured," Newton declared. "In them there is nothing else than a certain Power and Disposition to stir up a Sensation of this or that Colour."⁷ Roses are not red, grass is not green, the sky is not blue.

A century after Newton, Goethe championed the cause of pure sunlight and subjective experience in passionate tones: "we find this eighth

³ Ibid., p. 11e. On Wittgenstein's attitude toward Newtonian questions, see Monk, *Ludwig Wittgenstein*, p. 561.

⁴ See Marjorie Hope Nicolson, *Newton Demands the Muse: Newton's Optiks and the Eighteenth-Century Poets* (Princeton, N.J.: Princeton University Press, 1966); and Raymond L. Lee and Alistair B. Fraser, *The Rainbow Bridge: Rainbows in Art, Myth, and Science* (University Park: Pennsylvania State Press, 2001), pp. 207–241. For a description of the *experimentum crucis*, see Isaac Newton, *Optiks; or, A Treatise of the Reflections, Refractions, Inflections & Colours of Light* (New York: Dover, 1952), pp. 26–63; and Gale E. Christianson, *In the Presence of the Creator: Isaac Newton and His Times* (New York: Free Press, 1984), pp. 91–104, 134–137, 443–446.

⁵ Cited in Christianson, *In the Presence of the Creator*, p. 102. The paradox still attracts attention: the *New York Times* (19 July 2005) featured a synopsis of Glenn S. Smith, "Human Color Vision and the Unsaturated Blue of the Daytime Sky," *American Journal of Physics* 73, no. 7 (2005): 590–597.

⁶ Evan Thompson, *Colour Vision: A Study in Cognitive Science and the Philosophy of Perception* (London: Routledge, 1995), pp. 4–10; and H. Guerlac, "Can There Be Colors in the Dark? Physical Color Theory Before Newton," *Journal of the History of Ideas* 47, no. 1 (1986): 3–20.

⁷ Newton, *Optiks*, p. 124.

wonder of the world [Newton's science of colors] already nodding to its fall as a deserted piece of antiquity, and [we must] begin at once . . . to dismantle it from gable to roof downwards; that the sun may at last shine onto the old nest of rats and owls. . . ."⁸ Focusing on the complex phenomena of after-images, colored shadows, and reflecting surfaces, Goethe maintained that the existence of "physiological colors," colors as actually perceived, prove that Newton had "fettered" the eyes of the world with his overwhelming scientific authority, thereby banishing color from human reality. For Goethe, Newton's science reduces Earth to a gray ball revolving in space, while his own *Theory of Colours* would restore color to "the general dynamic flow of life and action which the present age loves to recognise in nature."⁹ As Mephistopheles says to a student in *Faust*, "My friend, all theory is grey, and green the golden tree of life."¹⁰

Indeed, the scientific deconstruction of light troubled those who objected to the conceptual exile of color from everyday life. A woman in the dramatic dialogue *Newtonianism for the Ladies* by Francesco Algarotti (1712–1764) voiced her distress at being "assimilated to a rainbow," with the color on her cheeks supposedly as much of an illusion as the pretty trick made by sunshine and water vapor in the sky.¹¹ At a dinner party in 1817, John Keats (1795–1821) and the critic Charles Lamb (1775–1834) lamented that Newton had "destroyed all the poetry of the rainbow, by reducing it to a prism."¹² Three years later, however, Keats created poetry from the very disenchantment of the rainbow:

Do not all charms fly
At the mere touch of cold philosophy?
There was an awful rainbow once in heaven:
We know her woof, her texture; she is given
In the dull catalogue of common things.

⁸ Johann Wolfgang von Goethe, *Theory of Colours*, trans. Charles Lock Eastlake (Cambridge, Mass.: MIT Press, 1970), p. xliii.

⁹ *Ibid.*, p. 298; see D. L. Sepper, *Goethe contra Newton: Polemics and the Project for a New Science of Color* (Cambridge: Cambridge University Press, 1988), pp. 4–7; and Arthur G. Zajonc, "Goethe's Theory of Color and Scientific Intuition," *American Journal of Physics* 44, no. 4 (1976): 327–333.

¹⁰ Johann Wolfgang von Goethe, *Faust, part one*, trans. David Luke (Oxford: Oxford University Press, 1987), p. 61.

¹¹ Cited in Michael Baxandall, *Patterns of Invention: On the Historical Explanation of Pictures* (New Haven, Conn.: Yale University Press, 1985), p. 79.

¹² Cited in Penelope Hughes-Hallett, *The Immortal Dinner: A Famous Evening of Genius & Laughter in Literary London, 1817* (Chicago: New Amsterdam, 2002), p. 138.

Philosophy will clip an Angel's wings,
 Conquer all mysteries by rule and line,
 Empty the haunted air, and gnomed mine—
 Unweave a rainbow. . . .¹³

In considering both color vision and color values, this paper aims to bring together natural history and human history. It assumes that taking account of evolution contributes to understanding the interactions of human nature and cultural patterns.¹⁴ The paper begins by examining the nature and development of color vision—or what may be regarded as the evolutionary “weaving of the rainbow.” After discussing positive and negative attitudes toward color, the historical weaving of the rainbow is explored by looking at the spectrum of Eurasian societies—Japan, China, West Asia, and Europe—in terms of their perceptions and evaluations of color.

VISIONS OF COLOR

Contemporary speculation on color remains split between those who see the world as intrinsically devoid of color and those who see the subjective experience of color as a straightforward consequence of the nature of colors themselves.¹⁵ Some students of color, however, have tried to bridge the gap between Newton (“colors are in our heads”) and Goethe (“colors are in the world”) by emphasizing the environmental context of color vision, the ways in which the world and the brain collaborate in generating awareness of hues. In this perspective, which has been called “ecological optics,” culture plays a central role in relating

¹³ John Keats, “Lamia,” in *The Complete Poems of John Keats* (New York: Modern Library, 1994), p. 155.

¹⁴ For works that share the same assumption, see David Christian, *Maps of Time: An Introduction to Big History* (Berkeley: University of California Press, 2004); Fred Spier, *The Structure of Big History: From the Big Bang until Today* (Amsterdam: Amsterdam University Press, 1996); Eric Chaisson, *Epic of Evolution: Seven Ages of the Cosmos* (New York: Columbia University Press, 2006). On relating evolution to world history, see William H. McNeill, “History and the Scientific Worldview,” *History and Theory* 37, no. 1 (1998): 1–13. On evolution and culture, see John Tooby and Leda Cosmides, “The Psychological Foundations of Culture,” in *The Adapted Mind: Evolutionary Psychology and the Generation of Culture*, ed. Jerome H. Barklow, Leda Cosmides, and John Tooby (New York: Oxford University Press, 1992), pp. 19–136.

¹⁵ The opposing views are set forth, respectively, in C. L. Hardin, *Color for Philosophers* (Cambridge, Mass.: Hackett, 1988) and David R. Hilbert, *Color and Color Perception: A Study in Anthropocentric Realism* (Stanford, Calif.: Center for the Study of Language and Information, 1987).

the visual system to the natural world, the head to the heart, Newton to Goethe.¹⁶ In truth, as Goethe suggested in his attack on Newton, cultural considerations are never far removed from scientific conclusions. Thus Newton identified seven primary colors in the spectrum to make it match with the seven notes in the musical scale, a correspondence he saw as confirmation of the divine harmony of nature.¹⁷ While experimental science guided his refraction of light through the prism, cultural assumptions dictated the number of colors he toted up.

Ecological optics builds upon what experimenters since the 1960s, armed with electron microscopes and knowledge of DNA, have revealed about color vision. Their research for the first time provided direct physiological evidence for the Young-Helmholtz-Maxwell theory. Based on Newton's finding that any color could be produced from a mixture of at least three spectral colors, the physician and polymath Thomas Young (1773–1829) proposed that all color sensations could be derived from three processes in the retina that are sensitive, respectively, to blue, green, and red.¹⁸ In his *Physiological Optics* (1856), Herman von Helmholtz (1821–1894) extended Young's trichromatic ("three-color") theory of vision by proposing three hypothetical photopigments in the retina—blue, green, and red—that absorb specific wavelengths of light, thus accounting for the principal facts of color mixture and the mechanism of color perception.¹⁹ While Newton removed color from objects, Young and Helmholtz located it within the complexities of retinal physiology.

Working at the same time as Helmholtz, James Clerk Maxwell (1831–1879) studied both color perception and the splitting of light by the prism. He aspired to reconcile three lines of investigation in color theory: "The Opticians, the Physiologists and the Artists have each taken their own branch of this inquiry and have arrived at results, which though all of them true are independent of each other so that at

¹⁶ On ecological optics, see Evan Thompson, Adrian Palacios, and Francisco J. Varela, "Ways of Coloring: Comparative Color Vision as a Case Study for Cognitive Science," *Behavioral and Brain Sciences* 15, no. 1 (1992): 1–74; and Thompson, *Colour Vision*, pp. 215–250.

¹⁷ Nicolson, *Newton Demands the Muse*, p. 86; and Wilton Mason, "Father Castel and His Color Clavecin," *The Journal of Aesthetics and Art Criticism* 17, no. 1 (1958): 103–116. According to Newton, the seven prismatic colors are red, orange, yellow, green, blue, indigo, and violet (*Optiks*, p. 50). He evidently included indigo to raise the total to the requisite number of seven; purple now is substituted for indigo and violet; see K. McLaren, "Newton's Indigo," *Color Research and Application* 10, no. 4 (1985): 225–229.

¹⁸ Paul D. Sherman, *Colour Vision in the Nineteenth Century: The Young-Helmholtz-Maxwell Theory* (Bristol: Adam Hilger, 1981), pp. 1–18.

¹⁹ *Ibid.*, pp. 81–92.

first sight they seem opposed to each other.”²⁰ In the 1860s, after Maxwell determined that the dynamic interplay of magnetic and electric fields propelled their movement through space, he calculated the speed of that movement and came to the astonishing conclusion that it was the same as that estimated for the speed of light. In the area of physics, he thus demonstrated that light itself is an electromagnetic phenomenon. Coupled with Newton’s mechanics, the discovery provided Albert Einstein (1879–1955) with insight about the constant speed of light that led in 1905 to his theory of relativity.²¹ In the study of retinal physiology, Maxwell proved mathematically that light interacts with structures in the retina to give rise to the sensation of sight. In the matter of color vision, he showed that electromagnetic vibrations, as they impinge on the human retina, increase in frequency from the red to the blue end of the visible spectrum.

Maxwell’s work revealed that Earth is saturated in electromagnetic radiation from the sun, ranging from radio waves whose peak frequencies are a dozen kilometers apart to cosmic rays separated by fractions of a nanometer (one billionth of a meter), oscillating many millions of times a second. Some of the radiation passes through our bodies (X-rays), some burns our skin (ultraviolet), some is experienced as heat (infrared), and some may be employed for communication (radar and shortwave broadcast).²² Those rays situated between ultraviolet (below 400 nm) and infrared (above 700 nm) constitute what is known as “the visible light octave.”²³ Human visual perception thus evolved to exploit a tiny fraction of the electromagnetic spectrum: as the wavelength expands from 400 billionths of a meter, the eye perceives color change progressively from blue (400–490 nm) to green (490–570 nm) to yellow (570–580 nm) to orange (580–610 nm) to red (610–700 nm).

Light reaching the eye is only the first stage in an exceedingly complex process, however. Cones in the retina take in visible light, with photons (particles representing quanta of light) being absorbed by a molecule that transforms that radiation into an electrical nerve signal.

²⁰ James Clerk Maxwell, *The Scientific Letters and Papers of James Clerk Maxwell*, ed. P. M. Harman (Cambridge: Cambridge University Press, 1990), 1:675.

²¹ On Maxwell’s discovery of the creation of light from electromagnetic fields and its significance for Einstein, see Michio Kaku, *Einstein’s Cosmos* (New York: W. W. Norton, 2005), pp. 26–29.

²² Rolf G. Kuehni, *Color: An Introduction to Practice and Principles* (New York: John Wiley & Sons, 1997), pp. 3–4, 12.

²³ S. L. Polyak, *The Retina: the Anatomy and the Histology of the Retina in Man, Ape, and Monkey* (Chicago: University of Chicago Press, 1941), p. 403; see George L. Wall, *The Vertebrate Eye and its Adaptive Radiation* (Bloomfield Hills, Mich.: Cranbrook Institute of Science, 1942), p. 1.

Traveling along as many as six different pathways, a message coded in color-wavelength frequencies is transmitted to structures deep in the center of the brain. Short-wavelength radiation (with a peak sensitivity at blue), medium-wavelength radiation (peak sensitivity at green), and long-wavelength radiation (peak sensitivity at red) are reconfigured into a four-color system—blue, green, yellow, and red—in which the pairs of blue-yellow and red-green are opposed—that is, they are primaries, with each of them excluding the other two. Secondary colors function as bridges between the primaries: green between blue and yellow, orange between yellow and red, purple between red and blue.²⁴ This “opponent processing” system creates all the colors seen by human beings; it gives us the rainbow.

While the speculations of Young and Helmholtz located color within the retina, Maxwell’s electromagnetic theory linked the functioning of the eye to the most fundamental forces in existence. As the French painter Paul Cézanne (1839–1906) asserted, color is “the place where our brain and the universe meet.”²⁵

THE EVOLUTIONARY WEAVING OF THE RAINBOW

The first encounter of brains and the universe on the field of color reaches back to what paleontologists term “the Cambrian explosion.” From 543 million years ago, within the remarkably short space of 5 million years, the number of animal phyla expanded from three to thirty-eight, the basis thereafter for the diversity of all life on Earth. Creation of eyes sparked the Cambrian explosion since vision led to a vast upsurge in predation, with a premium placed on development of a variety of body shapes with defensive parts—shells, teeth, tentacles, claws, and jaws—and on discerning, duping, and devouring adversaries. Body color developed as a sort of weapons technology, employed to hide from predators by means of disruptive coloration (camouflage) or to warn them off by conspicuous display, that is, by showing bright, intimidating hues.²⁶ In short, color first arose to help determine who ate dinner and who ended up on the plate.

²⁴ David Miller, *The Wisdom of the Eye* (London: Academic Press, 2000), pp. 34, 156; Rudolf Arnheim, *Art and Visual Perception: A Psychology of the Creative Eye* (Berkeley: University of California Press, 1974), pp. 352–353; Denis Baylor, “Colour Mechanisms of the Eye,” in *Colour: Art & Science*, ed. Trevor Lamb and Janine Bourriau (Cambridge: Cambridge University Press, 1995), p. 104.

²⁵ Cited in Thompson, *Colour Vision*, p. 215.

²⁶ On the Cambrian explosion as a consequence of the invention of the eye, see Andrew Parker, *In the Blink of an Eye: How Vision Sparked the Big Bang of Evolution* (New York: Basic Books, 2003), especially pp. 170–229, 232–233, 261–290.

The first great turning point in the evolution of color, with momentous consequences for the future of humanity, came at the end of the Cretaceous period (135 to 165 million years ago). The “crisis of the late Cretaceous,” when an asteroid collided with the Earth and wiped out the dinosaurs, gave mammals their great opportunity.²⁷ They had evolved from mammal-like reptiles in the Permian (from 280 to 230 million years ago) and developed into marsupial and placental mammals during the Cretaceous. Dominance of the dinosaurs, however, harried them into the night. Taking refuge in trees, our remote ancestors made a living as nocturnal insectivores, small, squirrel-like animals for the most part, none bigger than an opossum (or about the size of a toaster oven).

During the reign of the dinosaurs, nature still lacked most of its colors: plants did not produce flowers and colored leaves until late in the Cretaceous, and birds, bees, and butterflies had not yet evolved to feast on their sucrose-laden nectar.²⁸ Since colors cannot be seen in the dark, the vision of mammals evolved to concentrate on rods, color-blind (or achromatic) structures in the retina that mediate vision in dim light. In all likelihood, mammals lost a wavelength cone, and their vision came to rely on rods supplemented by cones receptive to only two wavelengths. In other words, after mammals found sanctuary in the night forest, they gave up trichromatic vision in favor of the visual acuity provided by massive numbers of rods adapted to deal with the shifting grays of a nocturnal environment.²⁹ They survived with only two-color (dichromatic) vision, a modality nearly indistinguishable from monochromatic vision. They were no more able to see colors than is a color-blind person: trichromatics can discriminate hundreds of colors, dichromatics just varying shades of a few.

Among the 4,301 species of mammals in the world (distributed across twenty-one orders), four species of catarrhine primates—a class that includes Old World monkeys, apes, and humans—regained trichro-

²⁷ The phrase comes from Christian, *Maps of Time*, p. 125.

²⁸ Hilda Simon, *The Splendor of Iridescence: Structural Colors in the Animal World* (New York: Dodd, Mead & Company, 1971), pp. 33–37; and Nathaniel J. Dominy, Peter W. Lucas, Daniel Osorio, and Nayuta Yamashita, “The Sensory Ecology of Primate Food Perception,” *Evolutionary Anthropology* 10, no. 5 (2001): 180.

²⁹ J. K. Bowmaker, “The Evolution of Vertebrate Visual Pigments and Photoreceptors,” in *Vision and Visual Dysfunction*, vol. 2, *Evolution of the Eye and Visual System*, ed. John R. Conly-Dillon and Richard L. Gregory (Boca Raton, Fla.: CRC Press, 1991), pp. 73–76; and Robert D. Martin and Callum F. Ross, “The Evolutionary and Ecological Context of Primate Vision,” in *The Primate Visual System: A Comparative Approach*, ed. Jan Kremers (New York: John Wiley & Sons, 2005), pp. 9–25. There are about 120 million rods and 7 million cones in the retina.

matic vision as they emerged into daylight after the dinosaurs died out; most mammals remained night dwellers and dichromatic. The move of primates from nocturnal to diurnal existence resulted in the human color sense bearing a stronger resemblance to that of birds, fish, and insects than to that of the collateral mammalian relatives of *Homo sapiens*.³⁰ Like blue jays and bees rather than dogs and cats, human beings see a wide variety of colors.³¹

As primates gained superior color vision from the Paleocene to the Oligocene (65 to 38 million years ago), the world for the first time blossomed into a range of hues. At the same time, other creatures and plants also evolved and settled into ecological niches. Flowering plants (angiosperms) radiated, developing colored buds and fruits; vivid insects and birds colonized the plants, attracted by their tints and serving to disperse their pollen and seeds. Plants, insects, birds, and primates evolved in tandem, with color playing a crucial role in the survival and proliferation of each. The heart of these developments lay in upland tropical Africa, where lack of cloud cover and therefore greater luminance resulted in selective evolutionary pressure for intense coloration.³²

Catarrhine primates developed trichromatic vision by modification and replication of an existing gene—a fundamental mechanism of Darwinian evolution.³³ When primates gained an additional wave-

³⁰ Christa Neumeyer, "Evolution of Color Vision," in Conly-Dillon and Gregory, *Vision and Visual Dysfunction*, pp. 287, 299; and F. G. Barth, *Insects and Flowers: The Biology of a Partnership*, trans. M. A. Biederman-Thorson (Princeton, N.J.: Princeton University Press, 1985), pp. 111–115.

³¹ They do not, however, see the same colors as birds and bees. Relative to human sight, the vision of insects and birds is shifted about 100 nm toward the shortwave end of the spectrum, thereby allowing for sight in the ultraviolet range; hence what appears yellow to us is seen by the bee as "bee-purple," a blend of ultraviolet and yellow. For a colored illustration of how a human and a dog perceive the same landscape, see Stephen Budiansky, *The Truth About Dogs: An Inquiry into the Ancestry, Social Conventions, Mental Habits, and Moral Fiber of Canis Familiaris* (New York: Penguin Books, 2001), p. 120.

³² Robert W. Sussman, "How Primates Invented the Rainforest and Vice Versa," in *Creatures of the Dark: The Nocturnal Prosmians*, ed. L. Alterman, Gerald A. Doyle, and M. Kay Izard (New York: Plenum Press, 1995), pp. 1–10; Gerald H. Jacobs, "The Distribution and Nature of Colour Vision among the Mammals," *Biological Reviews of the Cambridge Philosophical Society* 68, no. 3 (1993): 413–471; and David M. Hunt, Gerald H. Jacobs, and James K. Bowmaker, "The Genetics and Evolution of Primate Visual Pigments," in Kremers, *The Primate Visual System*, pp. 78–83. On genetic mechanisms for color mutation in birds and mammals, see Sean B. Carroll, *Endless Forms Most Beautiful: The New Science of Evo Devo and the Making of the Animal Kingdom* (New York: W. W. Norton, 2005), pp. 223–247.

³³ Examination of DNA of the retinal chromosomes reveals that the middle- and long-wavelength genes, which sit side-by-side on the sex-specific X chromosome gene, share 98 percent of their DNA, indicating that they originally doubled up in the process of cell division (or meiosis). See J. D. Mollon, "'Tho' she kneel'd in that place where they grew . . .':

length sensor, they plunged deep into the world of color, with the ability to discriminate in the green-yellow-red range of the spectrum. Random mutations, however, gain ground in populations only when they provide survival value to individual organisms. In the case of early primates, a powerful sense of color bestowed a significant nutritional advantage: it meant they could expand their diet from insects to the high energy portions of plants—seeds, nuts, fruit, and nourishing leaves. Against a background of green tropical foliage, fruits stand out as yellow, orange, and red while leaves with the most protein generally have a red or yellowish-red tint. A mammal with dichromatic vision would be effectively blinded to these resources, for anything yellow, orange, or red would appear to its eyes as dark green, signaling that it is not palatable.³⁴

In the very long term, the beginning of the development that led to the huge brain of *Homo sapiens* may be tracked back to the neural redesign called for by elevation of the eye over other means of acquiring and processing information. The brain was hierarchically restructured to accommodate new skills arising from extensive employment of sight—depth perception, frontally directed vision, precise hand coordination, perpetual scanning for predators, object recognition at a distance, creation of mental maps of the environment, purposeful behavioral responses, and identification of edible resources by color.

With their cone-poor vision, our fellow mammals rely mainly on the olfactory and auditory senses; they live and die by the nose and ear. Whereas dogs have an infinitely better sense of smell than we do, the total number of nerve fibers they possess going from the eye to the brain is 86 percent smaller than in humans. As sight rose to dominance over smell among the primates, their eyes grew larger, whereas their

The Uses and Origins of Primate Colour Vision," *Journal of Experimental Biology* 146 (1989): 21–38. Since females have two copies of the X chromosome, they have two chances for a red or green gene. But males have only one X chromosome, and if it is defective, they lack a backup; hence the incidence of red-green color-blindness is pronounced among men (about 8 percent of the population) and uncommon among women (less than 0.5 percent); see James T. Enns, *The Thinking Eye, the Seeing Brain: Explorations in Visual Cognition* (New York: Norton, 2004), pp. 88–89.

³⁴ Katherine Melton, "Foraging Behavior and the Evolution of Primate Intelligence," in *Machiavellian Intelligence: Social Expertise and the Evolution of Intellect in Monkeys, Apes and Humans*, ed. Richard W. Byrne and Andrew Whiten (Oxford: Clarendon Press, 1988), pp. 285–305; Nathaniel J. Dominy and Peter W. Lucas, "Significance of Color, Calories, and Climate to the Visual Ecology of Catarrhines," *American Journal of Primatology* 62, no. 3 (2004): 189–207; and Nathaniel J. Dominy, Jens-Christian Svenning, and Wen-Hsiung Li, "Historical Contingency in the Evolution of Primate Color Vision," *Journal of Human Evolution* 44, no. 1 (2003): 25–45. Dominy and his colleagues emphasize the significance of reddish leaves over fruit as a food resource for early primates.

muzzles turned smaller, retracting to the plane of the face.³⁵ In addition, the olfactory sense is connected to the brain's limbic system, which monitors emotional functions and biochemical processes, regulating unconscious behavior such as the reflex for food, sleep, and sex; but the visual sense is linked directly to the neocortex, the seat of consciousness and understanding, where information from the outside world is processed.³⁶ In fact, more than half of that portion of the human brain is devoted to handling visual intelligence. Trichromatic vision resulted in great demands being placed on the brain of early primates, helping ramp up the size of the organ relative to body mass (or the encephalization quotient) by a factor of twenty by the time *Homo sapiens* emerged after 200,000 years ago.³⁷

Through its effects on the brain at a critical turning point in the early evolution of primates, color vision contributed to the eventual human employment of symbols and language. Understanding of color itself, however, remains resistant to the conceptual world that color vision helped bring forth. This is a consequence of the very ubiquity of color: except in conditions of darkness or blindness, it is always there, impossible to evade, an indispensable condition of existence, equivalent to a fifth dimension complementing the four dimensions of space-time. Light itself, the source of color, never stops or slows but always travels at light speed, roughly 670 million miles per hour; it has no quanta and no specific frequencies until humans actually measure them.³⁸ In fact, Maxwell suggested that we see only color, never light, for the substance and speed of the latter make it utterly invisible to both eyes and instruments: "All vision is colour vision, for it is only by observing differences of colour that we distinguish the forms of objects."³⁹ Light, then, may be regarded as little more than a serviceable concept, a notion employed

³⁵ See Budiansky, *The Truth About Dogs*, pp. 111–112, 118–123; Wall, *Vertebrate Eye*, pp. 206–207; and H. Langdon, *The Human Strategy: An Evolutionary Perspective on Human Anatomy* (Oxford: Oxford University Press, 2005), pp. 28, 56–57.

³⁶ Victor S. Johnston, *Why We Feel: The Science of Human Emotions* (Cambridge, Mass.: Perseus Books, 1999), pp. 116–119; Alexandra Maryanski and Jonathan H. Turner, *The Social Cage: Human Nature and the Evolution of Society* (Stanford, Calif.: Stanford University Press, 1992), pp. 36–40, 46–49, 53–54.

³⁷ Enns, *Thinking Eye*, p. 51; Langdon, *Human Strategy*, pp. 134, 150–153, 160–170; and Steven Mithen, *The Prehistory of the Mind: A Search for the Origins of Art, Religion and Science* (London: Thames and Hudson, 1996), pp. 229–232. The earliest fossils of *Homo sapiens* now known are dated to 160,000 years ago.

³⁸ Brian Greene, *The Elegant Universe: Superstrings, Hidden Dimensions, and the Quest for the Ultimate Theory* (New York: Random House, 1999), p. 24. On color as an additional dimension and on perceiving color effects rather than light, see Patricia Sloane, *The Visual Nature of Color* (New York: Design Press, 1989), pp. 100–105, 231, 239, 244.

³⁹ Cited in Sloane, *Visual Nature of Color*, p. 97.

in the mathematics of relativity theory, while color is the reality of living creatures, the modality under which the world takes shape. In this perspective, as Wittgenstein believed, Goethe trumps Newton.

Yet a paradoxical consequence of color being all-encompassing, a fundamental and inescapable element of the human world, is that while everyone experiences it, there has never been agreement about what people actually perceive when they see and name a color. As a constituent part of the visual sense, color is linked to the neocortex; but as a psychological phenomenon, it is radically subjective, seemingly reporting directly to the emotional matrix of the limbic system. While wavelengths of red reach the upper stories of the brain, feelings about red—a color typically associated with fire, anger, desire, danger, and bloodshed—bubble up from its cellar.⁴⁰ As Goethe reports, “I have known men of education to whom its effect was intolerable if they chanced to see a person dressed in a scarlet cloak on a grey, cloudy day.”⁴¹ In short, humans respond to color more on the basis of subliminal emotion than on grounds of rational consideration. This helps explain the attractions of color (chromophilia) in all cultures as well as the nearly universal hostility toward bright color (chromophobia) in traditional societies.

CHROMOPHILIA AND CHROMOPHOBIA

Color is a notoriously protean phenomenon, eluding every attempt to categorize it. All human beings with normal sight possess the same visual equipment; but what colors individuals really see can be difficult to establish, dependent in the last analysis on what one reports about them. Endlessly contested, color is the only dimension of sensory awareness that also is taken entirely for granted. Wittgenstein regarded this as an intractable problem in applying logic to the question of color: “Look at the blue of the sky and say to yourself ‘How blue the sky is!’—When you do it spontaneously—without philosophical intentions—the idea never crosses your mind that this impression of colour belongs only to *you*.”⁴²

⁴⁰ See Leonard Shlain, *Art & Physics: Parallel Visions in Space, Time, and Light* (New York: William Morrow and Company, 1991), p. 171; and Peter K. Kaiser, “Physiological Response to Color: A Critical Review,” *Color Research and Application* 9, no. 1 (1984): 29–36.

⁴¹ Goethe, *Theory of Colours*, p. 310.

⁴² Ludwig Wittgenstein, *Philosophical Investigations*, trans. G. E. M. Anscombe (Oxford: Blackwell, 2001), p. 81e. On the ancient and beguiling question of the blue sky, see Peter Petic, *Sky in a Bottle* (Cambridge, Mass.: MIT Press, 2005).

That radical subjectivity, coupled with the breathtaking range of tints created by chemical science, means there is not even any agreement on the number of colors that exist. The Benjamin Moore paint company keeps 3,400 colored graphics in its stores for selecting named paints that are created using twelve basic tints. Since any set of graphics can be employed to create a unique color, a customer in principle has countless millions of shades available. Benjamin Moore perforce strains the resources of the thesaurus to concoct designations for its offerings: thus the nearly fifty shades of pink run the gamut from “sweet naiveté” and “blushing bride” to “hot lips” and “rosy glow.”

The Optical Society of America estimates that the eye can discriminate between 7.5 million and 10 million colors; other experts maintain that no more than about 180 hues effectively can be distinguished. Although there are some 3,000 English color names, people regularly use just a dozen. In all cultures, most colors are christened after specific things in the environment, such as peach, coffee, gold, turquoise, and alabaster.⁴³

After white, black, and red, the most commonly named colors in the languages of premodern cultures are green and yellow.⁴⁴ From at least the time of Confucius (ca. 551–479 B.C.E.), the Chinese considered those the canonical “five colors” (*wucui*). The same ones are most frequently mentioned in the Qur’an and remain the core colors throughout West Asia; they were also the most prominent colors during most of the European medieval period as well as in pre-Columbian Mesoamerica.⁴⁵ It is significant that red, yellow, and green figure in that order in the progression of the visible wavelength spectrum, whereas the succession of black and white followed by the cluster of red-yellow-green represents the order in which the ability to discern colors first was acquired by early primates. Studies indicate that the same

⁴³ Umberto Eco, “How Culture Conditions the Colours We See,” in *On Signs*, ed. Marshall Blonsky (Baltimore: Johns Hopkins University Press, 1985), pp. 167–168; Sloane, *Visual Nature of Color*, pp. 5, 14; and Arnheim, *Art and Visual Perception*, pp. 332–333.

⁴⁴ For ease of exposition, white, black, and gray are referred to here as colors. In fact, such inclusion is standard in traditional societies. On development of color naming in traditional societies, see Brent Berlin and Paul Kay, *Basic Color Terms: Their Universality and Evolution* (Berkeley and Los Angeles: University of California Press, 1969). But Berlin and Kay’s argument for the universal appearance of color names in an invariable evolutionary progression has not generally won acceptance; for a critique, see Barbara Saunders, *The Invention of Basic Colour Terms* (Utrecht: ISOR, 1992).

⁴⁵ Susan Bush and Hsio-yen Shih, eds., *Early Chinese Texts on Painting* (Cambridge, Mass.: Harvard University Press, 1985), p. 109; Erika Friedel, “Colors and Culture Change in Southwest Iran,” *Language and Society* 8, no. 1 (1979): 51–68; and Serge Gruzinski, *The Conquest of Mexico: The Incorporation of Indian Societies into the Western World, 16th–18th Centuries*, trans. Eileen Corrigan (Cambridge, Mass.: Polity Press, 1993), p. 173.

five colors possess the greatest perceptual salience in many cultures and that very young children pick them out most readily from other hues.⁴⁶ All this suggests that color preferences are influenced powerfully by the early development of color vision: selective evolutionary pressure determined that our primate forebears developed perceptual systems that mapped out the color space which remains dominant in cultures around the world.⁴⁷ The names assigned to colors obviously vary according to the language used, but the colors universally selected as most important are the same everywhere.

Nonetheless, the difficulties of pinning down color semantics become complex when studying entire populations inasmuch as cultures perceive and codify color in quite different ways. The people on Bellona, an atoll in the Solomon Islands, reportedly “don’t talk much about colour here” since they identify only three basic hues: white/light, black/dark, and red, with the latter encompassing the conventional shades of blue, green, brown, and purple.⁴⁸ At the other end of the spectrum, the Desana of the Columbian Amazon view reality as a stream of chromatic energies coursing through plants, animals, and individuals; every person is seen as endowed with a given amount of such energy, which returns to the sun, the treasury and fount of color, at death. The Huichol of the Sierra Madre of northwest Mexico believe that gods and spirits communicate with them in the language of color, a visionary tongue in which hues take geometric form and always materialize in a kaleidoscopic array, not as single, isolated tones.⁴⁹ According to Garcilaso de la Vega (1539–1616) in his *Royal Commentaries of the*

⁴⁶ James A. Schirillo, “Tutorial on the Importance of Color in Language and Culture,” *Color Research and Application* 26, no. 3 (2001): 179–192; and Charles J. Lumsden, “Color Categorization: A Possible Concordance between Genes and Culture,” *Proceedings of the National Academy of Sciences in the United States of America* 82, no. 17 (1985): 5805–5808.

⁴⁷ See Roger N. Shephard, “The Perceptual Organization of Colors: An Adaptation to Regularities of the Terrestrial World,” in Barklow, Cosmides, and Tooby, *Adapted Mind*, pp. 495–532; Peter H. Stephenson, “The Evolution of Color Vision in the Primates,” *Journal of Human Evolution* 2, no. 5 (1973): 379–386; and Berlin and Kay, *Basic Color Terms*, pp. 14–23, 104–109.

⁴⁸ Rolf Kuschel and Torben Monberg, “‘We don’t talk much about colour here’: A Study of Colour Semantics on Bellona Island,” *Man* 9, no. 2 (1974): 213–242. On the dominance of the same three colors in other cultures, see Anita Jacobson-Widding, *Red-White-Black as a Mode of Thought: A Study of Triadic Classification by Colours in the Ritual Symbolism and Cognitive Thought of the Peoples of the Lower Congo* (Uppsala: Acta Universitatis Uppsaliensis, Uppsala Studies in Cultural Anthropology, 1979).

⁴⁹ Constance Classen, “Sweet Colors, Fragrant Songs: Sensory Models of the Andes and the Amazon,” *American Ethnologist* 17, no. 4 (1990): 722–735; and Hope MacLean, “Sacred Colors and Shamanic Vision among the Huichol Indians of Mexico,” *Journal of Anthropological Research* 57, no. 3 (2001): 305–323.

Incas, when Peruvians saw a rainbow, a disturbing sacred symbol, “they used to close their mouth and place their hand in front, for they said if they exposed their teeth to it, it wore and decayed them.”⁵⁰

When the color values of relatively sophisticated cultures (as characterized by density of urban life, organized religion, and some measure of literacy) are taken into consideration, a great deal more information becomes available than is the case when examining primate color vision or the color beliefs of remote Amazonian societies. Still, the subject remains complex. Surviving sources concentrate on the perspectives of the elite—the wealthy, well born, and powerful—and pay little attention to the use and perception of color by general populations. And while textiles, painting, art criticism, and literature provide useful information, there was virtually no discussion of color theory in most cultures before 1800.

Chromophilia and chromophobia coexisted in most societies. Bright color typically was looked upon with ambivalence: valued highly in some respects, denigrated in others. Colored materials of any sort were costly, for processing pigment from plants and minerals was painstaking and laborious. It was also repugnant since it ordinarily required using ingredients such as stale human or animal urine, dung, saltpeter, rancid olive oil, sour red wine, ox and sheep blood, vinegar, and brine of pickled fish.⁵¹ A twelfth-century European dyeing manual suggested that a good azure color is obtained by stirring pulverized white marble into hot dung for a day or so, after which indigo-laden water is mixed into the brew.⁵² Dutch pigment manufacturers at the time of Rembrandt (1606–1669) obtained a pure white for canvas painting by locking clay pots of vinegar and lead in a hot sealed room with buckets of manure for ninety days so that flakes of lead carbonate (for lead-white coloring) could be produced through acidic action.⁵³

While all pigments were expensive, a few literally were worth their weight in gold. Ultramarine was processed from the mineral lapis lazuli, which was mined in Afghanistan; known in seventeenth-century England as “the diamond of all colours,” the dazzling blue cost the present-

⁵⁰ Garcilaso de la Vega, *Royal Commentaries of the Incas and General History of Peru*, trans. Harold V. Livermore (Austin: University of Texas Press, 1966), 1:183. On rainbows regarded as possessing malignant power, see Lee and Fraser, *Rainbow Bridge*, p. 26.

⁵¹ Victoria Finlay, *Color: A Natural History of the Palette* (New York: Ballantine Books, 2002), pp. 186, 230, 240, 287, 369.

⁵² Philip Ball, *Bright Earth: Art and the Invention of Color* (Chicago: University of Chicago Press, 2001), pp. 93–94.

⁵³ Finlay, *Color*, pp. 110–111.

day equivalent of roughly \$2,000 per pound.⁵⁴ During the reign of the Roman emperor Diocletian (284–305), the famous Tyrian (or Phoenician) purple derived from the eastern Mediterranean murex shellfish was used to dye cloth that cost 50,000 *denarii* per pound—or the wages of a skilled craftsman for three years. Saffron yellow came from the thin stamens of a purple crocus cultivated in India, Persia, and Asia Minor, two pounds of which called for harvesting 170,000 flowers. A bright red came from the kermes scale insect, which is parasitic on evergreen oaks around the Mediterranean; after huge quantities are killed with vinegar and dried in the sun, the larvae yields minute amounts of vermilion (diminutive of *vermis*, “worm”). In medieval England, seven and a half yards of fine scarlet cloth dyed with kermes cost the equivalent of an artisan’s income for almost six years.⁵⁵ In Europe during the same time, a small block of woad pigment, a blue dye processed from an indigenous plant, was known as “blue gold.” In eighteenth-century China, cobalt oxide from Persia, used for making a vibrant blue, was worth “twice the value of gold,” since every sixteen ounces of the unrefined ore yielded just six-tenths of an ounce of pure pigment.⁵⁶

Brilliant color was rare in the premodern world. An individual watching color television, strolling through a supermarket, or examining a box of crayons sees a larger number of bright, saturated hues in a few moments than did most persons in a traditional society in a lifetime. Color therefore became endowed with immense symbolic significance, suggesting an actuality beyond reality. From the origin of civilized societies, conceptual color coding was a universal phenomenon, used for identifying political status, social ranks, cardinal directions, physical elements, moral virtues, liturgical rituals, holy days, and venerated symbols.⁵⁷ In addition, the exorbitant expense of col-

⁵⁴ R. D. Harley, *Artists' Pigments, c. 1600–1835: A Study in English Documentary Sources* (London: Butterworth Scientific, 1982), pp. 43–45.

⁵⁵ Amy Butler Greenfield, *A Perfect Red: Empire, Espionage, and the Quest for the Color of Desire* (New York: HarperCollins, 2005), p. 20; Ball, *Bright Earth*, pp. 65–66, 100; and John H. Munro, “The Medieval Scarlet and the Economies of Sartorial Splendor,” in *Cloth and Clothing in Medieval Europe*, ed. N. B. Harte and K. G. Ponting (London: Heinemann Educational Books, 1983), p. 66.

⁵⁶ Michel Pastoureau, *Blue: The History of a Color*, trans. Markus I. Cruse (Princeton, N.J.: Princeton University Press, 2001), p. 64; and Stephen W. Bushell, *Description of Chinese Pottery and Porcelain: Being a Translation of the T'ao Shuo* (Oxford: Clarendon Press, 1910), p. 60.

⁵⁷ See Paul Fickler, “Fundamental Questions in the Geography of Religions,” in *Readings in Cultural Geography*, ed. Philip L. Wagner and Marvin W. Mikesell (Chicago: University of Chicago Press, 1962), pp. 99–102; and Jean Filliozat, “Classement des couleurs et des lumières en Sanskrit,” in *Problèmes de la couleur*, ed. Ignace Myerson (Paris: SEVPEN, 1957), pp. 303–311.

ored materials, especially dyed cloth, meant that some features of the mundane world itself represented a sort of reflection of the transcendent, elevating sacred ceremonies, royal celebrations, public pageants, carnival festivities, and aristocratic revels above everyday experience. Such events represented fleeting eruptions of color in a dull brown and green environment, with the scintillating hues endowing the occasions with a manifest patent of privilege and splendor. Above all, as the poet Thomas Randolph (1605–1635) grumbled, princely courts served as arenas of color: “As once in blacke I disrespected walkt / Where glittering courtiers in their Tissues stalkt.”⁵⁸

Dyed garments were the most visible, widespread, and extensively used signs of social status and conspicuous consumption. Rural laborers and common townsfolk everywhere dressed in homespun fabrics of lackluster tones, mainly washed-out browns, blues, and grays. In northern Europe during the late medieval period, wool in natural shades of tan or gray provided most of the clothing. Clerics were supposed to wear linen liturgical vestments of pure white but had to settle for shades of light gray and yellowish-white since the various whitening agents, such as ash, chalk, and magnesium, yielded muddy results.⁵⁹ In sixteenth-century England, some common hues for clothing were known as “horseflesh,” “gooseturd,” “rat’s color,” “pease porridge,” and “puke.”⁶⁰ In eighteenth-century France, “flea’s belly,” “Paris mud,” and “goose-droppings” identified a dark brown cloth. In China at the same time, “camel lung,” “rat skin,” “nose mucus,” and “dribbling spittle” numbered among the disagreeable colors.⁶¹

Only the elite could afford or legally wear clothing of certain colors. Sumptuary legislation almost everywhere prohibited low-status persons from dressing in the sort of colors and costumes worn by those in privileged circles. Japanese samurai, Chinese mandarins, Javanese chiefs, Indian Brahmans, Swahili oligarchs, Byzantine ecclesiastics, Venetian patricians, French aristocrats, Spanish hildagos, Aztec and Maya warriors—all dressed in costly dyed garments that set them proudly apart from color-deprived commoners.

⁵⁸ Cited in Ingrid D. Rowland, *The Culture of the High Renaissance: Ancients and Moderns in Sixteenth-Century Rome* (Cambridge: Cambridge University Press, 1998), p. 92.

⁵⁹ Pastoreau, *Blue*, p. 35.

⁶⁰ Cited in Jane Schneider, “Peacocks and Penguins: The Political Economy of European Cloth and Colors,” *American Ethnologist* 5, no. 3 (1978): 428.

⁶¹ Louis-Sebastien Mercier, *Panorama of Paris: Selections from Tableau de Paris*, ed. Jeremy D. Popkin, trans. Helen Simpson and Jeremy D. Popkin (University Park: Pennsylvania State University Press, 1999), p. 63; Bushell, *Description of Chinese Pottery*, pp. 49–50; and Geoffrey R. Sayer, ed. and trans., *Ching-tê-chên t’ao-lu or The Potteries of China* (London: Routledge and Kegan Paul, 1951), p. 55.

Color-coded grandees, however, generally disparaged the use of many bright shades. In tenth-century Japan, a poet observed that “the world now is obsessed with color, and people’s hearts are as fickle as flowers, only idle songs and mutable matters abound.”⁶² The Chinese Daoist classic *Dao De Jing*, warning against love of pleasure and beauty, asserted that “the five colors will blind the eye” to spiritual perception.⁶³ For Plato (ca. 429–ca. 347 B.C.E.), color represented an ornamental illusion, the epitome of the ephemeral and capricious, while Aristotle maintained that “the most attractive colours would never yield as much pleasure as a definite image without colour.”⁶⁴ St. Augustine of Hippo (354–430) confessed that “a delight to my eyes are beautiful and varied forms, glowing and pleasant colours,” yet he scorned the “queen of colours” who “works by a seductive and dangerous sweetness to season the life of those who blindly love the world.”⁶⁵

In the same tradition, the monastic reformer St. Bernard of Clairvaux (1090–1153), who regarded flamboyant hues as a devilish cloak thrown over God’s Creation, exclaimed, “We are blinded by colors!”⁶⁶ Desiderius Erasmus (ca. 1469–1536) stated that “wearing clothes that are striped and multicolored means wanting to look like mountebanks and monkeys.”⁶⁷ In the sixteenth century, a Protestant minister railed against alluring tints as an offense to God, an idolization of appearances that subverts spiritual truths:

Every man has fallen in love with himself . . . his mind is set on fashion, fangles, and garish clothes . . . in the judgment of wise men, such [people] are but a blowne bladder, painted over with so many colours, stuff full of pride and envy . . . in whomsoever such [outward] badges of vanitie appears, it is a sure token there is a stinking puddle of vainglory within.⁶⁸

⁶² Cited in Makoto Ooka, *The Colors of Poetry: Essays in Classic Japanese Verse*, trans. Takako Lento and Thomas V. Lento (Rochester, Mich.: Katydid Books, 1991), p. 38.

⁶³ Cited in Jerome Silbergeld, *Chinese Painting Style: Media, Methods, and Principles of Form* (Seattle: University of Washington Press, 1982), p. 26.

⁶⁴ Aristotle, *Poetics*, trans. S. Halliwell (Chapel Hill: University of North Carolina Press, 1987), p. 38. On classical depreciation of color, see Jacqueline Lichtenstein, *The Eloquence of Color: Rhetoric and Painting in the French Classical Age*, trans. Emily McVarish (Berkeley: University of California Press, 1993), pp. 37–54.

⁶⁵ Saint Augustine, *Confessions*, trans. Henry Chadwick (Oxford: Oxford University Press, 1991), pp. 209–210.

⁶⁶ Cited in Herman Pleij, *Colors Demonic and Divine: Shades of Meaning in the Middle Ages and After* (New York: Columbia University Press), pp. 3–4.

⁶⁷ Cited in Daniel Roche, *The Culture of Clothing: Dress and Fashion in the Ancien Régime*, trans. Jean Birrell (Cambridge: Cambridge University Press, 1994), p. 202.

⁶⁸ Cited in Jane Schneider, “Fantastical Colors in Foggy London: The New Fashion Potential of the Late Sixteenth Century,” in *Material London, ca. 1600*, ed. Lena Cowen Orlin (Philadelphia: University of Pennsylvania Press, 2000), p. 118.

Speaking to a more secular age, Goethe's remark still sums up the perspective of upper-class society in contemporary cultures: "people of refinement have a disinclination to colours."⁶⁹

In most societies, the elite displayed pronounced chromophobia. In their eyes, bright color was the province of barbarians, children, the rabble, and the ignorant; it exemplified the superficial, subjective, irrational, self-indulgent, sensual, disorderly, and deceptive. As an integral part of this sweeping defamation, color was despised inasmuch as it was seen to be cherished by women, who were (all men agreed) vain, flighty, foolish, shallow, seductive, and driven by emotion. Shape and line in painting epitomized Apollonian self-discipline and the male; color personified Dionysian abandon and the female.⁷⁰ The color theorist Charles Blanc (1813–1882) conveyed a secularized Augustinian view in elevated tones: "The union of design and color is necessary to beget painting just as is the union of man and woman to beget mankind, but design must maintain its preponderance over color. Otherwise painting speeds to its ruin: it will fall through color just as mankind fell through Eve."⁷¹ In depreciating color, the patriarchy maintained moral and social standards as well as aesthetic principles.

The very nature of color vision is at the root of the virtually universal prejudice against color itself. The mute, unavoidable visibility of color makes it resistant to theoretical understanding and thereby provokes critics and philosophers to denounce it as an unruly, disruptive element. While touch, taste, hearing, and smell are modalities that involve physical confirmation by more than one sense organ, color is accessed only by sight, thereby leaving it in a vulnerable conceptual position since it cannot be physically corroborated. With its unique, disconcerting properties, color is the common experience of humanity yet remains existentially subjective.⁷² Like a rainbow in the heavens, it is impossible to grasp and evanescent in thought; it transcends language, clouds the intellect, and evades categorization. Receptive to neither description nor facile explanation, color and the feelings it evokes seem beyond reason and control. As the Russian painter Wassily

⁶⁹ Goethe, *Theory of Colours*, p. 329; see John Gage, *Color and Meaning: Art, Science, and Symbolism* (Berkeley and Los Angeles: University of California Press, 1999), pp. 30–31.

⁷⁰ Shlain, *Art & Physics*, p. 171; Charles A. Riley II, *Color Codes: Modern Theories of Color in Philosophy, Painting and Architecture, Literature, Music, and Psychology* (Hanover, N.H.: University Press of New England, 1995), p. 6.

⁷¹ Cited in Riley, *Color Codes*, p. 6.

⁷² On the uniqueness of color experience, see Mohan Matthen, "Our Knowledge of Colour," in *Naturalism, Evolution, and Intentionality*, ed. Jillian Scott McIntosh (Calgary: University of Calgary Press, 2001), pp. 215–244.

Kandinsky (1866–1944) wrote, “Color is a power which directly influences the soul. Color is the keyboard, the eyes are the hammers, the soul is the piano with many strings.”⁷³

The conceptual difficulties presented by color are accentuated by another consideration: pure saturated colors are primarily synthetic creations since nature actually is meagerly endowed with them. Except for vivid birds, beetles, butterflies, and blossoms—legacies of the late Cretaceous crisis—the natural world is presented to the human eye chiefly in browns and greens beneath a sky of unsaturated blue. Brilliantly colored, man-made artifacts inherently overstimulate the visual cortex, thereby contributing to endemic chromophobia precisely among those social ranks that had access to intense pigments. Denis Diderot’s *Encyclopédie* (1751–1756) spelled out the strain inflicted by glowing hues:

Green is just the right mixture of clear and sombre to please and strengthen the sight instead of weakening and troubling it. Hence the fact that many painters have a green cloth hung near the place where they work, on which to throw their glance from time to time, and to relieve them of the fatigue caused by the brightness of the colours. All the colours, says Newton, which are most brilliant, dull and distract the minds of animals that see . . . whereas the rays which produce in us the idea of green, fall on the eye in such a just proportion, that they give animal minds all the play necessary, and by this means they arouse in us a very agreeable sensation.⁷⁴

Significantly, strong color is not employed promiscuously even in our own color-rich society—that is, most surfaces are not covered with vivid tones. This is doubtless because there is a physiological and psychological truth underlying Bernard of Clairvaux’s lament that we are “blinded by colors.”

Writers on art in East Asia and Europe focused on line and shape—what critics such as Giorgio Vasari (1511–1574) called *disegno* (drawing)—that is, elements that generally call for planning and intention; but since color is obstinately impervious to cognitive processes, it failed

⁷³ Cited in Nicholas Humphrey, *Seeing Red: A Study in Consciousness* (Cambridge, Mass.: Harvard University Press, 2006), p. 19.

⁷⁴ Cited in Annik Pardaillhé-Galabrun, *The Birth of Intimacy: Privacy and Domestic Life in Early Modern Paris*, trans. Jocelyn Phelps (Philadelphia: University of Pennsylvania Press, 1991), pp. 172–173. Almost a century later, Charles Dickens still took the practice for granted: “A painter who has gazed too long upon some glaring colour, refreshes his dazzled sight by looking upon a darker and more sombre tint”; *Nicholas Nickleby* (Oxford: Oxford University Press, 1950), p. 1.

everywhere to be justified and fostered in speculative traditions. Chinese scholars wrote countless paeans to the virtues of ink painting but dismissed color in a few words. Art theory flourished in Renaissance Florence, where line and contour dominated painting, yet it languished in Venice, the color capital of Mediterranean Europe.⁷⁵ Recoiling from the conundrum it presented at the opposite poles of Eurasia, both Confucian theorists and Western philosophers consigned color to the purgatory of mere sensation and perverse indulgence.⁷⁶

THE HISTORICAL WEAVING OF THE RAINBOW

While chromophobia and chromophilia both found expression in leading societies of Eurasia, the balance between them varied according to a pattern that may be characterized as “the spectrum of the ecumene.” The Eurasian landmass effectively constituted an ecumene (from Greek *oikoumene*, the “inhabited quarter” of the world) a series of extensive regional cultures in communication, however shaky and sporadic, between the Atlantic and Pacific.⁷⁷ There were no strictly bounded territorial divisions between Eurasian cultures, however: just as the spectrum of the rainbow is “an indefinite variety of Intermediate gradations” (as Newton explained), so too there was a progression in the spectrum of the ecumene.⁷⁸

Naturally, all regions of the ecumene showed some appreciation of color. Given the hues that come to everyone’s eyes, the intrinsically pleasing aspects of color, and the universal availability of diverse pigments, it is not surprising that color sooner or later gained a solid foothold in every swath of the premodern ecumenical spectrum. Of course, justice cannot be done here to most regional traditions of color, a task that would require a hefty book. Thus, Japanese artists and connoisseurs devoted themselves to an aesthetic of subdued beauty, but

⁷⁵ See Moshe Barasch, *Light and Color in the Italian Renaissance Theory of Art* (New York: New York University Press, 1978), pp. 90–93, 107, 120; and Patricia Rubin, “The Art of Colour in Florentine Painting of the Early Sixteenth Century: Rosso Fiorentino and Jacopo Pontormo,” *Art History* 14, no. 2 (1991): 175–191.

⁷⁶ See Philip Sohm, *Style in the Art Theory of Early Modern Italy* (Cambridge: Cambridge University Press, 2001), pp. 195–196, 198–199; and Yu Feian, *Chinese Painting Colors*, trans. Jerome Silbergeld and Amy McNair (Hong Kong and Seattle: Hong Kong University Press and University of Washington Press, 1988), pp. ix–x.

⁷⁷ The concept of the ecumene is employed extensively by William H. McNeill, *The Rise of the West: A History of the Human Community* (Chicago: University of Chicago Press, 1963) and Marshall G. S. Hodgson, *The Venture of Islam: Conscience and History in a World Civilization*, 3 vols. (Chicago: University of Chicago Press, 1974).

⁷⁸ The phrase is cited in Christianson, *In the Presence of the Creator*, p. 150.

imports of colorful Chinese cloth and gilded silk-screen paintings, often under the sponsorship of rulers such as the Ashikaga shoguns of the Muromachi period (1336–1573), created a countervailing force in elite circles.⁷⁹ In China, literati passion for monochrome painting ran parallel with a much less prominent tradition of exuberant, naturalistic color in “flower-and-bird” paintings, a specialty of artists south of the Yangzi River from the time of the Tang dynasty (618–906).⁸⁰ So too, the ancient Greeks preferred a limited, austere palette, and from at least the time of Plato and Aristotle, they regarded shape and contour as superior to color; yet Athenians painted the Parthenon blue, with Ionic capitals in gold and Doric ones in blue-and-red stripes, and they painted marble statues of temple gods in vivid colors, including pupils tinted red.⁸¹

Still, whatever the partiality for color found everywhere, it is illuminating to focus on what was distinctive about color perspectives in the principal regions of Eurasia inasmuch as it is revealing about significant values of the particular culture as well as about cross-cultural contact. The following survey highlights only what was exceptional about perspectives on color in the various cultures. In the spectrum of the ecumene, Japan disdained color in basic respects but at the same time developed a remarkably sophisticated perception of it. China shared Japan’s reservations about color yet also periodically followed the West Asian lead on it. West Asia represented the empire of color, the radiant center of the ecumenical spectrum, diffusing the rainbow both east and west. Classical Greece and Rome, however, rejected West Asia’s high valuation of color, thereby establishing a European tradition that eventually was overwhelmed by chromophilia during the early modern period as a consequence of Western merchants importing new pigments and colorful commodities from around the world.

Japan: Colors of the Mind

Japanese color values were established by the Heian era (794–1185), a couple of centuries after sophisticated Chinese dyeing technology came to the islands. Since Japan entered a lengthy era of national isolation in

⁷⁹ Gail Capitol Weigl, “The Reception of Chinese Painting Models in Muromachi Japan,” *Monumenta Nipponica* 35, no. 3 (1980): 257–272; and Miyeko Murase, *Masterpieces of Japanese Screen Painting* (New York: George Braziller, 1990), pp. 11, 12–14, 18.

⁸⁰ Françoise Cheng, *D’où jaillit le chant: La Voie des Fleurs et des Oiseaux dans le tradition des Song* (Paris: Phébus, 2000); and Saehyang P. Chung, “An Introduction to the Changzhou School of Painting—1,” *Oriental Art* 31, no. 2 (1985): 146–160.

⁸¹ Finlay, *Color*, pp. 126–127; and Patrik Reuterswärd, *Studien zur Polychromie der Plastik: Griechenland und Rom* (Stockholm: Svenska Bokförlaget, 1960), pp. 9–32.

794, the prolonged cultural supremacy of the Heian court meant that its color values dominated the elite and remained a reference point on the subject for many centuries. In fact, the Heian preference for “cold and withered” (*hiekareru*) metaphorical colors of the mind paradoxically resulted in an exquisitely subtle perception of color, one that remains unparalleled in cultural history.⁸²

The Tale of Genji by Murasaki Shikibu (ca. 978–1016), the literary masterpiece of the Heian period, often conveys the values, moods, and viewpoints of characters in terms of color. The author portrays her eponymous hero contemplating winter moonlight turn his garden a gleaming white: “People make a great deal of the flowers of spring and the leaves of autumn, but for me a night like this, with a clear moon shining on snow, is the best—and there is not a trace of color in it.” In prizing “the want of striking color,” Genji was representative of aristocratic ranks.⁸³ The notion of earthly things doomed to fade lay behind this perception. The Buddhist term *aware*, which occurs over one thousand times in *The Tale of Genji*, denotes pathos regarding the evanescence of mortal existence, a poignant melancholy prompted by contemplating life drained of vitality and color.⁸⁴ The concept was related to the Zen Buddhist term *yugen*, which connoted lingering pathos and an impermanent, transitional beauty. Kamo no Chomei, who wrote extensively on poetry at the end of the Heian era, influentially described *yugen* as “like an autumn evening under a colorless expanse of silent sky.”⁸⁵

The word for “color” in ancient Japan was *iro*, which originally denoted a beautiful woman as well as desire for sex with one—the ideogram signifies intercourse, with one person lying on top of another. *Iro* evolved to evoke the idea of passing time and transient hues. In like fashion, the verb *shimiru* (to penetrate) came to mean “to dip in dye”

⁸² The phrase is cited in Theodore M. Ludwig, “Chanoyu and Momoyama: Conflict and Transformation in Rikyu’s Art,” in *Tea in Japan: Essays on the History of Chanoyu*, ed. H. Paul Varley and Kumakura Isao (Honolulu: University of Hawai’i Press, 1989), p. 73. “Cold and withered” expressed an aesthetic ideal common to poetry, ink painting, and the tea ceremony. On the introduction of Chinese dyeing technology, see Mary Dusenbury, “The Art of Color,” in *Beyond the Tanabata Bridge: Traditional Japanese Textiles*, ed. William Jay Rathbun (London: Thames and Hudson, 1993), pp. 26–29.

⁸³ Murasaki Shikibu, *The Tale of Genji*, trans. Edward G. Seidensticker (New York: Alfred A. Knopf, 1987), pp. 340, 345.

⁸⁴ Ivan Morris, *The World of the Shining Prince: Court Life in Ancient Japan* (New York: Penguin Books, 1979), pp. 207–208; and Eiko Ikegami, *Bonds of Civility: Aesthetic Networks and the Political Origins of Japanese Culture* (Cambridge: Cambridge University Press, 2005), pp. 233–234.

⁸⁵ Cited in Haga Koshiro, “The *Wabi* Aesthetic through the Ages,” in *Japanese Aesthetics and Culture: A Reader*, ed. Nancy G. Hume (Albany: State University of New York Press, 1995), p. 253.

and “to absorb color,” while also taking on the nuance of inconstant feelings and fading beauty. The Japanese looked down upon peaches and plums, the most admired flowering plants in China, as vulgar and voluptuous because of their deep-pink blooms. Instead, they esteemed the delicate pinkish-white tint of cherry blossoms, whose petals flowered so briefly.⁸⁶ In general, contemporary Western taste highlights the climatic moment of the full-blooming rose and resplendent tulip, but traditional Japan favored the beginning and ending of things, transitional moments epitomized in barely opened buds, faded flowers, and withered autumn leaves.⁸⁷

In *Kokin wakashu* (A collection of verse past and present), an anthology of 1,111 poems put together in 905, a century before *Genji*, the melancholy beauty of autumn and winter is conveyed in imagery of color being siphoned off by the imagination: hues lost amid flakes of snow, garments dyed by morning mist, snowflakes penetrating a flowering bough, robes wet with cherry blossoms, brocade shot with threads of frost, flowers blossoming on the billows of the sea, color soaking into the heart.⁸⁸ Color is assimilated to the colorless by dissolving it in similes of moisture—fog, clouds, rain, dew, ocean, streams, and frost. After ephemeral blossoms and autumn foliage, snow figured as the principal object of aesthetic appreciation in Japanese poetry.⁸⁹ Princess Uchiko (807–847), an influential poet, wrote of “chilly flowers blooming alone in the snow’s reflected light.”⁹⁰ When the Dutch East India Company imported a tuneful gray-green-brown finch from the Canary Islands to Japan in the seventeenth century, bird-lovers bred it to snow-white—in Europe, it turned a sunny yellow—and white still remains the favorite color in Japan.⁹¹

Murasaki devotes a lot of attention to the dress of the privileged,

⁸⁶ Ooka, *Colors of Poetry*, pp. 37–38, 40–42, 49.

⁸⁷ Donald Keene, “Japanese Aesthetics,” in Hume, *Japanese Aesthetics and Culture*, p. 31.

⁸⁸ Helen Craig McCullough, ed. and trans., *Kokin Wakashu: The First Imperial Anthology of Japanese Poetry* (Stanford, Calif.: Stanford University Press, 1985), pp. 63–65, 72, 79, 91; and McCullough, *Brocade by Night: ‘Kokin Wakashu’ and the Court Style in Japanese Classical Poetry* (Stanford, Calif.: Stanford University Press, 1985), pp. 196, 414, 512, 521.

⁸⁹ McCullough, *Brocade by Night*, p. 360.

⁹⁰ Judith N. Rabinovitch and Timothy R. Bradstock, eds. and trans., *Dance of the Butterflies: Chinese Poetry from the Japanese Court Tradition* (Ithaca, N.Y.: Cornell East Asia Series, 2005), p. 92.

⁹¹ Richard W. Bulliet, *Hunters, Herders, and Hamburgers: The Past and Future of Human-Animal Relationships* (New York: Columbia University Press, 2005), pp. 103–104; and Miho Saito, “Comparative Studies on Color Preference in Japan and other Asian Regions, with Special Emphasis on the Preference for White,” *Color Research and Application* 21, no. 1 (1996): 35–49.

who favored muted colors, artful shading, and transitional (or *shibui*) tones.⁹² Women typically wore a heavy outer costume and a set of lined robes in as many as twelve layers. Cloth was rolled up before coloring, so that it came out in tie-dyed fashion, shaded slightly darker at the bottom of the garment. The hem of each robe became successively longer, as did the sleeve, thereby creating composite, intermediary colors to be glimpsed through the gossamer-thin material.⁹³ Representative garment colors mentioned by Murasaki include “pale magenta,” “pale unfigured pinks and lavenders,” “lilac lined with purple and saffron,” and “russet lined with yellow.” Young girls at an imperial ceremony are applauded for their “robes of lavender and pink and various deeper shades of purple, and yellow-green jackets lined with green, all appropriately autumn hues.”⁹⁴ Following the lead of their female counterparts, Heian gentlemen also devoted considerable attention to the assorted colors of their attire, and they used costly paper in pastel shades for sending notes to would-be lovers, sometimes accompanied by a flower whose hue denoted the degree of intimacy anticipated.⁹⁵

Court society in Heian Japan was rigidly stratified as well as sealed off from the wider world. It functioned as the sole center of culture, and it was not until well after the twelfth century that alternative places emerged for the elite to gather, especially the court of the Ashikaga shoguns of the Muromachi period.⁹⁶ The Heian court fostered an extraordinary hothouse environment, one in which a unique culture of color was created, compounded of Zen Buddhist principles, intense social inbreeding, and a leading female role in establishing fashion. Indeed, women stand out as crucial in propelling the Heian court

⁹² On Heian colors and *shibui* tones, see Helen Craig McCullough, “Aristocratic culture,” in *The Cambridge History of Japan*, vol. 2, *Heian Japan*, ed. Donald H. Shively and William H. McCullough (Cambridge: Cambridge University Press, 1990), pp. 394–395; and Augustine Hope and Margaret Walch, *The Color Compendium* (New York: Van Nostrand Reinhold, 1990), pp. 178–179.

⁹³ Richard Bowring, trans., *The Diary of Lady Murasaki* (London: Penguin Books, 1996), p. xxx; and Ivan Morris, ed. and trans., *The Pillow Book of Sei Shonagon* (New York: Penguin Books, 1971), pp. 269–270.

⁹⁴ Murasaki, *Tale of Genji*, pp. 137, 212, 314, 386, 407, 462.

⁹⁵ See Morris, *World of the Shining Prince*, p. 243, n. 57. The imperial court in the Kamakura period (1185–1333) closely modeled itself on its predecessor, hence delicately colored robes and pastel billets-doux remained central to elite life; see Karen Brazell, trans., *The Confessions of Lady Nijo* (Stanford, Calif.: Stanford University Press, 1973), pp. 2, 7, 11–12, 77, 83.

⁹⁶ See Paul H. Varley, “Cultural Life of the Warrior Elite in the Fourteenth Century,” in *The Origins of Japan’s Medieval World: Courtiers, Clerics, Warriors, and Peasants in the Fourteenth Century*, ed. Jeffrey P. Maas (Stanford, Calif.: Stanford University Press, 1997), pp. 192–208.

toward its nuanced sense of color, its emphasis on transitional shades and intricate ensembles.

All scientific studies indicate that females display greater color discrimination and have a larger color repertoire than do men; they also show greater ability in defining colors and in tests of matching colors. Girls learn the names of colors earlier than boys, and while the subsequent color superiority of adult females may be due to early socialization—playing with mommy’s cosmetics and costumes, winning praise for gay dresses and glossy ribbons—it is likely that their advantage also is related to genetic considerations. Not only do men suffer far more frequently than women from red-green color-blindness, recent genetic research has revealed that some women—no one yet knows how many—possess *tetrachromatic* (four-color) vision as a result of having an extra cone type between the middle- and long-wavelength cones. Such females have a much more refined discrimination of the hues seen by everyone else.⁹⁷

A built-in bias in a closed, face-to-face society, even if it is exerted by just a small minority, can exert powerful selection pressure over time; in the parlance of evolutionary theory, it works like a positive-feedback escalator.⁹⁸ If there ever was a place where a biologically determined, superior perception of color among women could find highly focused cultural expression, it surely was at the hermetic Heian court, where they played a crucial role in fashion and where the very conceptual negation of color impelled the elite to subtle color discrimination. Such a distinctive set of conditions would not arise again in history.

As Japanese society became more diverse in the Kamakura (1185–1333) and Muromachi periods, the imperial court lost its cultural dominance, and bright tones won a larger social space. Nevertheless, the consummate color sense established in Heian Japan remained a mainstream expression of Japanese elite culture. It even became reinforced in the Tokugawa period (1615–1868) as thinkers and reformers looked back to the culture of the ancient court to define the essence of a “Japa-

⁹⁷ David L. Bimler, John Kirkland, and Kimberly A. Jameson, “Quantifying Variations in Personal Color Spaces: Are There Sex Differences in Color Vision?” *Color Research and Application* 29, no. 2 (2004): 128–134. Tetrachromatic vision probably is related to chromosomal misalignment as a result of women being “carriers” for the genes of dichromatic fathers; see Enns, *Thinking Eye*, pp. 110–112. The number of tetrachromatic women remains unknown at present because considerable postmortem examination is necessary to determine its incidence. On gender, chromosomes, and color-blindness, see note 33.

⁹⁸ On the workings of positive feedback in creating variegated color among peacocks and birds of paradise, see Richard Dawkins, *The Blind Watchmaker: Why the Evidence of Evolution Reveals a Universe without Design* (New York: W. W. Norton, 1986), pp. 195–220.

nese sensibility” (*yamato gokoro*) in opposition to foreign influence.⁹⁹ The vitality of Heian color values helps explain the spacious, abstract designs, strikingly modern in character, that are characteristic of the Tokugawa era, during which potters turned out vessels painted with swirls of aubergine, tawny orange, and black enamel set in an expanse of snow-white, and weavers made samurai jackets (*jinbaori*) in which circles of white, yellow, and red fitted into holes cut out of cloaks as gray as autumn.¹⁰⁰

China: Color on the Silk Road

Color assumed a prominent place in Chinese life and art whenever strong political and commercial ties existed along the so-called Silk Road of central Asia, a network of trails and oases linking West and East Asia. Indeed, in regard to color, West Asia played the same role in relation to China that China itself did toward Japan: that is, the impulse toward use of stronger hues came from a region of the ecumene that was a distance away. As in Japan, however, the native Chinese tendency was to devalue color, a perspective that had its most remote origins close to the beginnings of Chinese culture in the Shang era (ca. 1570–1045 B.C.E.). The rulers of that time sought supernatural guidance through shamanistic interpretation of lines on “oracle bones,” cracks made by heating cattle scapula or turtle shell. The ancient progenitors of Chinese ideographic script, the cracks were read by diviners as linear patterns that revealed the will of heaven. Colorless oracle bones functioned as a magical, celestial technology, and greatly stimulated by the early invention of the writing brush, black ink, and paper, they helped determine that calligraphic art set off on a color-denying course.¹⁰¹

The visual dynamics of calligraphic script also continued to be

⁹⁹ See Ikegami, *Bonds of Civility*, pp. 232–235; Laura W. Allen, “Japanese Exemplars for a New Age: *Genji* Paintings from the Seventeenth-Century Tosa School,” in *Critical Perspectives on Classicism in Japanese Painting, 1600–1700*, ed. Elizabeth Lillehoj (Honolulu: University of Hawai’i Press, 2004), pp. 99–132.

¹⁰⁰ See Yoshiaki Shimizu, ed., *Japan: The Shaping of Daimyo Culture, 1185–1868* (exh. cat.) (Washington, D.C.: National Gallery of Art, 1988), pp. 318–322, 333–345; and Richard L. Wilson, *The Potter’s Brush: The Kenzan Style in Japanese Ceramics* (Washington, D.C.: The Freer Gallery of Art and Arthur M. Sackler Gallery, Smithsonian Institution, 2001), pp. 46, 67, 138.

¹⁰¹ David N. Keightley, *Sources of Shang History: The Oracle-Bone Inscriptions of Bronze Age China* (Berkeley: University of California Press, 1978); and Jonathan Chaves, “The Legacy of Ts’ang Chieh: The Written Word as Magic,” *Oriental Art* 23, no. 2 (1977): 200–215.

related to patterns of natural phenomena. Zhu Xie (1130–1200), the most influential exponent of what became known as “Neo-Confucianism,” said that the forms of nature were “patterns of heaven,” available to the artist or sage who empties his mind to look at them and who is not “concerned with clutching at externals.”¹⁰² Emptying one’s mind worked to eliminate extraneous detail, impelled the artist’s brushwork to spontaneity, and thereby revealed the personality of the artist. In contrast to Western aesthetic theory, which valued optic verisimilitude and faithful representation, Chinese art spurned the pursuit of what critics termed “formal likeness” (*xingsi*). The crucial consideration was the simultaneous revelation of natural forms and the artist’s character, the striving for “spirit resonance” (*qiyun*), which ideally would be manifest in the untrammelled character of calligraphic brushwork. Ke Qian (1251–1319), famous for his paintings of monochrome scenes with bamboo, said that “if one is able not to look at bamboo as bamboo but to seek its supreme unborn nature beyond all form and color,” then the character of the artist himself may be visualized.¹⁰³

Revealing the inner pattern of natural forms as well as the artist’s individuality did not require color—indeed, strong hues were a positive hindrance. The Chinese word for color, *se*, carried connotations of beauty but also referred to emotion, a baseline from which it came to have overtones of anger, passion, lewdness, and luxury.¹⁰⁴ In his immensely influential *Record of the Famous Painters for All Dynasties* (ca. 847), Zhang Yanyuan wrote that “[m]ountains are green without needing malachite, and the phoenix is iridescent without the aid of the five colors. For this reason one may be said to have fulfilled one’s aim when the five colors are all present in the management of ink [alone].”¹⁰⁵

The first substantial commercial traffic on the Silk Road took place during the period of the Western (or Former) Han (206 B.C.E.–9 C.E.), when the empire received quantities of luxury products—ivories, sable fur, silver, gold, and dyestuffs. Critics complained that because of alluring exotic commodities “women go to the extreme in finery” and

¹⁰² Cited in John Makeham, *Transmitters and Creators: Chinese Commentators and Commentaries on the Analects* (Cambridge, Mass.: Harvard University Asia Center, 2003), p. 203.

¹⁰³ Bush and Shih, *Early Chinese Texts on Painting*, pp. 274–275; see Wen. C. Fong, *Beyond Representation: Chinese Painting and Calligraphy, 8th to 14th Century* (New York and New Haven, Conn.: Metropolitan Museum of Art and Yale University Press, 1992), pp. 4–5.

¹⁰⁴ Silbergeld, *Chinese Painting Style*, p. 26; Yu, *Chinese Painting Colors*, p. 27; and Jacques Gernet, “L’expression de la couleur en Chinois,” in Myerson, *Problèmes de la couleur*, pp. 295–301.

¹⁰⁵ Bush and Shih, *Early Chinese Texts on Painting*, pp. 62–63.

that “one color vied with the other” in the decoration of aristocratic palaces.¹⁰⁶ Far more extensive connections with central and West Asia were formed in the Tang period. In the mid seventh century, Tang military forces even seized control of the oasis communities around the desolate Tarim Basin on the Silk Road, extending Chinese sway to the borders of Persia. Central Asian artisans in Chang’an, the Tang capital, fashioned vessels in silver and carved figurines from jade. West Asian entrepreneurs imported purple-dyed woolen cloth from Syria, colorful carpets and polychrome silk from Persia, rock crystal from Samarqand, jade from Khotan on the Silk Road, and lapis lazuli from the mountains of Afghanistan.¹⁰⁷

Chinese arts responded to the Tang opening to the west. The oasis communities on the Silk Road played the role of middlemen, conveying their versions of Indian and Persian pictorial methods to China, such as stylized flowers and exuberant hues.¹⁰⁸ What is called the “Tang international style” emerged, characterized by floral motifs and brilliant color.¹⁰⁹ Caves decorated by Buddhists at Dunhuang in the northwestern province of Gansu contained painted statues, rainbow images, vivid embroidery, multihued mandalas, and brightly colored wall murals that profoundly influenced Chinese art. Indian and Persian coloring were adapted to the Chinese emphasis on line and contour; the Buddhist figurative tradition, including polychrome haloes and a complex color symbolism, was integrated into Chinese aesthetics.¹¹⁰

With rebellion against the Tang regime in the mid eighth century, however, the Chinese military pulled back from their strongholds on the Silk Road, and during the Song dynasty (960–1279), northern

¹⁰⁶ The phrases are cited in Martin J. Powers, “Artistic Taste, the Economy and the Social Order in Former Han China,” *Art History* 9, no. 3 (1986): 287, 291.

¹⁰⁷ Étienne de La Vaissière and Éric Trombert, “Des Chinois et des Hu: Migrations et intégration des Iraniens orientaux en milieu chinois durant le haut Moyen Âge,” *Annales* 59, no. 5–6 (2004): 931–969; and Valerie Hansen, “The Hejia Village Hoard: A Snapshot of China’s Silk Road Trade,” *Orientalis* 34, no. 2 (2003): 14–19.

¹⁰⁸ Central Asia and India were aesthetic forces in their own right, not merely transmitters of West Asian influences; but not only is there a meager secondary literature on their Eurasian impact, there also is no room in the present discussion to deal with them.

¹⁰⁹ William Watson, “Iran and China,” in *The Cambridge History of Iran*, vol. 3:1, *The Seleucid, Parthian and Sasanian Periods*, ed. Ehsan Yarshater (Cambridge: Cambridge University Press, 1983), pp. 537–567; and James C. Y. Watt, “Art and History in China from the 3rd through the 8th Century,” in *China: Dawn of a Golden Age, 200–750 AD* (exh. cat.), ed. James C. Y. Watt (New York and New Haven, Conn.: Metropolitan Museum of Art and Yale University Press, 2004), pp. 2–55.

¹¹⁰ Sarah E. Fraser, *Performing the Visual: The Practice of Buddhist Wall Painting in China and Central Asia, 618–960* (Stanford, Calif.: Stanford University Press, 2004), pp. 109–130, 152–153; and Mario Bussagli, *Central Asian Painting*, trans. Lothian Small (New York: Rizzoli, 1979), pp. 28, 39–40, 90, 111.

powers—the Liao state of the Qidan (907–1125) and then the Jin state of the Jurchen (1115–1234)—cut off imperial China from almost all contact with West Asia.¹¹¹ In the realm of art, the most significant consequence of this political upheaval was the decline of color and the definitive triumph of monochrome. This is dramatically evident in porcelain styles. While ceramic statues of Bactrian camels, commonly painted with lively realism in vivid colors, represented the ecumenical perspective and imperial reach of the early Tang regime, the renowned vases of the Song exemplify the spirit esteemed and promoted by that dynasty—elegant, subtle, and self-contained. The hallmarks of Tang ceramics are exotic motifs and painted adornment; Song porcelains are characterized by reserved decoration and a range of cool-toned, monochromatic shades, most notably sea-green (or celadon) and white.¹¹²

A similar, even more decisive transition took place in painting. In the Tang period, a landed military aristocracy dominated politics and government, but under the Song, men of the book and culture, recruited in an examination system based on the Confucian classics, took precedence over men of the sword and lofty pedigree.¹¹³ This political shift was reflected in artistic practice: technically skilled professional painters, who had prevailed during the Tang, were supplanted by Confucian literati committed to calligraphic-style painting and scornful of artisan expertise, naturalistic representation, and strong hues.¹¹⁴

Color surged back into Chinese art with the Mongol conquest of China in 1279. The Yuan regime (1279–1368) maintained close ties with the Mongol Ilkhanid dynasty of Persia (1258–1353), and the polychrome traditions of that region of the ecumene beat back Song monochrome. Paintings with strong color gained in respectability and even became objects of connoisseurship among the literati.¹¹⁵ Furthermore,

¹¹¹ La Vaissière and Trombert, “Des Chinois et des Hu,” pp. 961–983; C. A. Peterson, “Court and Province in Mid and Late T’ang,” in *The Cambridge History of China*, vol. 3:1, *Sui and T’ang China*, 589–906, ed. Denis Twitchett (Cambridge: Cambridge University Press, 1979) pp. 474–486; and Frederick W. Mote, *Imperial China 900–1800* (Cambridge, Mass.: Harvard University Press, 1999), pp. 49–71, 193–221.

¹¹² Mary Tregear, *Song Ceramics* (London: Thames and Hudson, 1982); and Mary Ann Rogers, “The Mechanics of Change: The Creation of a Song Imperial Ceramic Style,” in *New Perspectives on the Art of Ceramics in China*, ed. George Kuwayama (Honolulu: University of Hawai‘i Press, 1992), pp. 64–79.

¹¹³ See Peter K. Bol, “*This Culture of Ours*”: *Intellectual Transitions in T’ang and Sung China* (Stanford, Calif.: Stanford University Press, 1992), pp. 148–175.

¹¹⁴ See the sentiments expressed by Song literati in Oswald Sirén, *The Chinese on the Art of Painting: Texts by the Painter-Critics from the Han through the Ching Dynasties* (Mineola, N.Y.: Dover, 2005), pp. 38–90, 112.

¹¹⁵ See James Cahill, *Hills Beyond A River: Chinese Paintings of the Yuan Dynasty, 1279–1368* (New York: Weatherhill, 1976). On Mongol preference for strong color, see Thomas T.

the great porcelain center of Jingdezhen in the province of Jiangxi, southeastern China, turned from producing pottery in white to making wares with pictorial and calligraphic designs in vibrant blue and white. The shift was inspired by Persian production of blue-and-white earthenware and necessitated importing cobalt oxide from Persia as the coloring agent.¹¹⁶ The Mongol conquest, then, had a significant influence on Chinese esteem for color, though calligraphy was not dislodged from its long supremacy—indeed, with blue-and-white porcelain, calligraphy, both Chinese and Arabic, became an ornamental element on pottery. It was, however, the last time West Asia would have an impact on the color experience of China. The next infusion of color would come from Europe during the early Qing (1644–1911) period, when Jesuit artists in Beijing introduced gleaming enamel pigments to the imperial workshops for porcelain, glass, and painting.¹¹⁷

West Asia: The Empire of Color

From the origins of civilization in West Asia, that region was the great homeland and reservoir of color. The center of chromophilia in the ecumene, it displayed no antagonism toward color, no equation of it with primitive emotion, feminine vanity, or ornamental illusion. Two considerations explain this unique devotion to color. First, the Nile and Tigris-Euphrates Rivers run through environments that would be barren, uninhabitable land without them, parched by Atlantic and Mediterranean winds that drop their moisture on higher elevations. Without the Nile River, the sands of the Sahara would roll unimpeded to the Red Sea; without the Tigris-Euphrates, the region of Mesopotamia would be too desiccated to sustain more than a thin pastoral population, much like the neighboring Syria desert. The two river systems flow, respectively, from the highlands of central Africa and Asia Minor, figuring as bright ribbons in a monotonously brown landscape, sharply marking off zones of cultivation and habitation. No other region that served as a setting for the emergence of civilized life presents such a stark physical contrast between the conditions encouraging such a develop-

Allsen, *Commodity and Exchange in the Mongol Empire: A Cultural History of Islamic Textiles* (Cambridge: Cambridge University Press, 1997), pp. 57–69.

¹¹⁶ Robert Finlay, "The Pilgrim Art: The Culture of Porcelain in World History," *Journal of World History* 9, no. 2 (1998): 150–158.

¹¹⁷ Louise Allison Cort, "Color," in *Joined Colors: Decoration and Meaning in Chinese Porcelain*, ed. Louise Allison Cort and Jan Stuart (Washington, D.C.: Arthur M. Sackler Gallery, Smithsonian Institution, 1993), pp. 19–31; and Emily Byrne Curtis, "Vitreous Art: Colour Materials for Qing Dynasty Enamels," *Arts of Asia* 24, no. 6 (1994): 96–100.

ment and those hostile to it. In such circumstances, vivid colors from early on became exemplary symbols for human existence in the midst of inimical nature.

A second consideration fostering chromophilia in ancient West Asia is less speculative but also arises from the environmental setting: the region had relatively easy access to the most prized pigments, decorative paraphernalia, and high-quality textiles. Cotton was cultivated in West Asia from ancient times and silk from the sixth century c.e. Ships brought saffron, indigo, and rubies from India, and camel caravans fetched jade, turquoise, and lapis lazuli from central Asia. Emeralds came from Egypt, carnelians and agate from Yemen, pearls from the Persian Gulf. The warm waters of the Levant nurtured murex shellfish, evergreen oaks of Lebanon hosted kermes insects, Persian soil held cobalt oxide, and nearby mountains yielded copper, gold, and silver.

In short, prone to embrace color in the first place, West Asia had less difficulty obtaining the most effective and treasured coloring agents than did any other part of the ecumene. As early as the Pre-Dynastic period (5000–2920 B.C.E.), Egyptians described the bodily forms of their gods in terms of silver, gold, jasper, and turquoise, and they produced blue-colored glass, known as *tjehnet* (luminous), as an inexpensive substitute for lapis lazuli.¹¹⁸ Ishtar, the Sumerian goddess of love and Assyrian goddess of war, had strong associations with color—she wore a jeweled necklace that symbolized the rainbow—and Nebuchadrezzar II (604–562 B.C.E.) of the Neo-Babylonian Empire (625–539 B.C.E.) of Mesopotamia called upon her protective power when he built the turquoise-colored Gate of Ishtar in Babylon, the grandest ancient achievement in the art of glazed brickwork.¹¹⁹

Although West Asia launched upon its trajectory of color centuries before the rise of Islam, the sacred text and traditions of that religion meant that chromophilia mounted to even greater heights. The Qur'an portrays a sensual, earthly Paradise where the elect lounge amid flower-filled gardens, sport gold bracelets, and dress in brocade robes (18:31). It also declares that God sustains mortal life with vegetation and animals of "diverse hues" (35:27–28, 39:21) and that "what He created for you

¹¹⁸ John Baines, "Color Terminology and Color Classification: Ancient Egyptian Color Terminology and Polychromy," *American Anthropologist* 87, no. 2 (1985): 284–288; and Robert Steven Bianchi, "Symbols and Meanings," in *Gifts of the Nile: Ancient Egyptian Faience* (exh. cat.), ed. Florence Dunn Friedman (New York: Thames and Hudson, 1998), pp. 22–31.

¹¹⁹ John Gray, *Near Eastern Mythology* (New York: Peter Bedrick, 1985), p. 50; and Frederick R. Matson, "Glazed Brick from Babylon—Historical Setting and Microprobe Analysis," in *Technology and Style*, ed. W. D. Kingery (Columbus: American Ceramic Society, 1986), pp. 133–156.

in the earth is of multifarious colours. . ." (16:13).¹²⁰ God is described as *musawwir* (59:24), the "fashioner" or "maker," an Arabic term also used for a painter.¹²¹ Indeed, the holy book informs believers that the Almighty created color for the sustenance and pleasure of his human creatures.

Islamic tradition envisages the incandescence of divinity as concealed behind seventy thousand veils of light and darkness; yet, as Jalal al-Din Rumi (1207–1273) declared, God possesses a "colour-mixing soul."¹²² The influential Sufi poet and mystic wrote that "[w]hen the reflexion of His beauty shines forth, mountainland and earth are silk and brocade."¹²³ Farid al-Din 'Attar (1142–1220), a Sufi poet and friend of Rumi, extolled the substantiation of God in nature in similar terms: "You cast the radiance of Your face on the earth and on the earth You paint marvelous pictures."¹²⁴ Elaborating on passages in the Qur'an, Sufi mystics and poets regarded all Creation as joined in celebrating God, including the scent of flowers, the song of birds, and the colors of sunset.¹²⁵ Rumi writes that when God appears on the Day of Resurrection even the painted figures decorating the walls of Persian baths will fall to their knees in adoration.¹²⁶

The iconoclastic strictures of Islam, the injunction against depicting God, generally became extended to realistic portrayal of all living beings. This had the effect of making color more important than ever since the vibrant yet suitably abstract motifs of pre-Islamic West Asia could be assimilated readily to the paint-wielding deity of the Qur'an. Denial of naturalism in art reinforced an aesthetic stylization of nature, with color providing variety and appeal to nonfigurative floral, geometric, and calligraphic motifs. To render things realistically was regarded as usurping God's prerogatives, but elaborate, colorful designs signified

¹²⁰ The quotations are taken from *The Qur'an: A Modern English Version*, trans. Majid Fakhry (London: Garnet, 1997).

¹²¹ Oleg Grabar, *The Formation of Islamic Art*, rev. ed. (New Haven, Conn.: Yale University Press, 1987), p. 81.

¹²² Jalal al-Din Rumi, *Mystical Poems of Rumi*, trans. A. J. Arberry (Chicago: University of Chicago Press, 1968), p. 63. On the Islamic tradition of light-theology, see the commentary by Al-Ghazzali (1058–1111), *The Niche of Lights*, ed. and trans. David Buchman (Provo, Utah: Brigham Young University Press, 1998).

¹²³ Rumi, *Mystical Poems*, p. 39.

¹²⁴ Cited in Hellmut Ritter, *The Ocean of the Soul: Man, the World and God in the Stories of Farid al-Din 'Attar*, trans. John O'Kane (Leiden: Brill, 2003), p. 629.

¹²⁵ Annemarie Schimmel, "The Celestial Garden in Islam," in *The Islamic Garden*, ed. Elisabeth B. MacDougall and Richard Ettinghausen (Washington, D.C.: Dumbarton Oaks, 1976), pp. 11–39. On the significance of color in Persian poetry, see Annemarie Schimmel, *A Two-Colored Brocade: The Imagery of Persian Poetry* (Chapel Hill: University of North Carolina Press, 1992), pp. 220–269.

¹²⁶ Rumi, *Mystical Poems*, p. 87.

an acknowledgment of the transcendent divinity that must never be represented.¹²⁷

In Islamic West Asia, color and variety of design were within reach of all social groups, not (as in medieval Europe) trappings of monarchy or facets of heraldic symbolism.¹²⁸ Geometric patterns in diverse hues appeared on all kinds of surfaces—stucco, brickwork, mosaics, manuscripts, saddles, swords, banners, robes, book bindings, mosque lamps, and pottery. Arabic calligraphy in various shades was similarly ubiquitous, gliding ineluctably into geometrics as letters were intricately embellished with colorful plaits, stars, and stylized flowers. Inspired by Sufi mysticism, Persian potters and metalworkers concealed the fundamental letters of God's name, *lam-alif* (L-A, *Allah*), amid a lattice of rosettes, flower buds, and cursive script.¹²⁹

Ornament typically consisted of squares and lozenges, zigzag bands, overlapping circles, radiating polygons, dovetailed hexagons, sunburst disks, floral-filled quatrefoils, and stellar grids. Sixteenth-century Persian "vase carpets" are characterized by central medallions around which are spread out mirror images on a longitudinal axis, sometimes with as many as six layers of detailed color patterns superimposed upon one another.¹³⁰ The works purportedly exemplify the *horror vacui* (or abhorrence of empty spaces) characteristic of Islamic art.¹³¹ That negative characterization, however, fails to capture the Islamic perspective. In fact, the comprehensive patterns stem simultaneously from the aesthetic principle that manifold hues and motifs epitomize the essence of beauty and from the pious assumption that the divine presence is signified by all-encompassing adornment. Of course, the ornamental designs necessarily had to be abstract, artificial, and imaginary, for creation or reproduction of physical reality were the exclusive province of God, not man.¹³²

¹²⁷ See Hodgson, *Venture of Islam*, 1:368–369, 469–472; 2:506–514; and I. R. Al-Faruqi, "Islam and art," *Studia Islamica* 37 (1973): 81–109.

¹²⁸ On an egalitarian ethos affecting all aspects of the Islamic community (*umma*), including artworks, see Hodgson, *Venture of Islam*, 2:62–151.

¹²⁹ Assadullah Souren Melikian-Chirvani, "Iranian Metal-Work and the Written Word," *Apollo* 103, no. 4 (1976): 286–291; and Annemarie Schimmel, *Calligraphy and Islamic Culture* (New York: New York University Press, 1984), pp. 9–11, 25, 32–33, 110–114.

¹³⁰ F. Spuhler, "Carpets and Textiles," in *The Cambridge History of Islam*, vol. 6, *The Timurid and Safavid Periods*, ed. Peter Jackson and Laurence Lockhart (Cambridge: Cambridge University Press, 1986), pp. 712–714; and P. R. J. Ford, *The Oriental Carpet: A History and Guide to Traditional Motifs, Patterns, and Symbols* (New York: Harry N. Abrams, 1981), pp. 118–125.

¹³¹ See Richard Ettinghausen, "The Taming of the Horror Vacui in Islamic Art," *Proceedings of the American Philosophical Society* 123, no. 1 (1979): 15–28.

¹³² Grabar, *Formation of Islamic Art*, p. 192.

Muslim artists favored colorful designs taken from vegetation since Paradise, lush and well-watered, appears prominently in the Qur'an, a consideration that gave prominence to gardens, fountains, and floral decoration in Islamic cultures.¹³³ A popular motif was the Tree of Life of Paradise, a symbol in West Asian religions since ancient Babylon. In a multitude of colors, the motif appeared on window grilles, prayer rugs, palace facades, city gateways, ceremonial robes, and earthenware platters. On the tiles of mosques, passages from the Qur'an threaded through stems and branches of the Tree of Life, the integration of the texts into the labyrinthine maze expressing the notion that the transcendent truths of Scripture are implanted in God's Creation.¹³⁴

Islamic tile makers produced individual pieces as components of a larger configuration, decorated so they could be joined edge to edge in a notionally infinite pattern, as when blue-and-gold tiles adorned with eight-pointed star medallions swathed the domes of mosques in Baghdad, Isfahan, and Samarqand.¹³⁵ Decorative design in Islam seems modeled on employment of textiles, as if representations of motifs, graphic symbols, and geometric elements were a colorful, brocade-like adornment to be wrapped around any object, large or small, fixed or mobile.¹³⁶ Indeed, fabric at times sheathed notable buildings: according to a twelfth-century observer, the Ka'aba, the holiest structure in Islam, was covered "with Chinese [silk] cloth, the value of which cannot be estimated," and in seventeenth-century Persia, gold brocade draped sacred tombs.¹³⁷

At the other extreme from mosque domes with their colossal, swirling arabesques of blue and gold, Persian miniature painting in manuscripts represents the most concentrated color experience ever created.

¹³³ See Jonas Benzion Lehrman, *Earthly Paradise: Garden and Courtyard in Islam* (Berkeley: University of California Press, 1980); and D. Fairchild Ruggles, *Gardens, Landscape, and Vision in the Palaces of Islamic Spain* (University Park: Pennsylvania State University Press, 2000), pp. 135–222.

¹³⁴ F. B. Flood, "The Tree of Life as a Decorative Device in Islamic Window-Fillings: The Mobility of a Motif," *Oriental Art* 37, no. 4 (1991–1992): 209–222; and Michael Barry, *Design and Color in Islamic Architecture: Eight Centuries of the Tile-Maker's Art* (New York: Vendome Press, 1996), pp. 11, 116.

¹³⁵ For vivid illustrations of tile decoration on mosques and other buildings, see Gérard Degeorge and Yves Porter, *The Art of the Islamic Tiles* (Paris: Flammarion, 2002).

¹³⁶ Lisa Golombek, "The Draped Universe of Islam," in *Content and Context of Visual Arts in the Islamic World*, ed. Priscilla P. Soucek (University Park: Pennsylvania State University Press, 1988), pp. 25–50.

¹³⁷ The description comes from S. M. Stern, "Ramisht of Siraf, A Merchant Millionaire of the Twelfth Century," *Journal of the Royal Asiatic Society of Great Britain and Ireland* 1 (1967): 10. On Persian tombs, see John Chardin, *Sir John Chardin's Travels in Persia* (London: Argonaut Press, 1927), p. xxxi.

Made to be examined closely, they were painted with pigments made from gold, silver, malachite, and lapis lazuli. The most frequently illustrated text was the famed *Shahnameh* (The Book of Kings), a 50,000-stanza epic poem by Firdausi (ca. 934–ca. 1026) that recounts adventures from the mythic and historical past of Persia. The *Shahnameh* bursts with color and richness—turquoise-studded crowns, ornate silk parasols, brocade shot with gold, a silver tree with buds of onyx, agate, and emerald.¹³⁸ A manuscript miniature titled *Firdausi Proves His Literary Talents at the Court of Sultan Mahmud of Ghaza* by Mir Musavir, a painter at the court of Shah ‘Abbas (r. 1587–1629) of Safavid Persia (1501–1722), is typical of the genre: even though the work measures only 12 × 7.5 in., it depicts fifty-eight stylized figures in luminous costumes with stippled, diaper, and herringbone patterns as well as some thirty-five comparable color motifs embellishing the architectural setting.¹³⁹

The ubiquity of all-enveloping ornament and calligraphic inscription reflects the Islamic conception that transcendent divinity informs the mundane world. Color was embraced as an integral part of mortal existence, its omnipresent and indispensable element. Just as God has painted the world a rainbow of shades, so too his human creatures appropriately should color and embellish their own creations, from monumental mosques to humble prayer rugs, for color glorifies the radiance of God on earth and thereby serves as a token of true faith. “The Islamic brightness of the Muslims,” a Persian poet declared in the sixteenth century, “has made manifest the faults of the Franks.”¹⁴⁰

Europe: From Chromophobia to Chromophilia

In the century before Plato and Aristotle, a distinctly European sense of color emerged in reaction to the bright hues and opulence of West Asia. While the philosophers’ elevation of contour and line above color reflected the focus of the Greek speculative tradition on essential forms rather than accidental appearances, it also stemmed from a deep-seated cultural response to tumultuous events of the early fifth century B.C.E.

¹³⁸ Abolqasem Ferdowsi, *Shahnameh: The Persian Book of Kings*, trans. Dick Davis (New York: Viking, 2006), pp. 47, 328; the pages cited are representative of many in the text.

¹³⁹ The work is reproduced in Stuart Cary Welch, *Royal Persian Manuscripts* (London: Thames and Hudson, 1976), p. 35; see Eleanor Sims, “The Illustrated Manuscripts of Firdausi’s *Shahnama* Commissioned by Princes of the House of Timur,” *Ars Orientalis* 22 (1992): 43–68.

¹⁴⁰ Cited in David J. Roxburgh, *Prefacing the Image: The Writing of Art History in Sixteenth-Century Iran* (Leiden: Brill, 2001), p. 187, n. 124.

The first intimations of a European self-consciousness formed in the crucible of the struggle between Greek city-states and the Achaemenid Empire of Persia (559–330 B.C.E.), with color values coming into play thereafter in distinguishing between the supposed virtues of the West as opposed to the perceived vices of the East. “Babylonian” became a Greek synonym for “multicolored” (*poiklos*).¹⁴¹ West Asia was far enough away from China that the latter did not regard powers there as a threat, hence it looked favorably upon the commodities (and colors) that ventured across the Silk Road. The Greek homeland, however, was a small, politically divided, and relatively impoverished territory at the edge of a mighty West Asian empire, and if Greek city-states were not to be swallowed up by it (as Miletus and other Greek cities on the Asia Minor coast recently had been), then they had to fight back.

In his *History of the Persian Wars* (480–479 B.C.E.), Herodotus (ca. 484–ca. 425 B.C.E.) recounts how a small Spartan force held off the army of Xerxes (r. 485–465 B.C.E.) for several days at Thermopylae and how Athenians soon after defeated the Great King at the naval battle of Salamis. When the Persians finally were crushed at the land battle of Plataea, Pausanias, the leader of Sparta, laughed with scorn as he surveyed Xerxes’ abandoned accoutrements, including “furnishings of gold and silver and richly colored curtains” as well as “couches of gold and silver, so richly covered.”¹⁴² His derision echoed through Greek literature. Since Persian garments and adornment stood for the empire’s wealth and power, Aeschylus (525–456 B.C.E.) stages the dénouement of his *Persians* (ca. 472 B.C.E.) with the appearance of Xerxes, his embroidered finery in tatters, lamenting the destruction of his forces, his “troops of gold” and “lazuli flashing” galleys.¹⁴³ The play presents a series of contrasts that expressed the emerging cultural identity of the Greeks (especially of Athenians): Europe against Asia, Greeks against

¹⁴¹ On *poiklos*, see Margaret C. Miller, *Athens and Persia in the Fifth Century BC: A Study in Cultural Receptivity* (Cambridge: Cambridge University Press, 1997), p. 165. On the emergence of Greek (and European) identity, see Edith Hall, *Inventing the Barbarian: Greek Self-Definition through Tragedy* (Oxford: Clarendon Press, 1989), pp. 1–13, 56–62. On similarities of Greek and West Asian culture before the fifth century, see Walter Burkett, *Babylon, Memphis, and Persepolis: Eastern Contexts of Greek Culture* (Cambridge, Mass.: Harvard University Press, 2004).

¹⁴² Herodotus, *History*, trans. David Grene (Chicago: University of Chicago Press, 1987), p. 648. On the colorful, sumptuous booty taken at the battle, see Miller, *Athens and Persia in the Fifth Century BC*, pp. 29–62. By the time of Plataea, Xerxes already had returned to Persia, leaving Mardonius behind as commander and in charge of the imperial gear.

¹⁴³ Aeschylus, “The Persians,” in *The Complete Greek Tragedies*, vol. 1, Aeschylus, ed. David Grene and Richmond Lattimore, trans. Seth G. Benardete (Chicago: University of Chicago Press, 1959), pp. 221, 224, 251–258.

barbarians, freedom against despotism, sobriety against extravagance, valor against effeminacy, plain Doric raiment against Persian fancy dress.¹⁴⁴ Prejudice against bright color underpinned all these distinctions, endowing them with a certain conceptual vibrancy.

An ideology of Spartan simplicity flourished in Athens as a reaction to many decades of threats from Persia after Plataea—as well as to consumption of rich West Asian merchandise by many wealthy Athenians.¹⁴⁵ Greeks culturally defined themselves in terms of opposition to West Asia, hence to exhibit regard for color and lavish appointments became distinctly un-Hellenic. According to Plutarch (ca. 46–ca. 120 c.e.), critics attacked Pericles (ca. 495–429 B.C.E.), the leader of Athens, for extravagant spending on building the Parthenon in the 440s. A colossal statue of Athena stood inside the temple, covered with gold weighing forty-four *talents* (or about 1.25 tons), a sum greater than the total cost of constructing the Parthenon. Opponents ridiculed the building program as vulgar and pretentious, as if Athens were “some vain woman, hung round with precious stones and figures and temples.”¹⁴⁶ Anti-feminine rhetoric played a leading role in the animus against color: Aeschylus depicted Xerxes behaving like a hysterical female upon defeat, while the construction project of Pericles supposedly testified to his sybaritic character and even suggested he was dominated by Aspasia, his formidable mistress.¹⁴⁷

With their conservative outlook and puritanical streak, Romans readily adapted to the Greek equation of West Asia with color, opulence, and effeminacy. Horace (65–8 B.C.E.) has a character declare that he hates “Persian luxury,” for garlands of roses are inferior to “the simple myrtle.”¹⁴⁸ In his *Natural History* (77 c.e.), Pliny the Elder

¹⁴⁴ Edith Hall, “Asia Unmanned: Images of Victory in Classical Athens,” in *War and Society in the Greek World*, ed. John Rich and Graham Shipley (London: Routledge, 1993), pp. 108–133; and William G. Thalmann, “Xerxes’ Rags: Some Problems in Aeschylus’ *Persians*,” *American Journal of Philology* 101, no. 3 (1980): 260–282.

¹⁴⁵ Miller, *Athens and Persia in the Fifth Century BC*, pp. 164–65, 179, 189, 255–257.

¹⁴⁶ Plutarch, *Plutarch’s Lives*, ed. Arthur Hugh Clough, trans. John Dryden (New York: Modern Library, 2001), 1:211. On the costs of the Parthenon and statue, see Jeffrey M. Hurwit, *The Acropolis in the Age of Pericles* (Cambridge: Cambridge University Press, 2004), pp. 97, 112.

¹⁴⁷ Mark D. Stansbury-O’Donnell, “Feminizing the Barbarian and Barbarizing the Feminine: Amazons, Trojans, and Persians in the Stoa Poikile,” in *Periklean Athens and Its Legacy: Problems and Perspectives* (Austin: University of Texas Press, 2005), pp. 89–102; and Anton Powell, “Athens’ Pretty Face: Anti-feminine Rhetoric and Fifth-Century Controversy over the Parthenon,” in *The Greek World*, ed. Anton Powell (London: Routledge, 1995), pp. 245–270.

¹⁴⁸ David West, ed., *Horace Odes I: Carpe Diem* (Oxford: Clarendon Press, 1995), pp. 190–191.

(23–79) condemns the lust for oriental merchandise among wealthy Romans, such as emerald-encrusted goblets and embossed-marble walls. In fact, he regarded such indulgence in luxury as decadent, precipitating the decline of Roman power.¹⁴⁹ He declares that while an austere palette of white, black, red, and yellow proved sufficient for time-honored Greek and Roman artists, nowadays “there is no such thing as high-class painting” since dazzling pigments stream in from India, the costly “blood of dragons and elephants.”¹⁵⁰ He holds up Apelles, the semi-legendary court painter to Alexander the Great (336–323 B.C.E.), as an ideal since that artist always applied a thin black varnish to his works “so that the brilliance of the colours should not offend the sight when people looked at them.”¹⁵¹

For Roman conservatives such as Cato the Elder (234–149 B.C.E.) and Cicero (106–43 B.C.E.), florid colors (*colores floridi*), an emblem of West Asian despots, were as alien to republican virtue and classical simplicity as florid senatorial oratory.¹⁵² Plutarch depicts Mark Anthony (ca. 83–30 B.C.E.) as besotted by “the Asiatic taste in speaking, which was . . . suitable to his ostentatious, vaunting temper, full of empty flourishes and unsteady efforts for glory.”¹⁵³ True to form, the flowery orator collapses into the embrace of Cleopatra of Egypt (r. 47–30 B.C.E.), a queen of color who first exhibits herself to the Roman in a barge with gilded stern and billowing purple sails, stretched out beneath a canopy of cloth of gold and flanked by “beautiful young boys, like painted Cupids.”¹⁵⁴ Lush color and exotic women were the bane of Western men.

After the fall of the Roman Empire in the fifth century, Greco-Roman color conventions formed the basis for Western aesthetics in the Middle Ages. They proved entirely congruent with the *contemptus mundi* of Christianity, which disparaged color as a deceptive, worldly gloss masking spiritual realities. Moreover, extravagant colors, like

¹⁴⁹ Sorcha Carey, “The Problem of Totality: Collecting Greek Art, Wonders and Luxury in Pliny the Elder’s *Natural History*,” *Journal of the History of Collections* 12, no. 1 (2000): 1–13. On the European history of *luxuria*, a notion with which sumptuous color was inextricably associated, see Christopher J. Berry, *The Idea of Luxury: A Conceptual and Historical Investigation* (Cambridge: Cambridge University Press, 1994).

¹⁵⁰ Pliny, *Natural History*, trans. H. Rackman (Cambridge, Mass.: Harvard University Press, 1938), 33:7, 35:261, 35:299. In this citation, Pliny’s *draconum* (“dragons”) has been substituted for Rackman’s “snakes.”

¹⁵¹ Pliny, *Natural History*, 35:333.

¹⁵² See Vincent J. Bruno, *Form and Color in Greek Painting* (New York: W. W. Norton, 1977), pp. 70–72.

¹⁵³ Plutarch, *Plutarch’s Lives*, 2:482.

¹⁵⁴ *Ibid.*, 2:496.

flowers, were associated with pagan practices, and it was a cliché of clerical homilies that the Almighty's decision not to create multihued sheep proved that he frowned on brightly colored clothing.¹⁵⁵ Using the same line of argument, a Parliament member in 1621 supported sumptuary legislation against the wearing of colored silks by arguing that "God did not attire our first parents with excrement of worms."¹⁵⁶

Northern Europe had a particularly jaundiced outlook on color since it was distant from the vivid dyes and polychrome fabrics of the eastern Mediterranean. Black was the natural pigmentation of northern sheep in the early Middle Ages, and they did not start turning white (with improved breeding) until the thirteenth century. The most common color in Anglo-Saxon poetry was black—Beowulf and Grendel battle through a grim landscape—and blackberries were the principal ingredient in early Germanic dyes.¹⁵⁷ Black cloth functioned as a kind of protest against the expensive colored textiles of the south, and by the early fifteenth century, black velvet had become the fabric of choice at the influential court of Philip the Good (r. 1419–1467), the duke of Burgundy. Charles V of the Holy Roman Empire (r. 1519–1558), who inherited Burgundy, took the fashion to his Spanish kingdom, where his son Philip II (r. 1556–1598) later made it the virtual national costume of the nobility.¹⁵⁸

From the tenth to the sixteenth century, the European bias against color slowly eroded, partly as a consequence of the growth of commerce, including expanding northern trade in woolens and consequent need for diverse pigments. In addition, an aesthetics derived from Pseudo-Dionysius the Areopagite, a fifth-century mystic, maintained that visible, immaterial light is a manifestation of God and that bright color can motivate viewers to contemplate spiritual realities. In all likelihood, the influence of Pseudo-Dionysius accounts for the vivid colors that appear in the Northumbrian Lindisfarne Gospels (ca. 700–725) and the Irish Book of Kells (ca. 800), which display a wide palette and stylized geometric design evocative of the eastern Mediterranean.¹⁵⁹

¹⁵⁵ Jack Goody, *The Culture of Flowers* (Cambridge: Cambridge University Press, 1993), pp. 73–74; and Pleij, *Colors Demonic and Divine*, pp. 11, 63, 68.

¹⁵⁶ Cited in Linda Levy Peck, *Consuming Splendor: Society and Culture in Seventeenth-Century England* (Cambridge: Cambridge University Press, 2005), p. 10.

¹⁵⁷ Schneider, "Peacocks and Penguins," pp. 423–424; and Nigel F. Barley, "Old English Colour Classification: Where Do Matters Stand?" *Anglo-Saxon England* 3 (1974): 15–29.

¹⁵⁸ Schneider, "Peacocks and Penguins," pp. 414, 422; and Harvey, *Men in Black*, pp. 52–56, 72–77, 80.

¹⁵⁹ See Michelle P. Brown, *The Lindisfarne Gospels: Society, Spirituality and the Scribe* (Toronto: University of Toronto Press, 2003), pp. 275–276, 280–281, 284; and Carol Farr, *The Book of Kells: Its Function and Audience* (London and Toronto: The British Library and

The clearest and most spectacular result of Pseudo-Dionysian light theology is the stained glass of medieval cathedrals. Abbot Suger (1122–1151), head of the royal abbey of Saint-Denis near Paris, extensively used blue-and-gold stained glass to evoke the “True Light” (*vera lux*) of the divine presence.¹⁶⁰ In tones redolent of Firdausi, Suger exulted that the tombs of holy men in Saint-Denis were luminously covered “with refined gold and a profusion of hyacinths, emeralds and other precious stones.”¹⁶¹ Yet this was a minority perspective, for the denunciation of color by Bernard of Clairvaux (Suger’s contemporary) remained characteristic of Western views.

Until the sixteenth century, Mediterranean influence was most important in the lengthy European reassessment of color, with Venice serving as the major conduit for Byzantine and West Asian hues.¹⁶² Perhaps influenced by the Huns, Constantine the Great (r. 312–337), who made Constantinople his imperial capitol, equipped the late Roman army with bright tunics and trousers, and the emperors Justinian (r. 527–565) and Heraclius (r. 610–641) favored multihued Persian fabrics, even bringing West Asian weavers to Constantinople.¹⁶³ Byzantium won renown for its rich brocades and polychrome silks, while Venice gained a virtual monopoly on Byzantine exports to Italy by the fourteenth century, helping make it the most important Italian city-state trading in the eastern Mediterranean.

Venetian galleys carried lapis lazuli (or ultramarine, “beyond the sea”) from Constantinople, one of the Asian commodities that made Venice the center for processed pigments in Europe. It imported Persian cobalt oxide for the manufacture of glass, and recycled colored broken

University of Toronto Press, 1997), p. 15. On similarities of eastern Mediterranean and Irish design, see Terry Allen, “The Arabesque, the Beveled Style, and the Mirage of an Early Islamic Art,” in *Tradition and Innovation in Late Antiquity*, ed. F. M. Clover and R. S. Humphreys (Madison: University of Wisconsin Press, 1989), pp. 209–244.

¹⁶⁰ Grover A. Zinn Jr., “Suger, Theology, and the Pseudo-Dionysian Tradition,” in *Abbot Suger and Saint-Denis*, ed. Paula Lieber Gerson (New York: Metropolitan Museum of Art, 1986), pp. 33–40; and Pastoureau, *Blue*, pp. 44–46.

¹⁶¹ Abbot Suger of Saint-Denis, *Abbot Suger on the Abbey Church of St.-Denis and Its Art Treasures*, ed. and trans. Erwin Panofsky (Princeton, N.J.: Princeton University Press, 1946), p. 107.

¹⁶² To a lesser extent, color also came to Europe by way of imports of Mongol brocade on the Silk Road; see Linda Komaroff, “The Transmission and Dissemination of a New Visual Language,” in *The Legacy of Genghis Khan: Courtly Art and Culture in Western Asia* (exh. cat.), ed. Linda Komaroff and Stefano Carboni (New York: Metropolitan Museum of Art, 2002), pp. 169–195. For a case study of such influence, see Cathleen S. Hoening, “Cloth of Gold and Silver: Simone Martini’s Techniques for Representing Luxury Textiles,” *Gesta: International Center of Medieval Art* 30, no. 2 (1991): 154–162.

¹⁶³ John Gage, *Color and Culture: Practice and Meaning from Antiquity to Abstraction* (Boston: Little, Brown and Company, 1993), pp. 62–63.

glass from Lebanon for its own vessels; it brought in new enameling techniques from Egypt and brightly colored earthenware from Syria and Islamic Spain.¹⁶⁴ Venice modeled its patterned fabrics on silks from West Asia and sold multicolored Damascene carpets throughout Europe. Venetian glassmakers turned out *millefiori* (thousand-flower) vessels, wares that replicated veined hardstones by the technique of melting cross sections of colored glass rods in tinted glass. Influenced by buildings in Cairo and Damascus, Venetian patricians decorated their palaces in polychrome, including colorful mosaics, windows with tinted bottle-glass, lozenge patterns of red-and-white stone, and pieces of precious colored marble. The façade of Ca' d'Oro (begun 1421) was decorated with ultramarine and gold leaf, a replication of the Persian palette of blue and gold.¹⁶⁵

Northern and southern Europe came increasingly into contact in the later Middle Ages, especially when regular maritime traffic was established between the Mediterranean and northern seas in the fourteenth century. Venice delivered its textiles, glass, and West Asian merchandise by galleys to England, the Netherlands, and France. In addition, increasing numbers of Italian craftsmen—potters, glassmakers, weavers, mirror makers, and dyers—sought employment in Antwerp and other northern cities.¹⁶⁶ Yet the greatest color innovation originated in the north. In the early fifteenth century, artists in the Netherlands started using oil paints in place of watercolors applied to wet plaster (fresco) or pigment mixed in egg tempera. With every particle of pigment enfolded in oil (such as poppy or linseed) and thus refracting light, colors gleamed with jewel-like brightness. In the hands of masters such as Jan van Eyck (ca. 1390–1441) and Rogier van der Weyden (ca. 1400–1464), the new technique was stunning. It vastly expanded possibilities for employing saturated colors and for render-

¹⁶⁴ Schneider, "Peacocks and Penguins," pp. 427–428; David Whitehouse, "Imitations of Islamic Glass," in *Glass of the Sultans* (exh. cat.), ed. Stefano Carboni and David Whitehouse (New Haven, Conn.: Yale University Press, 2001), pp. 297–301; and H. Blake, "The 'Bacini' of North Italy," in *La céramique médiévale en Méditerranée occidentale: Xe–XVe siècle* (Paris: Centre national de la recherche scientifique, 1980), pp. 93–111.

¹⁶⁵ Rosamond E. Mack, *Bazaar to Piazza: Islamic Trade and Italian Art, 1300–1600* (Berkeley: University of California Press, 2002), pp. 20, 22–23, 25, 30–31, 44, 97–99; Deborah Howard, *Venice and the East: The Impact of the Islamic World on Venetian Architecture, 1100–1500* (New Haven, Conn.: Yale University Press, 2000), pp. 146–153; and Paul Hills, *Venetian Colour: Marble, Mosaic, Painting and Glass, 1250–1550* (New Haven, Conn.: Yale University Press, 1999), pp. 64, 69, 117–118, 174.

¹⁶⁶ Richard T. Rapp, "The Unmaking of the Mediterranean Trade Hegemony: International Trade Rivalry and the Commercial Revolution," *Journal of Economic History* 35, no. 3 (1975): 499–525.

ing the texture of fabric, glass, metal, and flesh. By the mid fifteenth century, some Italian artists had adopted oils as the preferred medium for easel painting, though they often toned down their colors, softening edges and emphasizing the play of light and shadow.¹⁶⁷

Naturally, oil painting was fervently embraced in Venice, where the technique supplanted tempera from the 1480s. *Olio* became synonymous with *colore*. Working with quick-drying egg tempera or fresco was notoriously difficult, requiring rapid strokes and smooth brushwork. Oils, however, opened the way to a spontaneous, dynamic style, best illustrated in the works of Titian (ca. 1487–1576) and Tintoretto (1518–1594).¹⁶⁸ The two Venetians powerfully influenced the Spanish painter Diego Velázquez (1599–1660), who famously portrayed himself in *Las Meninas* (1656), a manifesto of modern art, holding a palette of ten colors.¹⁶⁹

By the middle of the seventeenth century, the European age of religious warfare had ended, and a new cultural climate had emerged. Newton carried out his *experimentum crucis* ten years after Velázquez finished painting *Las Meninas*. The scientist derived color from sunlight not long after color itself had been liberated from religious and technical constraints, freed (in a manner of speaking) from the stained glass of cathedrals and illuminated manuscripts of monasteries to the artist's palette, craftsman's workshop, and scientific laboratory. Newton's prismatic experiments took place around the same time that the Royal Society heard papers on the chemistry of dyeing and that professional "colormen" emerged, suppliers of pigment to painters.¹⁷⁰

Another development, however, was more significant than the secularization of color. For centuries, the links of Venice to the eastern Mediterranean meant that it transmitted West Asian color values to Europe, but by the time of Velázquez and Newton, Atlantic nations

¹⁶⁷ Paula Nuttall, *From Flanders to Florence: The Impact of Netherlandish Painting, 1400–1500* (New Haven, Conn.: Yale University Press, 2004), pp. 34–36, 176–177, 185; Marcia B. Hall, *Color and Meaning: Practice and Theory in Renaissance Painting* (Cambridge: Cambridge University Press, 1992), pp. 47–91; and Janis Bell, "Color and Chiaroscuro," in *Raphael's 'School of Athens,'* ed. Marcia Hall (Cambridge: Cambridge University Press, 1997), pp. 85–113.

¹⁶⁸ Arthur Steinberg, "Blurred Boundaries, Opulent Nature, and Sensuous Flesh: Changing Technological Styles in Venetian Painting, 1480–1520," in *Titian 500*, ed. Joseph Manca (Washington, D.C.: National Gallery of Art, 1993), pp. 199–220.

¹⁶⁹ Jonathan Brown and Carmen Garrido, *Velázquez: The Technique of Genius* (New Haven, Conn.: Yale University Press, 1998), pp. 181–194. On the modernity of *Las Meninas*, see Michel Foucault, *The Order of Things: An Archaeology of the Human Sciences* (New York: Random House, 1970), pp. 3–16.

¹⁷⁰ See Finlay, *Color*, p. 16; and Schneider, "Peacocks and Penguins," p. 435.

connected the West to everywhere else. As a consequence, the world's colors came to Europe, especially when the pace of maritime trade picked up after 1600.

Pigments came from the New World: purple dye from a Mexican shellfish and red dye from brazilwood (from the Arabic *brazier*, "fiery red"), the commodity that gives Brazil its name. The Caribbean offered an ideal climate for growing indigo, hence Europe no longer depended on meager supplies from Persia and India. Seeing their livelihood being destroyed, European woad manufacturers referred to indigo as the "devil's color" (*Teufelsfarbe*).¹⁷¹ The greatest treasure, however, was cochineal (from Latin *coccinus*, "scarlet"). A brilliant red dye, it derives from tiny insects that are parasitical on a Mexican prickly-pear cactus. It took 17,000 dried insects to yield a single ounce of pigment, making it almost as valuable as Mexican silver; more than 175,000 pounds of cochineal (from trillions of insect bodies) went off to Seville every year. Even Newton, a notoriously dour and puritanical character, became enraptured by the novel colorant: he turned his London residence into a study in scarlet, with curtains, cushions, bed hangings, and upholstered furniture in that flamboyant shade.¹⁷²

Color also arrived in Europe on East Asian porcelain. While some of it was Japanese, both brilliantly colored Imari pottery and delicately tinted Kakiemon, most was Chinese blue and white. As a Portuguese cardinal declared in 1563, chinaware is "so fine and transparent that the whites outshine crystal and alabaster, and the pieces which are decorated in blue dumbfound the eyes, seeming a combination of alabaster and sapphires."¹⁷³ Between 1500 and 1800, Western merchants imported some 300 million pieces, giving Europeans a new color experience along with their high-quality tableware. In turn, European manufacturers, especially in Holland, Germany, France, and Great Britain, replicated the East Asian pottery by the millions.¹⁷⁴ Porcelain also was employed to replicate the colors of the natural world. The Sèvres manufactory of France specialized in the production of porcelain flowers,

¹⁷¹ Harvey, *Men in Black*, p. 56; Finlay, *Color*, pp. 319–320, 329; and Pastoureau, *Blue*, p. 130.

¹⁷² Greenfield, *A Perfect Red*, pp. 34–37, 85, 89, 116, 153.

¹⁷³ Cited in Maria Antónia Pinto de Matos, "The Portuguese Trade," *Oriental Art* 45, no. 1 (1999): 27.

¹⁷⁴ H.-P. Fourest, *Delftware: Faience Production at Delft*, trans. Katherine Watson (New York: Rizzoli, 1980); Masako Shono, *Japanisches Aritaporzellan im sogenannten 'Kakiemonstil' als Vorbild für die Meissener Porzellanmanufaktur*, trans. Richard Rasch and Rainer Rückert (Munich: Editions Schneider GmbH, 1973); Jeanne Giacomotti, *French Faience* (New York: Universe Books, 1963); and Hilary Young, *English Porcelain, 1745–95: Its Makers, Design, Marketing and Consumption* (London: Victoria and Albert Publications, 1999).

and Madame de Pompadour (1721–1764), the mistress of Louis XV (r. 1715–1774), once surprised the king with a display of hundreds of brilliant porcelain blossoms, including roses, jonquils, and violets, all suitably perfumed to seem real.¹⁷⁵

Chinese silks and Indian cottons reached a much wider circle of consumers than did porcelain. Francesco Carletti (ca. 1573–1636), a Florentine merchant who visited Macao, noted that the Chinese produced silk “in all the colors that can be imagined, light as well as dark.”¹⁷⁶ In 1644, John Evelyn (1620–1706), one of Newton’s associates in the Royal Society, examined some Chinese merchandise in London, including garments made of embroidered cloth of gold “with such lively colours as for splendor & vividnesse we have nothing in Europe approaches.”¹⁷⁷ Samuel Pepys (1633–1703), Evelyn’s close friend, outfitted himself in a “new coloured-silk suit and coat, trimmed with gold buttons and gold broad lace round my hands, very rich and fine.”¹⁷⁸

Always keeping up with fashion, Pepys records in his diary that “after many tryalls bought my wife a Chinke [chintz]; that is, a paynted Indian Callico for to line her new Study, which is very pretty.”¹⁷⁹ In the 1630s, the English East India Company imported 150,000 Indian piece goods; fifty years later, it shipped almost three million annually. As one observer noted, people were attracted by “the Gaiety of the Colours” on the muslins, calicoes, and chintz (from Hindi *chint*, “many-colored”).¹⁸⁰ Since the Indian cottons were so much more colorful and convenient than woolen fabrics, they proved exceedingly popular. They had water-resistant colors, stemming from use of mordants and resist-dyeing, whereas European tinted textiles faded easily when washed.¹⁸¹ A Londoner remarked in the early eighteenth century that

¹⁷⁵ Svend Eriksen and Geoffrey De Bellaigue, *Sèvres porcelain: Vincennes and Sèvres, 1740–1800*, trans. R. J. Charleston (London: Faber and Faber, 1987), p. 88; and Geoffrey Wills, “European Porcelain Flowers,” *Apollo* 88, no. 9 (1968): 198–203.

¹⁷⁶ Francesco Carletti, *My Voyage around the World*, trans. Herbert Weinstock (New York: Pantheon Books, 1964), p. 148.

¹⁷⁷ John Evelyn, *The Diary of John Evelyn*, ed. E. S. de Beer (Oxford: Clarendon Press, 1955), 3:373–374.

¹⁷⁸ Samuel Pepys, *The Diary of Samuel Pepys*, ed. Robert Latham and William Matthews (Berkeley: University of California Press, 1970–1983), 6:125.

¹⁷⁹ *Ibid.*, 4:299.

¹⁸⁰ Cited in Rosemary Crill, “Asia in Europe: Textiles for the West,” in *Encounters: The Meeting of Asia and Europe, 1500–1800* (exh. cat), ed. Anna Jackson and Amin Jaffer (London: V&A Publications, 2004), p. 270.

¹⁸¹ On the popularity of Indian cottons, see Beverly Lemire, *Fashion’s Favorite: The Cotton Trade and the Consumer in Britain, 1660–1800* (Oxford: Oxford University Press, 1991), pp. 12–42. On Indian methods of staining silk and cotton, see Brenda M. King, *Silk and Empire* (Manchester: Manchester University Press, 2005), pp. 57–60.

“from the greatest gallants to the meanest cook maids, nothing was thought so fit to adorn their Persons as the fabrick from India!”¹⁸² On the eve of the French Revolution, colorful cottons, now woven in England as well as India, were the leading textile for almost all social ranks in England and France, with clothing, drapery, and curtains decorated with two-tone checks, variegated stripes, and floral patterns.¹⁸³ For the first time, European commoners enjoyed extensive access to diverse, bright colors.

Vibrant floral motifs appeared frequently on both cottons and porcelains. The same designs also surfaced on imported Chinese wallpaper and paintings, Persian and Indian carpets, Bengal silks, and Kashmiri shawls.¹⁸⁴ Even more important, depictions of flowers in assorted media were accompanied by real ones in the ground. While a culture of flowers bloomed perennially in China, India, and West Asia, medieval Europe paid negligible attention to flower gardens.¹⁸⁵ From the sixteenth century, however, that changed dramatically as Asian cuttings and bulbs came to Europe. The painter Jan Breughel (1568–1625) wrote to a client that he was working on a painting in which “there will be more than a hundred flowers in natural size of which the great part are rare and choice. The ordinary flowers are lilies, roses, violets and carnations; the others are unusual and have never been seen in this country.”¹⁸⁶ Novel flowers included the camellia, peony, chrysanthemum, jasmine, iris, heliotrope, cyclamen, jonquil, crocus, narcissus, begonia, hyacinth, marigold, magnolia, and tulip.¹⁸⁷ Louis XIV (r. 1643–1715)

¹⁸² Cited in Goody, *Culture of Flowers*, p. 210. On cottons and the rise of a consumer society, see Bruce P. Lenman, “The English and Dutch East India Companies and the Birth of Consumption in the Augustan World,” *Eighteenth Century Life* 14 (1990): 49–50.

¹⁸³ See Roche, *Culture of Clothing*, pp. 127, 138; and Pardaill -Galabrun, *Birth of Intimacy*, p. 172.

¹⁸⁴ Beverly Lemire, “Domesticating the Exotic: Floral Culture and the East India Calico Trade with England, c. 1600–1800,” *Textile* 1, no. 1 (2003): 64–85; Gill Saunders, *Wallpaper in Interior Decoration* (London: V&A Publications, 2002), pp. 63–67; Chen Ying, “Botanical Illustrations for the Western Market,” in *Souvenir from Canton: Chinese Export Paintings from the Victoria and Albert Museum* (exh. cat.) (Shanghai: Shanghai Classics, 2003), pp. 64–69; Onno Ydema, *Carpets and Their Datings in Netherlandish Paintings, 1540–1700* (Zutphen: Walburg Press, 1991), p. 7; David Walker, *Flowers Underfoot: Indian Carpets of the Mughal Era* (exh. cat.) (New York: Metropolitan Museum of Art, 1997); and Michelle Maskiell, “Consuming Kashmir: Shawls and Empires, 1500–2000,” *Journal of World History* 13, no. 1 (2002): 35–43.

¹⁸⁵ Goody, *Culture of Flowers*, pp. 73–100.

¹⁸⁶ Cited in Peter Coats, *Flowers in History* (New York: Viking, 1970), p. 23.

¹⁸⁷ On the most fabulous flower of the seventeenth century, see Anna Pavord, *The Tulip* (New York: Bloomsbury, 1999), pp. 129–161. On other flowers of the same period, see Coats, *Flowers in History*.

spent a fortune planting millions of flowers at Versailles, encircling that somber palace with a riot of color.¹⁸⁸ Given the Sun King's influence on aristocratic style, this made flowers as fashionable in Europe as blue-and-white porcelain, colored silks, painted calicoes, and Persian carpets. At Versailles and elsewhere, flowers passed on their hues from one medium to another: from pottery, chintz, and wallpaper to tapestry, upholstery, and still-life paintings.¹⁸⁹

With Asian imports and Newton's *experimentum crucis*, color became a subject of enormous aesthetic, commercial, and scientific interest in eighteenth-century Europe. The colors used on French royal tapestries increased from eighty around 1680 to almost 600 a century later.¹⁹⁰ The search for new techniques for creating pigments accelerated during the same time, with textile and pottery manufacturers taking the lead, mainly in order to compete with Asian commodities. The enterprise gave crucial impetus to the emergence of modern chemical science, with the first artificial color (Prussian blue) created in Berlin around 1706 and the first aniline dye (mauve or "Tyrian purple") discovered in England in 1856. In the twelfth century, Europe had only a handful of natural dyestuffs, but by the end of the nineteenth century, it had some 2,000 synthetic pigments, and thousands more were in the offing. The first watercolor paint boxes appeared in 1766, the first tin tubes for oil paints in 1841.¹⁹¹ Palettes and tubes in hand, the Impressionists moved outside to paint nature's colors in the sunlight.

Thus the rise of the West in the new global ecumene heralded the triumph of the rainbow at home. It also foreshadowed the globalization of color values that would take place in the late nineteenth and twentieth centuries as Western technology and industrial products had an impact on cultures everywhere.

¹⁸⁸ Elizabeth Hyde, *Cultivated Power: Flowers, Culture, and Politics in the Reign of Louis XIV* (Philadelphia: University of Pennsylvania Press, 2005), pp. 145–159.

¹⁸⁹ See Bettina von Meyenburg, "'Saying It With Flowers': The Flower as an Artistic Motif from the Late Middle Ages until the Baroque," in *Flowers into Art: Floral Motifs in European Painting and Decorative Arts*, ed. Vibeke Woldbye (Hague: SDU Publishers, 1991), pp. 37–56.

¹⁹⁰ Pardailhé-Galabrun, *Birth of Intimacy*, p. 171.

¹⁹¹ Anthony S. Travis, *The Rainbow Makers: The Origins of the Synthetic Dye Industry in Western Europe* (Bethlehem, Pa.: Lehigh University Press, 1993), pp. 35–44; and A. Clow and N. L. Clow, "The Chemical Industry: Interactions with the Industrial Revolution," in *A History of Technology*, vol. 4, *The Industrial Revolution, c. 1750 to c. 1850*, ed. Charles Singer, E. J. Holmyard, A. R. Hall, and Trevor I. Williams (Oxford: Clarendon Press, 1958), pp. 248–249. On the first aniline (or coal-tar) dye, see Simon Garfield, *Mauve: How One Man Invented a Color that Changed the World* (New York: W. W. Norton, 2001). On paint boxes and tubes, see Finlay, *Color*, p. 19.

CONCLUSION

Wittgenstein wondered if there could be such a thing as a “natural history of colour.”¹⁹² Bringing together evolution and human history suggests that it is possible, though the approach in fact works against the philosopher’s focus on the logical structure of color concepts inasmuch as there is nothing “logical” about color when it is placed in the context of both color vision and color values. While the same colors appear to everyone’s eyes, and people everywhere pick out the same fairly small assortment of colors as primary, ideas about them do not derive from pure, unmediated visual experience but instead are filtered through cultural standards and preconceptions that change over time.

Wittgenstein’s enterprise clearly was a product of his own era. He considered color from the perspective of a twentieth-century observer, one who naturally found himself (as he remarked) surrounded by a host of hues.¹⁹³ Yet color assumed a truly central place in the everyday life of the West only after Newton’s prismatic experiment and massive imports of vivid exotic commodities. The scientific exile of color from human reality along with the triumph of chromophilia in the West raised the question of color to the level of serious speculation for the first time. In other words, the context in which Wittgenstein pondered the logic of color perceptions was quite different from that experienced throughout most of human history.

The human potential for perceiving colors has always exceeded the range generally presented by the natural environment. After some 200,000 years of existence and several millennia of civilization, however, *Homo sapiens* now live in a world that is entirely commensurate with the acuity and discrimination of their color vision. The historical weaving of the rainbow—the expression of color in culture—finally matches the evolutionary weaving of the rainbow, the variety of hues that our primate ancestors acquired after the Cretaceous era. Thanks to science and technology, we inhabit a world so saturated with color—including neon lighting, flashy advertising, glowing nylons, glossy plastics, acrylic paints, color magazines, color photography, color cinema, color television, and color computer screens—that recognition of its historical uniqueness requires a leap of imagination.

Enrolling color in the dull catalogue of common things inexorably drained it of emotional force. Tethered to the earth, the rainbow finally

¹⁹² Wittgenstein, *Remarks on Colour*, p. 34e.

¹⁹³ *Ibid.*, p. 25e.

becomes commonplace. Conceptual color coding, a fixture of all societies since the origins of civilization, is now obsolete, while the struggle between chromophilia and chromophobia is exhausted. The modest amount of social color coding that survives is mandated by professional conventions and institutional necessities rather than by sumptuary legislation and community mores—fireman red, police blue, hospital white, military olive drab, corporate gray, convict orange, the hardhat’s yellow helmet. With saturated hues a routine experience, just a handful of occasions stand out for their color, mainly parades, athletic contests, and annual festivities such as Mardi Gras, Halloween, Christmas, and the Fourth of July. Perhaps the only colors that still carry a powerful emotional charge for many people are those in a certain configuration on flags, though that is true primarily in nations whose origins stretch back to the invention of the color-coded symbol in the eighteenth century, most notably Great Britain, the United States, and France.¹⁹⁴

Yet with all the differences between modern and traditional worlds in regard to color, there remains a fundamental similarity, one that arises from the very nature of the phenomenon: as always, it transcends understanding. Like Goethe, people still find it hard to accept that transparent light somehow produces an array of colors, every one of which is darker than light itself. Newton told the Royal Society in 1672 that this apparent contradiction represents “the oddest if not the most considerable detection which hath hitherto been made in the operations of Nature.”¹⁹⁵ The Newtonian paradox contributes to color remaining an elusive and problematic theme. Most people also understandably resist the notion that their perception of color, a cardinal dimension of reality, is founded on visual illusion and radical subjectivity. Such considerations help explain why the experience of color is so difficult to place within a framework of rational analysis. As Wittgenstein reluctantly conceded, “We stand there like the ox in front of the newly-painted stall door.”

¹⁹⁴ See Sasha R. Weitman, “National Flags: A Sociological Overview,” *Semiotica* 8, no. 4 (1973): 328–367; and Carolyn Marvin and David W. Ingle, *Blood Sacrifice and the Nation: Totem Rituals and the American Flag* (Cambridge: Cambridge University Press, 1999).

¹⁹⁵ Cited in Christianson, *In the Presence of the Creator*, p. 102.