

“Seen in my visions”:  
Klüver Form-Constant Visual  
Hallucinations in William Blake’s  
Paintings and Illuminated Books

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1 THIS essay introduces a novel method for assigning the incidence of Klüver form-constants, one type of visual hallucination, to their occurrence in Blake’s visual art. It also outlines a specific neurophysiology for some of the events that Blake referred to as “visions.” In short, I will argue that Blake’s paintings, including the designs in the illuminated books, suggest that he experienced Klüver form-constant visual hallucinations beginning no later than 1793 and possibly as early as c. 1780. These entoptic percepts were first described and classified in 1926 by the biological psychologist Heinrich Klüver (1897–1979).<sup>1</sup> Klüver form-constants have neural correlates. They would have appeared to Blake, with his eyes open or closed, as self-luminous geometric patterns on his retina. Their distinctive geometric patterns enable the identification of their presence in Blake’s art and allow an association to be made be-

tween their occurrence and the origins of his creative processes. Form-constants were one of several visual and auditory phenomena he called “visions.” The methodology employed here, when used in conjunction with Martin Butlin’s catalogue raisonné and other scholarship on the materiality of Blake’s art, holds out the potential of charting the incidence, prevalence, and distribution of this specific type of “visionary” creative origin in Blake’s artistic output. It offers the possibility of disaggregating the neural basis of Blake’s “visions” and analyzing their individual phenomenological characteristics.

2 That Blake was a “visionary” who had “visions” is a claim that he made about himself and that his contemporaries repeated; it has also become a description routinely included in the discourses of museum curators and literary critics, and in communications to the reading and gallery-going public. The idea that his “visions” had a neurophysiological origin, with an identifiable pathology and phenomenology, has not been considered.

3 Blake experienced “visions” throughout his life, although, as I argue below, their phenomenology suggests several different modalities. Three data points help catalogue their childhood onset and persistence into late life. His earliest visual hallucination, recorded in 1863 as a third-party anecdote by Alexander Gilchrist, occurred on Peckham Rye, London, when he was about eight or ten years old (“Sauntering along, the boy looks up, and sees a tree filled with angels, bright angelic wings bespangling every bough like stars”).<sup>2</sup> This “vision” of bright, shimmering or glittering points of light is likely to have been migraine aura. About 7–11% of children and adolescents experience migraine, with about 25% of those having migraine with aura.<sup>3</sup> In 1809, when he was about fifty-two, Blake wrote in *A Descriptive Catalogue* that some of the pictures were painted from the “wonderful originals *seen* in my visions” (E 531; my italics). Less than two years before Blake’s death, Henry Crabb Robinson, visiting him at Fountain Court, Strand, recorded how “he reverted soon to his favorite expression ... my visions—.”<sup>4</sup>

2. G. E. Bentley, Jr., *Blake Records*, 2nd ed. (New Haven: Yale University Press, 2004) [hereafter *BR(2)*] 10, quoting Gilchrist. Samuel Palmer’s account is simpler: “When very young Blake used to go out for walks in the country & would frequently come home & describe the angels he had seen in the trees” (*BR(2)* 10).

3. A. A. Gelfand, H. J. Fullerton, and P. J. Goadsby, “Child Neurology: Migraine with Aura in Children,” *Neurology* 75.5 (2010): e16–19; I. Petrusic, V. Pavlovski, D. Vucinic, and J. Jancic, “Features of Migraine Aura in Teenagers,” *Journal of Headache and Pain* 15 (2014): 87.

4. 17 Dec. 1825; see *BR(2)* 427.

1. Heinrich Klüver, “Mescal Visions and Eidetic Vision,” *American Journal of Psychology* 37 (1926): 502–15; William A. Hunt, “Heinrich Klüver: 1897–1979,” *American Journal of Psychology* 93 (1980): 159–61.

- 4 Ignored by art historians and literary critics alike, the possibility of a neural origin for Blake's "visions" was the subject of a short but significant exchange of correspondence initiated by Bristol surgeon George Munro Smith (1856–1917) in 1909 in the *British Medical Journal (BMJ)*.<sup>5</sup> Munro Smith made an explicit connection between Blake's "visions" and migraine aura at a time when the disorder's neural basis was only just beginning to be understood. Migraine is one of several inducers of Klüver-type visual hallucinations. His insight was missed by subsequent generations of scholars. Blake's imputed insanity had already become academically institutionalized, as evidenced in the 1895 verdict of Richard Garnett, the British Museum's keeper of printed books, that Blake was "mentally warped."<sup>6</sup>

### Research Parameters and Methodology

- 5 There are several caveats and critical parameters that need to be stated in order to avoid misunderstanding about what is (and is not) being claimed.

(i) This essay covers only one type of Blake's visual hallucinations. It is likely that he experienced several other hallucinatory types, some of which occurred in both visual and auditory modalities.

(ii) The essay is confined to studying Klüver form-constant visual hallucinations. These are self-luminous geometric percepts that would have appeared to Blake within his visual field (both exoptical and entoptical)—that is, with eyes open or eyes closed, whatever the level of ambient light, including complete darkness. They were percepts propagated along Blake's neural pathways, originating in the primary visual cortex (V1) and signaled to his retina.

(iii) It is not claimed that "visions" were the only experiences or influences affecting Blake's creativity, his concept of self-identity, or his aesthetic preferences. There is abundant scholarship on environmental factors influencing his creativity, some of which, where relevant, is repeated here. Environment, for the purposes of this essay, means all aspects of nurture and the determination of self- and social identity (for example,

nativity, social and political culture, race, class, aesthetics, and religion).

(iv) The perception of Klüver form-constant hallucinations, as the outcome of neural networks, occurs in *Homo sapiens* as a species, without regard to historical time or environment (although different cultural attitudes, historical and contemporary, affect its reporting). I am not aware that Klüver-type visual hallucinations are physiologically different across genders.

(v) This essay has little to say about connections between Blake's neural pathways and his mind or consciousness (for example, the state of his psychological health). Nevertheless, V1 is an area of cortex. The clinical neuroscientist Dominic H. ffytche makes a helpful suggestion for more easily conceptualizing V1's cognitive status: "If we use the folk terminology of a *mind's eye* (the inner space in which we consciously experience visual imagery), activity in specialized visual cortex could be conceived as the *eye's mind*. In the *eye's mind*, visual experience becomes related to mind."<sup>7</sup> As ffytche states elsewhere, there is evidence of "co-localization of perceptual and non-perceptual activity within individual cortical areas."<sup>8</sup>

(vi) The essay's working assumption is that Blake incorporated Klüver form-constants into his visual art by copying and creatively developing the percepts he saw in his visual field—see (ii). Klüver geometric patterns originating in V1 created a hallucinatory image directly onto his retina through retinocortical mapping.<sup>9</sup> V1, as described in (v), is a cognitive area of cortex, "the *eye's mind*," as ffytche puts it.

### The Physiology and Phenomenology of Blake's "Visions"

- 6 Blake's "visions" persisted throughout his life. Today they would be called hallucinations, a term not available clinically until Jean Étienne Dominique Esquirol's *Des maladies mentales, considérées sous les rapports médical, hygiénique et médico-légal* (Paris, 1838). Because Blake lacked such a conceptual vocabulary, his ability to self-diagnose (or be diagnosed) and articulate his experiences was limited. That

5. George Munro Smith, "Literary Notes," *BMJ* 2541 (11 Sept. 1909): 710, and "William Blake's Drawings," *BMJ* 2544 (2 Oct. 1909): 1012. They are not included in Bentley's *Blake Books* (1977) or *Blake Books Supplement* (1995), but appear in "William Blake and His Circle: A Checklist of Publications and Discoveries in 2012," *Blake* 47.1 (summer 2013).

6. Colin Trodd, *Visions of Blake: William Blake in the Art World, 1830–1930* (Liverpool: Liverpool University Press, 2012) 375–78, quoting Richard Garnett, *William Blake: Painter and Poet* (1895) 75.

7. Dominic H. ffytche, "The Hallucinating Brain: Neurobiological Insights into the Nature of Hallucinations," *Hallucination: Philosophy and Psychology*, ed. Fiona Macpherson and Dimitris Platchias (Cambridge, MA: MIT Press, 2013) 45–63 (on 53).

8. Dominic H. ffytche, "Neural Codes for Conscious Vision," *Trends in Cognitive Sciences* 6 (2002): 493–95.

9. S. W. Wilson, "On the Retino-Cortical Mapping," *International Journal of Man-Machine Studies* 18.4 (1983): 361–89.

he copied his entoptic percepts, as remarked in (vi) above, should not be controversial. On account of the absence of external stimuli, hand-drawn illustrations have always played an important part in understanding the phenomenology of visual hallucinations.<sup>10</sup>

7 Although this essay is limited to the presence of Klüver form-constants, it is important to note that this type of visual hallucination is only one modality among several that Blake encountered. Most are common, or reasonably common, hallucinatory phenomena, the majority with a neural foundation. That Blake in mid- to late life experienced hypnagogic- and hypnopompic-induced auditory and visual hallucinations is most clearly evidenced in *Jerusalem* (written no earlier than 1804): “This theme calls me in sleep night after night, & ev’ry morn / Awakes me at sun-rise, then I see the Saviour over me / Spreading his beams of love, & dictating the words of this mild song” (4.3-5, E 146). In this example, expressed through the figure of Albion, hypnagogic triggers of hallucination occur in the phrase “This theme calls me in sleep night after night” and hypnopompic in “& ev’ry morn / Awakes me.”

8 Even this short passage contains complexities. Auditory verbal hallucinations in command mode (“This theme *calls me*,” “*dictating* the words”; my italics) sometimes indicate psychosis, but in Blake’s case, in the absence of any social dysfunction, they are more likely to have been misattributed inner speech. This is congruent with the normal subvocalized inner speech that most of us practice as a cognitive aid for encountering our environment.<sup>11</sup> Blake hears “words,” which are specifically in grapheme mode (not hallucinations experienced as other types of sound or as colors). His seeing “the Saviour over me / Spreading his beams of love” may also imply a felt-presence experience, a phenomenologically distinct third modality of hallucination, in addition to visual and auditory. Felt-presence hallucinations have been recorded in cases of migraine aura.<sup>12</sup> Blake’s experience of several hallucinatory types, possibly concurrently—as *Jerusalem* suggests—is consistent with a hodological model. ffytche has argued that hallucinations originate not from changed activities within specific brain areas (a brain “topology” argument) but from altered con-

nections between brain areas (a brain “hodology” argument).<sup>13</sup>

9 In order to understand the physiological background and the phenomenology of Blake’s visual hallucinations, it is important to set out, as far as possible, the status of his general health, particularly where this might have a bearing on his susceptibility to hallucinations, illusions, or delusions. Apart from the possibility of childhood migraine (a condition that may have persisted into adulthood), indicated by the description of the Peckham Rye “vision,” he was in good neurological health. The clarity of his perception of Klüver patterns, which form the basic building blocks of vision, suggests that he had a neurologically healthy V1. He appears to have avoided the motor and neurological damage caused by lead poisoning from pigments, despite the high probability of its presence in similarly prolific artists, such as Michelangelo and Blake’s contemporary Goya.<sup>14</sup> Dangers to watercolorists from lead and copper poisoning were understood in Britain by 1784.<sup>15</sup> Blake may have taken steps to avoid the worst dangers. A modern retropathology of his physical morbidity did not note any cognitive impairment.<sup>16</sup> The astonishing manual dexterity and visual acuity of *Illustrations of the Book of Job* (1826), produced by engraving (a method requiring much greater motor control than etching), evidence no decline in late life.

10 Beyond the possibility of intermittent migraine with aura, the occurrence of hallucinations in visual modalities does not imply any unusual disorder, impairment, or deterioration in Blake’s normal visual field. He may have introduced measures to correct his sight for aging. Seymour Stocker Kirkup recalled Blake’s copying (the copy of) the Laocoön statue at the Royal Academy, wearing “his spectacles up

10. G. D. Schott, “Exploring the Visual Hallucinations of Migraine Aura: The Tacit Contribution of Illustration,” *Brain* 130 (2007): 1690-1703.

11. Sam Wilkinson, “Accounting for the Phenomenology and Varieties of Auditory Verbal Hallucination within a Predictive Processing Framework,” *Consciousness and Cognition* 30 (2014): 142-55. Another possibility is that this was one of the variants of synaesthesia, a topic beyond the scope of this essay.

12. Klaus Podoll and Derek Robinson, *Migraine Art: The Experience from Within* (Berkeley: North Atlantic Books, 2008) 123.

13. Dominic H. ffytche, “The Hodology of Hallucinations,” *Cortex* 44 (2008): 1067-83; Rowena Carter and Dominic H. ffytche, “On Visual Hallucinations and Cortical Networks: A Trans-diagnostic Review,” *Journal of Neurology* 262 (2015): 1780-90.

14. Julio Montes-Santiago, “The Lead-Poisoned Genius: Saturnism in Famous Artists across Five Centuries,” *The Fine Arts, Neurology, and Neuroscience: Neuro-Historical Dimensions*, Progress in Brain Research vol. 203, ed. Stanley Finger, Dahlia W. Zaidel, François Boller, and Julien Bogousslavsky (Amsterdam: Elsevier, 2013) 223-40. Bartłomiej Piechowski-Jozwiak and Bogousslavsky consider migraine in the same volume, but their chapter, “Neurological Diseases in Famous Painters,” makes no reference to Blake.

15. John Fothergill, “Observations on Disorders to Which Painters in Water-Colours Are Exposed,” *The Works of John Fothergill, M.D. ... with Some Account of His Life by John Coakley Lettsom*, 3 vols. (1784) 3: 377-81; Margaret DeLacy, “Fothergill, John (1712-1780),” *Oxford Dictionary of National Biography* (Oxford: Oxford University Press, 2004; online ed., Oct. 2007) <<http://www.oxforddnb.com/view/article/9979>>, accessed 3 March 2015.

16. Lane Robson and Joseph Viscomi, “Blake’s Death,” *Blake* 30.2 (fall 1996): 36-49.

side down & he says they were made on purpose to be worn so. ... Reversing the spectacles assisted him, as it raised them, the convexity resting upon his nose—he said it was better so than a double concave as they sometimes are.”<sup>17</sup> His eccentric appearance notwithstanding, Blake was quite reasonably modifying his sight with adjustments he could easily implement. A pair of contemporary iron-framed spectacles (Fitzwilliam Museum, Cambridge), traditionally associated with Blake at the time of his death, was dispensed within a normal prescription range for correcting short sight.<sup>18</sup> Robin Hamlyn, referencing the spectacles and the close work required for engraving, suggests that Blake “was ‘moderately’ myopic ... his near vision was much sharper than his distance vision, so close work would have come more naturally to him.” Incidentally, Hamlyn provides a useful examination of the direction of natural light in the houses that Blake worked in (also comparing it to light preferences among his more successful contemporaries). He notes that “during his working life Blake’s studio or workroom light came from all points of the compass.”<sup>19</sup>

- 11 These factors reduce the possibility that his “visions” were visual illusions or delusions arising from the misinterpretation of shadows or unusual light sources. A visual delusion hypothesis was rejected no later than 1964 by Nobel Prize co-winner Sir John Eccles: “The optical reality of the visions involved no act of credence on Blake’s part, because the eidetic image is actually seen. Nor did he confuse his visions with the appearance of material objects.”<sup>20</sup> Blake would fail many modern tests for visual delusion, mainly on the grounds that he functioned normally on a day-to-day basis (no face recognition problems, for example).<sup>21</sup> His auditory hallucinations, including the “Visionary Heads” (c. 1819–25), which were triggered by responses to speech, have pathologies beyond the scope of the present essay.

17. *BR*(2) 290.

18. G. E. Bentley, Jr., with the assistance of Keiko Aoyama, “William Blake and His Circle: A Checklist of Publications and Discoveries in 1995,” *Blake* 29.4 (spring 1996): 140–41.

19. Robin Hamlyn, “William Blake at Work: ‘Every thing which is in Harmony,’” *William Blake: The Painter at Work*, ed. Joyce H. Townsend and Robin Hamlyn (London: Tate Publishing, 2003) 12–39 (on 24–25).

20. Joseph Burke, “The Eidetic and the Borrowed Image: An Interpretation of Blake’s Theory and Practice of Art,” *In Honour of Daryl Lindsay: Essays and Studies*, ed. Franz Philipp and June Stewart (Melbourne: Oxford University Press, 1964) 110–27 (on 116).

21. P. R. Corlett, “Delusions,” *Encyclopedia of Human Behavior*, 2nd ed., ed. V. S. Ramachandran (San Diego: Academic Press, 2012) 667–73. For a wider discussion, see Richard Dub, “Delusions, Acceptances, and Cognitive Feelings,” *Philosophy and Phenomenological Research* 94 (2017): 27–60. P. R. Corlett, J. R. Taylor, X. J. Wang, P. C. Fletcher, and J. H. Krystal cite some of the more common pathologies of delusion in “Toward a Neurobiology of Delusions,” *Progress in Neurobiology* 92 (2010): 345–69.

- 12 Of the testimonies of contemporaries as to the subjective or phenomenological nature of Blake’s “visions,” perhaps the most interesting is an anecdote by the painter Samuel Palmer, who met Blake for the first time in the early 1820s, no later than May 1824. On 11 May 1859, J. C. Strange noted, “I had a lengthy discussion with M<sup>r</sup>. P. on the nature of Blakes visions—M<sup>r</sup>. P. on the whole thought they were seen as real objects by his outward eyes and as such painted.”<sup>22</sup> Palmer gave the impression that Blake’s “visions” were usually tangible “objects”; this is consonant with the nature of Klüver form-constants, which are projections from V1 onto the retina and would have been “seen as real objects by his outward eyes.” Palmer’s report is significant because of his close friendship with Blake,<sup>23</sup> his testimony accords with the understanding of Crabb Robinson, who wrote to Dorothy Wordsworth in 1826 that Blake’s “paintings are copies of what he sees in his Visions.”<sup>24</sup>

- 13 Yet it is important to realize that Blake’s Klüver form-constant “visions” were not passive retinal events. He says that “Vision is seen by the [*Imaginative Eye*] of Every one” (E 554; italics and square brackets in E, indicating a deletion), which is consistent with ffytche’s comments about the “*eye’s mind*” (noted in [v] above). “Vision,” based on visual hallucinations propagating from V1, is a cognitive event—or, as Blake tentatively describes it, it is “Imaginative,” using a term with a high cultural valency in European Romanticism. As he may have suspected, without being aware of the physiological basis, it is “seen by ... Every one” because all members of the species *Homo sapiens* have the same neurological wiring.

### Klüver Form-Constants

- 14 As noted, Klüver form-constants are the percepts of a specific type of visual hallucination originating in V1. They are geometric-patterned phosphenes perceived as self-luminous entoptic hallucinations in the visual field.<sup>25</sup> Klüver defines four form-constant patterns: tunnel, spiral, net or lattice, and cobweb or concentric circles (see *illus. 1*):

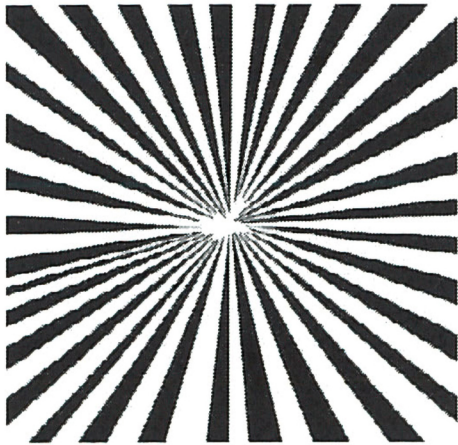
The author’s analysis of the hallucinatory phenomena appearing chiefly during the first stages of mescaline intoxication yielded the following form-constants: (a) grating, lattice, fretwork, filigree, honeycomb, or chessboard; (b) cobweb; (c) tunnel, funnel, alley, cone, or vessel; (d) spiral. Many [hallucinatory] phenomena are, on close exami-

22. *BR*(2) 729.

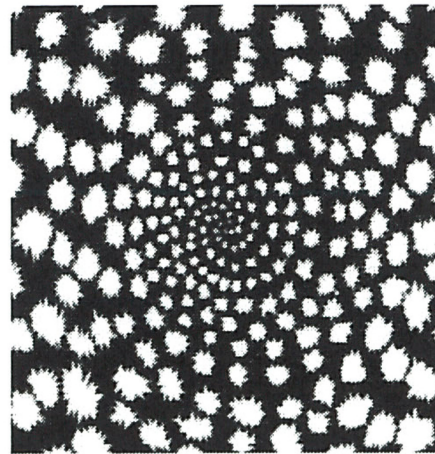
23. G. E. Bentley, Jr., *The Stranger from Paradise: A Biography of William Blake* (New Haven: Yale University Press, 2001) 404–09.

24. *BR*(2) 437.

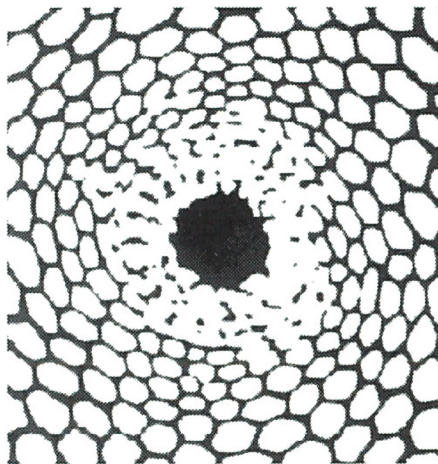
25. Phosphenes (from the Greek *phos*, light, and *phainein*, to show) are entoptic flashes of light propagated from V1.



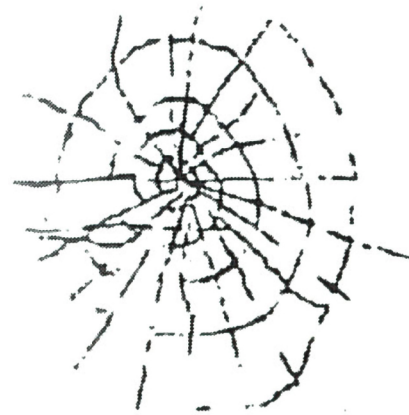
(I)



(II)



(III)



(IV)

1. Hallucinatory form-constants: (I) tunnel/funnel; (II) spiral; (III) lattice/honeycomb; (IV) cobweb.

Figure 1 in Paul C. Bressloff, Jack D. Cowan, Martin Golubitsky, Peter J. Thomas, and Matthew C. Wiener, "What Geometric Visual Hallucinations Tell Us about the Visual Cortex," *Neural Computation* 14.3 (March 2002): 473-91. © 2002, Massachusetts Institute of Technology.

Bressloff et al. redrew (I), (II), and (III) from representations of drug-induced hallucinations by David

Sheridan in Ronald K. Siegel and Murray E. Jarvik, "Drug-Induced Hallucinations in Animals and Man," *Hallucinations: Behavior, Experience, and Theory*, ed. R. K. Siegel and L. J. West (New York: John Wiley & Sons, 1975) 81-161. They redrew (IV) from Alex Patterson, *A Field Guide to Rock Art Symbols of the Greater Southwest* (Boulder: Johnson Books, 1992).

nation, nothing but modifications and transformations of these basic forms.<sup>26</sup>

These shapes occur repeatedly in Blake's paintings and in the designs to the illuminated books.

- 15 There are no other patterns associated with Klüver form-constants, although all four may appear, wholly or in part, in amalgamation, overlaying each other. Klüver's categories have been validated by two key sets of mathematical proof, by Ermentrout and Cowan (1979) and Bressloff, Cowan, et al. (2001).<sup>27</sup> These two studies, foundational to this essay, establish that the four form-constants have neural correlates in V1—that is, the neural architecture of V1 is configured so as to produce those four patterns as the basic elements of vision. The enduring importance of Klüver form-constants lies in their stability (on account of their occurring in only these patterns), which affords the opportunity to study the neural architecture of V1.
- 16 Klüver form-constant hallucinations are propagated by neural activity in V1 projecting onto the retina through retinocortical mapping (see [vi]). In normal exoptical vision, stimuli in the external visual field (a tree, a horse, etc.) are signaled from the retina to V1; in the case of Klüver form-constants, the signaling of stimuli or neural activity moves in the opposite direction, propagating from V1 but perceived on the retina. As Bressloff and Cowan state, "Any spontaneously generated or stimulus-evoked cortical activity pattern in V1 maps to a corresponding real or hallucinatory image on the retina."<sup>28</sup> Or, as Cowan puts it, this model of exoptical and entoptical perception "treats V1 as a cortical retina."<sup>29</sup> The four Klüver patterns enable V1 to process the basic contours of images that *Homo sapiens* has most urgently needed to prioritize (V2, V3, etc.—later visual cortex—process less frequently encountered shapes). In this sense, V1 has had a primary evolutionary role in the development of *Homo sapiens*. Discovering the neural correlates

of visual hallucination has also had a profound impact on understanding the relationship between vision and cortical function. Crucially, V1's role as cortex means that it is not just a passive signaler of percepts. This may have been something that Blake was trying to grasp when he referred to the "Imaginative Eye."

#### Agents Inducing Klüver Form-Constants

- 17 The physiological mechanisms producing Klüver geometric-pattern formations arise from inhibition and activation series in neurons on V1, with activated neurons suppressing inhibited neurons and reinforcing their own activations.<sup>30</sup> There are multiple agents known to bring about these hallucinations.
- 18 Klüver gave mescaline (which, of course, would not have been available to Blake) to his volunteer subjects (and took it himself) in order to induce visual hallucinations for controlled experiments. Tobacco with high concentrations of nicotine is also known to give rise to Klüver-pattern hallucinations (it is not known whether Blake smoked).<sup>31</sup> There are also several naturally occurring agents of induction, the most basic of which is probably digital pressure on the eyeballs (although, in this case, there are vascular as well as neural elements).<sup>32</sup> One of the earliest records of the incidence of Klüver form-constants, suggesting light deprivation as the agent, comes from the philosopher Thomas Hobbes (1588–1679), who wrote that "a man shall in the dark, (though awake) have the Images of Lines, and Angles before his eyes."<sup>33</sup> Light deprivation during sleep may be implicit in the hypnagogic and hypnopompic hallucinations referred to in plate 4 of *Jerusalem*.
- 19 As mentioned earlier, Klüver form-constants are also a comorbidity of migraine aura. Propagated from V1, they are perceived by the retina as networks and patterns of phosphenes, self-luminous entoptical percepts caused by the migraine's cortical spreading depression (CSD), which crosses the visual field at a rate coincident with the period of the migraine attack. The shimmering arc of the CSD's phosphenes (often referred to as fortification spectra) replicates the shape of the depression's transit. In the words of Vincent A. Billock and Brian H. Tsou, "Simple hallucina-

26. Heinrich Klüver, "Mechanisms of Hallucinations," *Studies in Personality*, ed. Q. McNemar and M. A. Merrill (New York: McGraw-Hill, 1942) 175-207.

27. G. B. Ermentrout and J. D. Cowan, "A Mathematical Theory of Visual Hallucination Patterns," *Biological Cybernetics* 34 (1979): 137-50; Paul C. Bressloff, J. D. Cowan, M. Golubitsky, P. J. Thomas, and M. Wiener, "Geometric Visual Hallucinations, Euclidean Symmetry and the Functional Architecture of Striate Cortex," *Philosophical Transactions of the Royal Society of London B: Biological Sciences* 356 (2001): 299-330.

28. Paul C. Bressloff and Jack D. Cowan, "The Functional Geometry of Local and Horizontal Connections in a Model of V1," *Journal of Physiology—Paris* 97 (2003): 221-36.

29. Jack D. Cowan, "Geometric Visual Hallucinations and the Structure of the Visual Cortex," *The Neuroscience of Visual Hallucinations*, ed. Daniel Collerton, Urs Peter Mosimann, and Elaine Perry (London: John Wiley & Sons Ltd., 2014) 217-53 (on 228).

30. H. Henke, P. A. Robinson, P. M. Drysdale, et al., "Spatiotemporal Dynamics of Pattern Formation in the Primary Visual Cortex and Hallucinations," *Biological Cybernetics* 101 (2009): 3-18.

31. Ronald K. Siegel, "Hallucinations," *Scientific American* 237 (1977): 132-41.

32. Christopher W. Tyler, "Some New Entoptical Phenomena," *Vision Research* 18 (1978): 1633-39.

33. Thomas Hobbes, *Leviathan, or The Matter, Forme and Power of a Commonwealth Ecclesiasticall and Civill* (1651) 6.

tions (phosphenes and fortification auras) are linked to the Klüver forms and to pattern-forming cortical mechanisms.”<sup>34</sup> The combination of migraine aura with “chequered” or lattice Klüver form-constants was observed in forty-six of 397 paintings made by anonymous artists who drew their migraine percepts in surveys conducted in the 1980s.<sup>35</sup>

- 20 Light flickering at a frequency above 3Hz (just enough to feel uncomfortable) induces a variety of phosphenes, including Klüver-type percepts. When twenty modern German graphic-design students were subjected to flickering light, they identified a large range of entoptic percepts, including ripples, tunnels, suns, rasters, honeycombs, cracks, drains, bows, clouds, spots, stars, crosses, spirals, and wheels, some of which seem to include Klüver elements.<sup>36</sup>
- 21 Although it is unlikely that Blake would have encountered the research, flickering-light hallucinations, together with hallucinations caused by the close work required by printmaking, were the subject of important investigations in the late 1810s. This is the groundbreaking work of the Bohemian anatomist and physiologist Jan Evangelista Purkinje (Purkině) (1787–1869).<sup>37</sup> In his doctoral dissertation at the University of Prague in 1819, republished in 1823, Purkinje recorded the first scientific observations of flicker-light and electrically induced visual hallucinations.<sup>38</sup> His experiments produced patterned hallucinatory phenomena (although apparently not Klüver-type percepts) cognate with phosphenes or photopsias.<sup>39</sup> Sometimes they were induced by digital pressure on the eyes; at other times waving his spread-out fingers in front of his eyes while looking at the sun resulted in flickering light.
- 22 Other experiments involved looking closely and fixedly at the parallel printed lines produced by copperplate etchings

34. Vincent A. Billock and Brian H. Tsou, “Elementary Visual Hallucinations and Their Relationships to Neural Pattern-Forming Mechanisms,” *Psychological Bulletin* 138 (2012): 744–74.

35. Podoll and Robinson 176, 201–12, table 7.5.

36. Carsten Allefeld, Peter Pütz, Kristina Kastner, and Jiří Wacker-mann, “Flicker-Light Induced Visual Phenomena: Frequency Dependence and Specificity of Whole Percepts and Percept Features,” *Consciousness and Cognition* 20 (2011): 1344–62, figure 9.

37. P. Schweitzer, “Profiles in Cardiology: Jan Evangelista Purkinje (Purkině),” *Clinical Cardiology* 14 (1991): 85–86; Andrzej Grzybowski and Krzysztof Pietrzak, “Jan Evangelista Purkynje (1787–1869),” *Journal of Neurology* 261 (2014): 2048–50.

38. Jan Purkinje, *Beobachtungen und Versuche zur Physiologie der Sinne (Observations and Experiments Investigating the Physiology of Senses)* (Prague, 1823). An English translation is included in Nicholas J. Wade and Josef Brožek, *Purkinje's Vision: The Dawning of Neuroscience* (Mahwah, NJ: Lawrence Erlbaum Associates, 2001). Subsequent references to Purkinje use Wade and Brožek's edition.

39. fytche, “The Hodology of Hallucinations.”

and engravings (“Parallellinienfeld in einem Kupferstiche”). This is how Purkinje describes one experiment:

XV. For some time I have noted an unclear glimmering when I looked steadily at a field of parallel lines precisely engraved on a copper plate [print]. When I move the page forward or backward or around a central point, the vision reveals blurry streaks and the individual lines become undistinguishable. When the lines are horizontal, the streaks are also horizontal but somewhat irregular. The vertical lines remain vertical, whereas in a field of concentric lines the shadowy segments move in a circle. For a long time I was unable to interpret the phenomenon.<sup>40</sup>

Purkinje's “unclear glimmering” “blurry streaks,” and “shadowy segments mov[ing] in a circle” were flicker-light-induced afterimages caused by “mov[ing] the page forward or backward or around a central point.” It is possible that Blake, while etching or engraving, slowly rotated the “engraver's boss,” the sand-filled leather pillow that helped embed the copperplates as he worked on them, altering their orientation to his line of sight (although it seems unlikely that he did this with any rapidity).<sup>41</sup> Although the single illustrative etching that accompanies Purkinje's book (based on his sketches of the percepts) does not show Klüver shapes, Billock and Tsou remind us of “the blurry distinction between phosphenes and Klüver forms”—that is, phosphenes scaled up into clusters appear to adopt the same symmetries of shape as form-constants.<sup>42</sup>

- 23 Purkinje deliberately set out to induce hallucinations, but we cannot rule out the possibility that, on occasion, Blake hallucinated some types of percept during his professional practice as an engraver. In such a case, apart from the Peckham Rye episode of his childhood, this might date his hallucinatory experiences back to 1772 and the beginning of his apprenticeship to James Basire.

#### Example 1: *Jacob's Ladder*, c. 1805

- 24 Those with even a cursory knowledge of the range of Blake's images will probably know his pen and watercolor drawing *Jacob's Dream* (c. 1805, British Museum) (illus. 2),

40. Wade and Brožek 87.

41. David Drakard and Paul Holdway, *Spode: Transfer Printed Ware 1784–1833*, rev. ed. (Woodbridge, Suffolk: Antique Collectors' Club, 2002) 45.

42. Vincent A. Billock and Brian H. Tsou, “Neural Interactions between Flicker-Induced Self-Organized Visual Hallucinations and Physical Stimuli,” *Proceedings of the National Academy of Sciences* 104 (2007): 8490–95; “Elementary Visual Hallucinations and Their Relationships to Neural Pattern-Forming Mechanisms,” *Psychological Bulletin* 138 (2012): 744–74.

exhibited first at the Royal Academy in 1808.<sup>43</sup> A year after the Royal Academy exhibition (where it remained unsold), Blake retitled it *Jacob's Ladder*, a "Drawing," and showed it at his private exhibition off Oxford Street in 1809. At some point, probably during his lifetime, it was acquired by his long-term patron Thomas Butts. Its status as one of Blake's rare Royal Academy pictures, its place in the 1809 exhibition, and the reliability of its provenance make it a significant composition.

- 25 The picture has attracted limited critical attention, although a recent essay by Jonathan Roberts (see below) is an exception. It is not discussed in David Bindman's *Blake as an Artist* (1977) or Christopher Heppner's *Reading Blake's Designs* (1995), still the two most substantial monographs on Blake's visual art. Perhaps the most pertinent comment is that of Anthony Blunt, who describes it as "a complete novelty in the iconography of this subject."<sup>44</sup>
- 26 As the subject is Blake's visualization of a biblical figure's dream, it would be difficult to argue that it is anything other than a representation of an experience known to lack external stimuli. *Jacob's Ladder* is dominated by an image of a symmetrical spiral staircase, apparently made of stone, on which are seen "the angels of God ascending and descending." The stairs rise in at least two vertical revolutions. Near the top, they disappear into a circle radiating spoke-like bars of light, representing the entrance into heaven. The two compositional structures in the picture are a spiral and a funnel or tunnel, conforming to two of the four form-constants described by Klüver.
- 27 There are good neurophysiological reasons why a spiral form was adopted by Blake for this work. The perception of the orientation of optical objects, principally through their edges or contours, is a crucial function of cortex. Spirals, lattices, and cobwebs have distinct edges and contours, facilitating fluent visual perception. The process of decoding these signals by the cortex is only beginning to be understood, offering the theoretical prospect of being able to "read out the detailed contents of a person's mental state."<sup>45</sup> The discrimination of spiral and radial forms, two of Klüver's form-constants, is foundational to visual percep-

tion on account of their structural role in V1. Recent research has detected a radial orientation bias in early visual cortex, including V1—that is, radial edges (such as those represented by the spokes of light in *Jacob's Ladder*) are processed by the cortex more fluently than other shapes. One paper claims that there is "evidence for an enhanced sensitivity to radial orientations in human perception," arguing that the evidence is so "robust" that "a radial bias may be neurally fundamental."<sup>46</sup> Such a neurophysiology appears to be consistent with fytche's observation that there is "co-localization of perceptual and non-perceptual activity within individual cortical areas" (see [v] above). I believe that the choice of dominant Klüver-pattern spiral and radial structures in *Jacob's Ladder* provides a good demonstration of V1's cognitive role and implies that Blake had insight into his visual hallucinations.

- 28 Spiral forms are important in Blake's art and poetry.<sup>47</sup> As part of an explanation of "the hermeneutic of his [Blake's] Christological 'fourfold vision,'" Jonathan Roberts offers an elegant discussion of *Jacob's Ladder* by setting it in the context of poems that Blake sent to friends upon his arrival in Felpham in September 1800. He makes an important connection between imagery in "To my dear Friend M<sup>rs</sup> Anna Flaxman" and the spiral structure of *Jacob's Ladder*.<sup>48</sup> Blake refers to "Sweet Felpham," where "The Ladder of Angels descends thro the air / On the Turret its *spiral* does softly descend / Thro' the village then winds at My Cot i[t] does end" (E 709; my italics). The emphasis on the descent of a kind of spiral divine creativity in this poetic image provides an important correlate for the role of the Klüver form-constant patterns at what was a significant moment in Blake's artistic life.
- 29 For the first time, *Jacob's Ladder* and one of Blake's poetic images can reliably be associated with the cognitive outcome of a specific type of visual hallucination (Klüver spiral form-constants), or what Blake later called, in an attempt to describe the experience of V1's cognitive capacity, a "Vision ... seen by the [*Imaginative Eye*]."

43. Blake inscribed "Genesis XXVIII c.12v", which reads: "And he dreamed, and behold a ladder set up on the earth, and the top of it reached to heaven: and behold the angels of God ascending and descending on it"; Martin Butlin, *The Paintings and Drawings of William Blake*, 2 vols. (New Haven: Yale University Press, 1981) [hereafter Butlin] #438.

44. Anthony Blunt, *The Art of William Blake* (New York: Columbia University Press, 1959) 37.

45. Y. Kamitani and F. Tong, "Decoding the Visual Subject and Subjective Contents of the Human Brain," *Nature Neuroscience* 8 (2005): 679-85.

46. Yuka Sasaki, Reza Rajimehr, Byoung Woo Kim, Leeland B. Ekstrom, Wim Vanduffel, and Roger B. H. Tootell, "The Radial Bias: A Different Slant on Visual Orientation Sensitivity in Human and Non-human Primate," *Neuron* 51 (2006): 661-70.

47. For spirals derived from religious and scientific texts that Blake might have known, see Marsha Newman, "'Milton's Track' Revisited: Visual Analogues to Blake's Vortex in the 'Law Edition' of Boehme," *Interdisciplinary Literary Studies* 5.2 (2004): 73-93.

48. Jonathan Roberts, "William Blake's Visionary Landscape near Felpham," *Blake* 47.2 (fall 2013): 39 pars.



2. William Blake, *Jacob's Ladder* (c. 1805). 39.8 x 30.6 cm. British Museum. 1949,1112.2. Photo: © The Trustees of the British Museum. All rights reserved.



3. William Blake, *Milton's Mysterious Dream* (c. 1816–20). 16.3 x 12.4 cm. Morgan Library & Museum. 1949.4:11. Purchased with the assistance of the Fellows with the special support of Mrs. Landon K. Thorne and Mr. Paul Mellon. Image courtesy of the *William Blake Archive*.

**Example 2: Milton's *Mysterious Dream*, c. 1816–20**

- 30 No later than 1816–20 and his watercolor *Milton's Mysterious Dream* (Morgan Library, Butlin #543.11) (illus. 3), Blake had identified, named, and discriminated three out of the four form-constant hallucinatory types. In a brief commentary written to accompany the picture, he refers to “Scrolls & Nets & Webs” (E 685); these are the spiral, lattice, and cobweb percepts defined by Klüver a hundred years later. There is no conceivably relevant textual origin for scrolls, nets, or webs in Milton's poetic corpus.<sup>49</sup> Scrolls always end in a spiral, even if it is truncated. It is easy to see that, within the visual grammar that Blake used throughout his work, scrolls and spirals fitted in with convenient iconographies he could frequently redeploy. Of course, the spiral's appearance in *Milton's Mysterious Dream* is consistent with Blake's lifetime assertion of his experience of “visions” and how they formed the basis of his “visionary” art. The naming of three Klüver form-constants is a significant contribution toward understanding the cultural history of visual hallucinations, confirming that Blake had cognitive insight into those events and was able to provide an accurate nomenclature and taxonomy.
- 31 *Milton's Mysterious Dream* is the eleventh in a set of twelve particularly magnificent watercolors that Blake produced to illustrate Milton's poems *L'Allegro* and *Il Penseroso* (1645). According to his commentary, the Milton passage he chose to illustrate is “Entice the dewy featherd Sleep / And let some strange mysterous Dream / Wave on his Wings in airy stream.” As with *Jacob's Ladder*, his selection of a “strange mysterous Dream” may suggest that his Klüver-type percepts were the outcome of hypnagogic or hypnopompic hallucinations, similar to those he refers to in *Jerusalem*.
- 32 The *L'Allegro* and *Il Penseroso* watercolors demonstrate Blake's art at the height of his creativity. They are of special interest because they relate to Milton, the poet whose dominant poetic presence had already been the subject of the illuminated book *Milton* (1804–11). Some of the drawings bear the watermark “M & J LAY 1816”, indicating the earliest possible date for their execution (assuming, as looks stylistically likely, that Blake painted them as a group). Their provenance is fully traceable: they were acquired and probably commissioned by Thomas Butts, sold in 1853 as one lot by his son Thomas, and then passed through several hands before arriving at the Morgan in 1949. It is conceiv-

49. The only matches are: “The Lord shall write it in a Scrowle,” Psalm 87; “Rove without rein, till in the amorous Net,” *Paradise Lost* 11.586; “Part good, part bad, of bad the longer scrowle,” *Paradise Lost* 12.336; “Hearts after them tangl'd in Amorous Nets,” *Paradise Regained* 2.162. For webs or its synonyms, there are no matches.

able that Butts requested the unusual set of descriptive commentaries (also held at the Morgan), written in Blake's hand on a separate piece of paper for each picture in the series (E 682–86).

- 33 Critical opinion has not been particularly helpful in determining either the compositional contents of *Milton's Mysterious Dream* or its meaning. Butlin lists the already considerable body of critical literature on the set by 1981, commenting that it contains “contradictory” interpretations.<sup>50</sup> In relation to the details considered here, John E. Grant obliquely notices the netting; Bette Charlene Werner suggests the presence of a wider—if vaguer—symbolism (“the waters and nets of materiality”); and Stephen C. Behrendt, offering one of the more nuanced perspectives on the series, simply characterizes *Milton's Mysterious Dream* as “far more intense, far less conventional” than the rest.<sup>51</sup>
- 34 It is Blake's short additional descriptive commentary that is so remarkable: “Milton sleeping on a Bank. Sleep descending with a Strange Mysterious Dream upon his Wings of *Scrolls & Nets & Webs* unfolded by Spirits in the Air & in the Brook around Milton are Six Spirits or Fairies hovering on the air with Instruments of Music” (E 685; my italics). In the picture, winged Sleep swoops around the supine and sleeping Milton, bearing on its wings “Scrolls & Nets & Webs.” The nets, Klüver's lattice percepts, are the hardest to discern, but their meshes (highlighted by Blake in black ink) reach from two small soaring figures to a single huddled figure in the lower section of the picture, all borne on the back of Sleep's right wing.<sup>52</sup> On the same wing are scrolls, Klüver's spiral percepts. They are represented as the ends of what seems to be a parchment, which is associated with a robed figure who touches it with both hands, its folds enclosing an embracing man and woman. Scrolled ends of garments also feature in the group encircled in spokes of light at the top of the picture.
- 35 The third and final Klüver pattern in this composition, a lattice or cobweb form-constant borne on the back of Sleep's left wing, dominates the upper portion of the design.

50. The most detailed treatment after 1981 is J. M. Q. Davies, *Blake's Milton Designs: The Dynamics of Meaning* (West Cornwall, CT: Locust Hill Press, 1993) 113–52.

51. John E. Grant, “Blake's Designs for *L'Allegro* and *Il Penseroso*, with Special Attention to *L'Allegro* 1, ‘Mirth and Her Companions,’” *Blake* 4.4 (spring 1971): 117–34; Bette Charlene Werner, *Blake's Vision of the Poetry of Milton* (Lewisburg: Bucknell University Press, 1986) 162; Stephen C. Behrendt, “Bright Pilgrimage: William Blake's Designs for *L'Allegro* and *Il Penseroso*,” *Milton Studies* 8 (1975): 123–47.

52. The nets in Blake's pictorial narrative (which departs in this detail from *Il Penseroso*) seem to be associated with figures living in the “brook” and “waters murmuring” mentioned in Milton's poem.

Describing it as a “rainbow sphere,” J. M. Q. Davies notes that “it is a highly unusual motif.”<sup>53</sup> Its status as apparently a depiction of radiant light is, of course, consistent with the self-luminous qualities of Klüver percepts. Instead of being a conventional symbol of radiance, it forms a set of very distinct concentric circles, differentiated by color but noticeably radially segmented. This fits Blake’s description of “Webs.” It is also a reminder, as with the spokes of light in *Jacob’s Ladder*, that “a radial bias may be neurally fundamental” to visual perception.<sup>54</sup>

- 36 That *Milton’s Mysterious Dream* contains three out of the four Klüver form-constants brings it into phenomenological unity with the details described in Blake’s commentary. These three elements in the painting can now be assigned with a precise neurophysiology based on the traces in the composition of the exact type of visual hallucination that Blake had experienced in one of the “visions” that inspired it. Indeed, Blake’s text could hardly be less ambiguous: “Sleep” has “a Strange Mysterious Dream upon” its “Wings,” explicitly made up of “Scrolls & Nets & Webs,” percepts that Blake had experienced no later than c. 1805 (as suggested by *Jacob’s Ladder*) and now, apparently, associated with Milton.
- 37 Although it is not certain that the image of Milton depicted here refers to the period after he lost his sight (he was completely blind by the age of about forty-four), Blake may have surmised that Klüver’s patterns could be perceived by the blind (in the same way that Milton’s contemporary, Hobbes, knew that they were visible in the dark).<sup>55</sup> One might speculate that self-luminous hallucinations held a special fascination for an artist who held the blind Milton in such high esteem. Whether this is the case or not, “Scrolls & Nets & Webs” make little other narrative sense in what was clearly a complex response to *Il Penseroso* except for their phenomenological unity within the range of the Klüver hallucinations that likely inspired Blake’s design—that is, Klüver spiral, lattice, and cobweb percepts are deposited in the picture as distinct markers of one of Blake’s “visions,” perhaps the true medium through which he felt continuing affinity with Milton.

### Example 3: The Illuminated Books (up to 1794)

- 38 Because the illuminated books were enterprises exploiting Blake’s printmaking skills for the admiration of affluent, socially and politically progressive bibliophiles,<sup>56</sup> it is perhaps

not surprising that Klüver form-constant patterns occur frequently in works less open to scrutiny than those that might have been exhibited in domestic or public spaces. They proliferate to such a degree that the discussion here is limited to just three of the works up to 1794.

- 39 That Blake used recurrent patterns in the illuminated books is not a new idea. In 1978, W. J. T. Mitchell observed that “abstract linear forms such as the vortex or the circle ... are repeated so systematically that they suggest a kind of pantomimic body-language, a repertoire of motifs.”<sup>57</sup> The vortex and circle (although they are not assigned by Mitchell to neurological causes) approximate to two of the four Klüver form-constants. Of course, sometimes they appear decoratively, although in such cases they may still be aesthetically selected echoes of entoptic percepts first seen in the “visions” that Blake claimed as integral to his art.
- 40 Until c. 2015 it was possible to quickly collect a range of results for Klüver-type shapes in the illuminated books by means of the visual motif search engine in the *William Blake Archive*. The feature is currently slightly less useful for this type of exercise because it appears not to gather tagged hits into totals in quite the same way as it did when the original research was done for this article. Its principal virtue for the present study was that the archive had independently deliberated and agreed descriptors to match the images they decided Blake’s works presented. By checking a box, a user could find out how often, for example, spiral shapes had been tagged in Blake’s visual art and collate them with the image search function. The results are both complicated and, perhaps, surprising.
- 41 The number of distinct spirals logged by the archive, when restricted to the illuminated books produced between c. 1788 and 1795, is sixty-seven.<sup>58</sup> The definition of these features (as well as the three other form-constant shapes), together with their locations in Blake’s work, is not my determination, but rests on the editorial decisions of the archive.
- 42 In *America a Prophecy* (1793) there are at least eight spirals, each potentially capable of being designated as a Klüver form-constant. Perhaps the most striking is on plate 7 (illus. 4), which has a cone-shaped, spiraling serpent, standing on its tail, and also includes an apparent revolu-

53. Davies 146.

54. Sasaki, Rajimehr, et al.

55. A. E. Krill, H. J. Alpert, and A. M. Ostfield, “Effects of a Hallucinogenic Agent in Totally Blind Subjects,” *Archives of Ophthalmology* 69 (1963): 180-85.

56. Rebekah Bliss (1749–1819), who may have bought copies of *Songs* and *For Children: The Gates of Paradise* by the end of the 1790s, was

affluent enough to have acquired an extensive library of fine printed books and manuscripts; see Keri Davies, “Mrs. Bliss: A Blake Collector of 1794,” *Blake in the Nineties*, ed. Steve Clark and David Worrall (Basingstoke: Macmillan, 1999) 212-30.

57. W. J. T. Mitchell, *Blake’s Composite Art: A Study of the Illuminated Poetry* (Princeton: Princeton University Press, 1978) 37.

58. *Blake Archive* image search, 6 Nov. 2015.



Albion's Angel stood beside the Stone  
of night, and saw  
The terror: like a comet, or more like the  
planet red  
That once includ'd the terrible wandering comets in its sphere.  
Then Mars thou wast our center, & the planets three flew round  
Thy crimson disk; so e'er the Sun was rent from thy red sphere;  
The Spectre glow'd his horrid length staining the temple long  
With beams of blood; & thus a voice came forth, and shook the  
temple

4. William Blake, *America* copy E, Bentley plate 7 [Erdman plate 5] (composed and printed 1793). 23.3 x 16.6 cm. Library of Congress, Lessing J. Rosenwald Collection. Catalogue no. 1804. Image courtesy of the William Blake Archive.

tionary tribunal condemning a hunched-up human figure to be forced through the tunnel of the serpent's folds.

43 The judicial ensemble and serpent spiral are fairly baffling. They possibly allude to political fractures in British society and national identity that occurred as a result of the American War of Independence; equally, they may refer to the Terror of the French Revolution. Reprising critical debate up to 1995 about the plate's meaning, Detlef Dörrbecker rightly remarks on its "reduction of the conventional pictorial pattern which has given rise to the contradictory interpretations in modern Blake criticism." In this particular detail, a "tormented figure is plunging headlong into a funnel or vortex that is formed by the seven coils ... of a hissing serpent that rises from the flames."<sup>59</sup>

44 Dörrbecker's description of "coils" in a "funnel or vortex" shape invokes two of Klüver's form-constants. Quoting verbatim from reports in his survey sample, Klüver writes that "a third important form-constant is the *spiral*. ... "There appears a brown spiral, a wide band, revolving madly around its vertical axis."<sup>60</sup> This account is certainly consistent with Blake's unusual image in plate 7. The human figure, described by Dörrbecker as "plunging headlong into a funnel or vortex," corresponds with what Klüver (incorporating feedback from his volunteers) describes as

a second form-constant ... designated by terms [such] as *tunnel*, *funnel*, *alley*, *cone* or *vessel*. To illustrate: "Sometimes I seemed to be gazing into a vast hollow revolving vessel ..."; "the field of vision is similar to the interior of a cone the vertex of which is lying in the center of the field directly before the eyes (or vice versa)" ... ; [a] "vision of a tunnel in copper-brown color ... lines seem to converge in the infinite"; ... "deep beautiful perspectives ... growing into the infinite ..."; ... "I was standing in a very long and wide tunnel."<sup>61</sup>

45 In contrast to the complexities of plate 7, *America* plate 4 (illus. 5) has merely a spiral-shaped piece of foliage (with its vegetable roots visible) edging the left-hand side of the page. Of course, it may be argued that while the spiral on plate 7 is meaningful, the other is simply decorative, but whatever the intention, the basic shape is dominant—that is, a limited range of motifs (here spiral and funnel forms) are visually modulated or repeated within the work.

59. Detlef W. Dörrbecker, ed., *William Blake: The Continental Prophecies* (London: William Blake Trust/Tate Gallery, 1995) 55-57 (commentary on this plate).

60. Heinrich Klüver, *Mescal and Mechanisms of Hallucinations* (Chicago: University of Chicago Press, 1966) 23 (Klüver's italics).

61. Klüver, *Mescal and Mechanisms of Hallucinations* 23 (Klüver's italics).

46 *Europe a Prophecy* (1794) presents another series of Klüver form-constants. Although Blake lived over a hundred years before Klüver, form-constants are the products of neural activity common to *Homo sapiens* as a species (see [iv] above). The neurophysiology of their triggers might be experienced differently, but their geometric patterning is identical. Their presence is so clear in *Europe* that it is best to identify them briefly before offering a discussion. Predating Klüver's work, Munro Smith's 1909 *BMJ* article drew attention to the phenomenological similarities of migraine aura fortification spectra, which are known to include form-constants, and the frontispiece, "The Ancient of Days." While I do not claim that Klüver patterns necessarily influenced "The Ancient of Days," I will argue that the title page and plate 13 are based upon spiral form-constants, and plate 15 on cobweb form-constants. Consonant with Munro Smith's claim about "The Ancient of Days," the known phenomenological variants of migraine aura would certainly provide a plausible neurophysiological basis for the Klüver form-constants in *Europe*.

47 The *Blake Archive* tagged nine *Europe* plates for spiral and web features and their synonyms.<sup>62</sup> Some, such as the calligraphic flourish at the end of the "Y" of "Prophecy" (*Europe* plate 6), appear functionally decorative, although, of course, this is because their decorative role reproduces the Klüver patterns of Blake's original visual hallucination. The incidence of decorative features suggests that the cognitive input experienced through V1 was processed by Blake both during and after what can now be recognized as a "vision."

48 The first Klüver form-constant is the title page (plate 2) (illus. 6), which is dominated by a single motif of a coiled serpent. Only a piece of foliage in the foreground and the suggestion of low rising hills in the background provide other visual elements in a starkness of composition best seen in copy H, the uncolored Houghton Library copy.<sup>63</sup> As to the iconographic tradition in which this plate might be said to stand, Dörrbecker concludes that "not just in Blake, but in British late eighteenth-century culture in general the meaning of all serpent imagery was nothing if not ambiguous."<sup>64</sup>

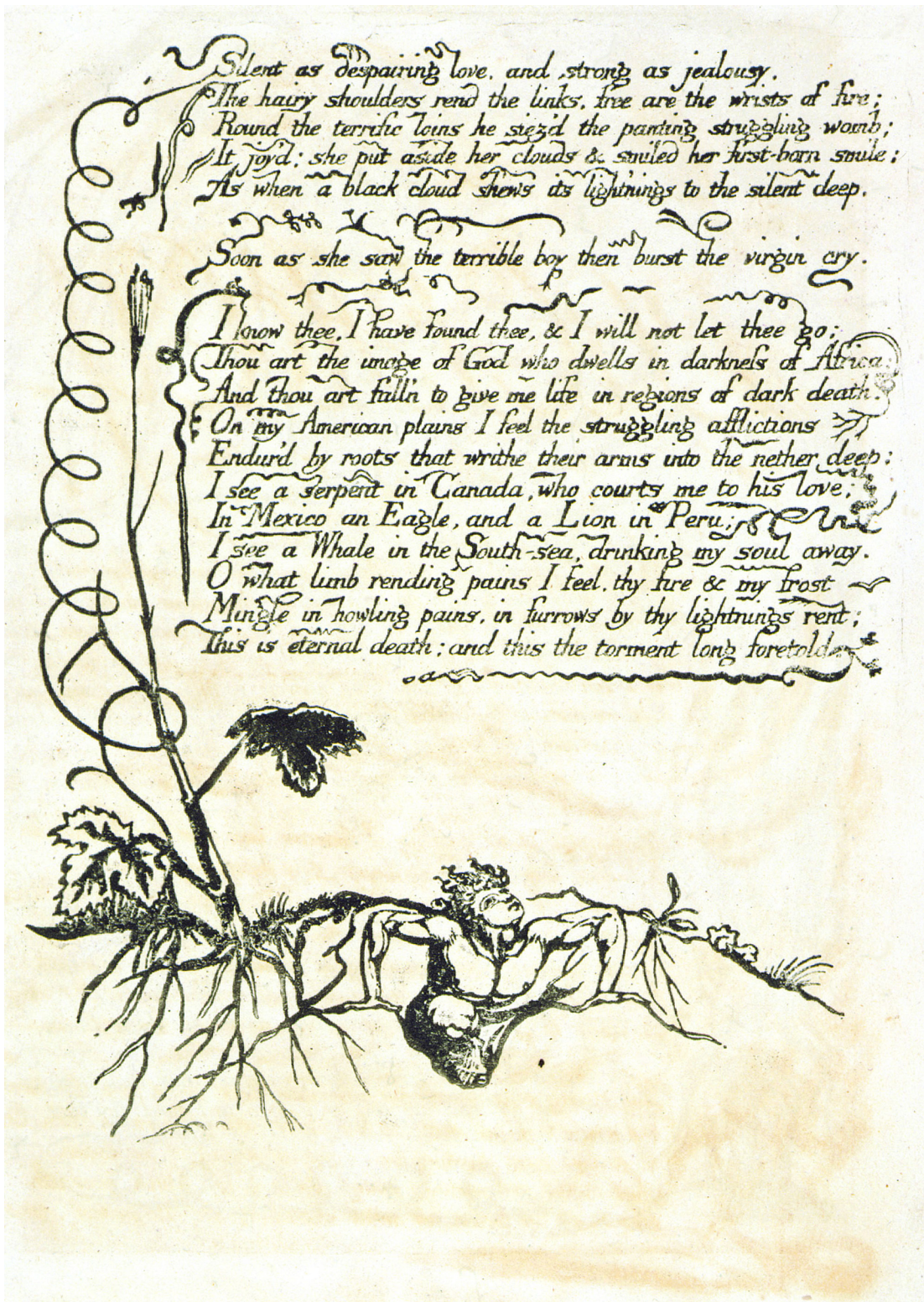
49 The explanation for its meaning comes in the next example, plate 13 (illus. 7), which shows a spiral-shaped serpent, standing on its tail, taking up the entire left-hand margin of the page and ending with a crested head radiating fire.<sup>65</sup>

62. *Blake Archive* image search, 8 Nov. 2015.

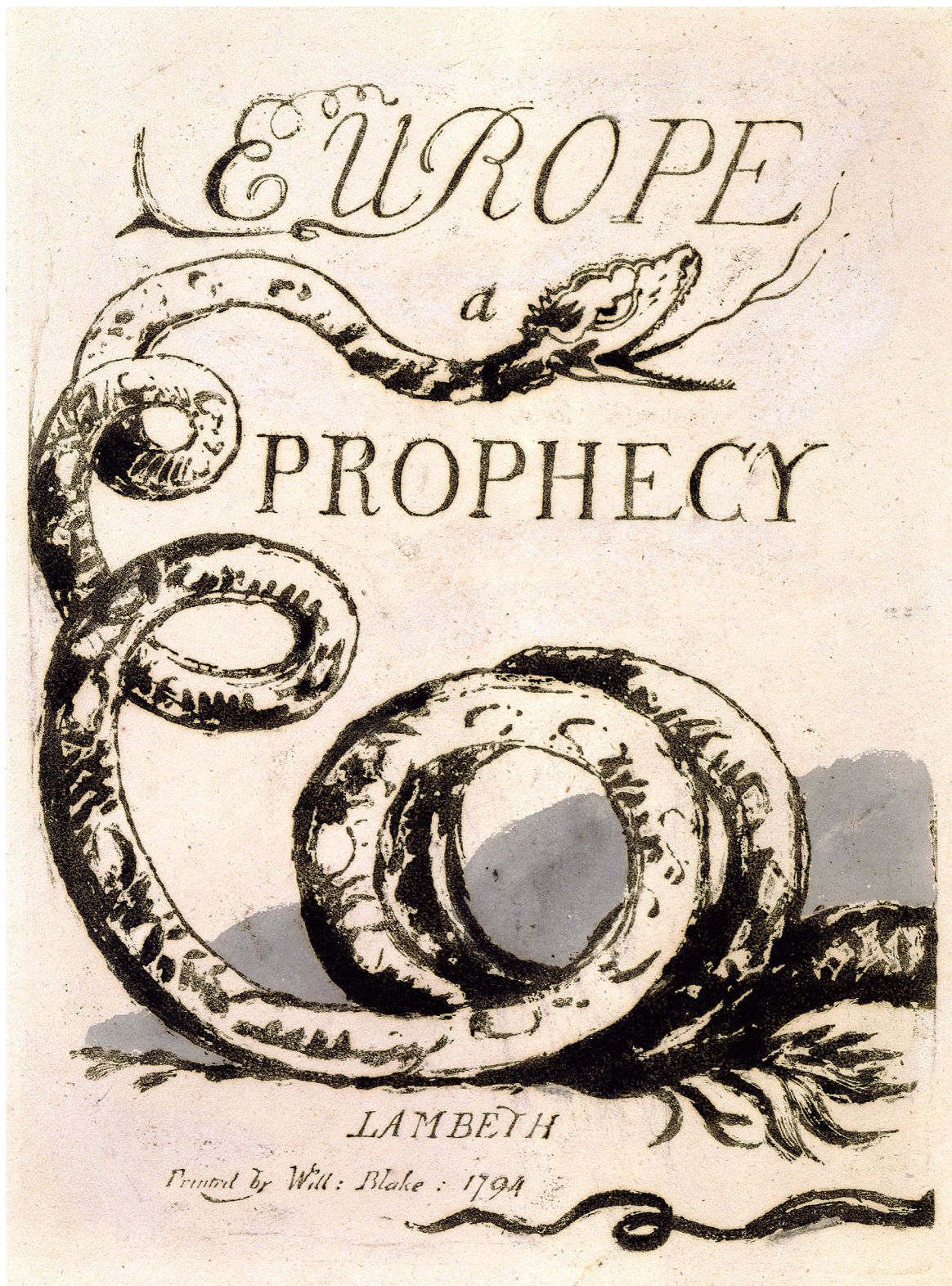
63. In most copies, this plate is preceded by "The Ancient of Days," which acts as a frontispiece. In copy H, however, a "Fairy" plate (plate 3) starts the book, followed by the title page, which is then followed by "The Ancient of Days."

64. For commentary on this plate, see Dörrbecker 168-74.

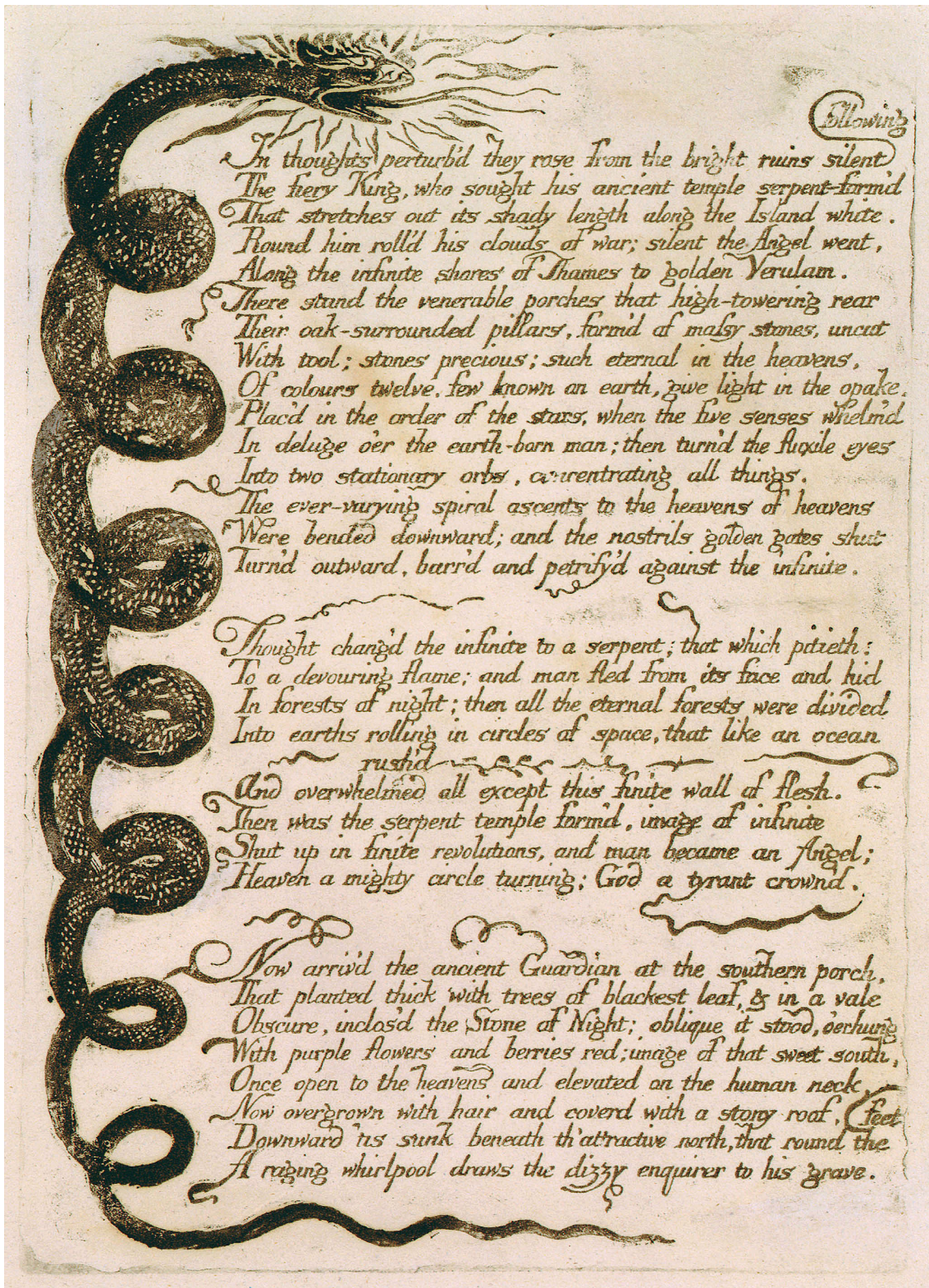
65. For commentary on this plate, see Dörrbecker 194-96.



5. William Blake, *America* copy E, Bentley plate 4 [Erdman plate 2] (composed and printed 1793). 23.8 x 16.6 cm. Library of Congress, Lessing J. Rosenwald Collection. Catalogue no. 1804. Image courtesy of the William Blake Archive.



6. William Blake, *Europe* copy H, plate 2 [Erdman plate ii] (composed 1794, printed 1795). 23.9 x 17.3 cm. Houghton Library, Harvard University. Typ 6500.41h. Image courtesy of the *William Blake Archive*.



(Following)  
In thoughts perturbid they rose from the bright ruins silent  
The fiery King, who sought his ancient temple serpent-formid  
That stretches out its shady length along the Island white.  
Round him roll'd his clouds of war; silent the Angel went,  
Along the infinite shores of Thames to golden Verulam.

There stand the venerable porches that high-towering rear  
Their oak-surrounded pillars, formid of malsy stones, uncut  
With tool; stones precious; such eternal in the heavens,  
Of colours twelve, few known an earth, give light in the opaque.  
Plac'd in the order of the stars, when the five senses whirlwind  
In deluge o'er the earth-born man; then turn'd the fluxile eyes  
Into two stationary orbs, concentrating all things.  
The ever-varying spiral ascents to the heavens of heavens  
Were bended downward; and the nostrils golden gates shut  
Turn'd outward, barr'd and petrify'd against the infinite.

Thought chang'd the infinite to a serpent; that which pitieth;  
To a devouring flame; and man fled from its face and hid  
In forests of night; then all the eternal forests were divided  
Into earths rolling in circles of space, that like an ocean  
rushed  
And overwhelmed all except this finite wall of flesh.  
Then was the serpent temple formid, image of infinite  
Shut up in finite revolutions, and man became an Angel;  
Heaven a mighty circle turning; God a tyrant crown'd.

Now arriv'd the ancient Guardian at the southern porch,  
That planted thick with trees of blackest leaf, & in a vale  
Obscure, inclos'd the Stone of Night; oblique it stood, overhung  
With purple flowers and berries red; unage of that sweet south,  
Once open to the heavens and elevated on the human neck  
Now overgrown with hair and cover'd with a stony roof, feet  
Downward 'tis sunk beneath th'attractive north, that round the  
A raging whirlpool draws the dizzy enquirer to his grave.

7. William Blake, *Europe* copy H, plate 13 [Erdman plate 10] (composed 1794, printed 1795). 23.4 x 16.7 cm. Houghton Library, Harvard University. Typ 6500.41h. Image courtesy of the William Blake Archive.

Plate 13 is concerned with a loss of revelation replaced through the intermedial presence of an “ancient temple serpent-formd” (E 63). The spiral form-constant, accessed by Blake through one of his “visions,” may in this guise indicate a distortion or corruption of his own founding hallucinatory revelation. Yet, as Dörrbecker hints, much of the serpent symbolism in Blake is a communicative dead end. In an analogous fashion, humankind’s synaesthesia-like powers of perception are exalted in *There is No Natural Religion* (series b), but then described as oppressively narrowed in *The [First] Book of Urizen* when Blake wants to comment on a different set of contexts. The serpent’s connection to the biblical story of Satan and its pervasiveness among the cultures of the eastern Mediterranean, as Jacob Bryant discovered, made it a cumbersome symbol.

50 Another form-constant in *Europe* is not only much clearer, it would be taken up by Blake with some vigor, and rather more successfully, as a continuum of images and symbols referring to concepts at the heart of his cultural and ideological positions about contemporary society. Pictured across much of plate 15 (illus. 8) is a large cobweb, fairly naturalistically rendered, accompanied by at least five spiders and several other insects.

51 This is the cobweb hallucinatory percept identified by Klüver, which, as discussed above, is also a prominent feature of *Milton’s Mysterious Dream*. “Web shapes” and “spiderwebs” motifs show up as eight examples defined and categorized in Klaus Podoll and Derek Robinson’s *Migraine Art*, with their case history of sources identifying such percepts dating as far back as W. R. Gowers’s paper of 1895.<sup>66</sup> Like the editorial team of the *Blake Archive*, Podoll and Robinson were independent assessors of the images presented to them. Cobwebs are percepts associated in some forms of epileptic hallucination with a neural disturbance of the cortex (although, as noted above, there is no evidence that Blake had this disorder).<sup>67</sup> In the late twentieth century, Klüver’s lattice and cobweb form-constants proved particularly difficult to correlate mathematically with VI; Cowan states that it took him and his colleagues from 1979 to 1993 to work out the mathematics of their geometry.<sup>68</sup> One of the more striking things about *Europe* plate 15 is Blake’s willingness to give dramatic articulation to the cobweb percept. In addition to the web with spiders, a reclining, huddled human figure, hands together in prayer or

entreaty and tightly bound or wrapped in a net, is clearly pictured at the bottom right of the plate.

52 The uncolored (save for touches of gray wash) copy H demonstrates that these shapes were made as relief-etched outlines on the plate and not added later (although in most copies of *Europe* Blake strengthened with ink the lines binding the netted human). As a decorative echo, the lattices of a fragmentary cobweb with spider form an interlinear design on plate 16. This detail is probably meant simply to enrich the depiction of the jailed and manacled figure in the prison scene, which may allude to the suspension of habeas corpus between May 1794 and July 1795.

53 The presence in plate 15 of both the cobweb and the netted human provides a significant example of Blake’s creative use of hallucinatory percepts. Moreover, these designs have a bearing on a specific strand of his poetics. Their incidence marks a distinction between the neural correlates of visual hallucination and the role of the cognitive environment of VI. “The Net of Religion” develops as a particularly effective metaphor in Blake’s work, graspable as a symbol of repression yet also directly linked to a characteristic visual percept experienced in his “visions.” From cobweb to net, the allusive symbolism is easily capable of extension. As referenced above, Klüver points out that the four form-constants may appear in amalgamation, occurring as “modifications and transformations of these basic forms.” Indeed, as one traces Blake’s development of these images from their original Klüver patterns, it is not hard to see how adapting the net of his lattice form-constant percept solved the expressive problem of following up the spiral images that *America* had explored. The serpent-like meaning of the spiral form-constants that Blake labored with elsewhere had become, as Dörrbecker argues, confusingly embedded in eighteenth-century mythological lore, and not readily translatable into commonplace activities. Nets of Religion, on the other hand, are much more memorable, on account of their association with snares and traps. For the first time, it is possible to trace how some of Blake’s “visions,” in their original visual hallucinatory modes, promoted the development of a particular poetics; in this example, they are strikingly linked to his perspective on contemporary religion.

54 This strand of imagery appears to reach a heightened stage of evolution and cultural valency in the poetic narrative of *The [First] Book of Urizen* (1794). Enitharmon’s strategy in *Europe* (and European history) to “Spread nets in every secret path” (5.2-10, E 62) is implicit in Blake’s use of the cobweb and lattice form-constants in that book, but in *Urizen* Blake provides a much more challenging direction in projecting an alternative to the Genesis story of creation. The incorporation of Klüver form-constants into its poetics

66. Podoll and Robinson 201-04, figs. 242, 244, 245. The reference is to W. R. Gowers, “Subjective Visual Sensations,” *Transactions of the Ophthalmological Societies of the United Kingdom* 15 (1895): 1-38.

67. P. Tass, “Cortical Pattern Formation during Visual Hallucinations,” *Journal of Biological Physics* 21 (1995): 177-210.

68. Cowan, “Geometric Visual Hallucinations and the Structure of the Visual Cortex.”



And the clouds & fires pale roll'd round in the night of Enitharmon  
 Round Albions dirts & Londons walls; still Enitharmon slept;  
 Rolling volumes of grey mist involve Churches, Palaces, Towers:  
 For Urizen unclasped his Book; feeding his soul with pity  
 The youth of England hid in gloom curse the pained heavens; compell'd  
 into the deadly night to see the form of Albions Angel  
 Their parents brought them forth & aged ignorance preaches canting  
 On a vast rock, perceiv'd by those senses that are clos'd from thought:  
 Bleak, dark, abrupt, it stands & overshadows London city  
 They saw his boney feet on the rock, the flesh consum'd in flames:  
 They saw the Serpent temple lifted above, shadowing the Island white:  
 They heard the voice of Albions Angel howling in flames of Ore.  
 Seeking the trump of the last doom

Above the rest the howl was heard from Westminster louder & louder:  
 The Guardian of the secret codes forsook his ancient mansion  
 Driven out by the flames of Ore; his furred robes & false locks  
 Adhered and grew one with his flesh, and nerves & veins shot thro them  
 With dismal torment sick hanging upon the wind; he fled  
 Groveling along Great George Street thro the Park gate; all the soldiers  
 Flew from his sight; he drag'd his torments to the wilderness.

Thus was the howl thro Europe:  
 For Ore rejoic'd to hear the howling shadows  
 But Palamabron shot his lightnings trenching down his wide back  
 And Rintrah hung with all his legions in the nether deep

Enitharmon laugh'd in her sleep to see (O womans triumph)  
 Every house a den, every man bound; the shadows are fill'd  
 With spectres, and the windows wove over with curses of Iran:  
 Over the doors Thou shalt not; & over the chimneys Fear is written:  
 With hands of iron round their necks, fasten'd into the walls  
 The citizens: in leaden pyres the inhabitants of suburbs  
 Walk heavy; soft and bent are the bones of villagers

Between the clouds of Urizen the flames of Ore roll heavy  
 Around the limbs of Albions Guardian, his flesh consuming  
 Howlings & hulsings, shrieks & growls, & voices of despair  
 Arise around him in the cloudy  
 Heavens of Albion, Furious

8. William Blake, *Europe* copy H, plate 15 [Erdman plate 12] (composed 1794, printed 1795). 23.4 x 17.3 cm. Houghton Library, Harvard University. Typ 6500.41h. Image courtesy of the William Blake Archive.

makes *Urizen* not only an alternative narrative but also one that alludes to an alternative basis for revelation. For Blake, these alternatives were validated by his experience of visual hallucinations, or what he preferred to call “my visions.”

- 55 *Urizen* ends with a created material world held captive, self-enslaved by “narrowing perceptions,” as memorably pictured on plate 28. Although one cannot be sure of priority, the cobweb and netted figure of *Europe* plate 15 appear to have developed into the “spiders web” and “Net of Religion” of *Urizen*. These provide fascinating examples of Blake’s cognitive processing of Klüver’s hallucinatory percepts and their transformation into poetry. It is worth tracing how he attaches poetic meaning to these entoptic visual images:

[6.] A cold shadow follow'd behind him [Urizen]  
Like a spiders web, moist, cold, & dim  
Drawing out from his sorrowing soul  
The dungeon-like heaven dividing,  
Where ever the footsteps of Urizen  
Walk'd over the cities in sorrow.

7. Till a Web dark & cold, throughout all  
The tormented element stretch'd  
From the sorrows of Urizens soul  
And the Web is a Female in embryo  
None could break the Web, no wings of fire.

8. So twisted the cords, & so knotted  
The meshes: twisted like to the human brain

9. And all call'd it, The Net of Religion. (25.9-22, E 82)

Blake’s utilization of Klüver form-constants in his poetics does not celebrate visual hallucinations but, on the contrary, describes their debasement, an insight perhaps prompted by the “dark & cold” environment of wartime Britain in the 1790s. In a remarkable development of the entoptic images he had experienced, the “spiders web,” a “Web dark & cold,” becomes a “Net” of “narrowing perceptions.”<sup>69</sup> Still retaining symmetrical stability, one percept (a Klüver cobweb) changes into a “Web,” or “a Female in embryo,” and another (a Klüver lattice) into a “Net of Religion.” Although the visual hallucinations—“the dark visions of Los” (*Urizen* 15.12, E 78)—have become acculturated (gendered and assigned a religion), they maintain the integrity of their form-constant patterns. In *Urizen*, the Klüver cobweb and lattice form-constants of Blake’s original “visions” are modified into their abstractions, offering a vivid example of how, in the 1790s, he developed a poetics based upon visual hallucination.

69. Podoll and Robinson treat nets as a subgroup of web forms, suggesting their close alliance within V1’s architecture (see 203-04).

- 56 What makes *Urizen* particularly noteworthy is the sophistication with which, by 1794, Blake has aligned the corruption (“the dark visions”) of Klüver form-constants with the “narrowing perceptions” he experienced in the repressive atmosphere of contemporary Britain. The degree of his cognitive insight into his visual hallucinations is remarkable, probably unparalleled. Tracing the developmental route of his transformation of the percepts of visual hallucination into literary poetics is challenging. Perhaps the most striking feature of these developing poetics, however, is their unswerving fidelity to the hallucinatory origins of Blake’s “visions.”

## Conclusion

- 57 The neural correlates of Klüver form-constants have been validated by Ermentrout and Cowan (1979) and Bressloff, Cowan, et al. (2001), who have successfully traced their source to V1. Klüver form-constant visual hallucinations are one of several types of “visions” that Blake claimed to have experienced. He would have perceived their distinctive patterns within his visual field through retinocortical mapping. Their propagation from V1, an area of cortex, means that each episode was a cognitive event. The evidence presented here suggests that Blake had insight into these episodes and reflected and responded to them creatively. His discrimination, categorization, and, above all, accurate naming of three of the four form-constant patterns in the commentary accompanying *Milton’s Mysterious Dream* revise the history of visual hallucinations, not only because they substantially precede Klüver but on account of his degree of cognitive insight into his experiences. Blake’s status as a healthy, well-educated, socially integrated individual who claimed a lifelong experience of hallucinations has the potential to provide a high-value point of reference for clinicians working with disorders such as psychosis, eye disease, dementia, and Parkinson’s disease.<sup>70</sup>

- 58 I am not suggesting that the majority, or even a large fraction, of Blake’s paintings and designs are founded on Klüver form-constant visual hallucinations. For most of the time, and in most of his works, he was *not* a “visionary” artist painting from “originals seen in my visions.” Nevertheless, the designs originating from Klüver percepts are not trivial in number or significance. Distinguishing between the form-constants and similar shapes in Blake’s art is, of course, a matter of judgment. It may be that what originated as a form-constant in one of his “visions” then got used decoratively. On balance, since Blake was so insistent on the role of “visions” in his creativity, their identification

70. Renaud Jardri et al., “Hallucination Research: Into the Future, and Beyond,” *Schizophrenia Bulletin* 45, supplement 1 (2019): S1-S4.

should take hermeneutical precedence where, as in the case of the traces of Klüver visual hallucinatory patterns in his work, his “visions” can be shown to have had neural correlates. Doing so necessitates honoring the origins of “visions,” something that ought to be uncontroversial for a poet who declared himself to be a “visionary.” Blake’s corpus needs reevaluation, not simply to look for evidence of hallucinatory types but also to revise our understanding of

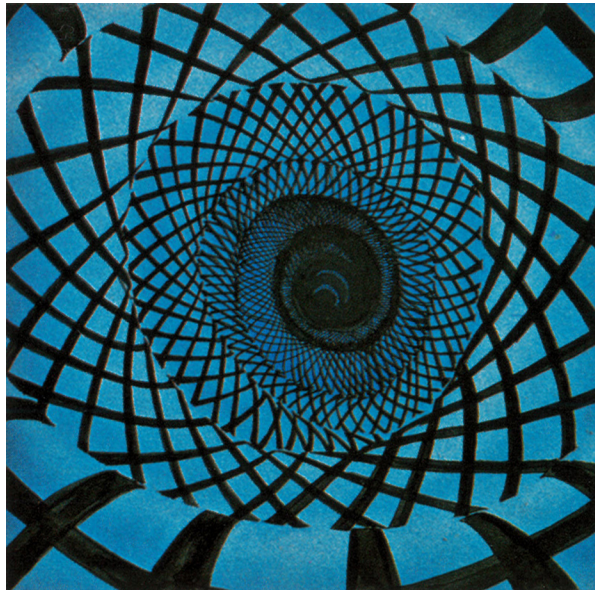
his contemporary and modern reception now that his “visions” can often be attributed with neural, rather than psychotic, correlates.

- 59 For example, a good case could be made that the very early watercolor *An Allegory of the Bible* (c. 1780–85, Tate Britain, Butlin #127) (illus. 9) is composed around Klüver’s lattice and tunnel/funnel form-constants. Its curious com-



9. William Blake, *An Allegory of the Bible* (c. 1780–85). 61.5 x 34.9 cm. Tate. T01128. Bequeathed by Miss Rachel M. Dyer, 1969. Photo: Tate.

position of curving tracery panels, black-and-white square tiles or flagstones, and receding and approaching figures is brought into phenomenological unity by the two form-constants structuring it. The picture (without the figures, of course) readily maps over a much-reproduced drawing used as a standard reference for Klüver percepts (illus. 10).



10. David Sheridan, representation of lattice-tunnel from reports of drug-induced hallucinations.

Figure 6 in Ronald K. Siegel and Murray E. Jarvik, "Drug-Induced Hallucinations in Animals and Man," *Hallucinations: Behavior, Experience, and Theory*, ed. R. K. Siegel and L. J. West (New York: John Wiley & Sons, 1975) 81-161 (following 146). Reproduced by permission of John Wiley & Sons; permission conveyed through Copyright Clearance Center, Inc.

That Blake painted from his visual hallucinations as early as c. 1780–85 would be consistent with his first "vision," on Peckham Rye, with migraine perhaps being the agent of induction and Klüver percepts a comodality of the aura.

- 60 As far as identifying the phenomenological characteristics of Blake's other "visions" is concerned, there are many traps for the unwary. His only written account of a "Vision," in the poem "To my Friend Butts I write / My first Vision of Light" (E 712-13), composed in October 1800 on his arrival in Felpham, almost certainly describes Scheerer's phenomenon. Scheerer's (or blue field entoptic) phenomenon was first reported by Richard Scheerer in 1924. It is essentially a vasogenic-induced perception of moving points or stars of light caused by white blood cells visible against a blue back-

ground.<sup>71</sup> This would have been a fleeting, chance experience (Blake never repeated its description) probably induced by Felpham's unfamiliar expanses of early autumn blue sky, blue sea, and smoke-free sunlight. His classification of it as a "Vision" is immensely revealing of how, by 1800, he readily pathologized such events, placing them on a continuum of "visions," both visual and auditory, that he had experienced since the incident on Peckham Rye.

- 61 A lot has been missed over the years. A humble starting point might be to return to George Munro Smith's long-forgotten correspondence with the *BMJ* in 1909.

71. Richard Scheerer, "Die entoptische Sichtbarkeit der Blutbewegungen im Auge und ihre klinische Bedeutung," *Klinische Monatsblätter für Augenheilkunde* 73 (1924): 67-107; S. H. Sinclair, M. Azar-Cavanagh, K. A. Soper, R. F. Tuma, and H. N. Mayrovitz, "Investigation of the Source of the Blue Field Entoptic Phenomenon," *Investigative Ophthalmology and Visual Science* 30 (1989): 668-73.