

Chapter Eight

When Your Eyes Are Closed, What Do You See?

What they were asked to do was briefly this: to close the eyes, allow the after-images completely to die away, and then persistently and attentively *to will* that the color-mass caused by the *Eigenlicht* should take some particular form, – a cross being the most experimented with.

– George Ladd, “Direct Control of the Retinal Field” (1894, p. 351, italics in original)

i.

I’d rather to end this book with a sprouting tangle of questions than with the pessimism of the previous chapter. I’m not an *utter* skeptic; nor do I think we should abandon efforts to understand the stream of experience. Let’s plunge once more into the thicket, with a fresh topic. My aim is not so much to establish pessimism as to see how things look through a pessimistic lens.

The first scholar I’m aware of to seriously consider what we see when our eyes are closed was the eminent early 19th century physiologist – the first great introspective physiologist – Johann Purkinje (a.k.a. Jan Purkyne, 1787-1868), in his doctoral dissertation *Contributions to the Knowledge of Vision in Its Subjective Aspect* (1819/2001), a work groundbreaking in its attention to phenomenological detail.¹

Purkinje begins his dissertation with a phenomenon he discovered in a childhood game:

I stand in bright sunlight with closed eyes and face the sun. Then I move my outstretched, somewhat separated, fingers up and down in front of the eyes, so that they are alternately illuminated and shaded. In addition to the uniform yellow-red that one expects with closed eyes, there appear beautiful regular figures that are initially difficult to define but slowly become clearer. When we continue to move the fingers, the figure becomes more complex and fills the whole visual field (figs. 1-4 [fig. 8.1]).

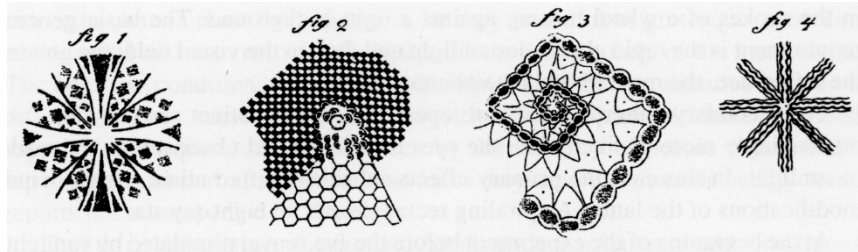


Fig. 8.1, “light and shade figures”, from Purkinje 1819/2001, p. 69

This is what happens in general. Now to the single instances and to closer definition of the conditions. I will first consider the observations of the figures in my right eye, and will mention those for the left eye later.

In general, I differentiate primary and secondary forms in the whole figure. The primary patterns define the background while the secondary are superimposed on it. The primary forms are larger and smaller squares (fig. 2) alternately light and dark, which cover most of the field, resembling a chess board.

At the borders of the squares longer and shorter zigzag lines develop that appear here and there and then vanish. Outward from the center, which is marked by a dark point surrounded by a light area, I see a field of larger hexagons, with gray sides and white centers. To the lower left of the central spot I see overlapping half circles, the direction of which continuously changes. They resemble tree rings or roses with many petals.... [Purkinje's descriptions continue for another page and a half.]

Further I must stress that the patterns I have described, especially the squares, have been seen by the majority of people with whom I have carried out the experiment, in so far as they can be communicated by verbal reports not accompanied by drawings....

The patterns in my left eye, which is weak sighted, can only be seen incompletely. The primary patterns appear as curvilinear networks rather than as regular squares. The secondary patterns, however, are the same, only they are placed at opposite sides (1819/2001, p. 69-71).

Several other authors attest to such phenomena: Helmholtz says that such figures emerge in conditions of a "rapid change of light and shadow" (1866/1909/1962, vol. 2, p. 257).

J.R. Smythies (1957) and Steven Stwertka (1993) call them "stroboscopic patterns" and find that they can be induced by a strobe light flashing about 10 times per second. G.B. Ermentrout and J.D. Cowan (1979) provide a mathematical explanation of why such geometrical figures might appear in hallucinations. I've so far been unable to find such geometric organization in my own case – neither using Purkinje's splayed fingers technique, nor with a stroboscope. In both cases, I seem to experience an unsteady,

quickly flashing, light and dark, noisy background and small colored figures that come and go.

In the passage above, Purkinje comments only briefly on *non-stroboscopic* experience while facing the sun with one's eyes closed – that “one expects” a “uniform yellow red”. Elsewhere in his dissertation, and in an 1823 follow-up volume, Purkinje discusses various striking subjective visual phenomena, some occurring with eyes closed, others with eyes open. Among the eyes-closed experiences he discusses are: the “cross-spiderweb” figures he sees when he suddenly wakes up with the sun shining on his closed eyes (1823/1919, §VIII), the “wandering cloudy stripes” he sees with eyes closed in darkness (see section iv below), the various “pressure figures” induced by pressing on his eyes (1819/2001, §II-III), the “galvanic light figures” produced by running electric current through his face (1819/2001, §IV), the squares he sees when he restricts the blood flow to his head (1819/2001, §III), and the ellipse he sees when, after closing his eyes and attending to things non-visual for a while, he with a sudden jerk of the eyes attends to his darkened visual field (1823/1919, §V). But experience in ordinary daylight with his eyes closed seems never to have attracted Purkinje's attention. Perhaps the casual remark in the passage above reflects his final opinion: It's a simple yellow-red, hardly worth further discussion.

ii.

Like Purkinje, later authors almost entirely ignore the question of what we normally experience with our eyes closed in well-lit environments. I can find no serious

treatments.² (More commonly discussed is visual experience with eyes closed in the dark; we'll get to that soon.) But can't we, if we want, just go out, lie in the sun, and see what it's like with our eyes closed? Will we then be doing cutting-edge science?

Here's what I'm inclined to report: a bright, relatively uniform field that fluctuates in color from warm hues like red and orange and brilliant scarlet, to white or dull gray, sometimes with a faint bluish tinge. The changes of hue are sometimes seemingly spontaneous, at other times precipitated by moving my eyes or tightening my lids. The field seems to churn throughout with a darker color, and I see flashes of brightness at the extreme periphery. The field seems broader than it is high, and either flat and a few inches before me or – alternatively and quite differently – entirely lacking any features of distance or depth or flatness.

I coaxed three acquaintances into reporting their visual experience while facing the sun for seven minutes with their eyes closed. All independently described experiences similar to mine: bright fields fluctuating in color from red to orange or yellow or white. All described the field as fairly uniform, though with some perturbations (one reported diagonal lines that came and went, another reported squiggles and lightning-like branching figures, the third drifting dark spots and patches and crisscrossing lighter strands or threads). When I asked about the periphery, all three described it as similar to the center, though possibly a bit darker. This similarity of report is, perhaps, encouraging. Incidentally, the pupils of all three were fairly contracted by the end of the experiment, suggesting that appreciably more light penetrates the closed eyelid when facing the sun than enters the open eye in normal indoor environments.

I also loaned random beepers (of the sort used in Chapter 6) to five experimental subjects, asking them to report on their visual experience with their eyes closed in a variety of circumstances. More on that later.

You might think: Who cares what we visually experience when the sun shines through our eyelids? Well, here are two possibilities: Everyone reports pretty much the same thing, in which case there is probably no reason to doubt the reports, and simply by lying on our backs in the sun we've discovered something new, despite having almost two centuries of consciousness studies behind us. Or people disagree, and we have the same wonderful, horrid mess on our hands that erupts in every other chapter of this book.

iii.

More theoretically valuable, perhaps, or maybe more intrinsically interesting – in any case much more discussed – is what we experience when our eyes are virtually or entirely darkened, for example when one sits with eyes closed in an unlit room at night. Purkinje calls this the “dark field”.

Wandering Cloudy Stripes

When I fixate the darkness of an eye, well protected from all external light, sooner or later weakly emerging fine, hazy patterns begin to move. At first they are unsteady and shapeless, later they assume more definite shapes. The common feature is that they generate broad, more or less curved bands, with interpolated black intervals. These either move as concentric circles toward the center of the visual field, and disappear

there, or break down and fracture as variable curvatures, or as curved radii circle around it (figs. 17-19 [fig. 8.2]). Their movement is slow, so that I usually need 8 seconds until such a band completes the journey and disappears completely. Even at the beginning of the observation the darkness is never complete. There is always some weak, chaotic light. It is strange that in this darkness the sense of proportions fails completely. The darkness is finite, extended in width. It is possible to measure it from the center, but one cannot determine precisely the peripheral limit. The closer we come to the periphery, the more difficult and finally impossible it gets to establish a visible peripheral limit....

The figures described were seen with my right eye, because the left eye, which is somewhat weak, would not notice these delicate phenomena. In individuals in whom the two eyes are identical, probably the figures would unite just as the two fields of vision fuse into one (1819/2001, p. 79-80).

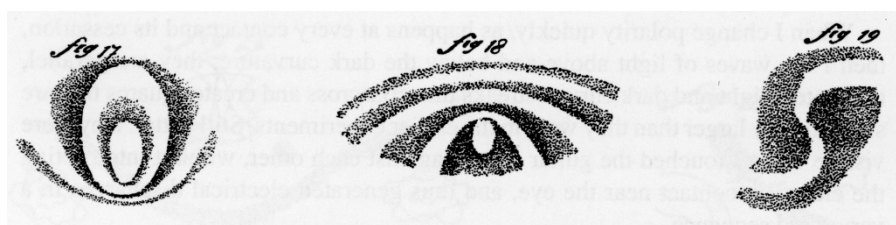


Fig. 8.2, “wandering cloudy stripes”, from Purkinje 1819/2001, p. 80

In his 1823 volume Purkinje adds:

In most cases after some minutes the... wandering cloudy stripes begin their game, often developing such vivacity that they give themselves colored appearances. Later a profusion of straight and crooked lines of

different lengths appear, the straight frequently standing parallel and vertical, the crooked irregular and fragmentary. Sometimes a checkerboard appears or fragments of an eight-ray star.... The slightest involuntary movements bring out the always delicate emerging sensitivity of the various light phenomena of appearance, even more toward the outer part of the visual field than in the middle (1823/1919, p. 105-106, my trans.).

Johann Goethe (whom Purkinje credits in his 1823 book but not his 1819) somewhat anticipated Purkinje's wandering cloudy stripes, writing:

If the eye is pressed only in a slight degree from the inner corner, darker or lighter circles appear. At night, even without pressure, we can sometimes perceive a succession of such circles emerging from, or spreading over, each other (1810/1840/1967, §96).

Let's follow these wandering cloudy stripes down through the 19th century, as they change and disappear.

iv.

The next discussion I can find of the dark field is by the 19th century's next great introspective physiologist, Johannes Müller, some fourteen years after Purkinje's second volume:

If we direct our attention to what takes place in the eyes when closed, not merely do we see sometimes a certain degree of illumination of the field

of vision, but also occasionally an appearance of light developed in greater intensity; sometimes, indeed, this luminous appearance spreads from the centre to the circumference, in the form of circular waves, disappearing at the periphery. At other times the appearance has more the form of luminous clouds, nebulae or spots; and, on rare occasions, it has been repeated in me with a regular rhythm (1837-1840, p. 742).

Though in some ways strikingly similar to Purkinje's description – and Müller mentions Purkinje four times on this page, but oddly not on this issue – Müller's description of the stripes is more limited, characterizing them only as circular and not in the other forms Purkinje reports. Müller also describes them as moving in the opposite direction: not toward the center but rather outward toward the periphery.

Nineteen years after Müller's discussion, Helmholtz first characterizes the dark field quite differently:

When the eyes are closed, and the dark field is attentively examined, often at first after-images of external objects that were previously visible will still be perceived.... This effect is soon superseded by an irregular feebly illuminated field with numerous fluctuating spots of light, often similar in appearance to the small branches of the blood-vessels or to scattered stems of moss and leaves, which may be transformed into fantastic figures, as is reported by many observers (1856/1909/1962, vol. 2, p. 12).

But then he adds that many people, including Goethe and Purkinje, report wandering cloudy stripes. Helmholtz continues:

The author's experience is that [wandering cloudy stripes] generally look like two sets of circular waves gradually blending together towards their centre from both sides of the point of fixation. The position of this centre for each eye seems to correspond to the place of entrance of the optic nerve; and the movement is synchronous with the respiratory movements. One of Purkinje's eyes being weaker than the other, he could not see those floating clouds except in his right eye. The background of the visual field on which these phenomena are projected is never entirely black; and alternate fluctuations of bright and dark are visible there, frequently occurring in rhythm with the movements of respiration... (p. 12-13).

In describing *two* sets of circular waves, Helmholtz departs from both Purkinje and Müller (though with a nod to Purkinje's weak eye). Helmholtz calls such visual experiences without outside light the *eigenlicht* or the "intrinsic light" of the eye.

Nine years later, Hermann Aubert, adopting a phrase from Purkinje, calls our visual experience in darkness *light chaos*. Although no previous author claims that cloudy stripes are the *only* stable inhabitants of the dark field, in Aubert they jostle against multiple competitors. Aubert describes the light chaos as "a swarm of spots, lines, and splotches of light, difficult to describe, spread over the entire visual field" and specifies five forms: (1.) black, but not deepest black, with yellow spots and lines of light like "hovering threads of fiber", (2.) colorless wandering cloudy stripes in Purkinje's sense, moving in all directions, (3.) fogballs in the middle of the visual field, expanding and contracting without much other movement, brighter in the center and fading toward the edges without a distinct boundary, (4.) very bright lights at the far periphery, usually

disappearing quickly, and (5.) zigzag lines, like bright lightning, blue or violet in color, moving slowly and disappearing within a few seconds (1865, p. 333-334, my trans.). Aubert estimates the brightness of the black background as similar to that of a sheet of white paper illuminated by a single candle 130 meters away (p. 64).

Despite their impressive pedigree in Goethe, Purkinje, Müller, and to some extent Helmholtz – and who could ask for more expert witness in the early 19th century? – after Aubert, the wandering cloudy stripes seem to dissipate. The next serious discussion of them is in an 1897 journal article by Edward Scripture. Scripture rejects Helmholtz’s claim that people see one figure for each eye, and he describes the stripe as a “spreading violet circle”. After Scripture, I can find no psychologist who treats wandering foggy stripes as the characteristic inhabitants of the dark field.

v.

Meanwhile, another tradition – or, really, set of conflicting traditions – was arising, which did not venture to predict any *particular* pattern in the visual field of the light-deprived eye.

Gustav Fechner offers the first substantial treatment of eyes closed visual experience with no reference to Purkinje’s cloudy stripes. His label for the experience, *augenschwarz*, literally eye-black, emphasizes its darkness. He writes:

The blackness that is present when the eyes are closed is rather just the same impression of light as we get when viewing a black surface, one which can change through all gradations to the most intense visual

sensation. Indeed, this intrinsic blackness of the eye changes occasionally through purely internal causes into bright light and contains, so to speak, a sprinkling of light phenomena.

By paying strict attention, one discovers in the blackness that is seen when the eyes are closed a kind of fine dust composed of light, which is present in different people and under different conditions of the eye in various states of abundance, and in certain diseases may increase to a lively phenomenon of light. In my own eyes there exists, since the time when I had a lengthy disease of the eye, a strong continuing flickering of light, which increases according to the stimulation of my eyes and is subject to great fluctuations (1860/1966, p. 138).

Fechner doesn't cite Purkinje, Müller, or Helmholtz here. Though his brief discussion on p. 136-138 doesn't preclude the possibility that wandering cloudy stripes may be among the "sprinkling of light phenomena", they rate no mention. Throughout his *Elements of Psychophysics*, especially in the second volume, Fechner treats the *augenschwarz* as near the lowest bound of blackness; and he discusses the self-reports of several correspondents who describe their visual field with their eyes closed as either purely black or very nearly so (1864/1889, p. 478-483).

While Fechner evidently regards the regular experience of bright light in the *augenschwarz* as a sign of pathology, American psychologist George Ladd suggests that it is only amateurish introspection that leads to reports of the field as mostly dark:

I have found by inquiry that a large proportion of persons unaccustomed to observe themselves for purposes of scientific discovery are entirely

unacquainted with the phenomena of the retinal *eigenlicht*. Ask them what they customarily see when their eyes are closed in a dark room and they will reply that they see nothing. Ask them to observe more carefully and describe what they see, and they will probably speak of a black mass or wall before their eyes, with a great multitude of yellow spots dancing about on its surface. Some few will finally come to a recognition of the experience with which I have long been familiar in my own case. By far the purest, most brilliant, and most beautiful colours I have ever seen, and the most astonishing artistic combinations of such colours, have appeared with closed eyes in a dark room. I have never been subject to waking visual hallucinations, but I verily believe there is no shape known to me by perception or by fancy, whether of things on the earth or above the earth or in the waters, that has not been schematically represented by the changing retinal images under the influence of intra-organic stimulation (1892, p. 300).

Galton writes:

[B]efore I thought of carefully trying, I should have emphatically declared that my field of view in the dark was essentially a uniform black, subject to an occasional light-purple cloudiness and other small variations. Now, however, after habituating myself to examine it with the same sort of strain that one tries to decipher a signpost in the dark, I have found out that this is by no means the case, but that a kaleidoscopic change of patterns and forms is continually going on, but they are too fugitive and elaborate

for me to draw with any approach to truth. I am astonished at their variety, and cannot guess in the remotest degree the cause of them. They disappear out of sight and memory the instant I begin to think about anything, and it is curious to me that they should often be so certainly present and yet be habitually overlooked (1883/1907, p. 114-115).

Pertinent to the “sparseness” issue I raise in section ix, note that although Galton says that the patterns and forms disappear when he thinks about anything (else), it’s not clear whether he thinks that there is no visual experience whatsoever or that instead the field persists without attention, only darker or blander. I’ve found no other author who goes even as far as Galton in asserting the relationship between attention and experience of the *eigenlicht*. For what it’s worth, I share Galton’s impression that attention to the *eigenlicht* tends to make its forms livelier.

Still differently, Ewald Hering calls the phenomenon *eigenrau*, “intrinsic gray” (1905, 1920/1964; in 1878 he was still using Helmholtz’s *eigenlicht*). His choice of *gray* over Fechner’s *black* is deliberate: In the absence of contrast, especially after a long time, Hering suggests, we experience not so much darkness as neutral gray:

If we awake at night when it is still completely dark, at first we distinguish no objects at all, but see the whole visual field filled merely by those weak, more or less unsteady, cloudy or spotty colors which one can call the *intrinsic gray* (intrinsic brightness or darkness) (1920/1964, p. 74-75).

That the field should be gray and not black fits nicely with Hering’s emphasis on opponent processes in vision, according to which visual sensation involves competition between light and dark, red and green, blue and yellow, all arising in contrast to a neutral

resting state, toward which one starts to gravitate with adaptation. On such a view it's natural to suppose that with persistent non-stimulation, one would revert to a neutral sensation, not a dark one (see also G.E. Müller 1896, p. 30-33, 1897, p. 40-46). Why, then, might people misreport the experience? Hering suggests that the gray or weak colors we experience when the eye is not stimulated, like afterimages and peripherally seen objects, have less "weight" (*gewicht*), that is, "the impressiveness or expressiveness that a visual quality or color possesses" which causes us to notice and remember it (p. 115-116). This is not at all the same as their being dark, but perhaps the casual introspector would confuse the two. Or – though I recall no hints of this thought in Hering – perhaps it's an instance of "stimulus error" (see Chapter 6 and Boring 1921) – the mistake of confusing the features of the outside world (that it's dark, or that no appreciable light is entering the eyes) with the features of the *sensory experience* the outside world produces in us.

Other psychologists offer passing comments. Alfred Volkmann describes the field as absolute blackness but with a "light dust" that varies between people (1846, p. 311). L.-F. Alfred Maury says that when people have maladies or congestion and close their eyes or look into darkness, sometimes they see hallucinatory figures (1861/1878, p. 84). Adolf Fick describes the field as "constantly changing, with all kinds of turbulence, in places colored, in places colorless marks, with shape and color steadily changing" (1879, p. 230, my translation). Edmund Sanford invites students to consider the "shifting clouds of [idio-retinal] light" in the darkened eye (1892, p. 485, brackets in original). G.F. Stout describes "the retina's own light" as "medium gray" with "specks and clouds of color" (1899/1977, p. 151). Titchener describes "hazy or cloud-like patches of dull

grey” (1901, vol. 1, p. 510) and says “we see a grey, ... an ‘intrinsic’ brightness sensation” 1896/1906, p. 79). An observer quoted at length in Ladd (1903) and referred to only as “Mr. H.D.” (with an 1896 Yale Ph.D.) says that his *eigenlicht* ordinarily has “the appearance of a dancing mass of vari-colored dust, red predominating” and that it’s normally circular, centered at the bridge of the nose, while “the radius extends to the corner of the eye and sweeps over the forehead to the other eye” (p. 145). Wundt describes “weak subjective light sensations” in the form of “light nebulas and light sparks” (1908a, p. 660, my trans.). William Peddie describes the “self-light” as an “irregularly flecked shimmer” of yellowish-white (1922, p. 44, 84). Leonard Troland says that the visual field is “relatively homogeneous and lacking in stereoscopic character”, and “faint patterns of colors... idio-retinal whirlings and the like, may be present” (1922/2008, p. 16). Frank Allen says we experience a “misty dark gray light” (1924, p. 275). Burch writes that with “prolonged resting of the eye in an absolutely dark room, the self light slowly diminishes and finally disappears” (quoted in Allen 1924), while Boring remarks in contrast that “the black of complete darkness gets subjectively lighter as it continues” (1942, p. 163). Karol Koninski says “the visual field appears as regular bluish-(ink-)black grains (the grains millet- to lentil-sized) on a yellow background” (1934, p. 362, my trans.). Donald Purdy describes the “self light” as “a uniform dim expanse of gray” (1939, p. 531). Phenomenological reporting went out of style in psychology and thoughtful descriptions of the *eigenlicht* become harder to find after the 1930s (though see this note³ for some later quotes, and this note⁴ for a few words on “sensory deprivation” and “ganzfeld” experiments).

Could all these men just be having different experiences, which they are each accurately reporting? Maybe Hering genuinely experienced gray, Fechner black, Ladd fantastic colors, Purkinje a parade of cloudy stripes converging inward, and Scripture a crimson band spreading outwards. Deprived of stimuli and free to play, our brains might fall into different habits. And yet Ladd is convinced that people who manage to introspect carefully will come to agree with him. Surely this must have been his experience in conversation, at least with his students? Most researchers represent their experiences not as idiosyncratic but as typical. One would hope that they'd base such claims partly in reports gathered from others; and Fechner, at least, does so explicitly. It would be strange if all of Fechner's acquaintances happened to see black and all of Hering's gray. There's also a historical arc to the reports of wandering cloudy stripes, which reminds me of the arcs of opinion about black and white dreams (Chapter 1) and the elliptical appearance of tilted coins (Chapter 2).

Maybe people experience more or less what they *expect* to experience? That could explain the historical arcs and the similarity among researchers' students and acquaintances. Against this, though, at least some people say they are surprised at what they discover, for example Galton, as well as many of the acquaintances and subjects I've interviewed.

vi.

We might turn to neuroscience. Neurons are always active, even in the absence of stimulation. Tal Kenet and colleagues (2003), for example, looking at cats, found that

“spontaneous activity” (in the dark or looking at a gray screen) in area 18 (associated with selectivity for the orientation of visual stimuli) often closely resembled, with somewhat less organization, ordinary area 18 activity in response to visually presented gratings. Kun Wang and colleagues (2008) also found spontaneous activity in human primary visual cortex, especially in areas associated with imagery and memory, when subjects rested with their eyes closed inside an fMRI scanner. But there is no straightforward inference from neural firing patterns to phenomenology, at least in the current state of neuroscience, and phenomenological studies are lacking: Despite the fact that subjects often lie in the dark in MRI machines, neuroscientists interested in vision understandably tend to focus on what occurs not in the darkness but rather when visual stimuli are presented.

One exception is a paper by Yuval Nir and colleagues (2006), in which subjects spent two minutes in complete darkness with eyes closed inside an MRI machine, and were asked “pay close attention to any visual-like percepts that might occur during darkness (e.g., visual-like dots) and to report it following the scan” (p. 1314). Five of the seven subjects reported no visual-like percepts whatsoever; one reported afterimages in the first few seconds, nothing otherwise; and one reported “visual-like” dots. Although there’s something to be said for brevity and neutrality in one’s introspective instructions, Nir and colleagues pose the introspective question too casually. What does it mean for a subject to report “nothing”? Does that mean blackness, or no visual experience at all (like the lack of visual experience of things behind your head; see the “phenomenal blindness” thought experiment in Chapter 6 and also section viii below), or nothing that seems important, or nothing that the subject would confuse with a sensation caused by an

ordinary outward object? The experimenter who has theoretical conversations with her subjects invites the charge of imposing her own views and thus biasing the reports. Rightly so. But sometimes, as here, without such conversations, the reports are uninterpretable, creating a methodological Scylla and Charybdis. (And no, Odysseus did not steer between them. He chose Scylla and paid the price.) Anyhow, Nir et al. found considerable fluctuation in visual cortical activity among their subjects, despite the subjects' minimal reports.

I see no reason neuroscientific studies couldn't cast some light. (Thus I'm more hopeful of progress here than I am about the sparse/abundant issue discussed in Chapter 6.) However, as far as I'm aware, nothing even close to methodologically adequate has yet been attempted.

vii.

I close my eyes right now, in my fluorescent-lit office, and consider my visual experience. I feel little room for doubt. The field is mainly black, with hints or tintings of color. After contemplating it for ten seconds, I place my palms gently over my eyes. Ah wait, I think, *now* it's black! I remove my palms and the field now seems like an intermediate gray – and that seems to me now to be the color it was before, originally, when I thought it was black. Was that first assessment, which seemed so easy, actually mistaken? Or am I losing track of how my experience has evolved over even these brief periods of time? Does my concept of blackness or darkness apply well only to the outside world, or to my experiences of the outside world, so that it's always something of

a distortion to apply it to my experience with my eyes closed? Why does even so apparently easy an introspection confound me?

Helmholtz writes:

Another general characteristic property of our sense-perceptions is, that *we are not in the habit of observing our sensations accurately, except as they are useful in enabling us to recognize external objects. On the contrary, we are wont to disregard all those parts of the sensations that are of no importance so far as external objects are concerned* [emphasis in original]. Thus in most cases some special assistance and training are needed in order to observe these latter subjective sensations. It might seem that nothing could be easier than to be conscious of one's own sensations; and yet experience shows that for the discovery of subjective sensations some special talent is needed, such as Purkinje manifested in the highest degree; or else it is the result of accident or of theoretical speculation. For instance, the phenomena of the blind spot [where the optic nerve exits the eye] were discovered by Mariotte from theoretical considerations. Similarly, in the domain of hearing, I discovered the existence of those combination tones which I have called summation tones [see Chapter 5, section iv].... It is only when subjective phenomena are so prominent as to interfere with the perception of things, that they attract everybody's attention.... Even the after-images of bright objects are not perceived by most persons at first except under particularly favorable external conditions.... No doubt, also, there are cases where one eye has

gradually become blind, and yet the patient has continued to go about for an indefinite time without noticing it, until he happened one day to close the good eye without closing the other, and so noticed the blindness of that eye (1856/1909/1962, vol. 3, p. 6-7).

Immediately following this passage is Helmholtz's assertion, quoted in Chapter 2, section vii, that people are typically astonished to discover that most of the objects in their visual field, most of the time, are seen double. Later on the same page, Helmholtz lists "the 'luminous dust' of the dark field" among the subjective phenomena so difficult to heed.

Here, as in my discussion of the subjective "flight of colors" after exposure to bright light (Chapter 5, section v), I find myself torn. On the one side, I feel intuitively confident. I have a sense that I couldn't really go *too* far wrong, a sense that I can doubt only inauthentically, as dogmatic skeptics are prone to do. On the other side, I'm concerned that my, or our, subjective confidence may be poorly tuned in this domain, as suggested by Helmholtz and Ladd – people who have studied the phenomena with (presumably) more subjects than I and who insist that it is remarkably easy for untutored introspection to go astray.

viii.

One thing that everyone in this literature appears to agree on is that we normally have *some* visual experience or other when our eyes are closed – at least, they all seem naturally to invite that reading, and they don't ward against it. Recall, however, the

sparse view of consciousness from Chapter 6. On the sparse view, we don't normally experience, even peripherally, the unattended hum of traffic in the background, the pressure of the shoes on our feet, or even the road before our eyes when we're driving inattentively. If it seems to us that we constantly experience all sensory inputs simultaneously, that's only because the act of attending *creates* the experience whose presence or absence we aim to assess. And if visual consciousness does indeed sometimes slip away, it might do so least conspicuously when our eyes are closed – unless, of course, for some reason we happen to be thinking specifically about our eyes-closed visual experience. We don't so much, then, discover the *eigenlicht* when we think about it, but bring it into being.

Borrowing the beeper methodology of Chapter 6, I loaned random beepers to five volunteers, who wore them for two hours at a stretch, keeping their eyes closed the whole time. I left it up to them what their activities and lighting environments should be, though I did ask them to collect no more than half of their samples in any single type of situation. When the beep sounded, they were to consider whether they had any sort of visual experience – blackness, colors, fantastic figures, whatever – in the last undisturbed moment before the beep, or whether they had no visual experience whatsoever, not even of blackness or grayness. If they did believe they had some experience, I asked them to describe it in as much detail as possible. I interviewed them closely about their sampled experiences (or non-experiences); I encouraged open questioning of the methodology; I attempted to clarify as much as possible what was being asked, while minimizing or hiding my own inclinations; and I aimed to elicit the participant's best judgment about the matter at hand under the pressure of frank but gentle expression of concerns.

I made as clear as I could the difference between no visual experience and the experience of black or gray. My standard technique was this: First I asked participants if it seemed to them that they experienced blackness or grayness or anything else visual in the region behind their heads and beyond the farthest boundary of their peripheral vision, or whether it seemed instead empty or blank – not black, but rather entirely devoid of visual experience. All expressed the view that beyond the periphery it was visually blank, not black. I then asked them to imagine the blankness encroaching, the periphery narrowing, until no visual experience whatsoever remained but only blankness. My question then was: Is *that* what it's like when your eyes are closed and you're caught up in thinking about something else, or is it more like seeing black, or gray, or colors, or figures?

I also distinguished *sensory* visual experience from visual *imagery* experience. Visually imagine a setting sun in a cloudy sky. If you can do that, you presumably had a visual imagery experience that was somewhat different in kind – or at least in vividness (Hume 1740/1978; Perky 1910) – from your sensory visual experience ongoing now as you are looking at this text. People don't seem usually to have trouble distinguishing imagery experience from sensory experience when their eyes are open, but when their eyes are closed, the distinction sometimes loses its grip. I invited participants to consider whether that distinction made sense to them, and if so to report whether any visual experience they had seemed more sensory or more imagistic. All participants accepted the distinction and confidently classified each of their visual experiences in one or the other category. In some cases, they reported both sensory and imagery experience. Always, in such cases, the two were experienced as distinct from each other – for

example, a sensory experience of a uniform, bright orange field and simultaneously a visual image of the Google guys dressed in black.

Table 8.1 displays the results, by subject, collected over three (or, for subject 1, four) separate beep-and-interview days. My sense of the subject's "bias" was based on what the subject said in the preliminary interview. Only S2 ever reported thinking about the experiment or about his ongoing visual experience in the moment immediately before the beep. Unfortunately, he reported this in 6 of his 10 samples. All other participants were quickly swept up in radio programs, telephone conversations, and the like. As is evident from the table, their reports varied enormously: One subject (S2) reported sensory visual experience in every single sample, while another (S4) never reported visual experience of any sort. Overall, the five subjects reported no visual experience of any sort – whether sensory or imagistic – in 25% of the samples, and they reported sensory visual experience (with or without a simultaneously experience of visual imagery) in 58% of the samples.

TABLE 8.1: Reported visual sensory and visual imagery experience in randomly sampled moments, with eyes closed

| subject | initial bias | total # of samples | # of samples with only sensory exp reported | # of samples with only imagery exp reported | # of samples reporting both sensory and imagery exp | # of samples reporting neither type of exp |
|---------|--------------|--------------------------|--|--|---|--|
| S1 | sparse | 14 | 1 (7%) | 8 (57%) | 3 (21%) | 2 (14%) |

| | | | | | | |
|-------|-----------|----|----------|---------|---------|----------|
| S2 | abundant | 10 | 9 (90%) | 0 (0%) | 1 (10%) | 0 (0%) |
| S3 | sparse | 12 | 9 (75%) | 0 (0%) | 0 (0%) | 3 (25%) |
| S4 | sparse | 9 | 0 (0%) | 0 (0%) | 0 (0%) | 9 (100%) |
| S5 | abundant? | 10 | 8 (80%) | 1 (10%) | 1 (10%) | 0 (0%) |
| total | | 55 | 27 (49%) | 9 (16%) | 5 (9%) | 14 (25%) |

Four of my beeper subjects had their eyes closed in near darkness in at least one sample. Considering, then, only those samples, the ones collected in darkness: One subject (S1) reported no sensory visual experience at all, not even of blackness, in six separate such samples (though plenty of visual *imagery*). Another subject (S2) reported, in two dark samples, a sensory visual experience of “undulating blackness” with small flashes of color. Another subject (S3) reported a sensory visual experience of turbulent blackness on one occasion, like water before a boil, but no visual experience at all on a second occasion. The fourth subject (S5) reported a sensory visual experience of grayish, angular wisps of foggy light against a black background in one sample and no sensory visual experience (but vivid visual *imagery*) in another.

S2 collected four samples outside, facing the sun. In each sample, he described complex latticeworks, like, he said, a “squashed Bucky-ball”; in two he also reported a glowing light in the center (though not quite in the direction of the sun and too large to be a direct perception or ordinary afterimage of the sun). When I showed him Purkinje’s “light and dark figures” (see section i, fig. 8.1), he said that his experience was similar but less geometrically regular. S5 collected two samples facing the sun. He reported neither S2’s latticework nor my own relatively uniform field fluctuating from red or

yellow to white or gray (section ii). In one sample, he described the field as a dark orange oval becoming bright white near the center, with a horizontal orange band dividing it across the middle, and bright, iridescent spots throughout, fading in and out. In the other sample he reported a bright yellowish-white field riddled with whitish-blue vertical stripes and spots, accented with flecks of orange.

We might take the reports at face value, as indicating substantial variability in people's experiences with their eyes closed. Or we might doubt the truth of the reports. The same issues arise as I noted Chapter 6, section x; no need to repeat them here. Also, the experimental situation – demanding closed eyes through extended wakeful activity – differs, perhaps importantly, from ordinary eyes-closed situations such as sinking into sleep or shutting them wakefully but only briefly. In Chapter 6's beeper experiment, two subjects did by chance have their eyes closed at the moment of the beep. One was closing her eyes in frustration; the other had fallen asleep. Neither reported any visual experience.

ix.

So, what do people typically experience when their eyes are closed? Either there are specific characteristic figures, such as wandering cloudy stripes (Purkinje, J. Müller, Helmholtz, Aubert) or there aren't (Ladd, Hering); the field is either very nearly black (Fechner) or middling gray (Hering, G.E. Müller) or highly variable with fantastic figures (Ladd); or maybe there's usually no visual experience of any sort at all (Nir et al. and presumably most of the advocates of sparse views as described in Chapter 6). Maybe

eyes-closed visual experience (or the lack of it) varies radically from person to person, and the diverse reports are mostly accurate; or maybe we all experience more or less the same range of phenomena, but many misdescribe it. Nothing at all is settled.

Let me conclude by mentioning some related issues almost untouched by existing research – issues so little studied that the range of plausible positions has not even yet been fully occupied.

What is it like to see through your eyelids? If I'm in an illuminated room and I wave my hand before my face, I seem to experience motion of some sort – fluctuations of the visual field synchronous with the motions of my hand; so also, though less reliably, if a friend waves her hand.⁵ Acquaintances and loitering undergraduates, I've found, differ substantially in their reports and apparent skill at detecting position and motion through their lids. I've also noticed that if I hold an occluding object like a book over half my visual field, the motion I see still spreads over the whole field, especially when the angle of occlusion matches the angle of motion (e.g., the book covering the lower half of the visual field and my hand moving right and left).

Is the eyes-closed field cyclopean? Purkinje thought not, in his own case: He clearly distinguishes what he sees through his right eye from what he sees through his left. However, as quoted above, he also thought that the two fields would unite for “individuals in whom the two eyes are identical”. My eyes are presumably not identical in the relevant sense: My left eye is very much more nearsighted than my right (though also dominant and more effectively corrected through lenses.) When I close my own eyes, however, it seems to me that although I can distinguish between the right and left halves of the darkness – yes it still seems like darkness to me – I don't find any impulse

to ascribe different fields to my two eyes. I can undermine my confidence in this as follows. First, with eyes open I press on the outside corner of one eye and note the figure, called a phosphene, that appears in the opposite corner. (This phosphene is usually for me a dark ring with a bright aura; see also Purkinje 1819/2001 and Helmholtz 1856/1909/1962.) Then I close my eyes and repeat the procedure (ignoring the colored smudge that now seems to appear at the point of pressure). I find myself torn between locating this phosphene about $2/3$ of the way toward the right border of a cyclopean dark field and locating it near the far edge of a field specifically associated with the disturbed eye. Furthermore, it helps in seeing the phosphene if I do something that feels a bit like shifting my energies or attention toward that eye.

Does a single closed eye have a visual field? Start with both eyes closed, then open one; or start with both eyes open and close one. Does that one closed eye see darkness or figures in the *eigenlicht*? Some people I've interviewed have said so. I have the contrary impression myself. With one eye open, it seems to me that I have just *one* visual field, centered on the open eye. There is a margin of darkness at the inside edge of that field, in the direction of the closed eye, but that darkness is as though seen from the perspective of the open eye, not the closed eye. It looks, more or less, like it's behind the nose. When I create a phosphene in that darkness behind the nose, the apparent spatial location of the phosphene is on the open-eye side of the nasal mid-line.

How broad and tall is the eyes-closed visual field? Recall that Purkinje says that though it is finite, it is impossible to establish the peripheral limit. With my eyes open, I'm inclined to say that there's a fairly straightforward (though indistinct) border to my visual field; but with eyes closed things seem less straightforward. The darkness feels

somehow more enveloping – though at the same time it feels to be more in my forward than in my rear perspective. Does it actually extend over a greater degree of arc? Well, I'm not sure I'm quite ready to say that. Others I've asked give diverse reports. Eyes open, the visual field seems wider than it is tall. Is that also true of the eyes closed field? Most of my interviewees seem willing to say this. H.D., however, you may recall, states that it is circular (quoted in Ladd 1903).

Is the eyes-closed visual field flat? I find this thought much more tempting than the parallel thought about my eyes-open visual field (see Chapter 2). Purkinje's descriptions of his field seem always, implicitly, to treat it as flat. His checkerboard shapes, for example (section ii, fig. 8.1) are drawn as though seen square-on, not receding into the distance at an angle. Likewise, he does not portray his cloudy stripes as moving forward or back or twisting in three dimensions. Although a number of authors (as well as most of my subjects in section viii) describe a "background" (often black or gray or in the sun more brightly colored) against which other figures sometimes move, this doesn't necessarily imply any real depth to the field. None of my subjects ever reported its seeming as though one object in their eyes-closed field looked farther away than another, though I was careful to explicitly ask each subject (except S4, who reported no experience) several times with several different samples whether the field had depth or distance. C.E. Ferree, on the other hand, talks about "look[ing] deep into the field vision... beyond the background as usually observed" (1908, p. 114-115). E.R. Jaensch says that although most subjects describe the *eigenrau* as a "surface" (*fläche*), others describe it as a "space" (*raum*) (1923, p. 52).

Does the eyes-closed field appear to be any particular distance away? Most of the people I've interviewed deny that the field appears to be any particular distance from them – an inch or a foot or a mile. But I myself confess a temptation to describe my afterimages and *eigenlicht* as about two inches in front of my subjective center, or right about at the backs of my eyes. This temptation seems to me oddly specific. I would not before have said that my subjective center is two inches behind my eyes. Consider this: Do figures in the closed-eye field appear to be any particular *size*? If so, then perhaps from their visual angle a distance is implied.

Do figures in the eigenlicht stand in any spatial relation to one's imagery? Jaensch says yes: His subjects reported their images as being drawn in the *eigenrau*, or ringed around by it (1923, p. 52). Jean-Paul Sartre, however, argues that perceptual experience and imagery cannot co-occur (1940/1972, p. 138). Stephen Kosslyn's view that the same cortical areas subserve both perception and imagery (e.g., Kosslyn et al. 2001) suggests that there will be competition, at least, between them, and presumably a common spatial framework. Russ Hurlburt's beeper subjects have sometimes reported experiencing, simultaneously and without interference, both visual imagery and sensory visual experience (1990, esp. p. 48-51). Three of my five beeper subjects reported at least one sample containing both visual sensory experience and visual imagery simultaneously (see Table 8.1). S1 (with three instances) and S2 (with one instance) said that the imagistic and the sensory experience did not appear to interact or to be (in S2's words) "in the same co-ordinate space". S5 in contrast, in his one report of this type, said that the imagery and sensory experience were "in the same field of space" though "not of a piece".

Can we control the eigenlicht? Most people don't believe they can control their sensory experience directly, through acts of will (though of course we can control it indirectly, for example by averting our eyes). One can't form a sensory visual experience of a cross-shape, for example, simply by willing it to be so. Some scholars even make passivity the mark by which sensory experience can be distinguished from imagery (Berkeley 1710/1965; Sartre 1940/1972; Wittgenstein 1967; McGinn 2004). This lack of responsiveness to the will is perhaps one reason to regard the *eigenlicht* as sensory rather than imagistic. In 1894, however, Ladd asserted that he and his students could form *eigenlicht* experiences by direct willing. (You'll recognize the beginning of this passage from the epigraph.)

What they were asked to do was briefly this: to close the eyes, allow the after-images completely to die away, and then persistently and attentively *to will* that the color-mass caused by the *Eigenlicht* should take some particular form, – a cross being the most experimented with.... Of the sixteen persons experimenting with themselves, four only reported no success; nine had a partial success which seemed to increase with practice and which they considered undoubtedly dependent directly upon volition; and with the remaining three the success was marked and really phenomenal. It should be said, however, that of the four who reported “no success,” only one appears to have tried the experiment at all persistently (p. 351-352; see also Tatibana 1938, p. 129).

I can find no recorded attempts to replicate Ladd's experiment.

The uncharted wilderness is behind your eyelids.

Why did the scientific study of the mind begin, historically, with the study of conscious experience? And why, despite that early start, have we made so little progress? The two questions can be answered together if we're victims of an epistemic illusion – if, though the stream of experience *seems* readily available, though it *seems* like low-hanging fruit for first science, in fact we're much better equipped to learn about the outside world. We're tempted to approach consciousness incautiously and it rebels. It leaps away or presents different faces when we approach it, and it won't comfortably wear our conceptions; we may never entirely master it. Should we leave it be, then, and study something less frustrating? Should we pursue only what yields easily to our methods?

I conclude with this chapter, rather than with the pessimism of Chapters 6 and 7, because my view is not uncompromisingly bleak. Though some crucial, foundational issues about consciousness may be intractable, or nearly so, at least in the medium term, other issues are, I think, merely difficult. Eyes-closed visual experience illustrates the situation – the historically patterned variety of opinion, the weird bloom of ensuing questions, the limited existing research, the dependence on probably unstable introspective judgments. It's unclear exactly how much progress we will make, in part because we haven't yet, really, given the scientific study of consciousness a proper try in full appreciation of its hazards.

¹ Goethe's *Theory of Colors* [1810/1840/1967] anticipates Purkinje's work partly but not fully. Goethe's subjective observations about color range widely but tend to be brief and lacking detail. Contrast, for example, the amount of detail in Goethe's and Purkinje's remarks about the wandering cloudy stripes below.

² If you're looking at this footnote, maybe you're just the sort of person who will embarrass me by finding discussions I've missed. They must be out there.

³ Rapport describes "Upon the dark background... an increasing kaleidoscopic riot" (1949, p. 272). Hurvich and Jameson, apparently summarizing the earlier literature, describe "floating light spots... of many forms peculiar to the individual observer", sometimes looking "like curved bands with dark intervals between them", sometimes "cloudlike streamers and ribbons" or "circular waves... clouds, specks, ribbons, swirls, and the like" (1966, p. 20-21). (I suppose Hurvich and Jameson are a partial exception to the statement with which I close section iii. They seem to have been very influenced by 19th century physiology and psychology, as – among other things – translators of Hering.) Horowitz quotes the following verbal report: "When I close my eyes I see darkness but then it lightens to gray. Next I see colored lights and sometimes very complex geometric forms that dance, rotate, or sparkle about" (1970, p. 11). Sorenson describes the experience as initially black, then defaulting to a very dark "brain gray" (the term seems to trace back to G.E. Müller), affected by retinal noise of "shifting clouds of floating light spots" and "retinal light swirls" (2004, p. 476).

Discussions also sometimes appear in works intended for non-academic audiences. Bates, in *The Bates Method for Good Sight Without Glasses*, writes:

It is impossible to see a perfect black unless the eyesight is faultless, because only then is the mind at rest; but some people can without difficulty approximate such a black nearly enough to improve their eyesight, and as the eyesight improves the deepness of the black increases. People who fail to see even an approximate black when they [cover their closed eyes with the palms of their hands] state that instead of black they see streaks or floating clouds of grey, flashes of light, patches of red, blue, green, yellow, etc. (1944, p. 54).

Note that Bates's view agrees with Fechner's: Seeing colors is symptomatic of pathology (though Fechner may have had more severe pathology in mind). Purkinje and Helmholtz, in contrast, suggest that weak vision makes it impossible to see forms in the *eigenlicht*. McCrone, writing for a popular science audience, says

It is easy to assume that when we shut out [sic] eyes, we should see just blackness. However if we stare into this void, we soon will notice thousands of shimmering points of light.... If we remain with our eyes shut, the *eigenlicht* does not fade but in fact becomes more active. Often flashes of colour, like summer lightning, will flare... (1993, p. 176-177).

⁴ In the 1950s, psychologists began to study the effects of days-long "sensory deprivation". Early reports emphasized hallucination (Bexton et al. 1954; Heron 1961). Later investigators often failed to replicate those results (Vernon et al. 1961; Zuckerman 1969; Suedfeld 1980), though Nigel Thomas has convinced me in conversation that at least some of the disagreement may be due to differing ideas about what qualifies as a "hallucination". Setting aside the work on (at most occasional) hallucinations, I have

found no careful studies of the basic visual phenomenology of subjects spending extended periods in absolute darkness. In any case, the effects of serious, prolonged sensory deprivation are not the topic of this chapter. Another related topic is the experience of the “ganzfeld” that is induced by presenting an unstructured field of light to the eyes (e.g., by shining light through two pingpong ball halves covering the eyes) and which is sometimes deployed in attempts to induce relaxation or discover paranormal phenomena. The ganzfeld is sometimes casually described as neutral gray. More serious phenomenological descriptions – variable, but often a gray cloud or fog with forms or colors – include Metzger 1930; Hochberg et al. 1951; Gibson and Waddell 1952; Avant 1965; and Gur 1989. Also, in what is known as Charles Bonnet Syndrome, people who lose their sight also sometimes report hallucinations (Bonnet 1760/1769, p. 176-178; Menon 2005).

Many people when falling asleep report “hypnagogic imagery” – vivid and fantastic images – and sometimes reports about hypnagogic imagery blur (legitimately or illegitimately) into reports about the *eigenlicht*. However, the topic of this chapter is not imagery experiences but rather, to the extent these can be kept distinct, *sensory* experiences with one’s eyes closed. Seminal sources include Müller 1826/1927 and Maury 1861/1878. See Schacter 1976 for a historically informed review.

⁵ In lightless caves, where not a single photon penetrates the darkness, people often report nonetheless being able to see their hands waving before their faces. They never see their friends’ hands. Call this the spelunker illusion. One possible explanation is the brain’s motor output is actually creating hints of visual experience in accord with that output. Another possible explanation is that since you know how you are moving

your hand, you interpret the low-level sensory noise in conformity with your knowledge (as you might see a meaningful shape in a random splash of line segments). Or maybe there is no visual experience of motion and the spelunker only mistakenly thinks there is. In the eyes closed experiment, something similar to the spelunker illusion may partly explain my seemingly better perception of my own hand than my friend's.