The Eye in Motion: Mid-Victorian Fiction and Moving-Image Technologies

BUSH, NICOLE,SAMANTHA

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Nicole Bush

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Abstract

This thesis reads selected works of fiction by three mid-Victorian writers (Charlotte Brontë, Charles Dickens, and George Eliot) alongside contemporaneous innovations and developments in moving-image technologies, or what have been referred to by historians of film as 'pre-cinematic devices'. It looks specifically at the moving panorama, diorama, dissolving magic lantern slides, the kaleidoscope, and persistence of vision devices such as the phenakistiscope and zoetrope, and ranges across scientific writing, journalism, letters, and paintings to demonstrate the scope and popularity of visual motion devices. By exploring this history of optical technologies I show how their display, mechanism, and manual operation contributed to a broader cultural and literary interest in the phenomenological experience of animation, decades before the establishment of cinematography as an industry, technology, and viewing practice.

Through a close reading of a range of mid-Victorian novels, this thesis identifies and analyses the literary use of language closely associated with moving-image technologies to argue that the Victorian literary imagination reflected upon, drew from, and incorporated reference to visual and technological animation many decades earlier than critics, focusing usually on early twentieth-century cinema and modernist literature, have allowed. It develops current scholarship on Victorian visual culture and optical technologies by a close reading of the language of moving-image devices—found in advertisements, reviews, and descriptions of their physiological operation and spectacle—alongside the choices Victorian authors made to describe precisely *how* their characters perceived, how they imagined, remembered, and mentally relived particular scenes and images, and how the readers of their texts were encouraged to imaginatively 'see' the animated unfolding of the plot and the material dimensionality of its world through a shared understanding of this language of moving images.

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An earlier version of parts of Chapter Three are forthcoming in 'Repetition, Virtuality, and Mechanical Pattern: The Significance of the Kaleidoscope for the 'Fine and Useful Arts'', *Art versus Industry: New Perspectives on Visual and Industrial Cultures in Nineteenth-Century Britain*, ed. by Kate Nichols, Rebecca Wade, and Gabriel Williams (Manchester: Manchester University Press, 2015).

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INTRODUCTION

‘Something in Motion’: Literature, Technology, and the Cinematic

> *This lecture [at the Royal Polytechnic Institution, on the Ashantee War] is very instructive, in its way; and my mother-in-law took notes, and asked my poor, dear children questions founded upon them, at breakfast, the following morning; but, for my part, I only smiled faintly at the dissolving views, finding much more real amusement in watching sundry couples ‘spooning’ in the dark recesses of the topmost seats; and eating pop-corn together, with loving unanimity.*
>
> [Aglen A. Dowty], ‘Smiff at the Polytechnic’, *The Figaro* (21 Feb 1874), p. 3.[1]

Between 5 May and 17 October 1857, the city of Manchester hosted the international Art Treasurers Exhibition, displaying some 16,000 works of fine art painting, photography, engraving, and sculpture. Of modern painting, Constable, Turner, and the Pre-Raphaelite Brotherhood drew attention, as did the first exhibition of Oscar Rejlander’s experiment in composition photography, *The Two Ways of Life* (1857). The Exhibition was a success, welcoming in the region of 1.3 million visitors, and followed earlier displays such as the Dublin Great Industrial Exhibition in 1853, and Paris’s 1855 Exposition Universelle—and of course London’s Great Exhibition of 1851—in its spectacular collection and appeal to a diverse public audience.[2] To ensure the greatest numbers could visit the Exhibition, a railway link was built to transport attendees directly to the site, particularly working-class families living in neighbouring industrial regions, and Thomas Cook’s travel company

[1] Miscellaneous newspaper clippings file, University of Westminster Archives, London, UK. Item reference RPI 4/1.
[2] See Elizabeth A. Pergam, *The Manchester Art Treasures Exhibition of 1857: Entrepreneurs, Connoisseurs and the Public* (Farnham: Ashgate, 2011).

organized group excursions. Among the period's literary names in attendance (Elizabeth Gaskell, John Ruskin, and Nathaniel Hawthorne all wrote about their visit), Charles Dickens's report is the most interesting for this thesis.[3] Visiting while he was in Manchester to give a public reading on 31 July, he later wrote to William Macready, commenting that

> The collection of Pictures in the Exhibition is wonderful. […] The care for the common people, in the provision made for their comfort and refreshment, is also admirable, and worthy of all commendation. But they want more amusement, and particularly (as it strikes me) *something in motion*, though it were only a twisting fountain. The thing is too still, after their lives of machinery, and Art fires over their heads in consequence.[4]

Dickens's expression echoes that made in *The Art Journal* of the 'puzzled anxiety' of working-class visitors and as Elizabeth Pegram's study of the Exhibition and its publics explains, the organizing committee had at times failed to realize 'just how removed the fine arts were from the factory workers' usual experience'.[5] What is most striking about Dickens's assessment, however, is its awareness and advocacy of a particular desire for animation amongst the 'too still' display of paintings and drawings lining the Exhibition's walls. What would provoke the interest of its audience would be the perception of movement, or '*something in motion*'.

The 'twisting fountain' Dickens refers to was a common feature of exhibition venues; the constantly streaming water, often illuminated with light effects, formed a moving spectacle in itself. Follett Osler's 27-foot-high glass fountain located inside the Great Exhibition's Crystal Palace was a great draw. Harriet Martineau remarked on the 'beauty' of its display, 'with its streams of water falling like a veil' which, 'when the slanting sunlight from the roof touched it, […] sent thousands of gleams and sparkles

[3] See pp. 15, 192, and 204 respectively in Pergam, *The Manchester Art Treasures Exhibition of 1857*.
[4] Letter dated 3 August 1857. Charles Dickens, *The British Academy/Pilgrim Edition of the Letters*, ed. by M. Brown, G. Storey, and K. Tillotson, 12 vols (Oxford: Oxford University Press, 2002), VIII: 399.
[5] 'Lectures at the Crystal Palace', *The Art-Journal* (October 1857), p. 325, qtd in Pergam, *The Manchester Art Treasures Exhibition of 1857*, pp. 204-206.

through it', choosing to focus not on its scale but on the spectacular optical effect produced when sunlight shone through its moving vessel of flowing water.[6] The Royal Panopticon of Science and Art in Leicester Square (opened 1854) similarly featured a giant fountain rising towards its central dome. When the rotunda was darkened, 'the stream of water [was] rendered luminous by means of optical apparatus [with] the fluid appearing now like a liquid stream of fire', as one review in the *Illustrated London News* of that year noted.[7] Again, movement is emphasized, and was purposely enhanced with mechanically engineered effects of light.

These fountains form just one example of the desire for novel and innovative moving perceptual experiences evidenced in Victorian visual culture. This thesis offers a thorough consideration of various optical technologies invented and manufactured across the mid-Victorian period which manipulated images and rendered them mobile using a range of mechanical means and techniques, creating a Victorian understanding and awareness of—and desire for—the technological moving image (Dickens's '*something in motion*'). By 'moving image', I mean that which gave the modern 'movies' its colloquial description: images, created and mediated by a technological apparatus, which either moved spatially (the moving panorama), gave the illusion of transformative movement upon a single space (the diorama and dissolving slides) for a single or multiple spectator(s), or displayed a fully animated sequence of illustrations (persistence of vision devices). Alongside those most well-known nineteenth-century visual technologies, such as the panorama and photographic camera, there were a variety of large-scale exhibitions

[6] Harriet Martineau, *Household Words* 5 (1852), p. 37, qtd. in Isobel Armstrong, *Victorian Glassworlds: Glass Culture and the Imagination 1830-1880* (Oxford: Oxford University Press, 2008), p. 1.

[7] *Illustrated London News* (7 October 1854), p. 342, qtd. in Richard Altick, *The Shows of London* (Cambridge, Mass.: Harvard University Press, 1978), p. 491. See also Brenda Weeden, *The Education of the Eye: History of the Royal Polytechnic Institution 1838 – 1881* (Cambridge: Granta Editions, 2008), p. 55 for description of an illuminated and cascading fountain on display at London's Royal Polytechnic Institution in 1854.

and small, portable, hand-held devices which offered the intriguing perceptual experience of viewing (and even creating) an image in motion, which culminated, as Lynda Nead writes, in the 'conceptual impossibility' of a static image by the end of the century.[8]

This is not to reduce or negate the importance of photography, magic lantern projection, or the panorama as key visual sites, experiences, and technologies. Their conceptual impact on the cultural imagination has been extensively studied and analysed, as I discuss in Chapter One. However, there I make the argument that critical narratives of Victorian visuality have tended to privilege forms of spectacular and spectatorial *stasis* by concentrating their focus on lantern projection, photography, and particularly, I argue, the static, 360-degree panoramic canvas popular in the very early nineteenth-century (but, importantly, overtaken by the technical development of the *moving* panorama by the mid-Victorian period). This has led to a condensing of visual experience and a lack of engagement with and analysis of the importance and cultural impact of the century's very active interest in the first visual experiences of a technologically-mediated moving image. Readings of spectacular stasis and the aesthetic of fixing still have tended not to be countered by the equal contemporary drive to make mobile, to loosen the image from its spectacular frame and move it through, past, around, and across the field of vision.

In their introduction to *Illustrations, Optics and Objects in Nineteenth-Century Literary and Visual Cultures* (2010), Luisa Calè and Patrizia Di Bello write of photography that 'in just one glance, one blink of the shutter, the camera petrifies a body, like Medusa metamorphosing it into a thing whose gaze and temporality are at once fixed in the moment and launched into the future'.[9] According to Norman Bryson, 'the screen

[8] Lynda Nead, *The Haunted Gallery: Painting, Photography, Film c. 1900* (New Haven and London: Yale University Press, 2007), p. 12.

[9] Luisa Calè and Patrizia Di Bello, 'Introduction', in *Illustrations, Optics and Objects in Nineteenth-Century Literary and Visual Cultures*, ed. by Luisa Calè and Patrizia Di Bello (Basingstoke: Palgrave Macmillan, 2010), pp. 1-24 (p. 3).

mortifies sight'.[10] Jennifer Green-Lewis brands the photographic camera a symbolic 'unblinking eye', observing, spying, and monitoring, echoing Deborah Epstein Nord when she writes that 'Dickens turns the camera on and keeps it running'.[11] Yet the Victorian period's visual culture was not solely concerned with tropes of petrification, mortification, and a permanently open 'unblinking' eye; the interest in and desire for visual motion formed a concurrent *blinking eye*, one which flickered, persisted, and was animated. Historiographical retellings of Victorian visual culture have—in their eagerness to support the period's role in developing important viewing practices which contributed to the invention of what might be seen as the ultimate moving image technology, the cinematograph (such as the passive spectator at the panorama)—passed over a keen engagement with the earliest forms of technologically-mediated moving images present in the culture. As the quotation which opens this Introduction shows, what we understand as practices associated solely with the twentieth century, such as eating popcorn and watching moving images on a large screen in a darkened auditorium, actually occurred much earlier and were explored and represented in the period's writing. It is the development and conceptual intrigue of Victorian moving pictures created in the diorama, moving panorama, dissolving slides, the kaleidoscope, and the various 'scopes and 'tropes of persistence of vision devices which this thesis traces.

By exploring this history of moving-image technologies I show how their display, mechanism, and manual operation contributed to a broader cultural and literary interest in the phenomenological experience of animation. I look specifically at fiction, written and published in the mid-nineteenth century (roughly 1840-70) by Charlotte Brontë, Charles

[10] Norman Bryson, 'The Gaze in the Expanded Field', in *Vision and Visuality*, ed. by Hal Foster (Seattle: Bay Press, 1988), pp. 87-114 (p. 93).

[11] Jennifer Green-Lewis, *Framing the Victorians: Photography and the Culture of Realism* (Ithaca: Cornell University Press, 1996), p. 230; Deborah Epstein Nord, *Walking the Victorian Streets. Women, Representation, and the City* (Ithaca: Cornell University Press, 1995), p. 60.

Dickens, and George Eliot, identifying and analysing their use of language closely associated with contemporary moving-image technologies to argue that the Victorian literary imagination reflected upon, drew from, and incorporated reference to visual and technological animation many decades earlier than critics, focusing usually on cinema and modernism, have allowed. This thesis develops current scholarship on Victorian visual culture and optical technologies by its close reading of the language of moving-image devices—found in advertisements, reviews, and descriptions of their physiological operation and spectacle—alongside the choices Victorian authors made to describe precisely *how* their characters perceived, how they imagined, remembered, and mentally relived particular scenes and images, and how the readers of their texts were encouraged to imaginatively 'see' the animated unfolding of the plot and the material dimensionality of its world through a shared understanding of this language of moving images.

The purpose of this Introduction is to explain the critical emphasis which has been placed on cinematic technologies, rather than Victorian devices, and how our present-day understanding of the cultural influence of moving images has been most widely and often associated with early twentieth-century literature, particularly modernist writing and techniques. Cinematic forms of perception such as the jump-cut, zoom, pan, and montage were all effects enabled by the invention of sophisticated cinematographic technology in the late-nineteenth and early-twentieth century but crucially were not, I argue, the first visual encounter with moving images; thus, it follows that modernist literature was not the first body of work to grapple with what it meant to visually experience the mechanically-created moving image, as literary scholarship has been keen to assert. I begin by surveying the dominant critical narrative which has aligned the 'birth' of cinema with literary modernism, then move on to consider the historiographical approaches to, adaptations of, and arguments against the teleological idea that cinema was 'born' at a specific point.

Scholars of cinematic media history have recently began to use terms such as 'emergence' to describe the development of cinema, or even to remove the term 'cinema' and 'cinematic' from their descriptions of Victorian visual technologies, and this work informs my approach to the earlier moving-image devices investigated here, such as dissolving slides, the kaleidoscope, zoetrope, and phenakistiscope.

Cinema and Literary Modernism

Writing on the intersections and influences between literature and film is a particularly dynamic field. Critics of cinema, literary studies, and some of the earliest filmmakers themselves have all contributed.[12] Within literary studies, modernist scholarship has applied itself rigorously to this area, aligning literature with the contemporaneous growth of the film industry by drawing connections between key writers of modernist texts and the cinema. This has taken two forms: biographical links have been strengthened, such as James Joyce's establishment of Dublin's first cinema, the Volta, in December 1909,[13] and a commonality of technique and aesthetic aim has been stressed, arguing that modernist writing drew stylistically and thematically from the emergence of the cinematograph (both as a technology and as a viewing practice) and that this was a *new* contextual backdrop for modernist authors to draw from.

An edited collection of essays on the culture of spectacle and visual entertainments by Leo Charney and Vanessa R. Schwartz is entitled, boldly, *Cinema and the Invention of Modern Life* (1995), reflecting the critical location of 'modern life' as occurring next to or

[12] See Chapters Four and Five of Laura Marcus's excellent *The Tenth Muse: Writing About Cinema in the Modernist Period* (Oxford: Oxford University Press, 2007).

[13] The Volta was initially very successful but unfortunately short-lived: in April 1910 Joyce was forced to sell the business to the British Provincial Cinematograph Theatre company. For more on this, see Luke McKernan, 'James Joyce and the Volta Programme' (pp. 15-27) and Erik Schneider, 'Dedalus Among the Film Folk: Joyce and the Cinema Volta' (pp. 28-42), in *Roll Away the Reel World: James Joyce and Cinema*, ed. by John McCourt (Cork: Cork University Press, 2010).

in relation to the temporally-specific technology of the cinema. Their Introduction goes as far as to claim that 'modernity can be best understood as inherently cinematic' and that the culture of this period 'rendered inevitable something like cinema', subscribing to a reductive teleology which downgrades all previous technology and innovation as contributing to the inevitable birth of cinema.[14] Lynne Kirby places under consideration the 'parallel' histories of the railway and silent cinema (although not, of course, chronologically parallel), positioning cinema as something akin to the industrial modernization of transport—cinema here does for vision what the railway did for travel: mechanizes its mode and launches it into modernity, effectively ignoring the earlier Victorian instances of technologically-mediated moving images.[15]

What is problematic about this focus on modernism and cinema is its creation of a critical narrative which celebrates early-twentieth-century literature for marking the beginning of a technologized visual modernity. This has worked to equate the rise of modernism in literature with what is claimed to be a *new* phenomenological experience of watching the moving image, with its attendant bodily and sensory effects. While studies of the intersections between modernism and the cinema are clearly relevant and valuable critical undertakings, their emphasis on perceptual newness has worked not only to obscure the genealogy of cinematic devices, but has softened critical perspective on the engagement of earlier writers and texts with their specific visual and technological context. Placing its focus on literary fiction of the mid-nineteenth century, this thesis questions the privileged position of the cinema in literary scholarship and asks how writers of the Victorian period responded to inventions in moving image technology, and how

[14] Leo Charney and Vanessa R. Schwartz, 'Introduction', in *Cinema and the Invention of Modern Life*, ed. by Leo Charney and Vanessa R. Schwartz (Los Angeles and Berkley: University of California Press, 1995), pp. 1-15 (pp. 1-2).
[15] Lynne Kirby, *Parallel Tracks: The Railroad and Silent Cinema* (Durham: Duke University Press, 1997).

texts were informed by the new visual experiences facilitated by innovative devices such as the kaleidoscope or zoetrope.

One of the earliest works of scholarship on literature and film is Edward Murray's *The Cinematic Imagination: Writers and the Motion Pictures* (1972). It splits its focus between dramatists and novelists with chapters considering, among others, G. B. Shaw, Gertrude Stein, Samuel Beckett, Thomas Mann, F. Scott Fitzgerald, and John Steinbeck, and finds in their work stylistic equivalents which show how literature was drawing on the techniques and representational strategies of cinema. *Ulysses* (1922), Murray argues, is 'edited' like a film utilizing montage techniques; its eighteen parts each have their own 'characteristic style and rhythm' which 'create an expressive variety of formal patterns'. Joyce's use of interior monologue 'qualif[ies] as a novelistic equivalent of a close-up'. Further, Virginia Woolf's writing is 'cinematic in technique' as it attempts to 'convey a sense of simultaneity through rapid crosscutting'.[16]

Later studies of modernist writing take the same approach, finding specific formal, stylistic, or aesthetic cross-overs between the two mediums. Two full-length studies of Franz Kafka and Marcel Proust look at the biographical interest in movie-going and intersections between literary style and filmic representation respectively.[17] H.D.'s novella, *The Usual Star* (1933), Jonathan Foltz argues, is 'indebted to cinematic sight': vision is 'disembodied and made fragmentary' through her prose style.[18] In *Cinema and Modernism* (2007), David Trotter considers T. S. Eliot, Joyce, Wyndham Lewis, and Woolf, positing that the neutrality of film as a technological process (drawing on André Bazin's description of cinema as primarily a recording device, a constantly-open

[16] Edward Murray, *The Cinematic Imagination: Writers and the Motion Pictures* (New York: Frederick Ungar Publishing, 1972), pp. 127-129, 149.

[17] Hanns Zischler, *Kafka Goes to the Movies* (Chicago: The University of Chicago Press, 2003) and *Proust at the Movies*, ed. by Martine Beugnet and Marion Schmid (Aldershot: Ashgate**,** 2004).

[18] Jonathan Foltz, 'The Laws of Comparison: H. D. and Cinematic Formalism', *Modernism/modernity* 18.1 (2011), 1-25 (p. 13).

mechanical eye) 'fascinated' modernist writers, who attempted to reproduce this aesthetic mode in their writing.[19] Susan McCabe's 2005 study extends work on this topic by exploring the still under-discussed area of modernist poetry and cinema, offering readings of work by H.D., Gertrude Stein, William Carlos Williams, and Marianne Moore.[20]

Andrew Shail's approach in his edited collection *Reading the Cinematograph* (2010) seeks to document and discuss instances of direct literary representation of cinematographic technology, specifically in the short story. Looking at fiction published in Britain between 1896 and 1912, Shail notes that these largely take the form of a simile 'in which a narrative event is 'like a cinematograph' [which] is evidence of what the cinematograph was, at the time, perceived to be *like*'. During these two dates, he is keen to stress that literary representations of film constantly adapted as the technology advanced to include, for example, its ability 'to move instantaneously between disparate views, its performance of a news function, […and] anxieties about achieving verisimilitude'.[21] Shail's collection is welcome for its adept critical awareness of the swift developments in cinema as a visual entertainment, technological process, and spectator activity. The transitions film went through in the period spanning the end of the nineteenth to the early twentieth century were quick and often radical. From the kinetoscope parlours of the mid-1890s to the burgeoning character of the celebrity 'film star' in the 1910s, the cinema as a mechanical process and as a leisure activity altered immeasurably in a short number of years, and Shail's study is notable for carefully recognizing and analysing changes in what it meant to be cinematographic across this period and in its discussion of how these changes can be tracked in literary representations.

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[19] David Trotter, *Cinema and Modernism* (Oxford: Blackwell, 2007), p. 5.

[20] Susan McCabe, *Cinematic Modernism: Modernist Poetry and Film* (Cambridge: Cambridge University Press, 2005).

[21] 'Introduction', *Reading the Cinematograph: The Cinema in British Short Fiction, 1896-1912,* ed. by Andrew Shail (Exeter: University of Exeter Press, 2010), pp. 1-19 (p. 12).

Other studies have looked back to nineteenth-century fiction, but they have continued, problematically, to use the perceptual model of the cinema to explore the literary representation of vision. Alan Spiegel's article makes connections between the directorial eye of film and narrative perspective in a range of authors, including Gustav Flaubert and Henry James, and David Lodge turns to Thomas Hardy's *The Return of the Native* (1878) to argue that this novel in particular demonstrates a filmic quality in its use of the 'camera eye' and 'hypothetical or unspecified observers', perceptual 'surrogates' which act like 'camera lenses', receiving and transmitting visual information to the reader.[22] Another aspect of Hardy's use of cinematographic form can be seen when Diggory and the reader first glimpse Eustacia Vye. Lodge notes that Hardy uses 'a carefully composed visual sequence that begins with a wide-angle shot of the heath and then zooms in on the distant barrow where a figure is outlined against the sky'. Lodge terms these moving views 'equivalent' to cinematic methods.[23] However, it seems anachronistic to apply this terminology ('wide-angle shot', 'zoom') and analysis to a novel published in 1878 when these types of filmic movement were not able to be technologically created—and likewise the term 'cinematographic' used in his title. Further, this type of visual experience and its representation in fiction is not specific to a cinematic way of seeing; the movement between long- and short-distance perspectives is often used in descriptive fiction and should perhaps be more fruitfully addressed as an example of fiction's influence upon film.

Following Shail's close attention to changes in media forms and the consequential differences in their linguistic and phenomenological significance, throughout this thesis I stress the dates of each technological development and popularity not to impart a sense of

[22] Alan Spiegel, 'Flaubert to Joyce: Evolution of a Cinematographic Form', *NOVEL* 6.3 (1973), 229-243 (p. 231); David Lodge, 'Thomas Hardy and Cinematographic Form', *NOVEL* 7 (1974), 246-264 (p. 250).
[23] Lodge, 'Thomas Hardy and Cinematographic Form', p. 251.

teleological progress but rather to ensure that I attend closely to the particular visual format and experience of each optical device, identifying the language with which its mechanism and spectacle was associated for contemporary users (unlike Lodge's analysis of Hardy's novel), and tracing the linguistic resonances within fiction of specific technologies. As I argue in the next section, each example of visual technology should be considered for its individual importance and cultural relevance, not simply for its momentary role in the long history of cinema.

Histories of Cinematic Media

The Lumières' 1895 invention of the cinématographe for projecting reels of film onto a large screen to offer viewers the spectacle of moving images is often thought of as the moment when technology extensively changed visual experience, thereby pushing culture into a new era of modernity.[24] So effective was the verisimilitude to the eye and the mind and, importantly, so radical and new was the spectacle confronting early audiences that, it is claimed, they jumped clear of the object shown on the screen, 'howling and fleeing in impotent terror before the power of the machine' as if playing out the role of 'savages in their primal encounter with the advanced technology of Western colonialists', as Tom Gunning colourfully describes.[25] As he asserts, this created a myth of the first audiences of the cinématographe as naïve to the spectacle of the mechanically moving image, with,

[24] For the historiography of and perspectives on cinema's development, see particularly Lewis Jacobs, *The Rose of the American Film: A History* (New York: Harcourt Brace, 1939); C. W. Ceram, *Archaeology of the Cinema* (London: Thames and Hudson, 1965); John Barnes, *The Beginnings of the Cinema in England*, 4 vols (Newton Abbot: David & Charles; New York: Barnes & Noble, 1976); *Film Before Griffith*, ed. by John Fell (Berkeley and Los Angeles: The University of California Press, 1983); Michael Chanan, *The Dream That Kicks: The Prehistory and Early Years of Cinema in Britain* (London: Routledge & Kegan Paul, 1980); David Robinson, *From Peepshow to Palace: The Birth of American* Film (Columbia: Columbia University Press, 1997); and Charles Musser, 'Historiographic Method and the Study of Early Cinema', *Cinema Journal* 44.1 (2004), 101-7.

[25] Tom Gunning, 'An Aesthetic of Astonishment: Early Film and the (In)credulous Spectator' in *Viewing Positions: Ways of Seeing Film*, ed. by Linda Williams (New Brunswick, New Jersey: Rutgers University Press, 1995), pp. 114-133 (p. 115). See also Martin Loiperdinger, 'Lumière's 'Arrival of the Train': Cinema's Founding Myth', *The Moving Image* 4.1 (Spring 2004), 89-118.

critically, 'no tradition by which to understand it'.[26] This thesis counters such myth-making in its focus on Victorian moving images.

The material technologies of Victorian visual culture which the following chapters explore are commonly associated with the long genealogy of the history of cinema. Some, especially persistence of vision devices, are termed 'precinematic' or 'proto-cinematic', equating them linguistically with an invention which was, roughly, sixty years away from their first appearance in the 1830s. To call these devices 'cinematic before the fact', as Ian Christie does, is to sever them from their specific cultural position and to ignore what they might *mean* as technologies, as processes, and as operable items to users for whom the notion of being *cinematic* was unknown.[27] André Gaudreault and Philippe Marion point out that this categorization 'derive[s] from an *a posteriori* perspective […] rather than from any awareness of this emergence by contemporary practitioners. To those who came *before* the birth of the cinema as the seventh art, early cinema was not, in fact, early cinema'.[28] Further, this retrospective categorization denigrates technological visual experience in the years before cinema as merely an act of anticipation.

Retrospectively imposing labels such as 'precinematic' is an unfortunate example, Gaudreault has argued, of 'cutting up history after the fact in a way that does not respect the integrity of the object under study': 'Because of this ideal standard of a cinema yet to come, early cinema [e.g. any other device or technique in existence before cinema proper], could only be a 'primitive' cinema whose sole goal was to strive towards its cinematic potential'.[29] As Gunning has rightly pointed out, 'This perspective is also to blame for the

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[26] Gunning, 'An Aesthetic of Astonishment', p. 114.

[27] Ian Christie, 'Moving-Picture Media and Modernity', *Comparative Critical Studies* 6.3 (2008), 299-318 (p. 299).

[28] André Gaudreault and Philippe Marion, 'A Medium is Always Born Twice…', *Early Popular Visual Culture* 3:1 (2005), 3-15 (p. 4).

[29] André Gaudreault, *Film and Attraction: From Kinematography to Cinema*, trans. Timothy Barnard (Urbana, Chicago, and Springfield: University of Illinois Press, 2011), pp. 32, 9.

fact that 'pre-cinema' is identified by a label that negates its own specificities, and which allows, in practice, its effective exclusion from the history'.[30] Drawing on the work of these scholars of film and media history, throughout this thesis I refer to the so-called pre- or proto-cinematic apparatuses as Victorian technologies of the moving image, eliminating the (linguistic) idea of cinema from my discussion in favour of exploring what Gunning describes as the '*longue durée* of visual media' forms which overlapped, co-existed with, and reinforced each other across the century.[31]

There has been a critical emphasis on one specific nineteenth-century technology—the 360-degree panoramic canvas—as 'paving the way' for cinema, which has worked to inculcate a sense that this period's visual culture was premised on passive spectacularity and the viewing of static images. The audience of the panorama is undeniably connected to later audiences of the cinema: at a spatial remove from the subject of vision (the spectacle on the canvas or screen), both require that their viewer gaze without interaction at a large-scale display which works to separate the observer from the creation of that which is viewed. I want to stress though that this connection should not be understood as straightforwardly teleological. The correspondences between the format and presentation of the panorama and the cinema are conceptually similar to those between theatre viewing and cinema but do not mean that one directly gave rise to the other. To place the cinema as a direct descendant of the panorama, as Angela Miller does, limits Victorian visuality to a teleological line composed only of stasis and passivity.[32] The proliferation of different visual media through the nineteenth century (photography,

[30] André Gaudreault, 'The Diversity of Cinematographical Connections in the Intermedial Context of the Turn of the 20th Century', in *Visual Delights: Essays on the Popular and Projected Image in the 19th Century*, ed. by Vanessa Toulim and Simon Popple (Trowbridge: Flick Books, 2000), pp. 8-15 (p. 8).

[31] Tom Gunning, ''We are Here and Not Here': Late Nineteenth-Century Stage Magic and the Roots of Cinema in the Appearance (and Disappearance) of the Virtual Image', in *A Companion to Early Cinema*, ed. by André Gaudreault, Nicolas Dulac, and Santiago Hidalgo (Chichester and Oxford: John Wiley & Sons, 2012), pp. 52-63 (p. 53).

[32] Angela Miller, 'The Panorama, the Cinema and the Emergence of the Spectacular', *Wide Angle* 18.2 (1996), 34-69.

the diorama, kaleidoscopes, persistence of vision devices, handheld and portable moving panoramas, and so on) makes such claims untenable. These devices, in contrast to the model of panoramic and cinematic spectating, necessitated physical involvement. The animated picture seen through persistence of vision technologies, for example, had no tangible existence but required the hand of the viewer to literally turn a series of illustrations into the illusion of a moving sequence. I address the amount of critical attention to the panorama in Chapter One, arguing that Victorian literary studies has too often adopted the panoramic spectator as an analogous model for the figure of the omniscient, guiding narrator, which has resulted in a lack of focus upon other models of interaction, animation, and creative play which we find when the full scope and variety of Victorian visual devices is taken into account.

The teleological history of such devices has been challenged recently by a number of film theorists and historians. Christie argues that the succession model of film history does not fit when mapped over the vast 'ensemble of visual media' which can be found throughout the nineteenth century.[33] Laurent Mannoni points out that the phenakistiscope was still being manufactured into the 1900s *alongside* cinema, interrogating a model in which the invention of each device formed a new step on the ladder to cinema—each step preceding it made redundant in the face of such progress.[34] The reconstruction of the history of optical gadgets has been the focus of Gaudreault and Marion's co-authored work, with the aim of providing a model for assessing the genealogy of cinema which does not rely on a specific end-point (and does not, therefore, position those technologies which came before as mere 'steps on the way'). They refute biological models which seek to find the date of cinema's 'birth', arguing instead for a model of 'intermediality' which,

[33] Christie, 'Moving-Picture Media and Modernity', p. 301.

[34] Laurent Mannoni, *The Great Art of Light and Shadow: Archaeology of the Cinema*, trans. by Richard Crangle (Exeter: University of Exeter Press, 2000), p. 223

although allowing the invention of the cinématographe to be described as 'an event whose proportions were nothing less than that of an epistemological break', still insists on a 'slow process of maturation' during which earlier media forms developed in dialogue with each other, and indeed continued to do so after the invention of the cinema proper.[35]

Gaudreault's recent work has argued that it is counter-productive to search for or even suggest a single date for the invention of cinema. Attending to the variety of professions, industries, and architectural spaces associated with cultures of visual media in the nineteenth century, he proposes instead that 'Cinema's emergence was thus the work of a *variety* of people with a *variety* of specific cultures, and it was out of this cultural broth—we might even say froth of cultures—that cinema *emerged*, many years after its initial procedure was in place'.[36] This focus on 'emergence' stems from his work with Marion on the dynamic 'constitution'—rather than single moment of invention—of any given type of technology or medium. They point out that 'when a medium appears, an intelligible media culture already exists', demonstrating that 'the very concept of the birth of a medium is problematic and paradoxical, at least if we consider birth as a unique and circumscribed event that punctuates the unfolding of history'.[37] Their approach is useful for my study of the varieties of technologically-generated moving image available to Victorian viewers as it prompts an engagement with the 'frothing' culture of visual animation which emerged in this period (especially its 'spill' into the literary imagination, as I go on to show); no single device, technique, or viewing practice is seen to take prominence, in favour of an engagement *across* the range of optical devices available to

[35] André Gaudreault and Philippe Marion, 'The Cinema as a Model for the Genealogy of Media', trans. Timothy Barnard, *Convergence* 8.12 (2001), 12-18 (pp. 12-13). Friedrich Kittler notably describes cinema's 'birth' in *Discourse Networks 1800/1900*, trans. Michael Metteer (1985; Stanford: Stanford University Press, 1990), p. 229.

[36] André Gaudreault, 'The Culture Broth and the Froth of Cultures of So-Called Early Cinema', in *A Companion to Early Cinema*, ed. by Gaudreault, Dulac, and Hidalgo, pp. 15-31 (p. 16, emphasis added).

[37] Gaudreault and Marion, 'A Medium is Always Born Twice…', p. 3.

users which all contributed to a broad experience of and engagement with moving images throughout the mid-nineteenth century. This thesis draws on these new models of film theory in its attempt to apply similar historiographical methods to visual culture and literary studies, not accepting that the literature contemporary with the cinema was the first cultural assessment of and reflection upon the phenomenological experience of viewing and creating a mechanical moving image.

Visual *in* Culture, Visual *as* Culture

What does the term 'visual culture' mean? Does it denote a study of the visual *in* culture, or the culture(s) produced *by* visual experience? Whose visual experience, involving what rules, objects, or technologies, and for what end? Can everything which is visually perceptible be co-opted into discussion? How should the field of the visual be delimited, and by what methods? What is the benefit of studying visual culture, and to which other disciplines might its research pertain?[38] The scope and sheer amount of critical work (encompassing anthologies, readers, position essays, monographs, and articles) undertaken since its development as a field of critical enquiry in the 1970s are testament to its importance as a cross-disciplinary framework with which to study not simply visual objects in themselves but the larger culture of visuality which produced them.[39] The term's inclusion of 'culture' to frame its remit and rationale commits visual culture studies, as W. J. T. Mitchell asserts, 'to a set of hypotheses': that vision is constructed through culture; that visuality is 'learned and cultivated'; and that it is deeply concerned with the 'ethics

[38] W. J. T. Mitchell addresses some of these issues in 'Showing Seeing: A Critique of Visual Culture', *Journal of Visual Culture* 1.2 (August 2002), 165-181.

[39] Michael Baxandall's *Painting and Experience in Fifteenth-Century Italy* (1972; Oxford: Oxford University Press, 1988) is thought to be the first use of the term 'visual culture' (p. 141). His focus not simply on visual artefacts (specifically here paintings) but on the quality and nature of visual experience undergone when consuming such items points towards the broad aim of visual culture studies.

and politics, aesthetics and epistemology' of perception.[40] With such a breadth of potential enquiry, it is no surprise that part of the objective of visual culture studies has been to define its parameters. As Martin Jay cautions, an approach to visual culture in which 'anything that can imprint itself on the retina [is] fair game' would be methodologically cumbersome and its conclusions so expansive as to be deleterious.[41]

It is, then, important to distinguish visual culture studies from what Jay, in a later attempt to demarcate the field, terms 'image studies', or the study of the history of art. If a definition is to be attempted, Jay's assertion that it is a study of aesthetic artefacts as 'stimulants to visual experience' is very useful, making visual culture a discipline in which the historical nature of perception itself becomes the focus.[42] Vanessa R. Schwartz and Jeaneanne Prysbtzki's definition similarly attests that 'visual culture thus includes the study of images/objects and also reaches beyond them to include the history of vision, visual experience, and its historical construction'.[43] What visual culture studies seeks to do is to excavate not necessarily solely *what* is seen (although this does undeniably play a part) but, more importantly, *how* seeing operates and what it means to perceive in a given social, political, economic, scientific, technological, and digital context. Unifying the work of its scholarship is an emphasis on understanding, as Jonathan Crary's work demonstrates, 'historical problems about vision' which he stresses are 'distinct from a history of representational artefacts'.[44]

Tracing the history of vision, its role in the creation of subjectivity, and modernity's 'scopic regimes', Jay's book, *Downcast Eyes* (1993), identifies a move

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[40] Mitchell, 'Showing Seeing', p. 166.

[41] Martin Jay, 'Visual Culture Questionnaire', *October* 77 (Summer 1996), 25-70 (p. 42).

[42] Martin Jay, 'That Visual Turn', J*ournal of Visual Culture* 1.1 (2002), 87-92 (p. 89).

[43] Vanessa R. Schwartz and Jeannene M. Przyblyski, 'Visual Culture's History', in *The Nineteenth-Century Visual Culture Reader*, ed. by Vanessa R. Schwartz and Jeannene M. Przyblyski (London: Routledge, 2004), pp. 3-14 (p. 7).

[44] Jonathan Crary, 'Visual Culture Questionnaire', *October* 77 (Summer 1996), 25-70 (p. 33).

towards 'antiocularcentric discourse' in French philosophy of the twentieth century.[45] This denigration of vision, he writes, was a response to the 'dominant scopic regime of the modern era', that of Cartesian perspectivalism.[46] Drawn from René Descartes' treatise on optics, *La Dioptrique* (1637), Cartesian perspectivalism describes an understanding of the eye as situated at the apex of a pyramid-like structure of vision, monocular and able to survey widely from a single privileged point (this provided a model for the theorization of an objectifying gaze).[47] Karen Jacobs declares the Cartesian eye 'disembodied, objective, and ahistorical'.[48] This classical model of vision, as Crary describes it in *Techniques of the Observer* (1990), was dominant in the seventeenth and eighteenth centuries, linking vision to the unobstructed reception of knowledge. As in the camera obscura, the eye of the observer ('isolated, enclosed, and autonomous') in Cartesian perspectivalism takes up a defined and objective vantage point from which it is able to study, without perceptual interruption or obstacle, an illuminated and perfect impression of the external world.[49]

Crary's book identifies a shift in the 1810s and 1820s from this model to a specifically nineteenth-century observer. He maps a transition from the 'pervasive suppression of subjectivity in vision', evidenced by the 'stable and fixed relations incarnated in the camera obscura' of the seventeenth and eighteenth centuries to a nineteenth-century model which no longer claimed that vision could establish unmediated knowledge and offer claims to truth.[50] Instead, the vision of this transformed observer was newly 'instrumental, modifiable, and essentially abstract'; visual experience became

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[45] Martin Jay, *Downcast Eyes: The Denigration of Vision in Twentieth-Century French Thought* (Los Angeles and Berkeley: The University of California Press, 1994), pp. 9, 150.
[46] Jay, *Downcast Eyes*, p. 70.
[47] For more, see Jay, *Downcast Eyes*, pp. 53-82.
[48] Karen Jacobs, *The Eye's Mind: Literary Modernism and Visual Culture* (Ithaca and London: Cornell University Press, 2001), p. 7.
[49] Jonathan Crary, *Techniques of the Observer: On Vision and Modernity in the Nineteenth Century* (1990; Cambridge, Mass.: MIT Press, 1992), p. 39.
[50] Crary, *Techniques of the Observer*, p. 9, 14.

unhinged from any concept of an overarching signifier and was no longer 'located in the empirical immediacy of the observer's body'. Any guarantee of authority or universality belonged, as Crary argues, to 'another epoch': new understandings of physiology and physical optics had dismantled any such certainties.[51] While Crary's notion of a single 'observer' figure is problematic, his work has helped define the field of nineteenth-century visual culture studies and informs many of the focal points around which this thesis is organized, particularly the emphasis on ocular science, the physicality of the eye, and the concentration on the many devices and 'techniques' of Victorian looking.[52]

Technologies, Texts, and Approaches

Writing in 1990, Crary comments that critical engagements with the small Victorian optical devices like the zoetrope and phenakistiscope were undertaken 'almost exclusively in the service of a history of cinema'. This has recently begun to change: work by cultural historians, literary scholars, and art historians—such as Isobel Armstrong, Lynda Nead, John Plunkett, and Tom Gunning—has incorporated these technologies into broader debates about vision, materiality, print culture, art and aesthetics, memory, and virtuality, and I am indebted to and engage with their work throughout this thesis. However, Crary's perspective that there has been a 'tendency to conflate all optical devices in the nineteenth century as equally implicated in a vague collective drive to higher and higher standards of verisimilitude' continues to be a rather insightful survey of the dominant critical approach

[51] Crary, *Techniques of the Observer*, p. 24.

[52] Crary admits he risks 'presenting something abstracted and divorced from the singularities and immense diversity that characterized visual experience in [the nineteenth] century', but his bold pronouncements on '*dominant* practices of vision' and 'the formation of a *dominant* model' of the observer can be criticized for their smothering of difference (*Techniques*, p. 7, emphasis added). Although Mitchell is wary of the 'totalizing master narrative' in evidence and cautions against his language of 'rupture', he, however, falls prey to the same impulse in his description of the 'pictorial turn': 'specific moments when a new medium, a technical invention, or a cultural practice erupts in symptoms of panic or euphoria (usually both) about the visual'. W. J. T. Mitchell, *Picture Theory: Essays on Verbal and Visual Representation* (Chicago: University of Chicago Press, 1994), pp. 22, 173.

to Victorian visual culture.[53] I address this thoroughly in Chapter One, arguing that emphasis has too often been given to the technologies of 'static spectacularity' which sought to reproduce, recreate, or represent a mimetic illusion or captured and copied image. This has reduced critical engagement with the various other types and techniques of Victorian vision, such as the smaller, hand-held devices discussed by those scholars cited above, and in whose path this thesis follows.

The production and viewing of technological moving images enlarges what we know of the ways the Victorians experienced perception, and of what they understood about the physical operation of the eye. Some motion devices not only grew directly out of scientific research into ocular physiology but importantly helped to spread an awareness of the ways that the eye and brain worked collaboratively to 'see' the illusion of animation; science mutated into popular entertainment, and popular entertainment in turn morphed into an everyday engagement with the latest scientific thinking. Beyond being spectators, the Victorians were keen producers of optical displays and understood how to manipulate technology to create enthralling scenes of movement and vitality, and, importantly, knew how these technologies were working on both the eye and the brain in order to create their animated scenes. By attending to those devices which necessitated physical operation and relied upon the particularity of human perceptual physiology, we can begin to understand how a history of technology must also assess the phenomenology of that process, of what it meant to not just see but to physically and cognitively *create a new type of seeing*, which is a key aim of this thesis. The nineteenth century was the first time such a wide variety of easily accessible optical devices were available for people to make and view moving images, and in reading the literature of this period I find a keen reflection upon and use of the language of animation. My approach to visual culture is not just to study the

[53] Crary, *Techniques of the Observer*, p. 110.

actual images produced and consumed in this period but to understand and trace the significance of how these new, animated spectacles were made, attending particularly to the physicality and physiology of their operation.

I look at those technologies which were newly able to *generate* visual motion, rather than simply *represent* it. One was able, of course, to *see* mechanically-mediated external motion using even the early camera obscura technology: Giovanni Battista della Porta describes how by using a lens, 'You shall presently see all things clearer, the countenances of men *walking*, the colours, garments, and all things as if you stood hard by'.[54] I follow Gunning's approach, arguing that Victorian optical technology of the moving image evidenced an important change in the history of visual media. Gunning writes that the imagery of the phenakistiscope created a threshold in the history of image production and consumption:

> Since the beginning of culture, movement has played a role within art works through the physical movement of actors and dancers, puppets and automatons, or shadows and pictorial figures. But with these mechanical devices we actually see moving images produced optically. I maintain this marks a revolutionary moment in the history of the image—one we have not fully appreciated or explored.

Whereas earlier devices 'represent, or allude to, movement through multiple pictures', the technologies under consideration in this thesis—the moving panorama, diorama, dissolving slides, kaleidoscope, and persistence of vision devices such as the zoetrope and phenakistiscope—all go beyond this and instead 'produce' visual motion, either through

[54] Giovanni Battista della Porta, *Magia Naturalis* (1589), p. 266 (emphasis added), qtd. in Olivier Darrigol, *A History of Optics from Greek Antiquity to the Nineteenth Century* (Oxford: Oxford University Press, 2010), pp. 24-29. For a good survey of examples of represented visual motion pre-1800s, see Laurent Mannoni, Donato Pesenti Campagnoni, and David Robinson, *Light and Movement: Incunabula of the Motion Picture, 1420-1896* (Pordenone: Le Giornate del Cinema Muto, 1995).

particular lighting techniques, projection, mirrors, or physiological and cognitive functioning.[55]

Each chapter focuses on one type of technological animation and attends to its history, paying particular attention to how contemporary viewers received and understood its moving display. I look at scientific writing, journalism, reviews, written and illustrated advertisements, and contemporary letters and accounts to show that the trope of motion is always present in the textual descriptions of its operation or spectacle. In identifying the types of language used to describe and report upon these new moving images, I then weave into my discussion close readings of popular fiction (particularly work by Charlotte Brontë, Charles Dickens, and George Eliot) to show how literary language was responding to the phenomenology and aesthetics of visual animation. I have not sought to trace firm biographical links between these authors and moving-image technologies (although occasionally this is appropriate to my discussion and has been included), preferring to let the texts themselves demonstrate the period's engagement with and knowledge of visual movement, and examining how what were originally scientific or technological descriptions of animation were being innovatively drawn on in fiction to offer new literary tropes which described memory, thought, and perception. While it is not possible, for example, to show beyond doubt that Eliot must have used a zoetrope, the amount and variety of references, implicit and explicit, to moving-image technologies and techniques in the texts under consideration makes it clear that all three writers were knowledgeable about and understood the mechanism, operation, and spectacle of these optical gadgets and, crucially, were confident that their readers, too, would appreciate this shared language of visual animation.

[55] Tom Gunning, 'The Play between Still and Moving Images: Nineteenth-Century "Philosophical Toys" and Their Discourse', in *Between Stillness and Motion: Film, Photography, Algorithms*, ed. by Eivind Røssaak (Amsterdam: Amsterdam University Press, 2011), pp. 27-44 (p. 38).

After turning first to the panorama, Chapter Two moves on to consider external projections of motion in the moving panorama, diorama, and dissolving lantern slides and explores how their subtly transforming views and architectural design produced an understanding of visual motion as passing or transforming 'before' the eyes of the viewer. Chapter Three looks at the hand-held kaleidoscope through a reading of the revised 1858 treatise on its operation, value, and application by its inventor, David Brewster. Taking this text as the core of this chapter, my discussion ranges across scientific writing, journalism, fiction, and the art of the Pre-Raphaelites to show how important the trope and popularity of 'kaleidoscopism' was to representations of sensory perception and mental experience. Following this, Chapter Four looks to another form of hand-held and hand-operated technologies: persistence of vision devices. Concentrating first on their scientific history and the understandings of physiology which underpinned their working, I then explore how their animated display (founded in the cognitive layering of near-simultaneously seen images) offered writers a way to newly represent memory, recall, and disordered perception. Finally, Chapter Five incorporates all the optical technologies under investigation to make a broader point about their physically manipulated operation. The need for the user to manually operate these devices contributed, I argue, to a Victorian understanding of haptic perception—some decades before this sensation began to be theorized. It also provoked a literary representation of perception (and especially the eye) as something tactile and physical that could be wielded and controlled, and which might metaphorically manifest in the landscape of the novel as a roaming, wandering, following *thing*.

I focus on the novel as the literary form most able to dramatize the experience of cognition, memory, recall, and imaginative speculation from the perspective of individual characters. This is swiftly becoming a fruitful and busy field of scholarly enquiry, with

critics taking approaches from the history of psychology, cognitive studies, aesthetics and physiological aesthetics (particularly the study of sympathy and/or empathy), and sensory studies.[56] Michael Irwin's *Picturing: Description and Illusion in the Nineteenth-Century Novel* (1979) is an early example of such work in its discussion of the nineteenth-century novelist's attempt to 'stir the reader's visual imagination' and to transmit imaginative pictures through particular descriptive techniques and choices.[57] Summarizing work in this area which has looked to the Romantic period, Alan Richardson points out that it is the highly visual nature of John Keats, P. B. Shelley, and William Wordsworth's poetic language which encourages the reader to create their own mental images in the process of reading. Richardson also adds Walter Scott to this list, arguing that

> It says something highly significant about the human mind-brain that, before there was anything like film, poets like Scott were providing 'moving pictures' for screening by the mind's eye. It could be argued that film did not create a new craving for vivid, moving images but arose to fill that hunger with a speed, readiness, and lack of effortfulness never before possible.[58]

Richardson's identification of Romantic authors' attempts to provide a type of 'moving picture' for their readers many decades before cinema is an astute and welcome analysis, especially in a period whose scholarship is so often concerned with the stasis of spectacularity, as I turn to in the next chapter. My thesis enters this debate and provides a reading of the period between Scott and the cinema, arguing that the same provocation of mental 'moving pictures', or the desire for Dickens's '*something in motion*', can be traced in the language of mid-Victorian fiction.

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[56] For good introductions to this area, see in particular Ellen J. Esrock, *The Reader's Eye: Visual Imaging as Reader Response* (Baltimore: Johns Hopkins University Press, 1994); Elaine Scarry, *Dreaming by the Book* (Princeton: Princeton University Press, 1999); Stephen M. Kosslyn, William L. Thompson, and Giorgio Ganis, *The Case for Mental Imagery* (Oxford: Oxford University Press, 2006); and Alan Richardson, 'Imagination: Literary and Cognitive Intersections', in *The Oxford Handbook to Cognitive Literary Studies*, ed. by Liza Zunshine (Oxford: Oxford University Press, 2015), pp. 225-245.

[57] Michael Irwin, *Picturing: Description and Illusion in the Nineteenth-Century Novel* (London: HarperCollins, 1979), p. vii.

[58] Alan Richardson, *The Neural Sublime: Cognitive Theories and Romantic Texts* (Baltimore: Johns Hopkins University Press, 2010), pp. 55-57.

CHAPTER ONE

Sights and Sites of Spectacular Stasis: Victorian Visual Culture and Panoramic Narratives

In their *Reader* of nineteenth-century visual culture, Vanessa R. Schwartz and Jeannene M. Przyblyski write that 'the very notion of 'visual culture' was made possible by the many changes in image production in the nineteenth century'.[1] The changes they have in mind include new ways of mechanically creating and replicating images (through engraving, printing, photography, and film); the systems and institutions through which visual artefacts and experiences were manufactured, debated, categorized, and commodified; and the often radical new understandings, investigated and validated by scientific experimentation, of the physiological and cognitive processes involved in producing and understanding visual perception. Such developments combined to create, particularly in the Victorian period, a thriving visual imaginary which evidenced a keen 'investment in the mechanics of seeing' and culminated in 'a growing culture of spectacle dependent on mechanical reproduction'.[2]

Like the composite photographs pioneered in the middle decades of the century, visual culture in this period has been pieced together from multiple disciplinary perspectives to offer a framework through which we might 'see' the Victorians seeing, and

[1] Vanessa R. Schwartz and Jeannene M. Przyblyski, 'Visual Culture's History' in *The Nineteenth-Century Visual Culture Reader*, ed. by Vanessa R. Schwartz and Jeannene M. Przyblyski (New York and London: Routledge, 2004), pp. 3-14 (p. 3).

[2] Schwartz and Przyblyski, 'Visual Culture's History' p. 10. For further discussion of the technological materiality of vision in this period, see *Illustrations, Optics and Objects in Nineteenth-Century Literary and Visual Cultures*, ed. by Luisa Calè and Patrizia Di Bello (Basingstoke: Palgrave Macmillan, 2010) and *Media, Technology, and Literature in the Nineteenth Century. Image, Sound, and Touch*, ed. by Colette Colligan and Margaret Linley (Farnham: Ashgate, 2011).

in such a historiographical collage certain aspects of visual experience have dominated critical discourse.[3] It is the contention of this chapter that Schwartz and Przyblyski's assessment of a burgeoning mechanical 'culture of spectacle' is indicative of a broader trend in Victorian visual culture studies which describes the period as one concerned foremost with spectatorship and technological spectacularity.[4] Definitions of spectacle, or that which is spectacular, imply an act in which only the sense of vision is involved and an experience which makes the looker physically distinct or even removed from the object of their gaze: 'A specially prepared or arranged display of a more or less public nature (esp. one on a large scale)'; 'A person or thing exhibited to, or set before, the public gaze'; 'something presented to the view'.[5] In framing Victorian visual experience as predominantly 'spectacular', there has been an overarching emphasis on the passive and physically uninvolved spectatorship of a static spectacle—what Helen Groth has called the 'spectacular stasis and visual mastery' suggested by the panorama.[6] This has led to a critical diminishment of other more interactive, animative models of perception.

Studies of Romantic-era visuality have tended to concentrate on moments and practices of disengaged spectacularity, largely because most visual apparatuses available at the time were only able to offer a stationary display and demanded a physically distant

[3] The following studies have been invaluable to this thesis, and their arguments surrounding the creation, mediation, and legacy of a Victorian visual culture will be engaged with throughout: Richard Altick, *The Shows of London* (Cambridge, Mass.: Harvard University Press, 1978); Martin Meisel, *Realizations: Narrative, Pictorial, and Theatrical Arts in Nineteenth-Century England* (Princeton: Princeton University Press, 1983); Jonathan Crary, *Techniques of the Observer* (1990; Cambridge, Mass.: MIT Press, 1992); *Victorian Literature and the Victorian Visual Imagination*, ed. by Carol T. Christ and John O. Jordan (Berkley: University of California Press, 1996); Kate Flint, *The Victorian Visual Imagination* (Cambridge: Cambridge University Press, 2000); and Isobel Armstrong, *Victorian Glassworlds: Glass Culture and the Imagination 1830-1880* (Oxford: Oxford University Press, 2008).

[4] Jonathan Crary distinguishes between the 'observer' and 'spectator', favouring the former on account of the latter's connotation of being 'a passive onlooker at a spectacle'; the 'observer' instead is one embedded within a system of 'rules, codes, regulations, and practices'. It is this creation and management of a nineteenth-century observer which his influential work draws out. *Techniques of the Observer*, pp. 5-6.

[5] 'Spectacle', *Oxford English Dictionary*, (Oxford University Press: December 2013) [http://www.oed.com.ezphost.dur.ac.uk/view/Entry/186057. Accessed 21 September 2014.]

[6] Helen Groth, 'Kaleidoscopic Vision and Literary Invention in 'An Age of Things': David Brewster, *Don Juan*, and "A Lady's Kaleidoscope"', *English Literary History* 74.1 (Spring 2007), 217-237 (p. 217).

spectator (as in the 360-degree panorama, discussed below).[7] However, new developments in optical devices and techniques throughout the Victorian period render this spectacle-consuming figure outdated, and it is the burgeoning mid-century interest in moving, interactive spectacles which this thesis addresses. Of course there were many aspects of Victorian visuality which were undoubtedly spectacular, and it would be churlish to argue against the presence of spectacle in any perceptual environment or experience. In this chapter, however, I argue that the critical emphasis placed upon spectacle has tended to over-privilege an idea of visual stasis and remove. Consequently, the sites, technologies, and experiences of visual interactivity, physical engagement, and *animated* spectacle have rarely been addressed in broader analyses of the period's 'visual imagination' (as studies by Christ, Jordan, and Flint term it). Critical figurations of Victorian perceptual experience often draw on a singular, still (and at times passive) observer and his opposite: a massy, delimited block of substance which is 'the thing to be looked at', unmoving in its appeal to the spectacular. Such a framing of visual culture excludes the explicit and intense perceptual interactivity between subject and object encouraged by technologies of the moving image which this thesis finds in both the history of the period and in the literary imagination's language of fictional representation.

Arguably, the most influential and long-lasting invention of visual technology in the Victorian period was photography, and its relationship with and impact upon literature has been much discussed in scholarship.[8] The invention of photography, of the ability to capture a scene exactly as it appeared to the eye and reproduce it as a physical artefact, has

[7] For broad discussion of Romantic technologies of vision and the capitalization of spectatorial behaviour, see William Galperin, *The Return of the Visible in British Romanticism* (Baltimore, MD: Johns Hopkins Press, 1993); Luisa Calè, *Fuseli's Milton Gallery: Turning Readers into Spectators* (Oxford: Oxford University Press, 2006); Sophie Thomas, *Romanticism and Visuality: Fragments, History, Spectacle* (New York: Routledge, 2008); and Peter Otto, *Multiplying Worlds: Romanticism, Modernity, and the Emergence of Virtual Reality* (Oxford: Oxford University Press, 2011).

[8] For good overviews of the history of Victorian photography, see John Tagg, *The Burden of Representation: Essays on Photographies and Histories* (Amherst: University of Massachusetts Press, 1988) and Larry Schaaf, *Out Of The Shadows: Herschel, Talbot, & The Invention Of Photography* (New Haven; London: Yale University Press, 1992).

been—and rightfully so—acknowledged as an important context for Victorian (particularly realist) fiction. Although a visual medium, it offered, as Jennifer Green-Lewis writes, a new 'language of representation': its captured moment seemed able to 'tell' or 'bear witness' to narrative.[9] Daniel Novak's excellent contribution to this field points out the overlapping stylistic and aesthetic ideals of photography and realist fiction in this period, looking specifically to the engineering of composite photographs (images made through combining, cutting, and overprinting negatives, transposing figures from one picture to another) to argue for the central importance of 'manipulation' to realism and photography in the creation of their 'novel bodies'; photography 'set the standard for what was *not* real', Novak writes.[10]

However, it was the late-eighteenth century panorama which offered the most spectacular experience of visual mediations of the real. As Gillen D'Arcy Wood writes in his study of popular 'mimetic media', the panorama's predominant mode was that of 'spectacular realism: the novelty of specially engineered visual spectacles and simulacra'.[11] Both photography and the panorama offered viewers a new visual experience and artefact which was *still*—almost unreally so—but it was the scale, scope, and immersive physical environment of the panorama which made it the period's most unique example of the spectacularity of disengaged looking. In surveying some of the major areas of scholarship on Victorian visual culture, this chapter draws attention to the critical focus, and indeed privileging, of what I term the stasis of spectacularity, witnessed clearly in the

[9] Jennifer Green-Lewis, *Framing the Victorians: Photography and the Culture of Realism* (Ithaca: Cornell University Press, 1996), p. 21. See also the following studies of photography and Victorian writing: Lindsay Smith, *Victorian Photography, Painting, and Poetry: The Enigma of Visibility in Ruskin, Morris, and the Pre-Raphaelites* (Cambridge: Cambridge University Press, 1995); Nancy Armstrong, *Fiction in the Age of Photography: The Legacy of British Realism* (Harvard: Harvard University Press, 1992); and, most recently, Owen Clayton, *Literature and Photography in Transition, 1850-1915* (Basingstoke: Palgrave Macmillan, 2015).

[10] Daniel A. Novak, *Realism, Photography, and Nineteenth-Century Fiction* (Cambridge: Cambridge University Press, 2008), p. 6.

[11] Gillen D'Arcy Wood, *The Shock of the Real: Romanticism and Visual Culture, 1760-1860* (Basingstoke: Palgrave, 2001), pp. 110-111.

architectural and perceptual arrangement of the panorama itself. I then consider how this has driven critical work on visuality and Victorian narrative, finding a particular preoccupation with the panoramic mode as an analogy for the figure of the omniscient narrator.

By opening with this background, this thesis seeks to point out an alternative contextual pathway down which Victorian literary and visual studies might turn (the argument for which is made throughout the following chapters): one that involves a consideration of other technologies of vision which invited viewers to physically engage, make, and play with the mechanism and physiology of spectacle, removing distance and creating instead a model of interactive, perceptual animation. First, I turn briefly to the phantasmagoria, a late eighteenth-century adaptation of magic lantern practice which offered the very crudest example of a visual technology which not only represented motion but created it, before moving on to discuss the dominant critical focus on the sights and sites of spectacular stasis in the panorama.

Projecting 'Living' Spectres in the Phantasmagoria

The magic lantern, its modern format invented by the Dutch scientist Christian Huygens in 1659, took the form of a box containing a light source, a slide holder, and two lenses to converge the light rays onto the slide and to focus and enlarge the image to be projected.[12] Its glass slides were painted by hand until the widespread use of mass-produced photographic slides from the 1850s onwards. Beyond simple projection, lantern technology could be used to produce a range of visual effects. I go on to discuss dissolving

[12] Laurent Mannoni's 'archaeology' of technologies which contributed to the development of cinema references a number of other figures working across Europe on creating and perfecting a projecting lantern. In Britain, the scientist Robert Hooke also claimed the magic lantern as his own invention in an article published 17 August 1688 in the Royal Society's *Philosophical Transactions*. Mannoni gives 1688 as the date when the term 'magic' was added to its description. *The Great Art of Light and Shadow: An Archaeology of the Cinema*, trans. Richard Crangle (Exeter: The University of Exeter Press, 2000), pp. 33, 46-66.

views in Chapter Two but turn here to the supernatural show of the phantasmagoria. Brought to London from Paris at the very end of the eighteenth century by Paul de Philipstal and shown at the Lyceum Theatre in 1801, the phantasmagoria played with viewers' perceptions by offering the illusion of images which floated in mid-air, seemingly untethered to any projection technology and able to grow and diminish in size.[13]

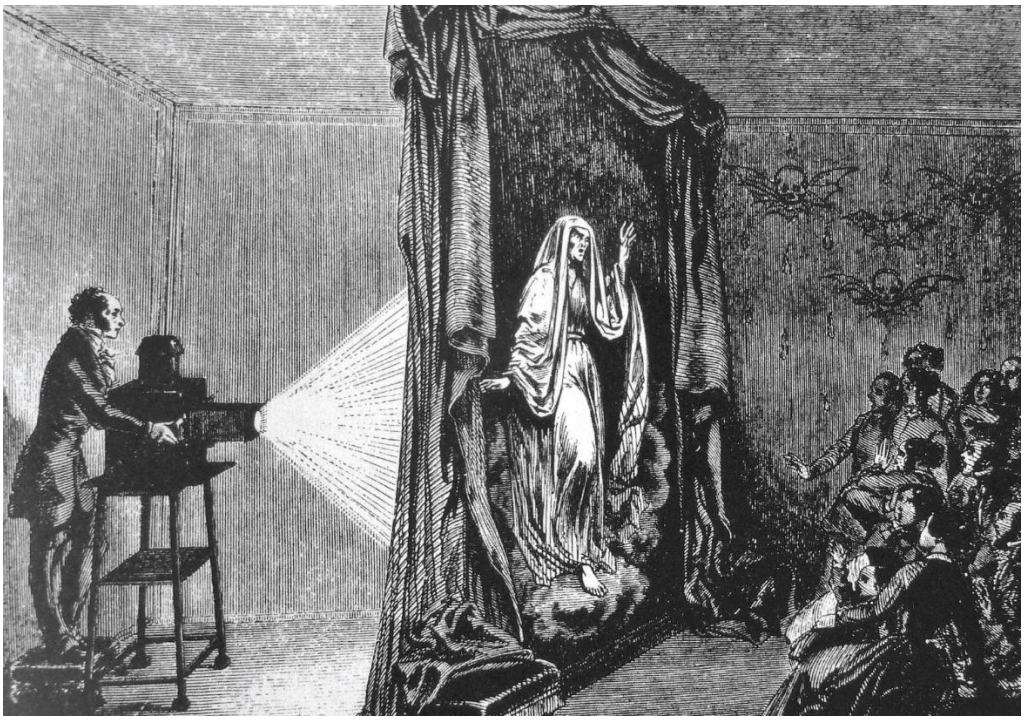

Figure 1. A phantasmagoria show. *La Magasin Pittoresque*, 1845.

Spectators sat in a darkened room, decorated with ghoulish images, and awaited the mysterious appearance of spectral images which appeared to move nearer and nearer the audience until they disappeared or receded back into the darkness (a trick of animation effected by moving the lantern nearer to or away from the screen). An advertisement for the show describes how 'the Objects freely originate in the Air, and unfold themselves

[13] See Mannoni, *The Great Art*, pp. 146-147 and Altick, *The Shows of London*, pp. 217-219 for a discussion of the phantasmagoria's history.

under various Forms and Sizes, such as Imagination alone has hitherto painted them'.[14] Philipstal's spectacle traded on the illusion of images 'freely originat[ing]' as if out of nowhere which were able to 'unfold themselves', promoting the lifelike movement of his visual apparitions to heighten their supernatural effect.

The phantasmagoria achieved its effects through mechanical ingenuity. Instead of projecting the magic lantern slide onto a solid white wall or sheet, the illustrated slide in the phantasmagoria was back-projected from behind screens so that the audience would see the projection appear in the middle of a dark gauze, seemingly without a mechanical origin (see fig. 1). By hiding the lantern behind this screen, the phantasmagoria offered a thrillingly immersive visual experience. Regular magic lantern shows displayed the lantern and its operator and in this way connected the projected image to the point of origin in the device, but the phantasmagoria severed this link of visible procedure in order to strengthen its frightful effect.[15] Although it offered one of the earliest examples of a visual spectacle which traded on motion as a key part of its appeal, the changing sizes of its projections did not constitute a sophisticated image of visual motion or animation, as later technologies such as the kaleidoscope or persistence of vision devices would, or indeed further lantern developments like dissolves. Its fashion was soon overtaken by the popularity of the panorama, which also required a specific exhibition environment, but which appealed for its contrastingly 'real', and indeed static, visual spectacle.

[14] Woodcut advertising the Phantasmagoria at the Lyceum, Strand, [London, 1801]. The Lewis Walpole Library, Yale University. Call number: Folio 74 OL1 v. 2. Image ID: lwlpr25447.

[15] Terry Castle has notably discussed the 'internalization' of visual, and specifically Gothic, imagery in relation to the phantasmagoria. Her essay surveys its appearance as metaphor and direct reference in literary works from Goethe and Mary Wollstonecraft to Byron, De Quincey, and Bulwer Lytton. The 'invisible' arrangement of its technology meant that 'from an initial connection with something external and public […] the word has now come to refer to something wholly internal or subjective: the phantasmic imagery of the mind'. Human consciousness has undergone a process of 'spectralization': 'I mean simply the absorption of ghosts into the world of thought'. 'Spectral Technologies and the Metaphorics of Modern Reverie', *Critical Enquiry* 15 (Autumn 1988), 26-61 (p. 29). See also Diane Long Hoeveler, 'Smoke and Mirrors: Internalizing the Magic Lantern Show in Villette', *Romantic Circles* (special issue on 'Gothic Technology: Visuality in the Romantic Era', ed. Robert Miles) (2005), n. p. [http://www.rc.umd.edu/praxis/gothic/index.html. Accessed 19 November 2014].

Looking Ahead: Spectacular Scale and Fixed Vision in the Panorama

In late eighteenth-century London, a venue opened offering a spectacular show, the scale of which had never before been encountered. Robert Barker's Leicester Square Panorama was a dramatic new entertainment space and a visual experience of unique painterly verisimilitude.[16] Opened in May 1793, Barker's Panorama boasted a central rotunda providing an exhibition surface for a panoramic canvas of over ten thousand square feet.

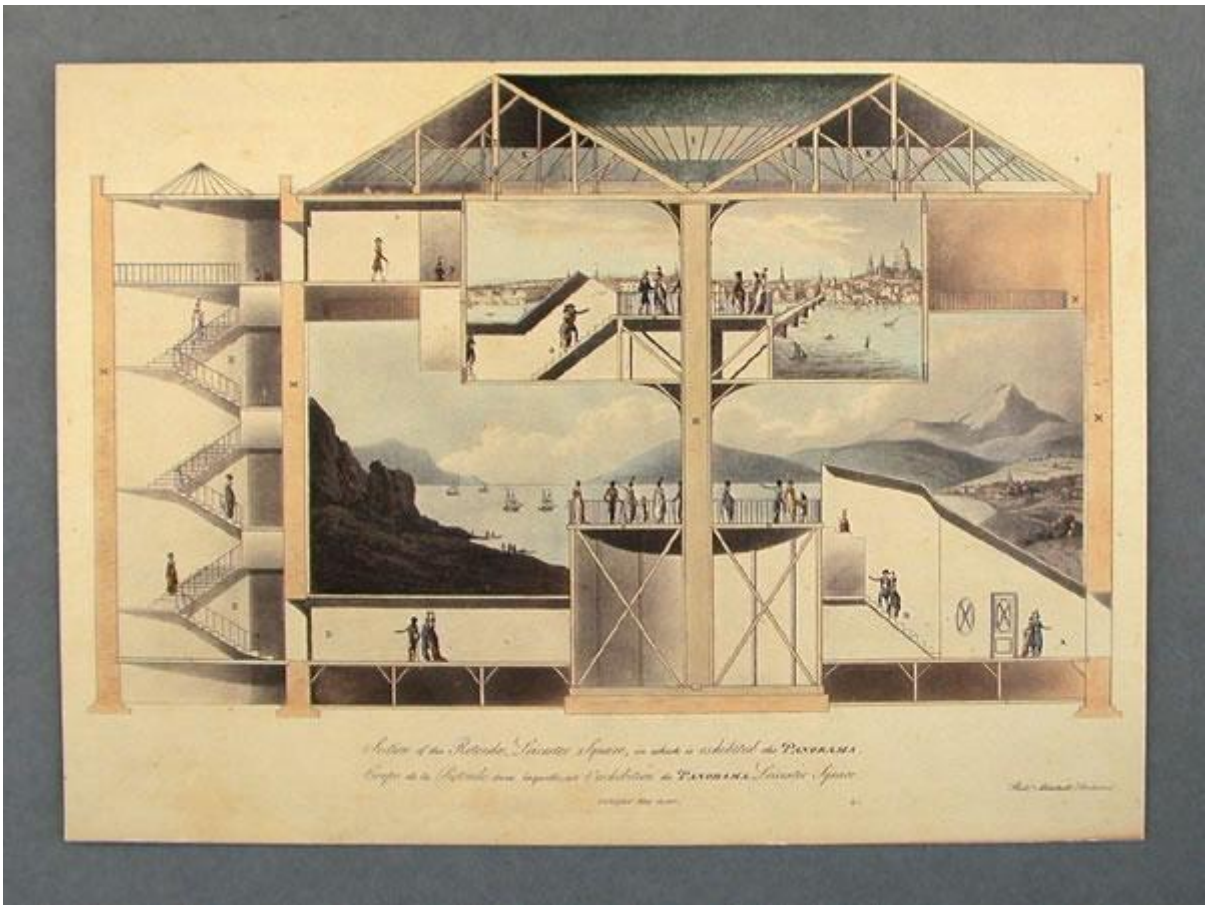

Figure 2. Section of the Rotunda, Leicester Square. The Bill Douglas Cinema Museum, University of Exeter, UK. Item number 85143.

Denoting both a specific apparatus—the huge 360-degree curved canvas hung in a specifically-designed building—and a more general panoramic viewing experience

[16] For further, see particularly Ralph Hyde, *Panoramania! The Art and Entertainment of the 'All-Embracing' View* (London: Trefoil Publications in association with the Barbican Art Gallery, 1988) and *Panoramas, 1787–1900: Texts and Contexts*, ed. by Sibylle Erle, Verity Hunt, Peter West, and Phoebe Putnam (series editor Laurie Garrison), 5 vols (London: Pickering & Chatto, 2010).

associated with scale and point of view, the term was, as Stephen Oetterman's history of the panorama explains, an 'artificial technical term', created in the late 1780s from two Greek roots: *pan* (all) and *horama* (view).[17] It offered, as its etymology suggests, an all-encompassing view from a single privileged point of spectatorship. Although moving panoramas, which unrolled steadily in front of their audience, were introduced in the 1840s (I discuss these in Chapter Two), the early panorama was principally a static form of visual spectacle whose appeal lay in the sheer scale of the painting and its mimetic detail. Barker had previously opened a temporary exhibition in 1787 offering a much more modest panoramic view of Edinburgh. This was then displayed in London in 1789 and commanded, as Markman Ellis has traced, an 'immediate media discussion […] comprising advertisements, patent grants, critical commentary and satire'.[18] Its success encouraged Barker to design and construct a permanent structure in which a much larger canvas could be housed. A key appeal was its relatively inexpensive entrance fee of one shilling, meaning visitors tended to be ordinary members of the public not requiring, as Angela Miller has pointed out, any 'specialized knowledge or aesthetic expertise' in order to enjoy the visual experience.[19]

Other panoramas soon began to operate across Europe, as Oettermann details, and within London new ventures opened in a bid to rival the popularity and success of Barker's Panorama. Thomas Hornor's Colosseum, housed in Regent's Park and opened in 1827, was said to be forty times larger than the original Leicester Square Panorama.[20] In Joss Marsh's assessment, the panorama was '*the* early Victorian London show'.[21]

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[17] Stephen Oetterman, *The Panorama: History of Mass Medium*, trans. Deborah Lucas Schneider (1981; New York: Zone Books, 1997), p. 6.
[18] Markman Ellis, '"Spectacles within doors": Panoramas of London in the 1790s', *Romanticism* 14.2 (2008), 133-148 (pp. 135).
[19] Angela Miller, 'The Panorama, the Cinema, and the Emergence of the Spectacular', *Wide Angle* 18.2 (1996), 34-69 (p. 43).
[20] Altick, *The Shows of London*, p. 141. See Chapter Eleven for a full history.
[21] Joss Marsh, 'Spectacle', in *A Companion to Victorian Literature and Culture*, ed. by Herbert F. Tucker (1999; Oxford: Blackwell, 2007), pp. 276-288 (p. 280).

Figure 3. Handbill advertising a 'Panorama of London' at the Colosseum. The Bill Douglas Cinema Museum, University of Exeter, UK. Item number 77255.

It offered its viewers a visual education in geographical locations they might not otherwise have seen (a form of virtual travel, as Alison Byerly has recently argued) and in historical events previously only accessible through textual description.[22] This aspect of instruction was a selling point 'aggressively highlighted by its promoters', as D'Arcy Wood remarks.[23] Most popular were views of cities, including London, Rome, Moscow, Cairo, Hong Kong, and Delhi, and depictions of military engagements, such as *The British Glory in Egypt*, exhibited in 1801. As Richard Altick points out, the panorama appealed to a broad audience because of its unique ability to realistically visualize subjects. 'The panorama was meant to illustrate history as it was being made', he writes; illustrated newspapers were not available at the turn of the nineteenth century and thus it fell to the panorama and the theatre to 'give pictorial realization to events'.[24]

The panorama was also promoted as spectacle for spectacle's sake: it attracted

[22] See Part One of Alison Byerly, *Are We There Yet? Virtual Travel and Victorian Realism* (Ann Arbor: University of Michigan Press, 2013).
[23] D'Arcy Wood, *The Shock of the Real*, p. 103.
[24] Altick, *The Shows of London*, p. 176.

audiences who wanted to experience its large-scale immersive view and inculcated a sense that the experience of observing was an end in itself. This was supported by its requirement of a purpose-built exhibition space. The panorama became a visual 'destination', a place for visitors to attend if they wanted to engage in a specific type of spectatorship. The panorama was also a place to be seen engaging in the act of looking, where the spectacle was not just the painted canvas—visits from King George III and Queen Charlotte would no doubt have strengthened this aspect of its appeal. The panorama ultimately offered an experience *of the experience of viewing*: it gave nineteenth-century observers the chance to survey a landscape, military scene, or historical event and in doing so tested and sharpened the practice of making perceptual sense out of abundant visual data.

However, the architecture and form of the panorama closely controlled and manipulated visual perception. The viewer was encouraged to experience 'specular dominance', as Catherine Waters terms it, through the spatial configuration of the panorama as an architectural and perspectival experience.[25] Visitors entered the auditorium through a darkened corridor aimed to deprive them of comparative references to 'real' scale. They then climbed a staircase to reach a viewing platform (seen in fig. 2), located at the vertical centre of the canvas, which offered views across, up, and down the stretch of the image from the horizon line. Natural light from the top of the rotunda added sun-like illumination, further enhancing its spectacle of verisimilitude. Once the observer had reached the viewing platform, they were able to take in 'nature at a *glance*' as Barker's patent asserted.[26] Encouraged by the regulatory architecture of the panorama, the observer's visual experience was one of passivity, a sweeping gaze skimming the surface

[25] Catherine Waters, *Commodity Culture in Dickens's* Household Words*: The Social Life of Goods* (Farnham: Ashgate, 2008), p. 70.
[26] Robert Barker, 'Specification of the Patent Granted to Mr. Robert Barker', *Repertory of Arts and Manufactures* 4 (1796), 165-167 (p. 165, emphasis added).

but not able to interact; details could not be focused on or looked at closely, and a different angle of viewing was impossible to obtain.[27] The dominance experienced by the viewer was that of the impersonal survey from an objective remove. Visual mastery was not fought for or earned in the panorama but given automatically by its spatial arrangement.

As a certain amount of mobility was required to ascend to the panoramic canvas and because the spectator had to choose where to position him or herself on the viewing platform, the panorama did engage to an extent with ideas of embodiment and motility. Therefore, my argument that it produced a passive viewer is in relation to perceptual, not bodily, motion. Spectators could shift position on the viewing platform but the stationary panoramic scene offered no illusion or representation of movement in its image. In this way, Waters connects its offering of a bird's eye view to other equally stationary nineteenth-century visual experiences which required a surveying eye, such as 'window-shopping, exhibitions, [and] balloon-flights'. Focusing on their representation in the magazine edited by Charles Dickens, *Household Words*, Waters asserts that the static observation required in these visual forms made their view a 'spectacle for consumption'.[28] The panorama then, required a mobile body but encouraged a form of spectacle which was reliant on perceptual passivity and the consumption of visual stasis.

The viewing platforms which separated the observers from the spectacle were named as 'inclosures' in Barker's patent, reinforcing a sense of visual restriction and 'correct' looking.[29] These balustrades, placed at select locations around the panoramic canvas, invited viewers to take up a position of observation which was predetermined, thereby assuring visitors that they were looking at the 'right' thing in the 'right' way, and

[27] John Plunkett comments that it was the panorama's encouragement of visual passivity and immersion over imaginative interactivity and engagement which so drew Wordsworth's criticism in Book 7 of *The Prelude*. 'Optical Recreations and Victorian Literature', in *Literature and Visual Media: Essays and Studies*, ed. by David Seed (Cambridge: D. S. Brewer for The English Association, 2005), pp. 1-28 (p. 5).
[28] Waters, *Commodity Culture*, p. 66.
[29] Barker, 'Specification of the Patent', p. 166.

that theirs was a privileged position of spectatorship. Bernard Comment writes that gazing across the panoramic vista from this proscribed distance gave a sense of 'totality and possession': spectators were rewarded with 'the happy feeling that the world was organized around and by them'.[30] Oetterman's survey of European panoramas asserts they functioned as a pedagogic tool in the creation of an ideal spectator: the panorama was 'a medium of instruction on how to see, an optical simulator in which the extreme sensory impression, the sensational new experience, could be practiced over and over again, until it became routine'.[31] The panorama thus enforced and normalized a method of organising visual experience which was founded on a privileged, spectacular vantage point and on an model of perceptual experience which favoured scale and spatial remove over detail, proximity, and physical interaction.

Sites of Seeing Spectacularly

If the panorama is of 'definitive importance' for our understanding of early nineteenth-century visual culture, as Wood argues, it is because of its conceptualization of the spectacular as, predominantly, a locational encounter premised upon a separation between spectator and the object of vision.[32] T. J. Clark writes that in the nineteenth century 'the city and social life in general was presented as […] a separate something made to be looked at—an image, a pantomime, a panorama'.[33] Supporting this was the growth in urban environments which themselves—through changes in architecture, consumer habits, and cultural spaces—increasingly became sites for both seeing and being seen, and encouraged new opportunities for the model of distanced spectacularity inculcated by the static panorama. Discussing the increased use of plate-glass, Andrew H. Miller writes that

[30] Bernard Comment, *The Panorama*, trans. Anne-Marie Glasheen (London: Reaktion, 1999), p. 19.
[31] Oetterman, *The Panorama*, p. 22.
[32] D'Arcy Wood, *The Shock of the Real*, p. 101.
[33] T. J. Clark, *The Painting of Modern Life* (Princeton: Princeton University Press, 1984), p. 63.

> Both department stores and exhibition halls created spectacles before which people adopted an attitude of solitary and passive observation. Glass walls allowed sunlight to enter, iron reduced the number of obstacles in the line of vision, and the objects on display were allowed to stand out for view. In department stores, passivity was further encouraged by the establishment of fixed pricing: consumers no longer bargained with salespeople; this social and active element of selling and buying was replaced with a more disengaged, solitary and reflective practice.[34]

A further material change in the urban environment which encouraged distanced spectacularity was the new visibility brought about by developments in lighting techniques; as Wolfgang Schivelbusch describes in his history of nineteenth-century illumination, 'the pools of light around solitary lanterns grew ever larger and finally merged, creating one vast sea of light'.[35] Newly lit environments, predominantly in urban settings, created 'micro-worlds' of constant visibility which encouraged a 'self-watching, self-regulating' spectacularity, and cultural institutions in particular became, as Tony Bennett puts it, a 'site for sight'.[36] The content of a theatrical performance, gallery, exhibition, or new glass-fronted department store became just one aspect of visual consumerism, as observers themselves became increasingly observed. New visual democracies encouraged by the pursuit of *looking at looking* support Bennett's assertion of a 'exhibitionary complex' in which the crowd was not 'atomize[d] and disperse[d]' (as in Foucault's rendering of Bentham's Panopticon) but rather was regulated 'by rendering it visible to itself, by making the crowd itself the ultimate spectacle'.[37]

Moving between such visual spaces—along wide and brightly lit streets or through plate-glass arcades which encouraged expansive vision *through* and reflective vision

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[34] Andrew H. Miller, *Novels Behind Glass: Commodity Culture and Victorian Narrative* (Cambridge: Cambridge University Press, 1995), p. 57.
[35] Wolfgang Schivelbusch, *Disenchanted Night: The Industrialization of Light in the Nineteenth Century*, trans. Angela Davis (Berkeley: University of California Press, 1995), p. 115. See also Chris Otter, *The Victorian Eye: A Political History of Light and Vision in Britain, 1800-1910* (Chicago: University of Chicago Press, 2008) for discussion of lighting practices in both wealthy and poor urban areas, architectural design, and the governance and management of society through visibility and surveillance.
[36] Tony Bennett, 'The Exhibitionary Complex', *New Formations* 4 (1988), 73-102 (p. 81-2).
[37] Bennett, 'The Exhibitionary Complex', p. 81.

within[38]—formed an ancillary 'site' of visibility, most often discussed in relation to the figure of the urban *flâneur*.[39] Discussions of *flânerie* have tended to position the *flâneur* as submissive to that which he is observing. Here, spectacle imposes itself upon the spectator, urging not a reciprocal or interactive perceptual experience but a one-way movement from the spectacle to the receptive eye. For Dana Brand, the *flâneur* in Baudelaire's often-cited mid-century rendering is 'passive and undiscriminating'; likewise in Deborah Parson's study, he is 'bombarded by the vivid spectacle around him'.[40] I discuss this particular visual figure further in Chapter Three, connecting the bodily mobility of his street-walking to the ever-changing kaleidoscopic display, but for the purposes of this chapter it is important to note that the spectacle offered to the *flâneur* has been figured by scholarship as an expansive scene of urbanity in which animation or interactivity has no role and to which the spectator is rendered perceptually vulnerable.

This stillness which dominates critical readings of Victorian visuality is reflected in the choice of topics offered by Vanessa R. Schwartz's study of the indoor and outdoor spaces of spectatorship. Describing a 'spectacularization of city life', Schwartz explores the mass visual consumption of spectacles of the real, a category which for her encompasses panoramas of recent historical events, bodies exhibited in the Paris Morgue, and their waxwork simulacrums. Yet these are all objects and 'sites of sight' which are embedded with a fundamental immobility: spectacle here signifies that which is inert, or even dead. Equating the consumption of mimetic, reality-effect media with Victorian

[38] For two excellent and thorough studies of urban visibility and the role and aesthetics of glass in this environment, see Armstrong, *Victorian Glassworlds*, Chapters Five through Nine, and Elizabeth Carlson, 'Reflections to Projections: The Mirror as a Proto-Cinematic Technology', *Early Popular Visual Culture* 9.1 (February 2011), 15-35.

[39] Elizabeth Wilson identifies the earliest use of the term '*flâneur'* in an anonymous pamphlet published in 1806. See 'The Invisible Flâneur', *New Left Review* 191 (1992), 90-110 for an extensive overview of the literature.

[40] Dana Brand, *The Spectator and the City in Nineteenth-Century American Literature* (Cambridge: Cambridge University Press, 1991), p. 5; Deborah Parsons, *Streetwalking the Metropolis: Women, the City, and Modernity* (Oxford: Oxford University Press, 2000), p. 22. See also Charles Baudelaire, 'The Painter of Modern Life', in *The Painter of Modern Life and other Essays*, trans. and ed. Jonathan Mayne (London: Phaidon Press, 1964), pp. 1-40.

spectacle confines visual experience in this period to the same waxy mould as the visual artefacts on display. [41]

Through these items of urban visual entertainment, Schwartz argues that the city became a 'legible and transparent […] spectacular realist narrative'.[42] Connected to this sense that exhibited objects or sites could turn the lived environment into a walk-through narrative of spectacle is Sara Thornton's work on the print culture of advertising, and the effect of reading the city through both word *and* image. For Thornton, this combination formed a new 'language of the walls' which effected the same bombardment of vision as that encountered in scholarship on urban *flânerie*: 'text was no longer something which had to be sought out and paid for dearly; it now sought out the subject, moved into the line of his or her gaze, and asked to be read'.[43] In such accounts, the materiality of spectacle urges itself upon the viewer, making the spectator an isolated figure at the mercy of perceptual encounter. In such critical narratives, there is no place for interactivity or play between looker and spectacle, and no sense of the body beyond the eye, or of the wider sensory engagement in visuality beyond that of sight.

Exhibiting Spectacle, Encountering Process

A similar but reversed relationship has been portrayed in accounts of exhibition culture: here, the viewing eye imposes itself upon a captured object of vision—a model which, however, sets up the same physical disconnectedness and lack of interactivity.[44] Nancy Armstrong has asserted that the growth in venues of display 'not only set the world on

[41] Vanessa R. Schwartz, *Spectacular Realities*: *Early Mass Culture in Fin-de-Siècle Paris* (Berkeley: University of California Press, 1998), p. 2.
[42] Schwartz, *Spectacular Realities*, p. 2.
[43] Sara Thornton, *Advertising, Subjectivity and the Nineteenth-Century Novel: Dickens, Balzac and the Language of the Walls* (Basingstoke: Palgrave Macmillan, 2009), p. 35.
[44] For a reading of exhibitions and 'cultures of the spectacular' in relation to the realist novel, see Dehn Gilmore, *The Victorian Novel and the Space of Art: Fictional Form on Display* (Cambridge: Cambridge University Press, 2014).

exhibition outside and apart from the viewer as a spatial field the viewer could survey, it also represented that world as though it actually existed primarily to be seen'.[45] As in the Panorama, the observer was placed in the privileged position of visual consumer to whom spectacular knowledge was offered directly.[46] Paul Young's description of London's 1851 Great Exhibition as a 'lens' which brought disparate objects 'into focus' emphasizes further the physical disengagement of the spectator; although surrounded by plate glass structures and cabinets designed to provide a clarity of vision, these also worked to visually enclose their object, just as a lens enables vision at the same time as it cuts between the viewer and his subject. As Isobel Armstrong writes, 'Glass's pellucid transitivity—you can see through it—represents at the same time the first gradation of opacity. It is both medium and *barrier*'.[47]

The aim of such exhibitions was to offer an experience which was both instructive and entertaining. Spectacle, then, became interwoven with education; looking was learning. From the 1830s there was a flourishing of permanent venues and touring shows which exhibited the latest technologies, mechanical processes, and scientific developments (especially those which could be performed or enacted in front of an audience). Popular in both rural and urban areas they were, unlike the Royal Institution and similar elite establishments, open to any interested member of the public—an appeal furthered by their one shilling entry fee. New societies, institutions, and venues opened offering demonstrations, exhibitions, lectures, educational classes, lantern projections, and

[45] Armstrong, *Fiction in the Age of Photography*, p. 82. See also *Museum Culture: Histories, Discourses, Spectacles*, ed. by Daniel J. Sherman and Irit Rogoff (Minneapolis: University of Minnesota, 1994) for a historical emphasis on the spectacle of display.

[46] Heather Glen invokes a similar passivity in her assessment of visual spectacle and exhibition in the novels of Charlotte Brontë. Lucy Snowe, the heroine and narrator of *Villette* (1853), is presented as a spectator 'rather than a shaping observer'. 'Again and again in the novel', Glen writes, 'the image recurs of the eye less as organizing than as simply receiving impressions, of a world that baffles, bewilders, dazzles, and strikes'. *Charlotte Brontë: The Imagination in History* (Oxford: Oxford University Press, 2002), pp. 213-237 (p. 223).

[47] Paul Young, *Globalization and the Great Exhibition: The Victorian New World Order* (Basingstoke: Palgrave Macmillan, 2009), p. 3; Armstrong, *Victorian Glassworlds*, p. 7 (emphasis added).

theatrical displays of some of the items exhibited.[48] However, these new sites of display did offer audiences the chance to handle and manipulate certain displays, highlighting the importance of understanding the mechanical *process* and *operation* behind the spectacle.

In June 1832, the venue informally known as the Adelaide Gallery opened, its full title reflecting its scope and intention: the 'National Gallery of Practical Science: Blending Instruction with Amusement'. It aimed to offer 'every possible facility for the practical demonstration of discoveries in Natural Philosophy, and for the exhibition of any new application of known principles to mechanical contrivances of general utility'.[49] Lectures were offered on chemistry and natural philosophy, photography was demonstrated daily, and numerous optical equipment was displayed. Moving panoramas were exhibited, along with forty-seven dissolving views (I discuss these in Chapter Two). The Adelaide closed in 1845 and reopened as the Royal Marionette Theatre, due in part, as Altick explains, to a change in tone from 'technological display place to amusement hall'; the competition for admission numbers between the capital's exhibition venues meant that diversification was essential, although not always successful.[50]

Rivalling the Adelaide was the popular Royal Polytechnic Institution (RPI), opened in 1838 on Regent Street.[51] Its central attraction was a working diving bell open to the public for an additional shilling and a chromatic water fountain. A number of smaller exhibition rooms displayed cosmoramic and panoramic views and a programme of evening classes for men and women in subjects such as chemistry, geology, botany,

[48] Good accounts of such venues include Bernard Lightman, *Victorian Popularizers of Science: Designing Nature for New Audiences* (Chicago: University of Chicago Press, 2007) and Chapter Three of Iwan Rhys Morus, *Frankenstein's Children: Electricity, Exhibition, and Experiment in Early-Nineteenth-Century London* (New Jersey: Princeton University Press, 1993).
[49] *National Gallery of Practical Science, Catalogue*, 7th edn (London, 1834), qtd. in Altick, *The Shows of London*, p. 377
[50] Altick, *The Shows of London*, p. 382.
[51] For an the excellent history of the Royal Polytechnic see Brenda Weeden, *The Education of the Eye: History of the Royal Polytechnic Institution 1838-1881* (Cambridge: Granta Editions, 2008).

physiology, mathematics, and languages was offered.[52] Its impressive Lecture Theatre could seat an audience of five hundred in front of the 425-square-foot screen, upon which a range of spectacular effects and displays were projected by a dedicated team of lanternists.[53]

Figure 4. Inside the Royal Polytechnic Institution. *Historical Times*, 11 January 1850, n.p.

Emphasizing the visual exhibition of working mechanisms, the catalogue for 1845 states that 'The object of the Directors has been to invigorate, by the most simple and interesting method of *illustration*, those sound and important principles upon which Science is based, to afford to the inquirer the means of obtaining a general knowledge of

[52] Programme, June 1876, p. 12. Item ref. RPI 3/15, Royal Polytechnic Institution Archives, University of Westminster.
[53] W. F. Ryan, 'Limelight on Eastern Europe: The Great Dissolving Views at the Royal Polytechnic', *The New Magic Lantern Journal* 4 (1986), 48-55 (p. 49).

processes by which the wonders of art and manufacture are produced'.[54] On entering its Hall of Manufactures and Machinery, this emphasis was apparent: numerous working models, tools, and instruments were exhibited, including the electrotype, daguerreotype, electro-magnetic telegraph, and the hydro-electric machine. Making the case for the benefit of visual illustration, a steam-powered loom with a weaver at work in the Hall allowed the machinery, its processes, and output to be 'minutely inspected', meaning that 'the nature of the weaving process can be learned much more quickly than by reading any description'.[55] Moving beyond static display, where the spectator was encouraged to gaze upon a finished item, the final *thing* to be displayed, the intention here was to educate in an object's procedural creation and operation, and to show not only products and outcomes but to exhibit the generative potential of material in action. This encouraged a visual engagement between observer and object as issues such as temporality, causation, interaction, and animation became integral to the spectacle of science and technology.

As Herbert Sussman has argued in relation to the Great Exhibition, 'Visitors delighted in learning how things were made by seeing the process by which machinery transformed raw material into finished goods. […] There was a powerful visual fascination to Victorian machinery such as the working loom or the rushing locomotive'.[56] Iwan Rhys Morus notes a similar tendency in the display of electricity: 'But it also clearly seems to be the case with the Polytechnic's Great Induction Coil, just as with [William] Armstrong's Hydro-electric Machine, that the technology itself was an important focus of attention'.[57] The spectacle rested on how process might be visualized; new emphasis was placed on the

[54] Catalogue for 1845, p. 5 (emphasis added). Item ref. RPI 3/5, Royal Polytechnic Institution Archives, University of Westminster.
[55] 'The Polytechnic Institution', *The Penny Magazine* 584.10 (8 May 1841), 178-179 (p. 178).
[56] Herbert Sussman, *Victorian Technology: Invention, Innovation, and the Rise of the Machine* (Santa Barbara, Calif.: Praeger, 2009), p. 65.
[57] Iwan Rhys Morus, ''More the Aspect of Magic than Anything Natural': The Philosophy of Demonstration', in *Science in the Marketplace: Nineteenth-Century Sites and Experiences*, ed. by Aileen Fyfe and Bernard Lightman (Chicago: University of Chicago Press, 2007), pp. 336-370 (p. 359).

action and effects of a technology, rather than simply its finished product, and a sight-seeing audience were more than willing to pay for a spectacular show with both enthralled and educated through its display of mechanisms at work.

This motivation was connected to a more general 'debunking' of aspects of superstition and belief prevalent throughout the nineteenth century. Seeing process performed similar work of 'debunking' scientific, technological, and industrial operations. David Brewster's 1832 work *Letters on Natural Magic*—a wide-ranging study which centres on physiology, anatomy, and the body's vulnerability to sensory manipulation—attempted, as Verity Hunt explains, to inculcate 'a transition from superstition to an educated wonder' by redefining particular fears and superstitions 'as illusions of sense, via scientific description and explanation'.[58] We can add to this the numerous shows, lectures, and performances as contributors to a growing awareness of the mechanisms—both technological and physiological—behind optical illusions. Lectures on projection, reflection, persistence of vision, and the biological functioning of the eye were often accompanied by a spectacular display (using magic lantern slides, or large-scale models) which provided visual entertainment at the same time as explaining how perception, and its technologies, operated. Martin Willis, exploring some of the 'experimental performances' that investigated vision in the late-nineteenth century, argues that rather than aiming to deceive, optical illusions and technologies often aimed 'to illuminate visual weakness by showing the extent of human ocular deficiency'.[59] This illumination of bodily and specifically ocular processes will be considered further in Chapter Four, when I turn to the various persistence of vision devices which relied upon viewers manipulating their own optical faculties to create durable images.

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[58] Verity Hunt, 'Raising a Modern Ghost: The Magic Lantern and the Persistence of Wonder in the Victorian Education of the Senses', *Romanticism and Victorianism on the Net* 52 (2008), paras 2-3. [http://www.erudit.org/revue/ravon/2008/v/n52/019806ar.html. Accessed 27 November 2014.]
[59] Martin Willis, *Vision, Science, and Literature, 1870-1920* (London: Pickering & Chatto, 2011), p. 185.

In turning its focus away from large metropolitan venues and towards regional sites of scientific display and dissemination, recent scholarship has argued that smaller exhibitionary venues encouraged an increased interaction between the object on display and its audience. In their essay on the prevalence of scientific exhibitions in regional venues and institutions, John Plunkett and Jill A. Sullivan uncover a thriving culture of small-scale, intimate settings for the dissemination of scientific knowledge and technological innovation to a diverse audience who were able, outside of the large formal lecture setting, to interact with the instruments and devices on display. Their article quantitatively maps the occurrence of and attendance at various bazaars, fairs, and conversaziones in Plymouth across a four-year period (1861-5), at which a variety of scientific experiments and innovative technologies were exhibited: from steam power and the galvanic battery to small visual gadgets such as the kaleidoscope, stereoscope, and zoetrope.[60] Plunkett and Sullivan argue that the 'multi-sensory appeal of the event, […] encouraged an active, hands-on relationship with the science on show', a tactile aspect of exhibition culture that was not available to the often seated audience at a scientific lecture or touring panorama.[61]

Word and Image: Reading Spectacle

In addition to these smaller and more intimate exhibitions, an additional aspect of 'engaged spectacularity' can be found in the print ephemera which accompanied popular displays. The panorama in particular generated numerous guidebooks, anamorphic

[60] See Table 2.1 of John Plunkett and Jill A. Sullivan, 'Fetes, Bazaars, and Conversaziones: Science, Entertainment, and Local Civic Elites', in *Popular Exhibitions, Science and Showmanship, 1840-1910*, ed. by Joe Kember, John Plunkett, and Jill A. Sullivan (London: Pickering & Chatto, 2012), pp. 41-60 (p. 50).

[61] Plunkett and Sullivan, 'Fetes, Bazaars, and Conversaziones', p. 48. Susan R. Horton writes that the increasing availability of hand-operated mechanical optical devices, such as domestic magic lanterns, led to a simultaneous experience of 'seeing the world through the lenses of optical gadgets and toys' while also observing the mechanics and operation of a particular device. This offered a new 'double experience of *having* an experience and of *watching* that experience from the outside'. See 'Were They Having Fun Yet? Victorian Optical Gadgetry, Modernist Selves', in *Victorian Literature and the Victorian Visual Imagination*, ed. by Christ and Jordan, pp. 1-26 (p. 8).

drawings, pleated accordion views, and sketch sheets detailing key features about the particular scene on display, enabling viewers to identify particular aspects and refer back to their printed guides for more information. Booklets containing fold-out panoramas, such as that of 'The Queen's Visit to the City', were produced, as were small scrolling panoramas housed in a tube (see figs. 5 and 6).

Figure 5. 'The Queen's Visit to the City'. Bill Douglas Cinema Museum, University of Exeter, UK. Item number 69325.

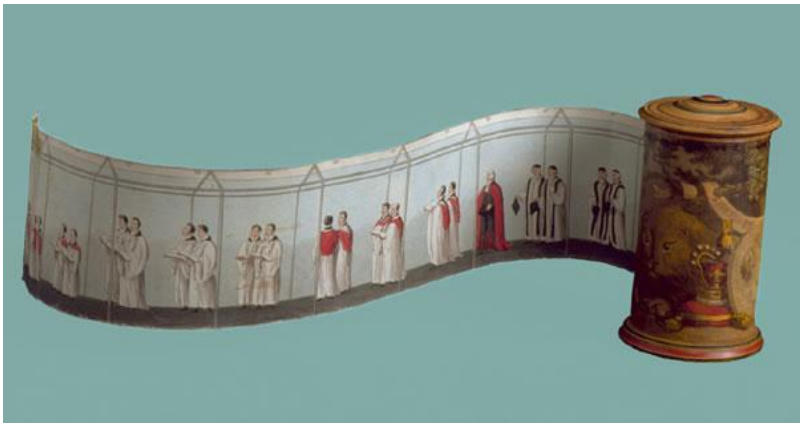

Figure 6. Handheld panorama of the Coronation procession of King George IV. The Bill Douglas Cinema Museum, University of Exeter, UK. Item number 69264.

Plunkett notes too that 'Numerous games based on the aesthetic form and instructional value of the panorama were also produced'.[62] Rather than simply taking in the panoramic view, these additional materials encouraged the viewer to physically engage with panoramic scenes beyond pure spectacularity. In handling fold-out panoramas, scale could

[62] Plunkett, 'Optical Recreations and Victorian Literature', p. 13. For an example of such, see The Bill Douglas Cinema Museum's holding of Joseph Poole's 'Myriorama', item number 69238.

be newly appraised and in navigating through guidebooks a tactile sense of the abundance of the panoramic show could be literally felt. Alison Byerly's recent study of the virtual travel inculcated by the panorama notes that one souvenir guidebook for a view of the Ganges included recipes for powders, chutneys, and mulligatawny paste; in what we might describe as an ingestion of spectacle, viewers could reengage with the visual sensation of exotic travel through their taste buds.[63]

Alison Griffiths has argued that 'panoramas laid claim to the historical and geographical real through an indexical bond, premised on their status as topographically correct and authentic reconstructions of battles, landscapes, or ancient antiquities'.[64] This sense of the panorama as an educational substitute for actual travel is satirically presented in Dickens's leader for the April 1850 issue of *Household Words*. In 'Some Account of an Extraordinary Traveller', Mr. Booley visually voyages ('all my modes of conveyance have been pictorial') across the world in a matter of days—by visiting panoramas. Dickens describes how he 'made a survey of' and 'minutely examined' New Zealand, after which he felt himself 'a perfect master' of the country's natural history.[65] A similar feature in *Punch* satirized the convenience of panoramic 'travel': the only passport required was one shilling, and along the way the traveller encountered 'no revolutions, as in France' and 'no monks or mosquitos' in Italy.[66] Such textual parodies of the panorama's attempt at verisimilitude register the ambiguity with which mid-nineteenth-century viewers approached its illusory spectacle. Captivating as its scale and painterly detail were, complicity in its mimetic illusion was part of the appeal: it was pedalling a 'double value' of imagination and reproduction, as D'Arcy Wood writes.[67] The panorama compelled

[63] Byerly, *Virtual Travel and Victorian Realism*, p. 51.
[64] Alison Griffiths, *Shivers Down Your Spine: Cinema, Museums, and the Immersive View* (New York: Colombia University Press, 2008), p. 42.
[65] 'Some Account of an Extraordinary Traveller', *Household Words* 1.7 (20 April 1850), 73-77 (p. 75).
[66] 'A Journey Round the Globe', *Punch* 22 (1851), p. 4.
[67] D'Arcy Wood, *The Shock of the Real*, pp. 5-7.

viewers to realize its falsity, engaging its audience in a play of feigned visual deception. As Ellis explains, the panorama was 'a machine for disillusionment, a spectacle of illusion clarified. It was the Enlightenment, open every day, Sunday excepted, for a shilling'.[68] Visiting the panorama may have provided an experience of mimetic wonderment, but it importantly educated its audience in the new tricks and techniques for visually representing reality.

Verity Hunt's study of the print ephemera produced to accompany the Great Exhibition shows that the format and style of this material frequently enlisted the viewing model of the panorama as an analogous perceptual experience. Printed materials utilized the panorama to respond to the 'challenge of figuring the visual scope of the show'.[69] Like the panorama, the Crystal Palace contained a profusion of sights which could be collated and presented in a guidebook or sketched map (similar to those purchased as souvenirs of the panorama) and in such material the surveying gaze encouraged by the panorama was called upon as a way to comprehend the varied and numerous items on display, to make sense of the mass of visual data presented within the vast exhibition space. In translating a visual experience into a textual one, these print commodities also symbolized an attempt to narrativize the Exhibition's uniquely spectacular experience. However, surveying these materials, Hunt finds that a 'resistance to narrativization and the deficiency of language became tropes for the visual grandeur of the show'; the project of narrating spectacle actually served to depict the *insufficiency* of narrative to encompass and confer a sense of the Exhibition's visual abundance. Utilizing the panoramic mode to communicate the Exhibition through text, in Hunt's analysis, 'tested the symbolic visual capacity of the panorama', and indeed its suitability as an analogous textual mode. She concludes that 'the disquieting superficiality of the panorama's smooth, expansive, borderless surface pointed

[68] Ellis, '"Spectacles within doors"', p. 144.
[69] Verity Hunt, 'Narrativizing 'The World's Show': The Great Exhibition, Panoramic Views and Print Supplements', in *Popular Exhibitions,* ed. by Kember, Plunkett, and Sullivan, pp. 115-132 (p. 116).

towards something missing at the Crystal Place. Panoramic breadth held out a totalizing ideal that could never be achieved'.[70] Hunt's sophisticated reading points to the limits of panoramic spectatorship as an analogous framework for the gathering and interpretation of visual data, and of the static panorama as a model to signify the easy comprehension of abundance and multiplicity.

Panoramic Perspective and Narration

However, critics have argued that this new visual practice forms an apt technological context in which to read the Victorian novel; the boldness of the panorama's scale, perceptual expanse, and multiple sites of interest (its appeal was not in viewing a singular detail but in viewing a comprehensive totality of many smaller details) evokes the scope and creative abundance of the nineteenth century's longer works, in which characters, episodes, and subplots are housed together across numerous pages which make perceptual and imaginative demands of the reader similar to those asked of panorama viewers, required to take in a vast mass of data in order to perceive the overall effect. Within literary studies, Victorian narrative has been discussed as a form of textual panoramic perspective, the narrator imagined to be applying a sweeping, all-encompassing gaze upon its subject and, in reporting its observations to the reader, able to present a story in full from a privileged position of spectacular knowledge. As Byerly comments, the panorama 'promised a synthesis and condensation of an entire landscape that would allow the viewer to comprehend and consume it'. She writes that the influence of the panorama can be seen in a 'wide range of texts from the 1830s through the 1880s' which 'promised a comprehensive and synoptic view of scenes'. This comprehensive view is passed to the

[70] Hunt, 'Narrativizing 'The World's Show'', p. 132.

reader via the panoramically-endowed figure of the narrator.[71]

This is not to say that an analogy between literature and the panorama has only been formulated retrospectively: as Tanya Agathocleous writes, 'many realist works were self-consciously panoramic and labelled as such in their own moment; the word was affixed to a wide range of texts, including novels, newspapers, and sociological works'. Agathocleous employs the panorama as a signifier of broad vision and connectedness in her study of what she terms 'cosmopolitan realism'. Taking two prominent visual forms, the sketch and the panorama, she shows that they offered two different perceptual modes: the sketch denoted a partial, fragmentary view of minutiae whereas the panorama signified an all-encompassing, surveying perspective. When combined, these forms 'conjured up a global whole', an interconnected totality composed of multiple smaller parts.[72]

Writing on the literary use of these two visual forms, Agathocleous contends that where the sketch 'performed the work of differentiation and classification' and detailed the 'local culture that grounded urban literature in a particular historical and geographical reality', the 'panoramic mode, on the other hand, allowed for the unification of that differentiated urban space through the overview of the realist narrator, which drew upon the all-encompassing perspective of panoramic paintings'.[73] It is the mingling of these differing scales and perspectives within a literary work which contributes to its 'cosmopolitan realism': 'Employing shifts in perspective from *polis* to *kosmos* and back again, realist writing produced both a sense of detailed, accumulative local knowledge and an ideal of totality'. Both forms were 'part of the same impulse to render the urban

[71] Alison Byerly, '"A Prodigious Map Beneath His Feet": Virtual Travel and the Panoramic Perspective', *Nineteenth-century Contexts* 29.2-3 (June-September 2007), 151-168 (p. 151).
[72] Tanya Agathocleous, *Urban Realism and the Cosmopolitan Imagination in the Nineteenth Century* (Cambridge: Cambridge University Press, 2011), pp. 70-71. See also Martina Lauster, *Sketches of the Nineteenth Century: European Journalism and its Physiologies, 1830-50* (Basingstoke: Palgrave Macmillan, 2007).
[73] Agathocleous, *Urban Realism*, p. 72.

comprehensible'.[74] This is evidenced particularly, Agathocleous writes, in the 'opening panorama' of Charles Dickens's *Bleak House* (1852-3), equating its narrative style with the all-seeing eye of the panoramic spectator.[75]

Productive as Agathocleous's study is in its generation of a framework through which to consider Victorian narrative's employment of multiple visual perspectives, and the connection between notions of the local and global, it fails to take into account the technological changes which took place across the century to the format and viewing experience of the panorama. Examples such as Wyld's Great Globe (a major London attraction between 1851 and 1862 which saw spectators climb *inside* a huge relief-sculpted globe showing plaster casts of the Earth's geographical features) and moving panoramas and dioramas, popular from the 1820s on, offered a very different visual epistemology to that of the large-scale, stationary 360-degree panoramic canvas which her study predominantly cites.

For example, most of the panoramas Dickens visited were of the moving kind (as I discuss further in Chapter Two, he refers to Paris as a rapid panorama, visited the moving panoramas of the Nile and Albert Smith's *Ascent of Mont Blanc*, and reviewed John Banvard's famous touring moving panorama of the Mississippi) and as Audrey Jaffe tells us, an early title for *David Copperfield* was 'The Copperfield Survey of the World as it Rolled'—a rolling survey being the main phenomenological experience of watching a moving panorama.[76] Despite his interest in and knowledge of the moving panorama, it is the static version popular in the late eighteenth and early nineteenth century which scholarship tends to focus on, comparing its totalizing conception of vision with the vast scale and panoramic overview of Dickens's novels. Although Grahame Smith does

[74] Agathocleous, *Urban Realism*, pp. xvi, 71.
[75] Agathocleous, *Urban Realism*, pp. 72, 110-113.
[76] Audrey Jaffe, *Vanishing Points: Dickens, Narrative, and the Subject of Omniscience* (Berkeley and Los Angeles: The University of California Press, 1991), p. 126.

consider the moving panorama and diorama as part of the range of visual experiences covered in his study of *Dickens and the Dream of Cinema* (2003) (such as the magic lantern, urban environments, travel narratives, and theatrical melodrama), he refers often to the static panorama, noting that 'panoramic elements are everywhere present in Dickens's work', particularly in the 'panoramic nature of his fictional structures'.[77] He comments that references to the panorama enter Dickens's work 'at the level of detail as well as in relation to the vast architecture of the novels as a whole. […] The panoramic concept returns as a governing metaphor in the structure of Dickens's major fictions. *Bleak House*, *Little Dorrit*, and *Our Mutual Friend* can be regarded as panoramic representations of Victorian society'.[78] The complexity of Dickens's novels is imagined as a giant panoramic canvas displayed to its reader as if they were contemplating a mimetic scene, yet the narrative intricacies and superabundant, at times incomprehensible, qualities of Dickens's prose and plotting do not fit easily with this reading.

The contextual linking of the panorama with the Victorian realist novel and its narratorial style also overlooks the complexities of narrative perspective seen, for example, in *Bleak House*'s switch between third- and first-person narrative. Even though Agathocleous argues that it represents by turns the sketch and the panorama, she contends that ultimately the novel favours the all-encompassing perspective associated with panoramic viewing. By switching between two perspectives, *Bleak House* offers 'a means of conceptualising collectivity' and is an attempt to show that 'London's visible details and individual storylines are part of a larger canvas in which everything might connect meaningfully'.[79] Jonathan Arac continues this, commenting that 'the panoramic unity in these works [*Bleak House* and Carlyle's *The French Revolution* (1837)] absorbs many

[77] Grahame Smith, *Dickens and the Dream of Cinema* (Manchester: Manchester University Press, 2003), pp. 166, 119.
[78] Smith, *Dickens and the Dream of Cinema*, p. 34.
[79] Agathocleous, *Urban Realism*, pp. 110, 113.

narrative perspectives and comprehends them in one whole'.[80] Again, narrative is linked to a totalizing visual perspective based on the architectural structure and visual experiences of the panorama.

Richard Maxwell, however, writes that in *Martin Chuzzlewit* (1843-4) Dickens questions the panorama as an adequate model of visual consensus and totality. If we take the centrality, accessibility, and overseeing perspective granted to the spectator of the panorama as a way to metaphorically 'imagine society's interdependence, the participation of its members in some kind of overall agreement', then Dickens's novel mocks such oversight and consensus with its 'scrambled view' across London from Todgers's boarding house, in which 'trivial details […] compete' with each other and 'do not imply or signify the whole, but merely distract from it', resulting in a 'collapse of decipherable appearances'.[81] Maxwell's reading reminds us of Hunt's argument—that the panorama's form actually draws attention to the *difficulties* of comprehension when the scope and scale of information is vast, abundant, and varied.

The inability to adequately capture this fullness of experience is referred to directly in George Eliot's *Adam Bede* (1859). The narrator compares the reduction of the panorama's scale into a printed format to the writer's task of describing a character's mind, implying that both mediums of textual description struggle to adequately represent the original experience. On learning of his grandfather's death, Arthur Donnithorne travels to his family home and passes the time with 'busy thoughts about the future, as the chaise carried him rapidly along'. Although saddened by the loss, he is preoccupied with the sense that 'Now his real life was beginning; now he would have room and opportunity for action'. He spends the journey musing upon and envisioning his future plans, how 'he

[80] Jonathan Arac, *Impure Worlds: The Institution of Literature in the Age of the Novel* (New York: Fordham University Press, 2011), p. 82
[81] Richard Maxwell, *The Mysteries of London and Paris* (Charlottesville and London: The University Press of Virginia, 1991), p. 132.

would show the Loamshire people what a fine country gentleman was […]. He felt himself riding over the hills in the breezy autumn days, looking after favourite plans of drainage and enclosure; […]; spoken well of on market-days as a first-rate landlord; by and by making speeches at election dinners, and showing a wonderful knowledge of agriculture; […] happy faces greeting him everywhere on his own estate, and the neighbouring families on the best terms with him'. I have shortened this quotation because Arthur's thoughts range over and list many types of activities he plans to undertake and relationships he hopes to develop. Drawing attention to this extensive listing, the narrator comments that

> These were Arthur's chief thoughts, so far as a man's thoughts through hours of travelling can be compressed into a few sentences, which are only like the list of names telling you what are the scenes in a long, long panorama full of colour, of detail, and of life.[82]

Arthur's thoughts are analogous to the colourful, detailed, and life-like scenes of a 'long, long' panorama (importantly, Eliot draws upon the lengthy *moving* panorama here, evidencing her engagement with contemporary developments in panoramic technology); when transposed into a written list (as in the guidebooks of panoramic displays) they become 'compressed', losing the vivacity and animation with which their original was endowed.

Eliot's reference to the 'colour, detail, and life' of the long moving panorama shows that scholarship of Victorian visual culture needs to take into account the full range of technological experiences offered, to extend beyond the panorama as the period's defining visual mode, and explore the phenomenology and language offered by other more interactive, animated spectacles and physical engagements with optical devices. Experience with and familiarity of the Victorian moving image was widespread, and certainly equal to that of the panorama or magic lantern, as reference in popular literature,

[82] George Eliot, *Adam Bede*, ed. by Carol A. Martin (Oxford: Oxford University Press, 2008), pp. 392-393.

letters, and journalism shows (examples of which are drawn on throughout the following chapters). The lack of attention to moving images in critical histories marks a lack too in our understanding of how a variety of perceptual experiences and encounters informed the intellectual and imaginative culture of the Victorian period: the static image of the panorama, stationary projections of lantern slides, and the captured representation seen in the photograph were not the only aesthetics to inform literary representations of vision, as I go on to demonstrate.

CHAPTER TWO

‘Pictured!—He Saw’: Moving Panoramas, Dioramas, and Dissolving Views

In 1876, W. R. Hill designed a set of ‘dissolving view’ lantern slides to accompany George Buckland’s performance of Lewis Carroll’s *Alice’s Adventures in Wonderland* (1865). A biography of Hill foregrounds the enchanting animation made possible by this method of visual illustration:

> The white rabbit which plays so prominent a part in the story was seen to walk across the screen and when nearly at the opposite end he halted, and taking his watch from his pocket, bent down his head to look at the time, after which he returned the watch and walked right off the screen, his legs moving in the most natural manner.[1]

Prefiguring the many later film adaptations of Carroll’s novel, the success of this visual display was in its ability to present the movements of the rabbit in an extremely ‘natural manner’; such is the quality of the projection that the character is seen to ‘walk right off the screen’, as if endowed with an independent agency. Favouring the capacity of this particular lantern technology to represent life-like movement (rather than offering a stylistic take on Alice’s imaginative world, as later adaptations sought to do), Hill’s slides provide a good example of the way Victorian screen-based technologies could bring images before the eyes of a viewer and animate them in such a way that it was possible to bring external visions ‘alive’.

[1] ‘Prominent Men of the Lantern World, no. XIV, Mr W. R. Hill’, *Optical Magic Lantern Journal* 8 (1897), 199-200, (p. 200), qtd. in Iwan Rhys Morus, ‘Illuminating Illusions, or, the Victorian Art of Seeing Things’, *Early Popular Visual Culture* 10.1 (2012), 37-50 (p. 44).

Lying ill in his bed, a young Paul Dombey in Charles Dickens's *Dombey and Son* (1846-8) watches as 'sunbeams struck into his room through the rustling blinds, and quivered on the opposite wall like golden water'. This is a sign, he knows, that 'evening was coming on, and that the sky was red and beautiful'. Unable to actually see the sunset, Paul registers the movement of light in his room to keep track of the progress of time, and to imaginatively wander through the outdoor world: 'he thought how the long streets were dotted with lamps', of how black the river was and 'how deep it would look, reflecting the hosts of stars', and of 'how steadily it rolled away to meet the sea'. His wakefulness means he 'would lie and watch the many-coloured ring about the candle, and wait patiently for day':

> When day began to dawn again, he watched for the sun; and when its cheerful light began to sparkle in the room, he pictured to himself—pictured! He saw—the high church towers rising up into the morning sky, the town reviving, waking, starting into life once more.[2]

Paul's imagination does more than simply bring images to his mind; such is the strength of his mental envisioning that the narrator scoffs at his own first description of 'pictured!' and replaces it with the more definite 'He saw'. Like the 'most natural' presentation of Carroll's white rabbit (where focus was placed on the generic movements of the character, walking, checking his watch, and so on), Paul's vicarious 'seeing' of the town stresses everyday aspects: its importance lies not in its content (which, from a child's imagination, we might imagine to be more spectacular and creative) but in the intensity of his mental imaginings—seeing over mere picturing.

This chapter focuses on three types of screen-based moving-image technology: the moving panorama, diorama, and dissolving view lantern slides. Taking each in turn, I discus their mechanism, spectacle, and reception, and show how their operation and visual

[2] Charles Dickens, *Dombey and Son*, ed. by Alan Horsman (Oxford: Oxford University Press, 2008), pp. 236-237. All further references are to this edition and appear parenthetically in the main text.

effect (of passing, transforming, and melting views, respectively) is reproduced in the language of mid-Victorian fiction. I concentrate on the work of Dickens in this chapter, demonstrating his particular interest in and reference to those forms of screen-based media which offered not simply a large, mimetic spectacle (as in the panorama, discussed in Chapter One) but which presented instead a visual display premised on gradual and subtle yet cumulative changes, or transformations which moved slowly, almost imperceptibly, but nonetheless presented a *moving* image. The moving panorama allowed images to unfurl, quite literally, before the eye and to pass steadily in front and outside of the viewer. The diorama confined motion to one defined space, but its use of lighting techniques to gradually transform a view showed that a picture could be both framed and moving at the same time; likewise dissolving views, which were so projected as to smoothly 'melt', sequentially, into each other. These three visual experiences are all evoked in mid-Victorian novels, as this chapter goes on to demonstrate.

Martin Meisel writes that although 'no novel of Dickens can be said to be built on a literal imitation of dioramic effect or panoramic form […] both enter his conception of the reality he wishes to represent, the means whereby it can be represented, the experience of the reader before and in the scene […]. Panoramic and dioramic models affect the style, the form, and the scope of Dickens fiction'.[3] Two aspects of Meisel's reading are of particular importance and will be discussed through this chapter: the 'means' of representing a fictional reality and the experience of readers 'before and in' the scene (both the panoramic or dioramic scene, and the imagined literary scene). References to the magic lantern 'could evoke metaphorical comparison with a more private experience', Stephen Bottomore has argued, finding in the writing of Nathaniel Hawthorne, Thomas Hardy, Gustav Flaubert, Dickens, and H. G. Wells a 'similarity between the disembodied,

[3] Martin Meisel, *Realizations: Narrative, Pictorial, and Theatrical Arts in Nineteenth-Century England* (Princeton: Princeton University Press, 1983), pp. 64-65.

immaterial lantern images and our own internal visual representations: our thoughts, dreams, psychological states, memories of earlier life, or hopes and fears for our future'.[4] This connection, between literature and optical technologies, demonstrates how widely known and well-understood such technologies were—authors would not draw metaphorically on their operation or display if readers were not themselves also familiar with such devices, Bottomore contends.

Beyond the explicit comparison of mental states with visual experiences—such as the 'panorama' of Gwendolen's future which Klesmer's words 'unfolded' and which 'filled her imagination' in George Eliot's *Daniel Deronda* (1876)—are many more nuanced references relating to memory, thought, and cognitive processes which, I will argue, draw on the moving panorama, diorama, and dissolving views. This most often takes the form of external projections, of sights passing in front of the eye or within an imagined space of mental 'viewing'.[5] Saying goodbye to Hetty after her stay at Hall Farm in Eliot's *Adam Bede* (1859), Dinah reassures her that 'I shall think of you often […] and see your face before me as it is now'. Her tender act of memory will result in the recreation of Hetty's image, spatially located 'before' Dinah in a like way to the functioning of her regular perception (of seeing things 'in front' of us). She elaborates:

> It's a strange thing – sometimes when I'm quite alone, sitting in my room with my eyes closed, or walking over the hills, the people I've seen and known, if it's only been for a few days, are brought before me, and I hear their voices and see them look and move almost plainer than I ever did when they were really with me so as I could touch them.[6]

[4] Stephen Bottomore, 'A Word Paints a Thousand Pictures: The Magic Lantern in Language and Metaphor', in *Realms of Light*, ed. by Mervyn Heard (London: Magic Lantern Society, 2005), pp. 56-61 (p. 59).

[5] George Eliot, *Daniel Deronda*, ed. by Terence Cave (London: Penguin, 1995), p. 261. See Chapter Two of Karen Jacobs, *The Eye's Mind: Literary Modernism and Visual Culture* (Ithaca and London: Cornell University Press, 2001) for an overview of the historical and philosophical debates about the images seen by the 'mind's eye'.

[6] George Eliot, *Adam Bede*, ed. by Carol A. Martin (Oxford: Oxford University Press, 2008), p. 129.

Dinah's visual memories appear as walking, talking sights which are 'brought before' her perception and appear to exist outside of the mind: they have something of their 'natural manner', as in Hill's animated slides of the white rabbit, looking and moving around much as they did in the flesh, so much so that they might even be tangible. Such moving images appear to Dinah not as hallucination for, as Kate Flint considers in her study of the Victorian visual imagination, such experiences 'usually are independent of external stimulus' and Dinah makes clear that her mental images are of familiar people seen in the recent past. Nor are they quite illusions which, for Flint, 'bear a perceptual relation to that which lies outside the perceiver': these sights stem from Dinah's memory and at the time of appearance are not drawn from a perceptual relation.[7] Falling between hallucination and illusion, Dinah's cognition instigates a powerful presentation, 'almost plainer' than the original, of images brought 'before' her mental perception which are imagined as if they were projections upon an invisible screen located outside the body.

Eliot's description of Dinah's memory evokes the way technologically-generated, and specifically projected, moving images were experienced. The panorama, dissolves, and the diorama, in particular, located their spectacle outside of the body yet within its reach (unlike persistence of vision devices, which I discuss in Chapter Four) and worked to bring motion 'before' the viewer as in Dinah's projected recall. We see this used often in Dickens's fiction: recollections and imaginative speculations of future occurrences are figured as external projections which draw on the mechanical process and visual experience of technologies of the moving image. As Susan Horton suggests, 'Part of

[7] Kate Flint, *The Victorians and the Visual Imagination* (Cambridge: Cambridge University Press, 2000), pp. 263-264. See also Catherine Maxwell, *Second Sight: The Visionary Imagination in Late Victorian Literature* (Manchester and New York: Manchester University Press, 2008) for a reading of mental images as projections of an inward, spiritual sight.

Victorian readers' pleasure in these novels would have been recognizing in the verbal text their own visual experiences with optical gadgets and toys'.[8]

As in the example from *Adam Bede*, John Plunkett has argued that one of the 'principal forms of interaction between print media and optical recreations' was 'the way writers employed optical devices as tropes for the working of the mind: they were particularly employed as figures to materialise processes of creativity, imagination, and memory'.[9] However, going beyond textual correspondences, his work has stressed that 'there are significant points of convergence and crossover between nineteenth-century print media and the panoply of optical recreations'.[10] Noting elsewhere that 'the growth of optical recreations as a leisure activity parallels that of popular publishing', Plunkett traces the impact of visual technologies upon the 'conceptual and material organisation of the book' (looking particularly at illustrated and moveable children's books).[11] Making a similar claim, Helen Groth has recently commented that 'those in the business of both early and pre-cinematic entertainment often combined literary and visual media in an endeavour to align the moving images on the screen with the moving images scrolling through the minds of their audiences. […] These convergences between literary and popular visual media invited an analogical interplay between reading and viewing'.[12]

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[8] Susan R. Horton, 'Were They Having Fun Yet? Victorian Optical Gadgetry, Modernist Selves', in *Victorian Literature and the Victorian Visual Imagination*, ed. by Carol T. Christ and John O. Jordan (Berkeley: University of California Press, 1995), pp. 1-26 (p. 4).

[9] John Plunkett, 'Optical Recreations and Victorian Literature', in *Literature and Visual Media: Essays and Studies 2005*, ed. by David Seed (Cambridge: D. S. Brewer for The English Association, 2005), pp. 1-28 (p. 1).

[10] Plunkett, 'Optical Recreations and Victorian Literature', p. 1.

[11] John Plunkett, 'Moving Books/Moving Images: Optical Recreations and Children's Publishing 1800-1900', *19: Interdisciplinary Studies in the Long Nineteenth Century* 5 (2007), 1-27 [http://www.19.bbk.ac.uk/index.php/19/issue/view/68. Accessed 18 November 2014] See also Eric Faden, 'Movables, Movies, Mobility: Nineteenth-Century Looking and Reading', *Early Popular Visual Culture* 5.1 (2007), 71-89.

[12] Helen Groth, *Moving Images: Nineteenth-Century Reading and Screen Practices* (Edinburgh: Edinburgh University Press, 2013), p. 2. Chapter One looks at 'a series of curious works produced during the Regency period that explicitly play with the analogy between reading books and operating optical devices, such as the camera obscura, the peep-show, and the magic lantern' (p. 16).

In Dickens's *The Old Curiosity Shop* (1840), Plunkett shows how 'optical tropes' are employed to 'stress the way his novels functioned as popular entertainments'. At the beginning of the final chapter, the narrator announces that 'The magic reel, which, rolling on before, has led the chronicler thus far, now slackens its pace, and stops'.[13] Here, Plunkett writes, 'The reader's passage through the novel, the 'magic reel', is equated with viewing a moving panorama, the dominant exhibition practice for panoramas from the 1820s. […] Dickens's use of the moving panorama clearly positions him as a lecturer-cum-showman, whose role is to explain the moving scene passing before his readers'.[14] This particular visual technology, premised specifically on offering a moving display, is employed 'as a figure for both the imaginative journey of his readers and the novel's status us a visual show'.[15] This chapter turns first to the technology of the moving panorama—Dickens's 'magic reel'—and gives an account of its history, focusing on how the mobile elements of its spectacle were stressed in reviews, then shows how it provided a way to represent the temporal unfolding of characters' thoughts.

'Passing Before Our Eyes': Temporality in the Moving Panorama

The circular panoramic canvas displayed in a purpose-built exhibition space of the late-eighteenth century compelled viewers with its novelty, detail, and scale (as I addressed in Chapter One) but by the second decade of its exhibition this appeal had begun to fade, as Richard Altick has ably documented (this chapter owes much to his field-defining study, *The Shows of London*). One reason for this was that the static panorama could not represent temporal progression—an element that was especially lacking in views of battle

[13] Charles Dickens, *The Old Curiosity Shop*, ed. by Elizabeth M. Brennan (Oxford: Oxford University Press, 1998), p. 546.
[14] Plunkett, 'Optical Recreations and Victorian Literature', pp. 7-8.
[15] John Plunkett, 'Visual Culture', in *English Literature 1830-1914*, ed. by Joanne Shattock (Cambridge: Cambridge University Press, 2010), pp. 222-247 (p. 232).

scenes and travel narratives, for example.[16] The large canvas offered its viewer an overwhelming picture in which all details could be seen at once, yet depictions of historical events, for example, required a more chronological eye to take in their narrative as it unfolded. As Errki Huhtamo asserts, 'the format of the circular panorama could not avoid stopping time'.[17] Further, its minute accuracy and claims to be painted from life only captivated viewers briefly until the lifeless scene appeared more unlike than like. One review proposed that 'in order to complete the pleasure to be derived from it, it's necessary that motion should be imparted to the Sublime scenery it copies'.[18] A spectacle which *could* incorporate motion is here a 'necessary' element of the visual pleasure to be derived from the panoramic form. Additionally, as Altick explains, the 360-degree panorama lacked variety. The necessity of a custom-built exhibition space and sheer painterly effort meant that showing new views regularly was impractical; once hung for exhibition, the early panorama was quite literally static. In a leisure market crowded with multiple appeals to visual delight, this lack of variety was not sustainable. Addressing this, two technological adaptations were made which added motion and enhanced and updated the panorama's visual appeal.

The first adaptation was the peristrephic panorama (the invention of Peter and William Marshall of Edinburgh) which presented a successive series of small panoramic views to an audience seated in an auditorium. Each individual image depicted sequential moments of a fictional narrative or historical event and was painted on a single canvas rolled slowly past its viewers. First mentioned in *The Freemans Journal* of April 1815, it

[16] Richard Altick writes that the panorama's appeal weakened for two main reasons: a lack of variety and an absence of motion in its display. *The Shows of London: A Panorama History of Exhibitions 1600-1862* (Cambridge, Mass.: The Belknap Press of Harvard University Press, 1978), pp. 197-199.

[17] Errki Huhtamo, 'Penetrating the Peristrephic: An Unwritten Chapter in the History of the Panorama', *Early Popular Visual Culture* 3.6 (2008), 219-238 (p. 227). Anne Friedberg makes a similar point that the static panorama 'offered a spectacle in which all sense of time and space was lost'. *Window Shopping: Cinema and the Postmodern* (Berkeley: University of California Press, 1993), p. 22.

[18] Handbill, Westminster City Libraries Archive, box 42, no. 4, qtd. in Altick, *The Shows of London*, p. 198.

reached a wide audience when it toured from Edinburgh to London in the 1820s, presenting the *Coronation of George IV*, the *Battle of Waterloo*, and the *Bombardment of Algiers*.[19] Promotional handbills refer to its novel moving views and note that 'Each View is accompanied by a full Military Band as it approaches and withdraws'.[20] The image was able to 'approach and withdraw' from the viewer due to the use of a convex semi-circular structure over which the canvas was rolled. This meant that the middle section of each scene was physically closer to the viewer and gave a sense of depth, and formed a link to the original panoramas whose canvas was hung within a large circular dome and utilized painterly illusions of perspective.

A second development of panoramic technology created the moving panorama, a spectacle which traded on length as its defining feature instead of the immersive scale of traditional panoramas such as Barker's. They were in regular use from the early 1820s, being employed most often as stage backdrops for theatrical performances and seasonal pantomimes, but a number of 'blockbuster' moving panoramas became exhibitions in their own right. Spectators sat as if watching a theatrical production while the panoramic canvas was mechanically rolled before them, often beneath a proscenium arch, with the canvas passing steadily from one roller to its opposite. Early versions of this type of panorama displayed a sequence of images on this canvas roll (much like the format of the peristrephic panorama) but the short-lived, yet popular, Padorama show bridged these first moving panoramas and the later Victorian moving panorama which presented a single continuous scene across the length of canvas. The Padorama offered a topical view of the

[19] See Huhtamo's excellent history of this medium in 'Penetrating the Peristrephic', pp. 219-238, and his 'Global Glimpses for Local Realities: The Moving Panorama, a Forgotten Mass Medium of the Nineteenth Century', *Art Inquiry* 4 (2002), pp. 193-227. His recent book *Illusions in Motion: Media Archaeology of the Moving Panorama and Related Spectacles* (Cambridge, Mass.: MIT Press, 2013) covers the moving panorama in further detail and engages with it as a 'figure of speech, writing, or visual representation' (p. 15).

[20] Handbill advertising the Battle of Waterloo peristrephic panorama at the Great Room, Spring Gardens, London, 1824. Dioramas 2 (6b), John Johnson Collection, Bodleian Library, University of Oxford. Further references to items in this collection are cited as 'J. J. Coll.'.

recently opened Liverpool to Manchester railway (1830). It was exhibited at the Theatre Royal in York in April 1831 before moving on to the Theatre Royal in Hull by the end of the year.[21] That the Padorama opened very shortly after the railway route it depicted emphasized the increasing interest in contemporaneity in visual entertainments. Before the arrival of illustrated newpapers and periodicals in the early 1840s, portable panoramas offered a way to disseminate information pictorially to audiences across the country.[22] Their focus on topical scenes made them a form of visual reportage and a predecessor of the cinematic news reels popular at the beginning of the twentieth century.

An advertisement for the York Padorama boasted that its scene was 'painted upon upwards of three thousand yards of canvas', beginning the appeal to length which would be seen in later advertisements for Victorian moving panoramas (in contrast to the appeal of verisimilitude and scope offered in the static panorama).[23] A review in the *Athenaeum* remarked that this new adaptation gave 'a more correct idea of the mode of transit of this great work of art and science [the railway] than can be conveyed by any description, however elaborate. Every one of our juvenile friends ought in particular to see it'.[24] The moving Padorama was touted as a superior way of experiencing the first passenger railway and as more educational in its evocations of the journey than any other form of account, textual or pictorial. For a one shilling admission fee, visitors could experience the sensation of travelling in a passenger train as the landscape rolled past with no interuptions or cessations of its motion. The popularity of the Padorama led to a great number of moving panoramas which displayed a single continuous scene in an effort to reproduce the sensation of watching a landscape or event roll past with a correct sense of motion.

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[21] See the handbill for the 'Padorama', Theatre Royal York and Hull, 1831. Provincial Playbills folder 6 (65) – York, and Provincial Playbills folder 2 (46) – Hull (J. J. Coll.).

[22] Altick, *The Shows of London*, pp. 174-179.

[23] Handbill for Theatre Royal York 27 April 1831. Provincial Playbills folder 6 (65) – York (J. J. Coll.).

[24] *Athenaeum* (5 July 1834), p. 509, qtd. in Altick, *The Shows of London*, p. 204.

Popular scenes included rivers, city ‘tours’, railway journeys, and historical battles—views for which lateral movement and an unfolding temporality was essential, making the spectacle more about engaging with narrative and animation than detailed representation or scale.


The Rapidity of Steam Conveyance Superseded
AT
PROUT'S ORIGINAL
MOVING & MOST POPULAR
PANORAMA OF THE
Voyage to Australia
AND
VISIT TO THE GOLD FIELDS
309, REGENT STREET,
(NEXT THE POLYTECHNIC.)

THE EMIGRANT SHIP leaves PLYMOUTH SOUND
Daily, at 3 and at 8 o'Clock, and arrives at
MELBOURNE IN FORTY MINUTES!!!
From which place the Voyagers, after witnessing a few phases of MELBOURNE LIFE, and enjoying a hearty laugh at the absurdities of
A GOLD DIGGER'S WEDDING,
Are taken by a most easy conveyance through the PASTORAL DISTRICTS; linger awhile with the ABORIGINAL INHABITANTS, and are introduced to the society of the GOLD DIGGERS at
MOUNT ALEXANDER.
From thence, passing through the Tropical and Romantic district of Illawarra, they visit the AUSTRALIAN METROPOLIS—SYDNEY, and terminate their journey at OPHIR, and the Gold Regions of New South Wales;
The whole Distance from England being Performed in One Hour and a Half!!!

Figure 7. Advertisement for a moving panorama of a ‘Voyage to Australia’, which ‘supersedes’ the speed of travel by steamer, Regent Street (29 July 1853). John Johnson Collection, Bodelian Library, University of Oxford, UK. Reference Dioramas 1 (21).

Mobility was physically embedded within the apparatus of the moving panorama. Its canvas, mounted on and unfurled between two large rollers, could be transported between venues, cities, and continents. This portability allowed for a variety of topics to be exhibited, for subjects to be refreshed frequently, and enabled a greater number to experience the spectacle. One of the most popular touring panoramas was John Banvard's Mississippi River landscape view. Painted in 1846, it travelled to exhibition sites in New Orleans, Boston, and New York before reaching London's Egyptian Hall in December 1848 for a twenty-month residency.[25] This 'truly extraordinary work', as the *London Observer* described it, was painted on three miles of canvas and presented three thousand miles of landscape scenery (again, length was promoted over detail—see fig. 8) from the vantage point of a traveller on a steamboat.[26] Each showing of the moving panorama was accompanied by music and an informative lecture given by Banvard himself. As the scenery passed in front of the viewer, Banvard's lecture directed the eye and informed the audience what they were seeing, strengthening the link between continuous moving panoramas and the progression of narrative.

[25] Altick, *The Shows of London*, pp. 204-206.

[26] Thomas Ruys Smith, *River of Dreams: Imagining the Mississippi before Mark Twain* (Louisiana: Louisiana State University Press, 2007), p. 127.

Figure 8. Excerpt from a handbill advertising Banvard's Mississippi moving panorama. Egyptian Hall, London ([1848]). John Johnson Collection, Bodelian Library, University of Oxford, UK. Reference Entertainments folder 7 (4) – Panoramas.

Dickens reviewed Banvard's panorama in *The Examiner* in 1848, noting that 'It is a picture irresistibly impressing the spectator with a conviction of its plain and simple truthfulness […]. It is an easy means of […] seeing every town and settlement on the river's banks, and all the strange wild ways of life that are afloat upon its waters. To see this painting is, in a word, to have a thorough understanding of what the great American river is'. Although Dickens grants that the panorama is 'not a refined work of art', nor is it

'remarkable for accuracy of drawing, or for brilliancy of colour', it did offer viewers a way to experience a landscape and location not easily accessible. When Dickens wrote it offered an 'easy means […] of seeing' he praised the format of the moving panorama for its ability to entertain but crucially inform its spectators: its moving pictorial scenes enabled an imaginative, virtual journeying which most would not have otherwise been able to see.[27]

Many other moving panoramas were exhibited during this period which demonstrated, as the *Illustrated London News* described, that Banvard's Mississippi journey 'excited what would appear to be an insatiate taste for that class of artistic production'.[28] Their moving depiction attracted visitors in huge numbers: the *Overland Route to India* which could be seen in 1850 at the London Gallery of Illustration was estimated to have drawn a quarter of a million attendees.[29] As soon as Banvard's panorama closed at the Egyptian Gallery it was replaced with a moving panorama of the Nile in July 1849 (to which Dickens invited Daniel Maclise).[30] Arguably the most popular panoramic attraction was Albert Smith's long-running *Ascent of Mont Blanc* at the Egyptian Hall. Opened in March 1852, it offered a moving canvas accompanied by Smith's own lecture and incorporated sound effects and real objects to heighten its immersive appeal: chalets, foliage, rocks, and live animals all featured on the stage. Smith's spectacle was one of the most successful of the decade: its second season attracted

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[27] Charles Dickens, 'The American Panorama' (originally published 16 December 1848 in *The Examiner*), reprinted in *The Amusements of the People and Other Papers: Reports, Essays, and Reviews 1834-51*, ed. by Michael Slater (Columbus: Ohio State University Press, 1996), pp. 135-136.

[28] *Illustrated London News* (30 March 1850), p. 220, qtd. in Altick, *The Shows of London*, p. 206.

[29] John Timbs, *Curiosities of London* (London, [1867]), p. 308, qtd. in Altick, *The Shows of London*, p. 207.

[30] Dickens, in a letter to Maclise, wrote 'I want to see the panorama of the Nile (I believe it begins at 3); and if you have not seen it, perhaps you will go. If you *have* seen it, I will come later'. Dated 22 February 1850, *Letters*, 6: 42. *Punch* offered an article satirizing the amount of river panoramas: 'We have been overrun with so many rivers lately, that it is quite a relief, after having had nothing but cataracts in our eyes, to see the land again'. 'Constantinople Moved to Regent Street', *Punch* (31 August 1850), p. 97.

193,754 visitors and the show ran, with a modified programme each season, for eight years before finally closing in 1860.[31]

The moving panorama's popularity began to wane following the closure of Smith's show: 'all the panoramas which have amazed the London school-boy for a dozen years seemed rolled into one', remarked the *Athenaeum*.[32] The fatigue of these shows lay, then, not in their technological operation or representation of motion; rather, their subject matter was tired, and often repeated. Also, there were many other visual technologies competing for viewers' attention by the mid-Victorian period, such as hand-held kaleidoscopes and persistence of vision devices, as discussed later on.[33] What is clear from the development of panoramic technology, however, is that Victorian viewers did not attend simply for its format; after all, the notion of a panoramic view was nothing new, having been popular since the end of the eighteenth century. What piqued and sustained interest was its offering of new ways to bring physical and imaginative animation to a scene by introducing movement through space and time.

I discussed the critical interest in static panorama viewing and conceptions of the omniscient narrator in Chapter One. Here, I focus on how the innovative moving panorama suggested that thoughts might metaphorically 'pass before' the eyes, externalized as representations within the landscape which move across the vision, and show that this offered a way to dramatize the flow of a character's thoughts, as ideas move

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[31] Altick, *The Shows of London*, p. 477.

[32] *Athenaeum*, (6 October 1860), p. 453, qtd. in Altick, *The Shows of London*, p. 479.

[33] This is not to suggest that the format of the moving panorama disappeared completely from the growing catalogue of moving image technologies. Rather, it developed into something beyond the traditional panoramic spectacle. A revival of interest in the 1880s, traced by Vanessa Schwartz, saw Paris exhibiting eleven moving panoramas by 1889. At the Paris Exposition of 1900 Hugo d'Alesi's Maréorama attracted audiences with its enhanced virtuality: sat on a moving platform decorated to give the impression of being aboard a steamer and simulating the rocking of the sea using hydraulic cylinders and electric motors, up to seven hundred viewers per showing watched moving scenery of the voyage from Marseille to Istanbul pass on the left and right while lightning flashed, wind whipped, and horns and whistles sounded. As Schwartz writes, 'The measure of the attraction's reality resided in its push beyond visual simulation. If the attraction promised to transport spectators elsewhere, they would now experience the ride'. *Spectacular Realities: Early Mass Culture in Fin-de-Siècle Paris* (Berkeley: University of California Press, 1998), p. 173.

in and out of their consciousness. Describing the inner life of young Paul Dombey, the narrator of Dickens's *Dombey and Son* tells that 'all that the child observed, and felt, and thought, that night—the present and the absent; what was then and what had been—were blended like the colours in the rainbow […]. He sees 'faces flitting by':

> The many things he had had to think of lately, passed before him in the music; not as claiming his attention over again, or as likely evermore to occupy it, but as peacefully disposed of and gone. […] Thus little Paul sat musing, listening, looking on, and dreaming; and was very happy. (214)

Paul's thoughts, musings upon what he had observed at a party held that evening, present as images which 'pass before' him. None command a particular attention; each move past steadily and disappear in a movement redolent of the passing of a panoramic canvas in front of the viewer's eye, in which no single aspect dominates the scene displayed.

Later in the novel, Walter's memories of his youth 'floated past him sometimes even lately', metaphorically turning his mental experience into a moving apparition located outside of the mind (279). Captain Cuttle's response to Walter's fate after the shipwreck is similarly presented as a kind of spatial envisioning: 'The Captain sat in the dark shop, thinking of these things; […] and looking with as sad an eye upon the ground, as if in contemplation of their actual fragments, as they floated past him' (497). In both these episodes, thought is described as a series of images which laterally 'float past', aligning them predominantly to the unfurling moving panorama than to any other technology (only the panorama could smoothly 'pass' images before the eyes). This connection is supported in Dickens's letters. During a stay in Paris in 1847, he describes using his 'unoccupied fortnight of each month' to wander the city, seeing 'Hospitals, Prisons, Dead-houses, Operas, Theatres, Concert Rooms, Burial-grounds, Palaces, and Wine shops. […] Every description of gaudy and ghastly sight has been *passing before* me

in a rapid Panorama'.[34] His review of Banvard's Mississippi panorama a year later compares its unrolling canvas to the backdrops painted by his friend Clarkson Stanfield (who worked for the Theatre Royal, Drury Lane from 1823 until 1834) which used '*to pass before our eyes* in like manner'.[35]

The thoughts, dreams, and speculations which are said to 'pass before' the eyes of characters in *Dombey and Son* are modelled on a similar process of unfurling through time found in the moving panorama—both in its mechanism, and in its metaphorical usage, as in Dickens's letter from Paris. As Meisel comments, Dickens 'recognizes that in the moving panorama […] as in the novel, the representation combines simultaneity and succession, and all motion is relative to the spectator', a subjectivity stressed through the use of this technology to represent the inner life of certain characters.[36] Turning from the temporality of laterally 'passing' sights, I now look at the transformations effected upon a single, defined space in the diorama.

The Diorama: Narrativizing Light

The diorama, a screen-based technology like the panorama, effected pictorial transformations solely by the manipulation of light upon a single canvas. Its reliance on illumination connects it to earlier media such as moving shadows (or *ombres chinoise*), transparencies, and the short-lived Diaphanorama.[37] Its clearest predecessor was Philip de

[34] Letter to Rev. Edward Tagart, dated 28 January 1847. Dickens, *Letters*, 5: 18 (emphasis added). Some years later, Dickens describes Paris similarly as a 'moving panorama' (dated 21 October 1855, *Letters*, 7: 724.

[35] Dickens, 'The American Panorama', p. 135.

[36] Meisel, *Realizations*, p. 63.

[37] Daguerre, co-creator of the Diorama, saw Franz Niklaus König's Diaphanorama in the early 1810s. Its eight successive scenes appeared to undergo changes when light was shone selectively through and onto the small transparency (oiled watercolour paper) they were painted onto. Like the early moving panoramas, their evocation of movement was sequential not continuous. See Alison and Helmut Gernsheim, *L. J. M. Daguerre: The History of the Diorama and the Daguerreotype* (New York: Dover Publications, 1968), p. 14.

Loutherbourg's Eidophusikon (1781), a theatre-style optical entertainment popular in the last two decades of the eighteenth century. Loutherbourg had worked as a set painter at Drury Lane where he was able to experiment with light filters and transparencies. His scenery became so popular that, Altick writes, 'the public was now coming to some plays as much for the scenery as for the actors, and in reviews the press devoted more and more space to the spectacle'.[38] The Eidophusikon presented a moving scene in miniature: carved scenery and models were set against a transparent background through which varying concentrations of light was shone. Cut-out wings fostered a sense of perspective and sound effects helped the realization of each scene. A small number of rival eidophusikons opened across London after Loutherbourg's but by 1800 all had closed, their subtle effects not able to compete against the immensity of the newly opened Panorama. Yet the manipulation of light to achieve a sense of animation would reappear later in the century in the form of the Diorama, a technology informed by the transparent media which had gone before.[39]

Invented by J. L. M. Daguerre (later to be known for his contributions to photography) and Charles Bouton, the Diorama opened in Paris in 1822 and in London's Regent's Park a year later. Like the panorama, the audience entered through a darkened corridor and were seated in an auditorium which faced down one of two tunnels. At the end of these corridors of vision was hung a large transparent screen (22x14m) on which a landscape or architectural feature was painted.[40] Wolfgang Schivelbusch has called this

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Altick pinpoints David Garrick's 1759 pantomime, *Harlequin's Invasion*, for its use of moving shadows and transparencies in its stage set. *The Shows of London*, p. 118.

[38] Altick, *The Shows of London*, p. 120.

[39] Plunkett has written on the history of transparencies as optical media, noting that their proliferation in both public and domestic life of the early nineteenth century marks them as important media forms for later Victorian visual recreations. See 'Optical Recreations, Transparencies, and the Invention of the Screen', in *Visual Delights Two: Exhibition and Reception*, ed. by Vanessa Toulmin and Simon Popple (Eastleigh: John Libbey Publishing, 2005), pp. 175-193.

[40] Bernard Comment, *The Panorama*, trans. Anne-Marie Glasheen (London: Reaktion Books, 1999), p. 57.

exhibition space an 'optical device' in itself, which 'created the illusion of infinity. It was a further development, on a much larger scale, of course, of the peep show and the kaleidoscope. Common to all these optical devices and the diorama was that they cancelled the visual distance and made the viewer feel that he was right inside the picture'.[41] This sense of being 'within' a visual world which was transforming before the eyes is used by Dickens to give an immediacy and intimacy to the reader's imaginative experience, as I go on to discuss.

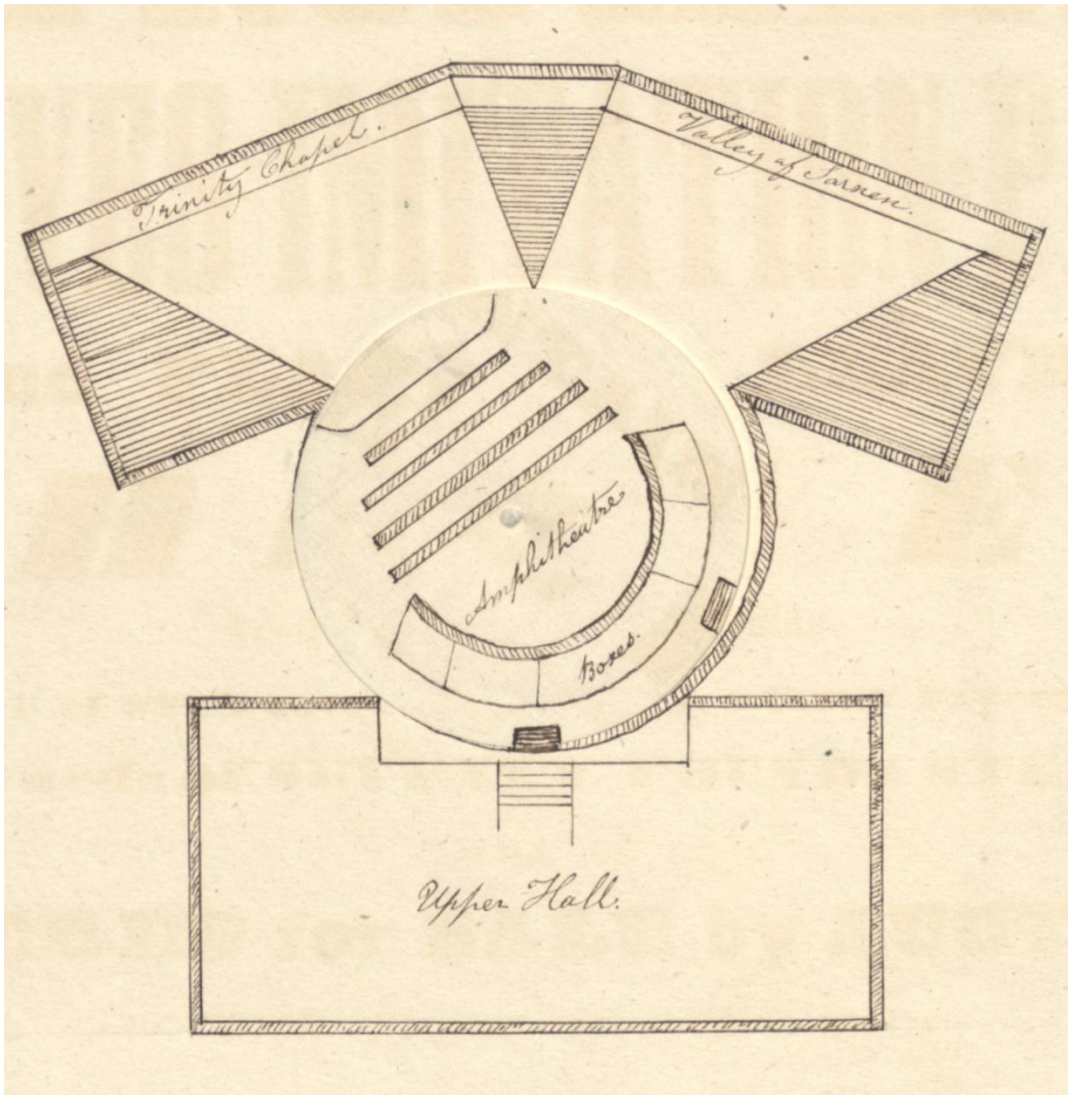

Figure 9. Drawing showing the architecture of the diorama, with its rotating amphitheatre and two different views: 'Trinity Chapel' and the 'Valley of Sarnen' ([c. 1840-50]). John Johnson Collection, Bodelian Library, University of Oxford, UK. Reference Dioramas 2 (69a).

[41] Wolfgang Schivelbusch, *Disenchanted Night: The Industrialization of Light in the Nineteenth Century*, trans. Angela Davis (London and Berkeley: The University of California Press, 1995), p. 217.

Using a highly developed system of pulleys, shutters, mirrors, filters, blinds, and a varied opacity of paint, light was directed to shine on and through the transparent screen and so illuminate, shade, tint, and mottle specific parts of the painting to give the appearance of transformation. The image 'moved' from day to night, and in later dioramas details were made to appear or disappear, such as the unfolding of an avalanche or worshipers entering a church (subjects included *The Ruins of Holyrood Chapel by Midnight, Effect of Fog and Snow seen through a Ruined Colonnade*, and *The Valley of Sarnen, Switzerland*).[42] As Schivelbusch points out, 'In light-based media, light does not simply illuminate existing scenes; it creates them'.[43] The saloon seating the venue's two hundred spectators was designed to revolve on its axis, driven from below by a staffed mechanism which turned the audience from one tunnel to the next (see fig. 9). The admission price of two shillings, then, provided two dioramic spectacles of fifteen minutes each and meant that the diorama offered a variety of views without the impractical need to switch screens after each showing; the audience was literally moved from one transforming image to the next.

Exhibition of the diorama was not restricted to Paris and London, as R. Derek Wood's extensive tracing of early nineteenth-century purpose-built dioramic venues demonstrates. Dioramas were built in Liverpool's Bold Street (1825-1832), Manchester's Cooper Street (1825-1827), in Dublin on Great Brunswick Street (1826-28), and on the Lothian Road in Edinburgh (1827-1839). All opened soon after the first appearance of the diorama in London in 1823, but were relatively short-lived, even though, as Wood notes, advertisements for their spectacle appeared frequently on the front page of local

[42] Altick points out that although inspired by the Phantasmagoria, Daguerre's subjects were much more 'earthly, instructive, 'rational', and aesthetically pleasing'. *The Shows of London*, p. 219.
[43] Schivelbusch, *Disenchanted Night*, p. 220.

newspapers, demonstrating their popularity outside of the metropolitan capital.[44] The London Diorama was popular and well-received. *The Mirror of Literature, Amusement, and Instruction* remarked that 'Among the many exhibitions in the metropolis, there is not one which has excited more surprise, or has been more attractive, than the Diorama. The novelty of the plan, and the singular illusion of the views, took the town by surprise'.[45] Alison and Helmut Gernsheim's calculations support *The Mirror*'s enthusiasm, finding that on Easter Monday of the Diorama's first year of opening admission receipts total over £200 and indicate an attendance of two thousand viewers.[46]

Reviewing an exhibition of *The Valley of Sarnen, Switzerland*, *The Times* described it as an 'immeasurable' improvement on the panorama. The article cites transformation as the spectacle's 'most striking effect':

> From a calm, soft, delicious, serene day in summer, the horizon gradually changes, becoming more and more overcast, until a darkness—not the effect of night, but evidently of approaching storm—a murky tempestuous blackness, discolours every object, making us listen almost for the thunder which is to growl in the distance.

So convincing is the transformative effect of light that viewers are inspired to listen for the expected sounds. The representation of the storm reflected upon the lake 'is very beautifully contrived': 'the warm reflection of sunny sky recedes by degrees, and the advancing dark shadow runs across the water […]. At the same time, small rivulets show with a glassy black effect [and] new pools appear which, in the sun-shine, were not visible'. It is the moving, transformative parts of the scene which are continually stressed: gradual changes, receding sun, advancing shadows, running rivulets, and previously

[44] The cost of frequently transporting dioramic screens from venue to venue may have led to their closure. See R. Derek Wood, 'The Diorama in Great Britain in the 1820s', *History of Photography* 17.3 (Autumn 1999), 284-295.

[45] 'Diorama: The Ruins of Holyrood Chapel', *The Mirror of Literature, Amusement, and Instruction* (26 March 1825), 193-196 (p. 193).

[46] Gernsheim, *L. J. M. Daguerre*, p. 23.

invisible pools of water. The review concludes that 'the whole thing is nature itself'; the moving scene is closer to a visual impression of nature than could be achieved without the element of motion.[47]

The consistent stress upon the *unfolding* of the scene, of its incremental changes before the eyes, is found too in a description of the landscape surrounding Chesney Wold in Dickens's *Bleak House* (1852-3):

> All that prospect, which from the terrace looked so near, has moved solemnly away and changed […] into a distant phantom. Light mists arise, and the dew falls, and all the sweet scents in the garden are heavy in the air. Now the woods settle into great masses as if they were each one profound tree. And now the moon rises to separate them, and to glimmer here and there in horizontal lines behind their stems, and to make the avenue a pavement of light among high cathedral arches fantastically broken. Now, the moon is high […and] the stained glass is reflected in pale and faded hues upon the floors.[48]

The repeated 'now' allows Dickens's prose to achieve a sense of immediacy as his readers imagine and visually recreate, as if watching in real time, the viewing of the landscape described by the narrator. Notice the similarity of language between *The Times*' review and this passage: in both, each transformation of the scene is recorded and cumulatively builds upon the last to give a sense of continual animation. Dickens's text, too, stresses the role of light in transformation. The moon rises, illuminating the gardens, and its light falls upon tall trees, making them appear like 'high cathedral arches' (a nod to the Gothic architecture so often found in dioramic scenes, as noted above). It shines through glass panels and causes projections of coloured shapes to play across the floor. In contemporary reviews and in Dickens's rendering of a dioramically-transforming landscape, the

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[47] 'Diorama', *The Times* (4 Oct 1823), n.p. Another review of this same diorama confessed that 'the representation of a stream of water flowing down […] is so perfectly natural as to impress every observer that the artist has contrived, by some ingenious mechanism, to let real water issue from an aperture made in that part of the canvas'. *The Mechanics' Magazine* (31 January 1824), qtd. in Gernsheim, *L. J. M. Daguerre*, p. 19.

[48] Charles Dickens, *Bleak House*, ed. by Stephen Gill (Oxford: Oxford University Press, 2008), pp. 593-594. All further references are to this edition and will be cited parenthetically in the main text.

sequential movement of daylight fading to reveal a moonlit scene offered a sense of unfolding temporality, of immediacy, and of a developing process being enacted in front of the eye in a way that the static panorama or projected lantern slide could not. Rather than ekphrastically describing the scenic landscape of Chesney Wold, Dickens turns to the popular diorama to dramatically narrate the passing of time within that landscape, heightening the reader's imaginative involvement in and conception of this fictional world.

The narrativization of transforming dioramic scenes was strengthened in 1834 with the introduction of the double-effect diorama. This modification enabled an even greater range of animations to be presented to the viewer. The double-effect screen was painted recto and verso with two individual images sharing a core subject, a process which followed earlier ways of painting transparencies.[49] By reflecting and refracting light through and off the screen from both sides the painting underwent a series of changes in which a number of new elements could be introduced to the image.[50] One of the most renowned double-effect views, *Midnight Mass at St. Etienne*, was exhibited continuously for three years. Reviews of this show drew attention directly to its effects of motion: 'We have a painting that is not only beautifully painted, […] but also a scene that is animated'.[51] A handbill advertising the *Ruins of Fountaine's Abbey, York*, informed readers that its visual spectacle is engineered using

> mechanical arrangements by which an almost startling reality is given. The silver moon […] appears traversing the cool grey sky, shedding her beams over and through the massy pile of ruins […]. Those who are accustomed to beholding the bungling manner in which a moon is moved in our theatres can have but a slight

[49] See Plunkett, 'Optical Recreations, Transparencies, and the Invention of the Screen', p. 185.
[50] Daguerre described this process of alternatively transmitting and blocking light the 'decomposition of form'. See J. L. M. Daguerre, *An Historical and Descriptive Account of the Various Processes of the Daguerréotype and The Diorama*, ed. by Beaumont Newhall (1839; New York: Winter House, 1971), p. 6.
[51] 'Midnight Mass', *L'Artiste* 7 (1834), p. 228, qtd in Comment, *The Panorama*, p. 60.

> idea of the magical effect of the machinery here exhibited: the moon is so much *like* the real thing.[52]

Associating the diorama with prior conventions in theatrical scenery, this handbill promotes the diorama's ability to display a more sophisticated spectacle of motion. Further, the mechanical operation and skilful two-sided transparency enabled the dioramic painting to evidence moving effects so well-wrought that they appeared *like* their real counterpart, attracting viewers to marvel at its life-like animation. As Sophie Thomas remarks, the panorama attracted on immensity, but the diorama on intensity.[53]

Mirroring the move to topicality seen in the moving panorama, scenes of contemporary interest were increasingly a feature of the double-effect dioramas of the 1830s. In 1835 both the Regent's Park Diorama and the Queen's Bazaar, Oxford Street exhibited views entitled *The Destruction by Fire of the House of Lords & Commons*, depicting the October 1834 fire which destroyed much of the Houses of Parliament. Another view, *The Village of Alagna, Piedmont*, represented the approach of a storm and a terrible avalanche descending upon the village (an event which had occurred in 1820). Its lighting effects emphasized the tragic narrative by first introducing viewers to the scene in daylight then showing the approaching storm and the avalanche itself, before depicting the village as it appeared after the event. This short narrative enhanced the viewer's emotive response, with the *Athenaeum* remarking that 'It is a work of witchcraft, if it *be* a picture […it is] so admirably managed as to be almost awful'.[54]

The Alagna avalanche scene was made into a small transparency by the London printseller W. Spooner in 1835, enabling its transformative effects to be experienced in a

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[52] Dioramas 2 (21a) (J. J. Coll.).

[53] Sophie Thomas, *Romanticism and Visuality: Fragments, History, Spectacle* (London: Routledge, 2007), p. 128.

[54] *The Athenaeum* (2 April 1836), qtd. in Gernsheim, *L. J. M. Daguerre*, p. 39.

domestic setting by utilizing a small light source.[55] Although dioramas were most often experienced as public spectacles it was possible to purchase a portable diorama to recreate a similar display in the home. John Heaviside Clark's 1826 apparatus comprised a compact proscenium arch and a structure in which to hold upright two removable translucent screens, which when backlit would present transforming views. As Plunkett explains, it could display six separate scenes composed of two screens each, the second adding effects such as that of the rainbow seen in fig. 10.[56] A similar item, the *polyrama panoptique*, was manufactured in France by Pierre Seguin in 1849. Viewers looked through an aperture to see a lighted scene and operated a hinged shutter to create dioramic effects.

Figure 10. John Heaviside Clark's portable diorama. The Bill Douglas Cinema Museum, University of Exeter, UK. Item number 69058.

[55] Gernsheim, *L. J. M. Daguerre*, p. 39.
[56] Plunkett, 'Optical Recreations, Transparencies, and the Invention of the Screen', p. 187.

Of the portable diorama, Heaviside Clark commented that it offered a 'promotion of that knowledge by which an increased pleasure may be experienced, either in witnessing the admiral productions of pictorial representation, or in beholding the beautiful scenes of *animative* nature'.[57] In this way, as Plunkett argues, 'to an even greater degree than transparencies, the diorama was a picturesque homage to the ability of light to create the variousness of landscape' and could 'embody the changing illumination of a landscape far better than any series of consecutive watercolours'.[58] The dispersal of dioramic visual principles outside of a predominantly metropolitan site of public exhibition meant that the diorama was not confined to denoting simply an exhibition type; its spread into the domestic market ensured that the conception of a *dioramic perception* was instilled within the public's visual imagination and linguistically referred to a *way* of seeing based on unfolding transformation, not simply to a specific exhibitionary site or apparatus.

The diorama's use of transparencies was innovative, prefiguring both celluloid film and the cinematic experience of watching an externalized, screen-based image transform in front of the eye without any need to move the screen through or across the field of vision. It provided an apt metaphor for describing perception *at work*, as exemplified in the quotation above from *Bleak House*, and for dramatizing mental life on the page. Its optical techniques offered a new way to textually present the fluctuation and transience of memory; of George Eliot's fiction, as Plunkett has argued, the diorama is used 'as a figure to suggest the way individuals could be captivated by the shifting scenes of memory' and

[57] John Heaviside Clarke, *The Amateur's Assistant* (1826), qtd in Plunkett, 'Optical Recreations, Transparencies, and the Invention of the Screen', p. 187 (emphasis added).
[58] Plunkett, 'Optical Recreations, Transparencies, and the Invention of the Screen', p. 188.

'the working of imagination'.[59] In *Middlemarch* (1871-2) the narrator states that 'The memory has as many moods as the temper, and shifts its scenery like a diorama. At this moment Mr Bulstrode felt as if the sunshine were all one with that of far-off evenings when he was a very young man and used to go out preaching beyond Highbury'.[60] The gradually transforming spectacle of the diorama is evoked in the description of memory's 'shifting scenery' and 'many moods'. So too is its single space of display: just as the dioramic picture unfolds within the bounds of a defined frame, the sun shining upon Bulstrode feels 'all one' with his earlier memory and works to connect the two experiences as one in his mind.

In *Adam Bede*, remembered and speculative thoughts appear as images, or 'scenes', which move rapidly in and out of Adam's mental vision:

> The night was very still: when Adam opened the door to look out at twelve o'clock, the only motion seemed to be in the glowing, twinkling stars; every blade of grass was asleep. Bodily haste and exertion usually leave our thoughts very much at the mercy of our feelings and imagination; and it was so to-night with Adam. While his muscles were working lustily, his mind seemed as passive as a spectator at a diorama: scenes of the sad past, and probably sad future, floating before him, and giving place one to the other in swift succession.[61]

First, Eliot presents the landscape as a dioramic scene: all is still apart from the illuminated stars which appear to 'twinkle', evoking the techniques and special effects of the diorama's mechanism. Then, reflecting this dioramic scene inward, the diorama provides a metaphor for Adam's mental experience. Undertaking physical activity, the passage asserts, effects both an increase in cognitive processes (Adam is 'at the mercy' of feelings and imagination) and a passivity of mind.[62] The mind is both a producer and a

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[59] Plunkett, 'Visual Culture', p. 232-3.

[60] George Eliot, *Middlemarch*, ed. by David Carroll (Oxford: Oxford University Press, 2008), p. 490.

[61] Eliot, *Adam Bede*, p. 44.

[62] Focusing on the experiential activity of *watching* a diorama, Adam's passivity of mind for Plunkett, in contrast to my reading, demonstrates that 'Rather than exploiting the transforming scene of the diorama,

watcher: recalled images 'float' before him, and each are swiftly replaced by the next. Eliot's metaphorical reference to contemporary optical technology, however, is not restricted to a single technique or mechanism. Past memories and future imaginings appear as visual apparitions within the physical space (they are 'before' him).

While we might associate this language with the moving panorama, here the images 'before' Adam evoke ideas of projection and external screens. Although the diorama was a screen-based technology, its display was premised on gradual and accumulating transformation within a defined space; in this passage these spatial imaginings wholly 'give place to one another'—the *entire* image changes upon the same space (not simply transforming in part, as in the diorama), a technique associated predominantly with the 'dissolving' of a magic lantern slide into another. This 'giving place' occurs in 'swift succession', again turning away from the diorama's model of subtle changes of light and instead looking to mid-century advances in optical technology able to effect more dramatic instances of visual movement, such as the persistence of vision devices which relied on such a 'swift succession' of serial images to create an animation. This passage, then, specifically names one moving-image technology but employs the technique and aesthetic of other contemporary technologies to fully represent the activity of Adam's mind, and the operation of his memory. I turn first to explore the scenes 'floating before' Adam, as if his thoughts are projections, then consider the dissolving of one image into the next ('giving place one to another') in the specific lantern technique of creating 'dissolving views'.

Eliot plays off the way the illusory scene of the diorama captivates the audience'. 'Optical Recreations and Victorian Literature', p. 12.

Projections Floating 'Before' the Eyes

Although magic lantern shows could be created in the home, their requirement of bulky lanterns and potentially dangerous light sources meant that they were most frequently experienced as a public spectacle and performed by professional projectionists. Venues were being established, most often in London, in the early Victorian period for the promotion and public understanding of science and technology which aimed to both educate and entertain (as I discussed in Chapter One). Many boasted a lecture hall with a fully-staffed projection room from which lantern slides and dissolving views would be projected to illustrate lectures and shows. The spectacular effects of these projections were frequently advertised in prospectuses, catalogues, and handbills and formed one of the most competitive attractions for each institution.

The main lecture hall of London's Royal Polytechnic Institution (RPI), which could seat up to five hundred, projected lantern slides, dissolves, chromatropes (lantern slides containing a geometrical pattern which appeared animated when one slide mechanically 'slipped' over the next), and enlarged kaleidoscopic and microscopic views onto a 425-square-foot screen.[63] The projection room housed up to six lanterns which were operated in combination by a team of lanternists, one of which was Henry Childe who was employed to present a changing programme of dissolving views. In 1848, John Henry Pepper was hired as a lecturer and later became the Institution's manager. As Bernard Lightman writes, Pepper intended to 'exploit the relationship between the Polytechnic and the London entertainment scene by bringing in more music and spectacle'.[64] His theatrical optical shows were a great draw for the RPI: Pepper wrote a number of books on science

[63] W. F. Ryan, 'Limelight on Eastern Europe: The Great Dissolving Views at the Royal Polytechnic', *The New Magic Lantern Journal* 4 (1986) 48-55 (p. 49).

[64] Bernard Lightman, *Victorian Popularizers of Science: Designing Nature for New Audiences* (Chicago: University of Chicago Press, 2007), p. 200. See Chapter Four of this book for a good history of the performance of dissolves and 'Pepper's Ghost' at the RPI.

and optics for a general readership of adults and children and, along with Henry Dirks, was known for his famous 'Pepper's Ghost' illusion. Through a combination of hidden mirrors and magic lanterns, a 'spectre' (the reflection of an actor beneath the stage) could be projected onto the stage which appeared to walk, float, and pass through windows and doors.[65]

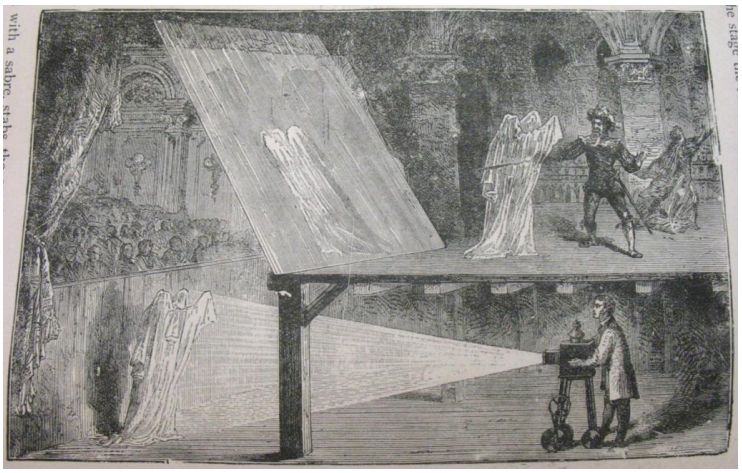

Figure 11. Pepper's Ghost. Gaston Tissandier, *Popular Scientific Recreations* (London, [1883]), p. 138. The Bill Douglas Cinema Museum, University of Exeter, UK. Item number 42637.

It was first used in a stage adaptation of Charles Dickens's *A Haunted Man and the Ghost's Bargain* (1848), shown in late 1862. Exploring the interplay between Dickens's text, its illustrations, and the visual techniques employed in its stage production, Helen Groth describes how the central character, Redlaw, a man unable to forgive incidents which have occurred in his past, is haunted by his 'spectral double' who grants his wish of erasing, or 'cancelling' his painful memories. The figure of this ghostly presence became, in Pepper's hands, a 'real' animated spectre who was as apparent upon the stage as the actors and worked to materialize the 'illusions generated by minds under the influence of extreme emotion'.[66]

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[65] Jeremy Brooker gives a full account of the history of this illusion in 'The Polytechnic Ghost: Pepper's Ghost, Metempsychosis and the Magic Lantern at the Royal Polytechnic Institution ', *Early Popular Visual Culture* 5.2 (2007), 189-206.

[66] Groth, *Moving Images*, pp. 105, 109. Citing psychological theories such as Henry Holland's 'double-consciousness' and William Carpenter's unconscious cerebration, the phantasmagoric effect of the illusion

Metaphorical projections of images appearing before the eyes and within the external surroundings (as in Adam Bede's reverie) did not only appear as a result of psychological disturbance; in the following examples, speculative ideas and pleasurable memories of the recent past are figured using the same optical trope. In Charlotte Brontë's *Villette* (1853), the narrator Lucy Snowe wonders early in the novel if Madame Beck has 'floating visions of adopting Dr John as a husband'.[67] As Philip and Maggie discuss books they have enjoyed in their childhood in Eliot's *The Mill on the Floss* (1860), Philip impresses a book upon Maggie which he believes she will enjoy. Its title 'revived an old impression with overmastering force' as Maggie realizes she has read it previously. She 'spoke rapidly, with glistening eyes […]; she was absorbed in a page at which she had opened. But suddenly she closed the book, and gave it back to Philip, shaking her head with a backward movement, as if to say 'avaunt' to floating visions'.[68] Mr George in Dickens's *Bleak House* has a 'whirling head' after attending his brother's party and sees 'images' of his family 'waltzing […] over his counterpane' after he retires to bed (881). In a similar moment of reflective memory, Lydgate's 'meditations' as he walks home from dinner at Mr Vincy's 'brought back the Vincys and all the pictures of the evening. They floated in his mind agreeably enough, and as he took up his bed-candle his lips were curled with that incipient smile which is apt to accompany agreeable recollections'.[69]

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of Redlaw's haunting participates in the wider 'debunking' of superstition and supernaturalism, seen earlier in the century in David Brewster's publications, and in mid-century scientific literature. 'Pepper's lecture script framed Dickens's story with an anti-spiritualist lecture that taught the audience about optical illusions more generally', Groth writes, and contributed to a wider culture of 'training audiences to recognise and normalise mysterious or anomalous visual stimuli' (pp. 113, 116). See also Morus's 'Illuminating Illusions' for an analysis of the 'vocabulary of spectacle' which Pepper drew on in order to frame his performance in relation to contemporary theories in optics, physics, and philosophy. Morus concentrates on how optical and cognitive experiments with illusion were crucial for an understanding of the process of making knowledge (pp. 38, 46-48).

[67] Charlotte Brontë, *Villette*, ed. by Herbert Rosengarten and Margaret Smith (Oxford: Oxford University Press, 2008), p. 102.

[68] George Eliot, *The Mill on the Floss*, ed. by Gordon S. Haight (Oxford: Oxford University Press, 2008), p. 306.

[69] Eliot, *Middlemarch*, p. 153-155.

Talking a walk to Twickenham, Arthur Clennam in *Little Dorrit* 'had plenty of unsettled subjects to meditate upon […]. If there was a last subject in his thoughts, […] its form was so indefinite that it was little more than the pervading atmosphere in which these other subjects floated before him'.[70]

Joss Marsh has written that Dickens's work in particular (his novels, letters, and journalism) is 'saturated in lantern reference'. Focusing, like Groth, on popular adaptations, Marsh traces the history of magic lantern performances of *Gabriel Grub* (1836) and *A Christmas Carol* (1843) which 'became lanternist favourites not only for commercial, but for profoundly imaginative reasons. For Gabriel's and Scrooge's Christmas-tide changes of heart are directly inspired and made possible by the experience of the lantern show'. Her close reading of each text shows that both incorporate references to lantern shows and dissolving views through their descriptive language. 'The lantern inheritance of Dickens's work lives in techniques and metaphor, not in storyline or explicit reference', she argues, showing that the traffic between Dickens's writing and visual productions was not simply a one-way process: Dickens inspired such adaptations because he incorporated the language of optical techniques and technologies within his prose.[71] *A Christmas Carol,* for example, plays with time, 'rewinding and revisiting' the past 'with the freshness and conviction of cinematic flashbacks, seventy years before flashbacks came to be'.[72]

Extending Marsh's analysis, though, we find not just projection metaphors in *A Christmas Carol* but clear references to a particular type of lantern projection: that of dissolving slides. On the appearance of the very first 'ghost', the narrative describes that

[70] Dickens, *Little Dorrit,* p. 189.
[71] Joss Marsh, 'Dickensian "Dissolving Views": The Magic Lantern, Visual Story-Telling, and the Victorian Technological Imagination', *Comparative Critical Studies* 6.3 (2009), 333-346 (pp. 336-337).
[72] Marsh, 'Dickensian "Dissolving Views", p. 339.

> It was a strange figure—like a child: yet not so like a child as like an old man, viewed through some supernatural medium, which gave him the appearance of having receded from the view, and being diminished to a child's proportions. […] Even this, though, when Scrooge looked at it with increasing steadiness, was not its strangest quality. For as its belt sparkled and glittered now in one part and now in another, and what was light one instant, at another time was dark, so the figure itself fluctuated in its distinctness: being now a thing with one arm, now with one leg, now with twenty legs, now a pair of legs without a head, now a head without a body: of which dissolving parts, no outline would be visible in the dense gloom wherein they melted away. And in the very wonder of this, it would be itself again; distinct and clear as ever.[73]

As soon as Scrooge looks at parts of the figure, aspects appear to 'dissolve' or 'melt' from view and then return—terms associated widely with dissolving lantern slides. The vision fluctuates, and changes its illumination, one minute light, then next dark. It dramatizes a projected visual show being performed before Scrooge's, and the readers', eyes.

Dissolving Slides, Melting Views

Before the nineteenth century, magic lantern displays comprised a series of static images projected onto a screen. Slides were either square and contained a single depiction or they were long, narrow rectangles containing five or six related scenes. These longer strips would be fed through a slider between the lantern's light source and lens, allowing the lanternist to project a sequence of images illustrating a spoken narrative of fictional or educational interest. The transition between each scene was likely to be apparent to the perception, as one image was pushed to the side to allow another to be brought onto the centre of the screen. Mechanical slides were used, which, through a system of overlapping glass panes and hand-operated levers and cogs, produced a repetitive movement on the

[73] Charles Dickens, *A Christmas Carol and Other Christmas Writings*, ed. by Michael Slater (London: Penguin, 2003), pp. 54-55.

screen, but magic lantern displays in the eighteenth century were primarily enjoyed for their ability to show large projections of images and not for their spectacle of animation.[74]

The nineteenth-century invention of 'dissolving views' meant that a lantern slide projected upon a screen could be made to dissolve or 'melt' into the next in front of the viewers' eye. This smooth transition between scenes cultivated a sense of progression and narrative flow not able to be demonstrated by a staccato sequence of images as in previous lantern shows. Further, the disruptive halt of mechanical transition as one slide passed out of view was no longer apparent, allowing the apparatus of the lantern and the mechanical manipulation of the projectionist to be elided in favour of an increased emphasis on the animated display. As the clumsy slide transitions could no longer be witnessed it was the transformations taking place upon the screen that became the most important part of the visual experience.

The description 'dissolving view' itself reminds us why this type of lantern projection was often described in contemporary accounts as 'magical': the disintegration of a view upon the screen and the final decomposition of its form before another image smoothly took its place appeared a feat of scientific and technological optics when first demonstrated.[75] A handbill advertising an 1837 display of dissolves at the Adelphi Theatre claimed that 'the dissolving of the Views into each other is considered a masterpiece in the Science of Optics'.[76] The term 'melting' was also applied to this type of slide presentation, supporting the sense of a collapse in the image's physical integrity. Reviewing a

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[74] Laurent Mannoni cites the first example of a mechanical moving slide as Christiaan Huygens's *Dance of Death* around 1659. However, we should be cautious using the term 'moving' here, as Mannoni does, because these slides showed only a crude sequential narrative and cannot be said to demonstrate a fluid visual motion of transition in the way that later dissolving view slide technology would allow. *The Great Art of Light and Shadow: Archaeology of the Cinema*, trans. by Richard Crangle (Exeter: University of Exeter Press, 2000), pp. 38-39.

[75] One reviewer wrote that dissolving views offered 'a change which has something of magic in its appearance'. 'Dissolving Views', *The Mirror of Literature, Amusement, and Instruction* 1.7 (12 February 1842), 97-99 (p. 98).

[76] 20 March 1837. London Playbills Adelphi box 1 (10) (J. J. Coll.).

dissolving view show, *The Penny Magazine* described 'passing gleams of sunshine, day melting into night, and this into moonlight', and for *Blackwood's Edinburgh Magazine* 'the scenes of a life, […] melt gradually into one another, like dissolving views'.[77] As we saw in *A Christmas* Carol, above, in *Bleak House* the language used to describe Mr Tulkinghorn's movements registers this specific term:

> [He] transfers himself to the stale heat and dust of London. His manner of coming and going between the two places is one of his impenetrabilities. He walks into Chesney Wold as if it were next door to his chambers and returns to his chambers as if he had never been out of Lincoln's Inn Fields. He neither changes his dress before the journey nor talks of it afterwards. He melted out of his turret-room this morning, just as now, in the late twilight, he melts into his own square. (611)

Reflecting Tulkinghorn's sly and wily nature, for Dickens's readers this narrative is a slide show in which the physicality of moving from place to place is elided in favour of the transformative 'melting' of his body from one location to the next, echoing the 'magical' transformations wrought upon the screen by the dissolve's technology.

These melting, dissolving views also signalled the unreality and transience of perception, imagination, and memory. Travelling across Europe, the narrator of Dickens's *Little Dorrit* (1855-7) describes of the title character that

> Sitting opposite her father in the traveling-carriage, and recalling the old Marshalsea room, her present existence was a dream. All that she saw was new and wonderful, but it was not real; it seemed to her as if those visions of mountains and picturesque countries might melt away at any moment, and the carriage, turning some abrupt corner, bring up with a jolt at the old Marshalsea gate.[78]

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[77] 'Portable Diorama—Dissolving Views', *The Penny Magazine* 12 (7 Jan 1843), 2-3 (p. 3); 'Personal Identities', *Blackwood's Edinburgh Magazine* 578 (December 1863), 733-741 (p. 741).

[78] Charles Dickens, *Little Dorrit*, ed. by Stephen Wall and Helen Small (London: Penguin, 1998), p. 447. For more on the connection between travel and optical experiences, see Ana Parejo Vadillo and John Plunkett, 'The Railway Passenger; or, The Training of the Eye', in *The Railway and Modernity: Time, Space, and the Machine Ensemble*, ed. by Matthew Beaumont and Michael Freeman (Bern: Peter Lang, 2007), pp. 45-68 and *Travel Writing, Visual Culture and Form, 1760-1900*, ed. by Brian Murray and Mary Henes (Basingstoke: Palgrave Macmillan, forthcoming).

The landscape is not physical, but rendered as if a flattened vision, unreal and liable to 'melt away', as in the action of a dissolving slide. Space and time are collapsed in this landscape; the carriage might instantly arrive at the old location, the Marshalsea prison. In her bewildered mental state, one virtuality, or one visual projection, can quickly be exchanged for another. In *David Copperfield* (1849-50), David's 'speculations' about his uncertain future after his mother's death 'were transient visions, daydreams I sat looking at sometimes, as if they were faintly painted or written on the wall of my room, and which, as they melted away, left the wall blank again'.[79] Uncertainty and unreality figure prominently too in Maggie's sudden and disastrous elopement with Stephen in Eliot's *The Mill on the Floss*. As they sail aboard the Dutch vessel headed for Mudport, 'Stephen's passionate words made the vision of such a life more fully present to her than it had ever been before; and the vision for the time excluded all realities'. In a passage which echoes Adam Bede's dioramic mental state, we read that

> Behind all the delicious visions of these last hours, which had flowed over her like a soft stream, and made her entirely passive, there was the dim consciousness that the condition was a transient one, and that the morrow must bring back the old life of struggle; that there were thoughts which would presently avenge themselves for this oblivion. But now nothing was distinct to her; she was being lulled to sleep with that soft stream still flowing over her, with those delicious visions melting and fading like the wondrous aerial land of the west.[80]

Maggie's 'delicious visions' very almost exclude the reality of what she has done and the consequence of her actions (this is present only as a 'dim' awareness) while most of her thoughts are taken up with the 'melting and fading' of a 'steam' of images, presented using the descriptive language and action of dissolving views.

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[79] Charles Dickens, *David Copperfield*, ed. by Nina Burgis (Oxford: Oxford University Press, 2008), p. 129. Of this episode, Susan R. Horton writes that 'If most transparencies represented edifying scenes, Davy's seeing his young life as an appropriate subject for one of them accentuates his entirely illusory sense of his own self-importance—and it also suggests his seeing himself as a *spectator* at his own life'. 'Were They Having Fun Yet?', p. 12.

[80] Eliot, *The Mill on the Floss*, pp. 469-470.

The provenance and exact date of invention of dissolving slides is uncertain, although they were in regular use in London by the late 1830s.[81] Henry Langdon Childe is most often cited as the inventor, although Paul Philidor (also known as de Philipstahl who introduced the phantasmagoria to Britain in 1801) is rumoured to have created an early dissolve by passing thin cloth across the lens during slide changes.[82] Childe's dissolves were displayed at the Colosseum five evenings a week in 1835.[83] In March 1837, Childe exhibited a 'new series' of dissolves at the Adelphi Theatre. Along with tableau scenes of St. Paul's Cathedral, the Thames Tunnel, the polar regions, and the tomb of Napoleon, certain views were advertised for their properties of transformation and motion, such as the effects of a rainbow, a water mill shown in summer then winter, and a village accompanied by effects of the aurora borealis. The handbill states that 'the novel and interesting features will be relieved and diversified by a variety of grotesque and splendid diminishing and increasing figures! constituting a degree of grandeur and interest never before combined', suggesting that phantasmagoric techniques of moving the lantern closer to and away from the screen to alter the size of its projections were used in conjunction with dissolving view apparatus.[84]

The introduction of dissolving views was concurrent with improvements in lantern technology and their mass production: lanterns of a lower quality were produced as toy projectors for children; sophisticated and powerful lanterns were sold to professional projectionists and proprietors of large exhibition venues such as the Adelaide Gallery and

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[81] M. Henry exhibited 'astonishing illusions' and 'wonderful metamorphoses' of projections at the Adelphi, 1824, and scholars have questioned whether these are early, unnamed displays of what would later be termed 'dissolving views'. See Edwin Dawes and Mervyn Heard 'M. Henry's Dissolving Views' in *Realms of Light,* ed. by Mervyn Heard (London: Magic Lantern Society, 2005), pp. 159-161.

[82] Altick, *The Shows of London*, p. 219. See Franz Paul Liesegang, *Dates and Sources: A Contribution to the History of the Art of Projection and to Cinematography*, trans. Hermann Hecht (London: Magic Lantern Society, 1986), pp. 20, 184-188 for discussion of this history.

[83] See London Play Places 3 (5b), London Play Places 2 (72), and London Play Places 2 (36d) for relevant handbills and reviews (J. J. Coll.).

[84] 20 March 1837. London Playbills Adelphi box 1 (10), (J. J. Coll.).

the Royal Polytechnic Institution; and decorative lanterns, made of mahogany and brass, were displayed in the home and operated by a family member or travelling lanternist. Further, illumination by candle and oil was replaced by gas and limelight in 1837, allowing the lantern image to be projected a greater distance while also increasing its clarity and vividness. A variety of new shutters, faders, and wipers were added to the front of the lantern to produce the dissolving transition. By using multiple lanterns or lenses all aligned upon the screen, the projectionist would lower the light behind one slide and increase the light of the next while passing a tooth-edged shutter across the lens to produce a smooth and visually dissolving image. The programme for London's New Strand Theatre described its production of dissolving views as 'imperceptibly melting into each other in a most pleasing and surprising manner, before the eyes'.[85]

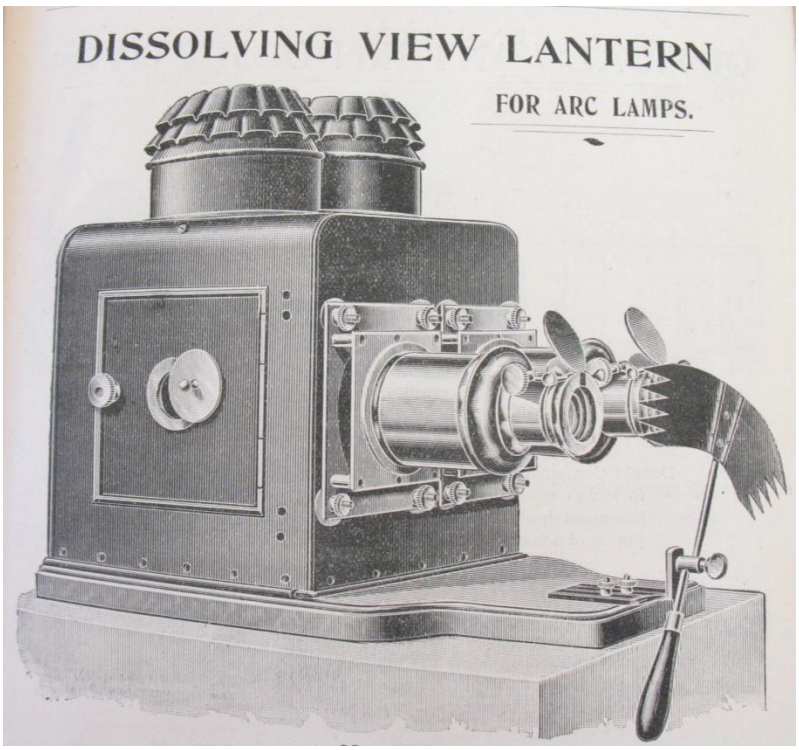

Figure 12. Early twentieth-century dissolving view lantern. *Illustrated Catalogue of Magic, Optical, and Dissolving View Lanterns* ([1902-3]), p. 39. The Bill Douglas Cinema Museum, University of Exeter, UK. Item number 36623.

[85] Altick, *The Shows of London*, p. 220.

The Mirror of Literature, Amusement, and Instruction included a two-part front page article on dissolving views in February 1842 in which they sought to describe the spectacle for readers in order that they might 'form an idea of that peculiarity in the exhibition termed 'dissolving'', if they had yet to witness its display first-hand. The article does so by offering two illustrations of the same scene, the 'Water Girls of India', which differ subtly in lighting, the placement of figures, foliage, and architectural feature. Accompanying these engravings are instructions to the reader to enable them to imaginatively experience the visual effect of a dissolve.

> Suppose a picture were exhibited on a disk, representing (as we have done in our engraving) the 'Water Girls of India': while the eye is fixed upon it, a gradual but almost imperceptible change comes over the scene; this is what is termed *dissolving*, and which our second engraving represents. The original picture fades insensibly from the sight, and another has stealthily taken its place.
>
> The means by which this singular and truly charming effect is produced is so simple that we are apt, on ascertaining it, to exclaim in astonishment, 'How simple, yet how wonderful!'
>
> Two lanthorns are placed near each other […], the slider [glass slide] of one being up and the other down; the painting in the one with the slider will now be fully and alone reflected on the disk; but if the slider of this lanthorn be moved slowly downwards, and that of the other slowly raised, the first picture will gradually fade from the sight in proportion as the rising slider unfolds the other – a change which has something of magic in its appearance.[86]

The Mirror's clever approach to representing dissolving views uses text and illustration to direct their readers' ocular behaviour in order to impart an understanding of the visual experience of *watching* a dissolve: the eye is encouraged to fix on the engraving as if it were a projected image, and then the mind is asked to visualize a subtle transformation in the details—a process guided by the existence of the second illustration. Importantly, the two illustrations are printed with a page of text between them, requiring the reader to turn

[86] 'Dissolving Views', *The Mirror of Literature, Amusement, and Instruction* 1.7 (12 February 1842), 97-99 (emphasis in original). See also the second part: 'Dissolving Views Concluded', *The Mirror of Literature, Amusement, and Instruction* 1.8 (19 February 1842), 113-114.

the page to physically enact the imagined dissolving view. In keeping the eye fixed on the first, the turn of the page finds the second illustration falling into the exact space upon which the eye is focused, thus working to 'dissolve' one view into another.

Although this material play is an innovative way of describing the newest trend in lantern project for those not able to see a dissolving show, the textual instructions describing the dissolve are vital to the reader's understanding, without which the illustrations would form a regular series of views. The accompanying text provides essential details about what *type* of visual experience readers should be imagining: the change is encoded as 'imperceptible', it 'fades', the second image appears 'stealthily'. Without this guiding language, a reader turning the page back and forth between illustrations might easily conclude that this lantern practice violently switches the image in a moment of rapid displacement. The textual rendering of new optical technologies and techniques was therefore central to the visual understanding of experiencing moving images; it could both simulate their display and encourage an accurate imaginative experience.

Plunkett's work has shown that 'there are significant points of convergence and crossover between nineteenth-century print media and the panoply of optical recreations', and looks particularly at the trope of the book as a form of optical entertainment: Robert Seymour's *Sketches by Seymour* (c.1836) illustrates the 'sketches' as if they were magic lantern slides, and children's gift books were often modelled as if they were a peepshow or panorama. *Dean's New Book of Magic Illuminations* and *Dean's New Book of Dissolving Views* (1862) comprised pages of transparencies which, when held to a light, would transform and reveal hidden aspects in the picture.[87] Joss Marsh, writing on George Cruikshank's sequential illustrations entitled *The Bottle* (1847), comments that he

[87] Plunkett, 'Optical Recreations and Victorian Literature', pp. 1, 18.

> not only took inspiration from the fear-inducing fantasy of the now-repudiated phantasmagoria, but specific instruction from the techniques of the uplifting dissolving view. For, in seven of Cruikshank's eight prints, the orientation of the drunkard's room (door on the left, hearth on the right, etc.) allows us more clearly to follow his metamorphosis from 'loving father to murderous maniac', as if we were dissolving from one image to the next. Dissolving views made possible, even helped shape, a still newer kind of story than that drunkard's 'progress', however – a story that allowed travel through time and space.[88]

The article in *The Mirror* forms another key example of the 'aesthetic crossover between optical and print media' identified by Plunkett and Marsh.[89]

Yet this crossover is also registered at the level of language: the imperceptibility of perceptual changes offered by dissolving views is drawn on in Dickens's *Bleak House*. Looking out of her window, Esther relates:

> It was interesting when I dressed before daylight to peep out of window, where my candles were reflected in the black panes like two beacons, and finding all beyond still enshrouded in the indistinctness of last night, to watch how it turned out when the day came on. As the prospect gradually revealed itself and disclosed the scene over which the wind had wandered in the dark, like my memory over my life, I had a pleasure in discovering the unknown objects that had been around me in my sleep. At first they were faintly discernible in the mist, and above them the later stars still glimmered. That pale interval over, the picture began to enlarge and fill up so fast that at every new peep I could have found enough to look at for an hour. Imperceptibly my candles became the only incongruous part of the morning. (195)

The window frames her view outside as a 'picture' in which her candles are reflected. The change of this picture from indistinct darkness to daylight is so 'gradual' and 'imperceptible' that Esther suddenly realizes they are no longer needed in the morning light; they are 'incongruous'. *The Mirror*'s article on dissolves also uses these two terms to describe the transformation of a dissolving view, as does an article on dissolves entitled

[88] Marsh, 'Dickensian "Dissolving Views"', p. 335.
[89] Plunkett, 'Moving Books/Moving Images', p. 1.

'Optical Magic of Our Age' in *Chambers's Edinburgh Journal*: 'The effect to the beholder is the gradual and imperceptible transition of the one scene into the other. If the reader will be so kind as to suppose that his two eyes represented magic lanterns, and will close one eye first, and then gently lift the lid while he shits down that of the other, he will obtain a perfect idea of the dissolving mechanism'.[90] Dickens draws on the language of these reviews and the evocative, 'magical' changes wrought by dissolving views in Esther's narration of her perceptual experience. Both *The Mirror* and *Chambers's* articles actively encourage readers to 'try out' seeing dissolves, using the materiality of print or the eye itself; Dickens is much more subtle, yet his language still presses the reader to likewise imagine the landscape of *Bleak House* as an animated scene undergoing the same transformations as might be seen in a dissolving view display, enlivening and strengthening the narrative's creation of a 'living' fictional world.

Mental Moves

In Dickens's *Pictures from Italy* (1846), the cross-overs and convergences between literary, printed, and optical media explored by Plunkett and Groth are apparent in both the form and the language employed to describe his travels. The chapters, Groth comments, 'guide the reader through a progression of dissolving images, as a magic lantern lecturer might have done'.[91] Indeed, the final chapter, entitled 'A Rapid Diorama', explicitly draws attention to its status as a kind of fast-paced, animated show, meant to be imagined as a series of visual images as it is being read. One passage in particular is notable for its allusions to the perceptual experience of spectating moving images, and here the reader is

[90] 'Optical Magic of our Age', *Chambers's Edinburgh Journal* 278 (April 1849), pp. 259-261 (p. 260), in *A History of Pre-Cinema*, ed. by Stephen Herbert, 2 vols (London: Routledge, 2000), II, p. 240.
[91] Groth, *Moving Images*, p. 15.

given not only a textual travel narrative of the various sights and scenes witnessed, but a sense of *how* these experiences were witnessed. Dickens writes that:

> The rapid and unbroken succession of novelties that had passed before me, came back like half-formed dreams; and a crowd of objects wandered in the greatest confusion through my mind, as I travelled on, by a solitary road. At intervals, some one among them would stop, as it were, in its restless flitting to and fro, and enable me to look at it, quite steadily, and behold it in full distinctness. After a few moments, it would dissolve, like a view in a magic-lantern; and while I saw some part of it quite plainly, and some faintly, and some not at all, would show me another of the many places I had lately seen, lingering behind it, and coming through it. This was no sooner visible than, in its turn, it melted into something else.[92]

Although Kate Flint rightfully comments in her Introduction to this text that 'Dickens is especially fascinated with the act of seeing, and with the consideration of how his memory operates in relation to what he has seen. He presents his mind as an open screen which receives impressions. […] Dickens presents Italy like a chaotic magic-lantern show', she does not take account of the specific type of projection technology referred to; in this case, Dickens is linguistically drawing on the mechanism and display of dissolving views to enhance the passage's descriptive effect.[93]

The remembered sights of Dickens's travels are presented as dissolving slides, 'flitting' within his mind. They are pictured intact but only temporarily; all too soon, they 'dissolve' and lapse in and out of recognition. This visual disintegration *resists* the transmission of information: a memory never appears *complete* but is rendered as a crowded collage of lingering images which 'come back' and appear to show *through* each other, evoking the layered action of dissolving view slides projected upon the same space, with each image 'melting' into the next. In this way, Dickens's references work to

[92] Charles Dickens, *Pictures from Italy*, ed. by Kate Flint (London: Penguin, 1998), p. 77.
[93] Kate Flint, 'Introduction' to *Pictures from Italy*, pp. vii-xxx (pp. xiii, vii).

'materialis[e] the work of the imagination', as Plunkett has argued of the use of optical tropes in literature.[94]

This passage communicates less as a travel narrative and more as a self-presented case study of psychological and perceptual experience, bringing to readers not only *pictures* of Italy but the phenomenological experience of *getting* those pictures, and the mental affect of travelling. The armchair traveller not only expands their understanding of foreign lands but might also, through the use of familiar terminology drawn from popular visual technologies, gain a virtualized understanding of the *feeling* of travel. In her reading of this passage, Groth asserts that Dickens 'exploits the psychological resonances of these optical allusions' and suggests that 'the oscillations between the momentary stasis of an image illuminated by memory, and its gradual dissolution as another image' invokes G. H. Lewes' conception of the 'streams of consciousness'.[95] Lewes' choice of the term 'stream' seems particularly pertinent here, evoking the motion of the moving panorama which this chapter began with, and the consistency of gradual transformation witnessed in dioramic pictures or dissolving views. It also points towards the slipperiness of cognitive process, the ungraspable spill of consciousness which is ever-moving but never adequately captured—an experience which the simple kaleidoscope, and persistence of vision devices, offered to the viewer, creating visual landscapes of illusory and intangible movement, as I explore across the following two chapters.

[94] Plunkett, 'Optical Recreations and Victorian Literature', p. 8.

[95] G. H. Lewes, *The Physiology of Common Life*, 2 vols (Edinburgh: Blackwood and Sons, 1860), II: 66, qtd. in Groth, *Moving Images*, p. 15.

CHAPTER THREE

Dynamic Structures and Regulated Animation in the Kaleidoscope

In the late 1810s a new craze swept from Edinburgh to London, the United States to Italy: 'kalleidoscopism', as Percy Bysshe Shelley termed it.[1] The kaleidoscope, invented by Sir David Brewster in 1815, was a small, portable, and manually operated optical instrument which, with a shake or twist, produced an infinite selection of dynamic symmetrical patterns. Holding an eye to its aperture, users saw the coloured display spread instantly across the entire visual field and entered a perceptual environment in which vision became kaleidoscopic. Writing in 1818 to her friend Dora Wordsworth, Sara Coleridge recounts being gifted a kaleidoscope whose appeal was such that one neighbour 'nearly blinded herself with looking at it':

> Mr [Humphrey] Senhouse was here a week or two ago. [H]e brought me a letter from Elizabeth [and] also he brought from London, a very curious toy called the Kaleidoscope. [Y]ou look through a hollow tube and see at the end little pieces of glass in all sorts of beautiful forms[,] these forms vary as often as you shake the tube. [A]nd if you are to shake for a hundred years you'd never see exactly the same again. Mr Senhouse says every[body] is mad after them in London. [W]e showed it to Mrs Crothers and left it at her house for a day or two and when we came to fetch it she said she had nearly blinded herself with looking at it…. Miss [Barker] is so delighted with the Kaleidoscope that she has ordered Glover to make her one….[2]

An awareness of the mechanical structure and operation of the device did not cloud Coleridge's enjoyment of its 'beautiful forms', and if the glass pieces were 'shake[n] for a

[1] Letter dated 21 December 1818. *The Letters of Percy Bysshe Shelley*, ed. by Frederick L. Jones, 2 vols (Oxford: Clarendon Press, 1964), II, p. 69.
[2] Letter dated 23 May 1818. Wordsworth Trust Collection, Grasmere, UK. Ref MS. WLMS A/ Coleridge, Sara/1. I am grateful to Beatrice Turner for kindly transcribing this unpublished letter.

hundred years' its spectacle would remain just as captivating. In fact, its ability to continually display new patterns might lead viewers (like Mrs Crothers) to overindulge, to gamble on the limitlessness of its display as the desire to see one more permutation took hold.

The kaleidoscope could generate in its viewfinder the image of multiple symmetrical forms able to be put in motion by the hand of the viewer, thereby displaying a successive series of reflecting patterns. It was a technology of compelling iteration which offered continual newness instead of striving for static resolution. Its angled mirrors inverted and reflected form, visualizing an intricately pleated view of turns, twists, echoes, and oppositions, and of new potentials which steadily unfolded in time according to the manipulation of the user's hand. The fragments of glass and other miscellaneous items from which its pattern was composed became abstracted within its mechanism: its display was a virtual environment of shifting colour and form. Its combination of materiality and manipulation added up to visual intangibility and like the persistence of vision devices considered in the following chapter, it relied on human intervention and physical operation to make an illusory vision of that which was never materially extant: its symmetrical kaleidoscopic patterning existed nowhere, produced only by the perception of light refracted from inclined mirrors. Existing within a material culture of glass- and lens-based media, its principle, as Isobel Armstrong writes, was 'pure atomization abstracted to the furthest degree, […] content distilled into pure, formal, molecular being'.[3]

This chapter builds on Helen Groth's account of an 'emerging visual vernacular' of 'kaleidoscopic metaphors to capture moments of transformation' in Romantic poetry to argue that the kaleidoscope continued to appear as object and metaphor throughout the nineteenth century, driven in part by the 1858 publication of an enlarged edition of

[3] Isobel Armstrong, *Victorian Glassworlds*: *Glass Culture and the Imagination, 1830-1880* (Oxford: Oxford University Press, 2008), p. 342.

Brewster's treatise on the device and by keen interest in the mid-nineteenth century in optical commodities and hand-operated technologies.[4] At the level of simple presence, we read that a kaleidoscope sits on the 'fine art' table of Mrs Jamieson's drawing room in Elizabeth Gaskell's *Cranford* (1853), and Mr Brogley in Charles Dickens's *Dombey and Son* (1846-8) places looking-glasses around his second-hand furniture shop at angles of 'reflection and refraction' whose multiplying sightlines 'presented to the eye an eternal perspective of bankruptcy and ruin', this kaleidoscopic perspective mimicking the history of his pawned goods. Charlotte Brontë's *Jane Eyre* (1847) favourably likens the title character's imagination to an 'ever-shifting kaleidoscope' of creativity.[5] Reference to the device itself and to the term 'kaleidoscopic' enters the lexicon of literature, art criticism, and scientific writing noticeably quickly and easily, as this chapter shows, suggesting that its value was more meaningful than scholars have tended to appreciate. In drawing attention to the uptake of the kaleidoscope as a consumer gadget and then to its wide and fluid use as metaphor and motif in the mid-nineteenth-century's fiction, journalism, psychological writing, and visual artwork, this chapter examines what it meant to be 'kaleidoscopic' in this period and demonstrates how the mechanical structure and necessary physical manipulation of the device impacted upon this meaning.

In the first part of this chapter, I explore how the kaleidoscope was increasingly aligned with notions of a stable, controlled, and unified visual environment in which mobility was valued but digression was mechanically impossible. Its display of twisting symmetry and vivid colour arrangements produced a structured framework upon which colour and form could be collated, reordered, and unified to produce a harmonious composition of visual cohesion and sensory appeal. I show that the kaleidoscope offered a

[4] Helen Groth, 'Kaleidoscopic Vision and Literary Invention in an 'Age of Things': David Brewster, *Don Juan*, and 'A Lady's Kaleidoscope'', *ELH* 74 (2007), 217-236 (pp. 218, 232).
[5] Elizabeth Gaskell, *Cranford*, ed. by Patricia Ingham (London: Penguin, 2005), p. 91; Charles Dickens, *Dombey and Son*, ed. by Alan Horsman (Oxford: Oxford University Press, 2008), p. 123; Charlotte Brontë, *Jane Eyre*, ed. by Sally Shuttleworth (Oxford: Oxford University Press, 2008), p. 233.

measured, organized, and finite visual environment, free from deviation or digression, in which composite parts were synthesized into new displays of harmonious integration (a process Baudelaire likened to the work of an artist). Further, the fundamentally mobile nature of the kaleidoscope meant that with each new twist the same parts could be rendered into further unified groupings, making the device a useful metaphor for the dynamism and multifunctionality of mental and physiological processes.

Its display of moving sequences of colour was not always as dazzling and overwhelming as critics have suggested. Barbara Stafford, in an exhibition catalogue of 'Devices of Wonder', asserts that the kaleidoscope 'contrived to destabilize rational vision and estrange the senses'.[6] I go on to suggest that the device offered a different cultural meaning than that of sensory destabilization and estrangement, and counter the critical narrative of visual disorientation by arguing that its visual effects promoted an enjoyment of its slow speed, serially-repeating pattern, and steadily moving display of harmonic colours. In attending to the necessity of manual manipulation by the viewer's hand to create its spectacle of motion, this chapter makes a case for a revised cultural meaning of the kaleidoscope based on physical agency, balance, and visual pleasure. Then, I develop this sense of pleasurable optical ordering to address its formal arrangement of line and colour as a stylistic motif of sensorial harmony in works of visual art by William Holman Hunt and Dante Gabriel Rossetti.

This chapter concludes by drawing these threads of kaleidoscopic metaphor and motif together in a reading of Brewster's textual promotion of his device's application as a mechanical tool for producing colour palettes. Here, he envisioned a remarkable intermedial projection system which harmoniously set kaleidoscopic patterns to music; an affective experience of animated, sequential progression only realized at the end of the

[6] Barbara Stafford and Frances Terpack, *Devices of Wonder: From the World in a Box to Images on a Screen* (Los Angeles: Getty Research Institute Publishing, 2001), p. 25.

century in the new technology of cinema. Although I do not suggest a causal or teleological line of development from the kaleidoscope to the cinema, nonetheless this small and often overlooked optical technology should, I argue, be included in histories of nineteenth-century moving images for its contribution to what critics have called the 'cinematicity' of Victorian visual media.[7]

Inventing Mirrored Motion

Brewster, the inventor of the kaleidoscope, was a prominent mathematician and natural scientist who regularly contributed to leading scientific journals; he specialized in optics and made important advances to understandings of light polarization, the visual perception of depth and dimension, and retinal afterimages.[8] Alongside his publication of scientific work Brewster wrote a number of popular treatises on visual perception, as I outlined in Chapter One. His commitment to popularizing contemporary science for a public audience was marked by a keen interest in the operation and function of optical (or 'philosophical') instruments. In 1849, he adapted Charles Wheatstone's mirror stereoscope (an instrument which gave the visual perception of a three-dimensional photograph) into the less cumbersome lenticular stereoscope, making the device newly 'mobile and convenient' for its domestic users, as Sheenagh Pietrobruno points out.[9] Three months after its display in 1851 at London's Great Exhibition, reports suggested that a quarter of a million stereoscopic images had been sold in England and France.[10] The stereoscope became hugely popular in the nineteenth century, but Brewster could claim an additional success

[7] See the recent collection *Cinematicity in Media History*, ed. by Jeffrey Geiger and Karin Littau (Edinburgh: Edinburgh University Press, 2013) for a theorization of cinema history '*as* media history', comprising a patchwork of 'cinematic trace[s]' from an 'ensemble of visual media' (pp. 4, 47).
[8] See Nicholas Wade, *Brewster and Wheatstone on Vision* (London: Academic Press, 1983) for a survey of Brewster's writings on physiological optics and ocular instruments.
[9] Sheenagh Pietrobruno, 'The Stereoscope and the Miniature', *Early Popular Visual Culture* 9.3 (August 2011), 171-190 (p. 172). See also John Plunkett, 'Selling Stereoscopy, 1890-1915: Penny Arcades, Automatic Machines and American Salesmen', *Early Popular Visual Culture* 6.3 (November 2008), 239-255 for discussion of the revival of popular interest in the stereoscope into the twentieth century.
[10] Stafford and Terpak, *Devices of Wonder*, p. 357.

with the earlier invention of the kaleidoscope in 1815. As his daughter Margaret Maria Gordon noted, it was this simple optical device 'spread his name far and near, from schoolboy to statesman, from peasant to philosopher'.[11]

While undertaking research on the polarization of light, Brewster found that planes of mirrored glass inclined at a certain angle simultaneously created and exhibited a symmetrical arrangement of colours and shapes reflected around a centre which could be animated by the viewer's hand. Seeking to recreate this mechanical pattern-work, Brewster designed a simple instrument consisting of an outer tube containing specifically-inclined mirrors with an aperture for the eye at one end and a glass cell at the other in which coloured beads and other such items could be fixed. (Commonly used objects included pieces of glass, coloured liquids, iron or brass wire, lace, beads, and even insects.) When the tube and the cell were rotated against each other, the mirrors multiplied the reflections into an infinite variety of symmetrical geometric patterns, described by Brewster in the device's patent as producing 'an ever-varying succession of splendid tints and symmetrical forms' which are 'highly pleasing to the eye'.[12] This initial design was termed the 'simple kaleidoscope' which, like the late nineteenth-century cinématographe, had the duel function of simultaneously generating and exhibiting images. The manual loading of items into this glass cell meant that newness only inhered in the combinations of pattern produced, not in the composite elements of its view, as I will go on to discuss. A later modification created a 'compound' kaleidoscope: instead of a fixed end cell, a focal or telescopic lens was appended to end of the mirrors, thus enabling the viewer to make a kaleidoscopic pattern out of any external object or scene at any distance from the lens. This compound form of the kaleidoscope allowed Brewster to assert in his treatise on the

[11] Margaret Maria Gordon, *The Home Life of Sir David Brewster*, 3rd edn (Edinburgh: Edmonston and Douglas, 1881), p. 53.
[12] 'Specification of Dr. David Brewster's new Optical Instrument, called The Kaleidoscope, for exhibiting and creating beautiful Forms and Patterns, of great use in all the ornamental arts. Dated 10 July 1817', *The New Monthly Magazine* 8.47 (1 December 1817), 444-445 (p. 444).

device that its value was not just as a child's toy or 'instrument of amusement' but as a functional visual tool which could 'take its place as a general philosophical instrument, and become of the greatest use in the fine, as well as the useful arts'.[13] Brewster's device was to have a value beyond that of play: his textual insistence on its status as an 'instrument' indicates its use as a maker, a mechanical system which is capable of producing and creating visual experiences which have a function and worth beyond that of simple entertainment or delight.

When using the compound form to view scenes of mobility, such as busy streets or carriages in operation, the patent notes that 'the combination of images will likewise be put in motion, and new forms, perfectly different, but equally symmetrical, will successively present themselves, sometimes vanishing in the centre, sometimes emerging from it, and sometimes playing around in double and opposite oscillations. When the object is tinged with different colours, the most beautiful tints are developed in succession'.[14] The stress on the presentation of successive shapes and animated configurations is echoed in a description given by P. M. Roget: 'A blazing fire viewed by it, gives the appearance of beautiful fireworks, at one time rushing with great rapidity towards the centre, and at another issuing from it towards the circumference over the field of vision. These varieties in the spectrum are occasioned both by turning the instrument round its axis, and by moving it forwards in any direction'.[15] Roget emphasizes the animation created by its arrangement of reflecting mirrors: forms are not simply reproduced but are made to appear in motion through the manipulation of its position—

[13] David Brewster, *The Kaleidoscope: Its History, Theory, and Construction, With Its Application to the Fine and Useful Arts* (London: John Murray, 1858), p. 82. All further references are to this enlarged second edition and follow quotations parenthetically in the text. The third reissue of *The Kaleidoscope* was published after Brewster's death in 1870 but includes no revisions and was likely republished as a reaction to his passing. I use, therefore, the expanded 1858 edition as the version which best reflects Brewster's intentions for his text.

[14] 'Specification of Dr. David Brewster's new Optical Instrument, called The Kaleidoscope', p. 444.

[15] P. M. Roget, 'Kaleidoscope', *Supplement to the Fourth, Fifth, and Sixth Editions of the Encyclopaedia Britannica*, 6 vols (Edinburgh: Archibald Constable & Co., 1824), V: 163-171 (p. 170).

one of the kaleidoscope's key characteristics. Prominence is given to the perception of process, of seeing one view transform into the next as visual data is rearranged into new formations.

A Genealogy of the Kaleidoscopic

A number of claims of plagiarism were levelled at Brewster in magazines and periodicals around 1818 for claiming the kaleidoscope as his own invention.[16] While it is certainly true that Brewster gave the device its name and designed its specific apparatus of a tube through which an individual would look at either a filled glass cell or through a focal lens, the fundamental premise of angled mirrors and their symmetrical patterning did have a much earlier precedent. Commentary alighted on a number of figures associated with the history of optics, such as Giambattista della Porta, Athanasius Kircher, and Professors Wood and Harris; however, the technologies cited simply used perpendicular mirrors (and sometimes just plane mirrors) placed on paper and used to trace reflections. Brewster devotes a large chapter to these assertions of plagiarism in his treatise on the device, claiming that 'no allusion whatever is made, in the propositions themselves, to any *instrument'* (181-2; emphasis added). It was this which set Brewster's nineteenth-century invention apart: taking a principle of optics and transforming this into a portable lens-based instrument which acted as both scientific device and commodity item. Sniping that 'All those, indeed, who had observed the multiplication and circular arrangement of a fire blazing between two polished plates of brass and steel; who had dressed themselves by the aid of a pair of looking-glasses, or who had observed the effects of two mirrors placed upon rectangular sides of a drawing-room, were entitled, upon such a definition, to be

[16] See particularly 'On the Kaleidoscope', *The Philosophical Magazine* 51.242 (1818), 376-381 and 'History of Sir David Brewster's Kaleidoscope', *The Journal of Science and the Arts* 5.10 (1818), 324-335. An article on 'The Kaleidoscope' in the *Caledonian Mercury* (4 June 1818) collated passages on the contended history of the device to enable readers 'to form a correct opinion on a question now very generally discussed, respecting the originality of the instrument' (n.p.).

constituted inventors of the Kaleidoscope', Brewster defended his right as an inventor of a specifically 'philosophical instrument' (162-3). Earlier arrangements of mirrors merely reflected form; the kaleidoscope animated form by '*multiplying* objects' and as I will go on to discuss, this enabled it to be regarded as a creator of new, compound visual displays. As Brewster writes, 'Its beauty is derived from the accumulation of individual images' (167; emphasis in original).

However, one connection to an earlier incarnation is particularly interesting, and not solely for its arrangement of plane mirrors. One of the claims Brewster refutes relates to a 1717 publication by Richard Bradley on the philosophical and practical aspects of landscape gardening. In Part II of his study, Bradley describes using two small mirrors held together along one edge like the 'leaves of a book' which, when placed on paper, allow a design to be easily mirrored. The application of this 'new invention' enabled garden designers to see reflected the 'compleat Figure' of a partially completed design and to use this 'speedy designing' process to make 'many Varieties of Designs'.[17] Although Brewster rebuts a connection between this device and his kaleidoscope for the reasons stated above (and it is clear that Bradley's mirror arrangement was much less sophisticated), there is a remarkable similarity between Bradley's publication and Brewster's treatise in the language they use to frame the value of the device as a design tool. Brewster devotes a chapter of his treatise to the application of the kaleidoscope as an instrument for mechanical pattern-making (the same use Bradley identifies); designers of architectural ornamentation, stained-glass windows, carpets, and wire-workers are some of the professions to which the kaleidoscope's symmetrical views might be of service. Bradley writes that his mirrors 'may improve and help' the work of designers, and likewise for Brewster 'the operations of the artist may be facilitated and improved by

[17] Richard Bradley, *New Improvements of Planting and Gardening, both Philosophical and Practical: Part II*, 2nd edn (London: W. Mears, 1718), p. 1

using the kaleidoscope (135). Bradley claims his invention is both 'delightful and profitable'; the kaleidoscope 'insures us a more regular supply of these articles [symmetrical patterns], and enables us to receive them at a cheaper rate' (135). Both claim their invention is of economic value and temporally efficient: 'we may produce more variety of figures in an Hour's time, than are to be found in all the Books of Gardening now extant', Bradley writes, and for Brewster the kaleidoscope 'will create, in a single hour, what a thousand artists could not invent in the course of a year (136).[18]

In 1819 (a year after the explosion of 'kalleidoscopism', as Shelley termed it), Bradley's eighteenth-century publication was reissued anonymously as an abridged pamphlet. Entitled *Description and Use of the Instrument now called a Kaleidoscope, as published by its original inventor, Richard Bradley*, it clearly responds to such similarities (and to the many articles tracing the kaleidoscope's history in the press) and explicitly attempts to revive Bradley's earlier invention in the public's mind, painting Brewster as nothing more than a plagiarist renaming Bradley's device. Beginning with an 'Address to the Public', its author claims that the earlier instrument fell 'into oblivion' due to its circumscribed use solely as a tool for designing garden landscapes, whereas Brewster's device, with its 'well-sounding name' and 'convenient […] form' more thoroughly captured the attention of the public.[19]

While the similarity in language, aim, and promotion of these two mirrored items is undeniable—and indeed enough to provoke the anonymous republication of a hundred-year-old work—it should not temper the sophistication of Brewster's instrument. In comparison with Bradley's two hinged mirrors, it is clear that his device offered an entirely new visual display premised on more than simple reflection, and its mass-manufacture and retail as a commodity item responded to a specific nineteenth-century

[18] Bradley, *New Improvements of Planting and Gardening*, p. 1.
[19] Anon., *Description and Use of the Instrument now called a Kaleidoscope, as published by its original inventor, Richard Bradley* (London: E. L. Simmons, Darton, Harvey, and Co., 1819), p. iv.

context of optical gadgets and popular scientific demonstrations. Indeed, an article in *The Journal of Science and the Arts* refuted claims that Brewster was a plagiarist, stating that although earlier mechanisms held a basic principle in common the kaleidoscope was unique because it was able to *generate* pleasing designs which had a variety of practical applications. The basic instrument created by Bradley's angled mirrors 'has often been made by the opticians, and was principally used for multiplying the human face, when placed between the mirrors; but no person ever thought of applying it to any purpose of utility, or of using it as an instrument of rational amusement, by the creation of beautiful forms'.[20] *The Literary Gazette* went further, stating that 'the difference of this instrument and the Kaleidoscope is so great, that contrasting the properties of the two will be the best arguments that can be used to prove the invention of Doctor Brewster new'.[21]

The contested history of the kaleidoscope's fundamental mechanism—its inclined mirrors—offers an indication as to why its patent was so swiftly and flagrantly broken almost as soon as the device began manufacture, as I address below. Brewster himself admitted, in a letter explaining the operation and design of his invention to James Watt, that 'it is so excessively simple that I can scarcely expect any credit for the contrivance'.[22] However, although its basic operation may have stemmed from earlier uses of plane mirrors, the nineteenth-century kaleidoscope undeniably offered viewers a new visual experience of looking through an aperture into a visual field turned completely kaleidoscopic, and which could be modified to individual taste, sparking a craze for the kaleidoscope as a commodity item which continued throughout the century.

[20] 'History of Sir David Brewster's Kaleidoscope', p. 328.
[21] 'The Kaleidoscope', *The Literary Gazette and Journal of Belles Lettres, Arts, Sciences, etc*. (4 July 1818), p. 427.
[22] Letter dated 22 March 1817. James Watt and Family Papers, Birmingham Archives and Heritage, Birmingham, UK. Ref MS 3219/4/53/18. I am grateful to Fiona Tait, archivist at Birmingham Archives and Heritage, for permission to quote from this unpublished letter.

Kaleidoscopic 'Initiation': Popularity and Patents

The manufacture of patented devices began in 1817. Initially produced by John Ruthven in Brewster's hometown of Edinburgh, Brewster quickly realised that Ruthven 'cannot possibly supply the demand' and arranged for the Birmingham optician, Philip Carpenter, and the Leeds manufacturing firm Cam and Cutt to take a share of the production. Writing from Sheffield to his wife, Juliet Macpherson (Brewster was travelling between Leeds and Birmingham to meet the contracted manufacturers), he describes seeing two kaleidoscopes placed ornamentally on the hotel's chimney piece and notes an enthusiastic paragraph in the local newspaper about the device. On meeting Mr Cam, he reports 'I saw lying on his table a kaleidoscope, most beautiful without, but deplorable within'.[23] The device Brewster saw was most likely a cheaply made reproduction which lacked the detail and precision of his patented specifications.

Figure 13. Ruthven's kaleidoscope, with interchangeable filled glass cells. National Museums Scotland, ref. T.1825.20.

[23] Letter dated 17 May 1818, qtd. in Gordon, *The Home Life of Sir David Brewster*, p. 96.

Almost as soon as Ruthven, Carpenter, and Cam and Cutts began to manufacture and sell the devices to Brewster's requirements, the patent was broken and their design copied and sold in a crude form. Made of cheaper materials—often cardboard or tin—and lacking the mathematical precision required, the pirated versions were inferior to Brewster's patented device and their spectacle greatly reduced.[24] Writing to his wife, Brewster confessed that the 'mortification' of their circulation 'is very great', especially as he could have 'made one hundred thousand pounds by the device'; nonetheless, witnessing first-hand the popularity of his invention (in whatever form it was realized) provoked an astonished and keen delight:

> You can form no conception of the effect which the instrument excited in London; all that you have heard falls infinitely short of the reality. No book and no instrument in the memory of man ever produced such a singular effect. They are exhibited publicly on the streets for a penny […]. Infants are seen carrying them in their hands, the coachmen on their boxes are busy using them, and thousands of poor people make their bread by making and selling them.[25]

Brewster's report compares the kaleidoscope's 'singular effect' to other instruments and, interestingly, to the book, alluding to their shared materiality as manually-operated and portable technologies which simultaneously encased and enabled varieties of sensory and imaginative enchantment. Such a proliferation of cheaply manufactured or homemade replica devices testifies to the swift and broad appeal of the kaleidoscope which was, as *The Philosophical Magazine* observed, 'now in the hands of almost every person'.[26]

Ruthven had by late May 1818 failed to keep up with the high level of demand as Brewster's wife aggrievedly reported, communicating to Brewster the public's dismay in finding that 'the capital of Scotland, and your place of residence, should not contain a single kaleidoscope for sale for the last eight days!'. She continued that

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[24] Helen Groth, writing on these corrupted devices, comments on the 'depleted visual experience' they offered as evidenced by an extant selection of papier-mâché kaleidoscopes from the mid-nineteenth-century held by the Science Museum, London. 'Kaleidoscopic Vision', p. 236, n. 43.
[25] Letter dated May 1818, qtd. in Gordon, *The Home Life of Sir David Brewster*, pp. 97-98.
[26] 'On the Kaleidoscope', p. 376.

> the public are becoming impatient and clamorous now at the delay, and he has orders to an amount that is prodigious. One person offers him the money for 150 to send abroad in ten days. […] From six in the morning till six at night his room is beset with people. […] Patrick was at his house this evening at half-past eight o'clock, and found it full of people all wanting kaleidoscopes […]. This delay is worse that all the piracies that ever were attempted. Ruthven could sell a hundred per day, and at Glasgow they are quite wild, and at Montrose the same, and at Paisley, and, in short, everywhere.[27]

The Journal of Science and the Arts corroborates this level of popular appeal, remarking that a 'universal mania' for the optical device had 'seized all classes, and from the lowest to the highest, from the most ignorant to the most learned'.[28] We might think of its quick uptake and the speed with which its appeal 'seized' the public (both local and international as the above letter indicates) as the kaleidoscope 'going viral'.[29] In his article on the kaleidoscope for the *Encyclopaedia Britannica* Roget described that 'large cargoes of them were sent abroad, particularly to the East Indies. They very soon became known throughout Europe, and have been met by travellers even in the most obscure and retired villages in Switzerland'.[30] Descriptions of its application and technical specifications in *The Philosophical Magazine* were reprinted in *The American Monthly Magazine and Critical Review* as early as 1818, indicating that interest spread to the United States simultaneously with the instrument's appearance on the British market.

Writing from Italy in 1818 to his friend Thomas Jefferson Hogg, Shelley reported that 'Your kalleidoscope spread like the pestilence at Livorno. A few weeks after I sent your description to a young English mechanist of that town, I hear that the whole population were given up to Kalleidoscopism. It was like the fever […]'.[31] The sweep of interest in the kaleidoscope spread like a virus, or a fashionable mania, and turned its use

[27] Letter dated 22 May 1818, qtd. in Gordon, *The Home Life of Sir David Brewster,* pp. 98-99.
[28] 'History of Sir David Brewster's Kaleidoscope', p. 335.
[29] See Tony Sampson, *Virality: Contagion Theory in the Age of Networks* (Minneapolis: University of Minnesota Press, 2012).
[30] Roget, 'Kaleidoscope', p. 163.
[31] Letter dated 21 December 1818. Percy Bysshe Shelley, *Letters*, II, p. 69.

into a behavioural phenomenon to which the town's inhabitants were 'given up', powerless to resist its fascination. His term 'kalleidoscop*ism*' points towards the creation of a set of practices premised on the sharing and spread of information and enthusiasm for the device, culminating in a viral popularity worthy of the appended 'ism'. The 'English mechanist' who turned his hand to constructing a pirated kaleidoscope on the written instruction of Hogg was Henry Reveley, an engineer and son of the Gisbornes who were also living in Livorno and were recent friends of the Shelley's. It seems likely that Shelley showed Hogg's written instructions for making the device to Mary Shelley, who in turn passed this on to Maria Gisborne. On the 5 June 1818 Mary had written to Maria 'I send you something that will amuse you' (presumably Hogg's instructions), and followed this up ten days later by asking 'Has Mr Reveley made a Calleidoscope? and do you find as much pleasure as the Londone[r]s in looking through it?'.[32] In response, Maria reported that

> Kaleidoscopism is at this moment with us in a most triumphant state, though, owing to a *flaw* in the description of your friend [Hogg], Henry has had some trouble with the instrument. It is now complete; but as we are not *eagle-eyed*, our initiation into this delightful science has occasioned us many a headache. But what ache would one not endure for so captivating an enjoyment![33]

That the kaleidoscope was regarded as a 'science' and not a child's plaything is important, and identifies the device as a philosophical instrument rather than a simple and amusing toy. Gisborne's reference to undergoing an 'initiation', or proscribed entry point, into the operation of the device further defines Shelley's coined phenomenon of 'kalleidoscopism' and attests to the networks of shared knowledge and enthusiasm which enabled devices

[32] Letters dated 5 June 1818 and 15 June 1818. Mary Wollstonecraft Shelley, *The Letters of Mary Wollstonecraft Shelley*, ed. by Betty T. Bennet, 2 vols (1980; Baltimore: Johns Hopkins University Press, 1991), I: 71, 73.
[33] Letter dated 21 June 1818. Shelley, *The Letters of Mary Wollstonecraft Shelley*, II: 73. Emphasis in original.

like the kaleidoscope to proliferate among a public keen to experience the latest technological and visual craze.

The *Treatise* and Kaleidoscopic Intermediality in the Mid-Nineteenth Century

Although boasting that 'no fewer than two hundred thousand instruments were sold in London and Paris during three months', Brewster was quick to protest that

> out of this immense number there were perhaps not one thousand constructed upon scientific principles, and capable of giving anything like a correct idea of the power of the Kaleidoscope; and of the millions who witnessed its effects, there is perhaps not a hundred individuals who have any idea of the principles upon which it is constructed, who are capable of distinguishing the spurious from the real instrument. (7-8)

To defend his invention against this rapid spread of imitation devices he wrote *A Treatise on the Kaleidoscope* (1819) with the purpose of 'explaining, in as popular manner as I could, the principles and construction of the Kaleidoscope'.[34] The treatise underwent revisions later in the century—almost certainly in response to mid-century developments in visual spectacle, photography, and other popular optical instruments, some of which are the focus of this thesis—and was republished in March 1858 as *The Kaleidoscope: Its History, Theory, and Construction, With Its Application to the Fine and Useful Arts*, indicating a continued popular interest in both the device itself and Brewster's explanatory context.

Newly added chapters offer further explanation of using the kaleidoscope as a compound device (by adding a focal lens) to view scenes of mobility, such as 'the moving branches and foliage of trees and shrubs, […] carriages in motion, the currents of a river, waterfalls' (84). Brewster's 1858 revisions concentrate attention on using the kaleidoscope as a device through which to view external animation, noting that this format yields a

[34] David Brewster, *A Treatise on the Kaleidoscope* (Edinburgh: Archibald Constable & Co. 1819), p. 8.

value greater than that of simply viewing static patterns: 'here the objects are independent of the observer, and all their movements are represented with the most singular effect in the symmetrical picture, which is as much superior to what is given by the simple instrument, as the sight of living or moving objects is superior to an imperfect portrait of them' (84-5). Also included is a new chapter entitled 'On the photographic delineation of the pictures created by the kaleidoscope'. It describes the 'kaleidoscope camera': a modification of the camera in which the lens is replaced with a kaleidoscope to enable each patterned arrangement to be photographically captured and copied. Brewster demonstrated this multimedial use of the device to members of the St Andrews Literary and Philosophical Society on 30 January 1858.[35] Other chapters explained how its display could be projected in combination with a strong light source and the lens of a magic lantern (see fig. 14). Brewster writes that 'When the instrument is thus fitted up, an enlarged image of the pattern will be thrown upon the wall, which must be covered with white paper, or some white ground, in order to exhibit the colours to advantage. […] [T]he pattern on the wall will undergo every possible transformation, and exhibit to the spectators, in a magnified form, all those variations which have been observed by applying the eye to the Kaleidoscope' (118).

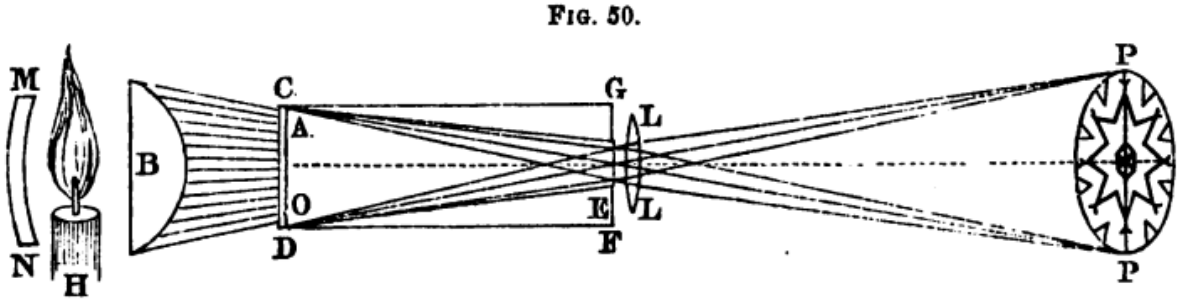

Figure 14. Projecting the kaleidoscope's display. Brewster, *The Kaleidoscope*, p. 117.

[35] Martin Kemp, '"Philosophy in Sport" and the "Sacred Precincts": Sir David Brewster on the Kaleidoscope and Stereoscope', in *Muse and Reason. The Relation of Arts and Sciences 1650-1850*, ed. by B. Castel, J. Leith and A. Riley (Kingston: Royal Society of Canada, 1994), pp. 203-232 (p. 229).

This use of combined media forms continued throughout the century, evidenced by a late-nineteenth-century article in *Hobbies* which informs its readers that by utilizing a strong light source and a kaleidoscope holder, its 'design may then be reflected on to a sheet of paper' to be viewed by 'a whole company of persons'.[36] An earlier example was the manufacture of projection kaleidoscopes from 1865 by the London firm C. & F. Darker.[37] Called the 'oxy-hydrogen kaleidoscope' (fig. 15) for its use of the magic lantern's strong light source (commonly known as limelight), it was displayed daily at the Royal Polytechnic Institution from Christmas 1866 and was, John Henry Pepper (a popular scientist and Director of the Polytechnic) recounts, 'the greatest success'. He furthers that 'by its means the principle of the instrument could be better understood', suggesting that the ability to project the kaleidoscope's display on to a large screen for an audience assisted in their grasp of how the device created its unique mirrored patterning.[38]

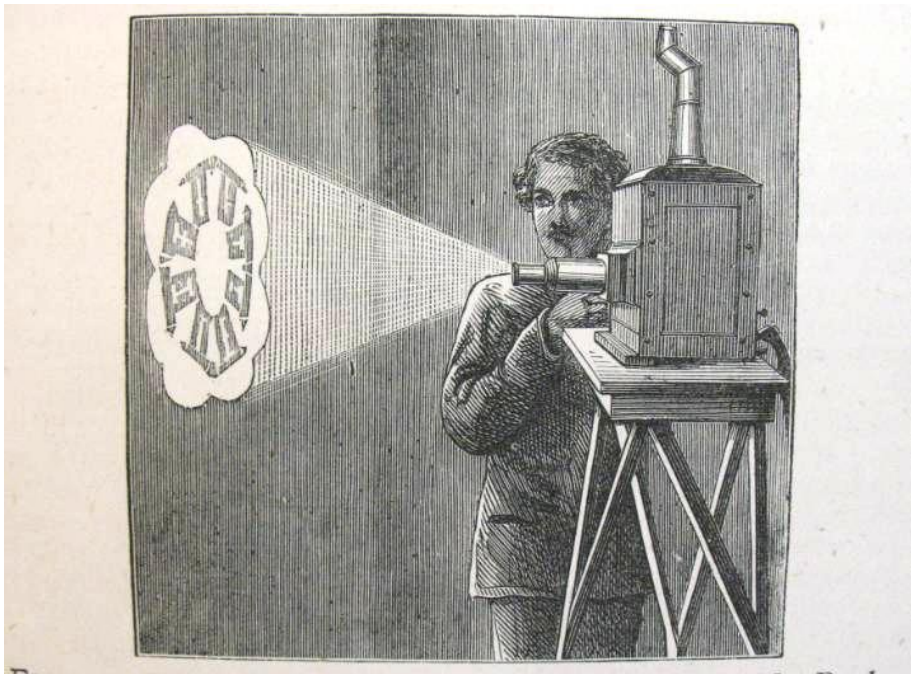

FIG. 33.— *The Oxy-hydrogen Kaleidoscope as made by Mr. Darker.*
Key pattern, produced from a key.

[36] 'An Improved Kaleidoscope', *Hobbies* (April-October 1896), p. 437, quoted in *A History of Pre-Cinema*, ed. by Stephen Herbert, 2 vols (London and New York: Routledge, 2000), I: 239.
[37] *The Encyclopedia of the Magic Lantern*, ed. by David Robinson, Stephen Herbert, and Richard Crangle (London: The Magic Lantern Society, 2001), p. 147.
[38] John Henry Pepper, *Chemistry, Electricity, Light* (Frederick Warne & Co., 1875), p. 34. Reference number 20918, The Bill Douglas Cinema Museum, University of Exeter, UK.

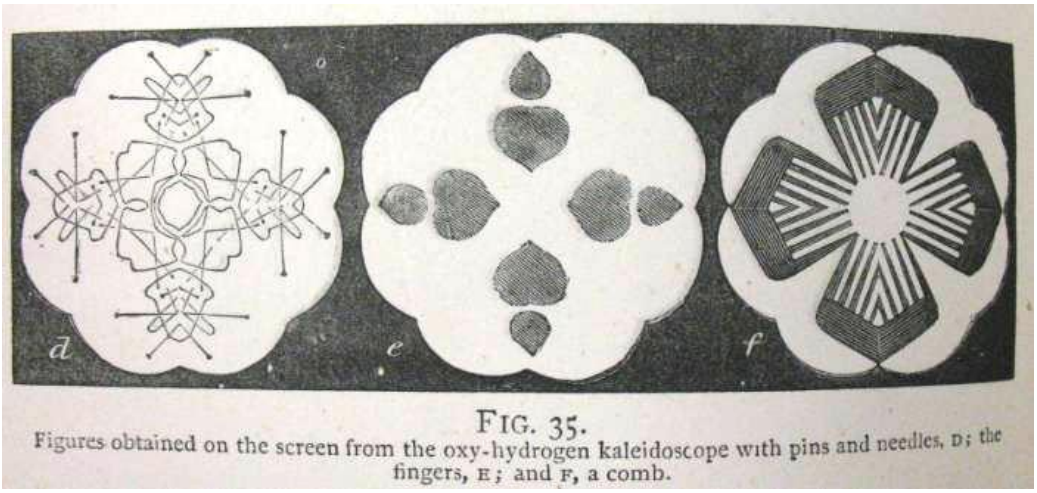

FIG. 35.
Figures obtained on the screen from the oxy-hydrogen kaleidoscope with pins and needles, D; the fingers, E; and F, a comb.

Figure 15. Darker's oxy-hydrogen projection kaleidoscope, and detail of display. John Henry Pepper, *Chemistry, Electricity, Light* (Frederick Warne & Co., 1875), pp. 33-34.

Alongside such intermedial uses could be found other miscellaneous items which contained aspects of the kaleidoscope. A decorative wooden box was manufactured by the well-known opticians Negretti & Zambra (the firm were appointed the official scientific instrument makers to the Queen) circa 1857-1862. Currently held in Oxford's Museum of the History of Science, the item comprises a wooden box topped with rotating flowers onto which a brass tube is affixed, suggesting that this device contained an mechanism for moving the flowers and was intended to be viewed with the box held stationary, and likely placed upon a table top.[39] Another is the 'chromapolygon', documented in this article in *The Mechanic's Magazine*:

> We have been favoured by Mr. Mordan, the celebrated mechanist, with a view of this addition to our domestic arts. The chromapolygon, which will be early submitted to the public, consists of geometrical paper figures, which are susceptible of multiplied combinations *ad infinitum*, thus forming a realization of the innumerable and ever varied objects and colours on the kaleidoscope. [...] By a judicious employment of the various shades of colour the perspective of solid geometrical figures may be produced, and thus an outline of the science of solid geometry be insensibly acquired.[40]

[39] Item number 86196, Collections and Archives, Museum for the History of Science, Oxford, UK.
[40] 'The Chromapolygon', *The Mechanic's Magazine* (3 February 1838), p. 304.

These interchangeable coloured figures are similar the moveable cards of the Myriorama game, popular in the early nineteenth century,[41] but crucially the kaleidoscopic chromapolygon activity aims to educate in the science of geometry—an aim which suits the intention of Brewster's treatise. The kaleidoscope's technology, however, stands apart in its sophistication, noted in a wry response published some weeks later in the same magazine:

> [T]hinking the article might assist me in my business (a pattern drawer) I was induced to purchase one of Mr. Mordan's *new* additions to our *domestic arts*. Guess my surprise, on finding all I had got for my four shillings was sundry bits of coloured paper neatly cut into diamonds (rhombics); half diamonds (obtuse angled and equilateral triangles); and quarter diamonds (right angled-triangles). These *four figures*, with limited variety as to colour, constituted what was said to be susceptible of combinations *ad infinitum*. Shades of my great-grandmother's bed-quilt [...] to supersede the ever-changing and elegant designs of Brewster's kaleidoscope![42]

For this commentator, it is the mechanism of the kaleidoscope as an technological instrument able to creatively arrange many new and aesthetically-pleasing designs which recommended it over the simple rearrangement of coloured shapes.

As these examples of media modification show, the middle decades of the nineteenth century saw a renewed interest in the device. That it could be used in combination with the photographic camera and magic lantern helped renew its popularity and embed it in a burgeoning culture of optical technologies. This is further evidenced by the scope and frequency of its use as metaphor in a variety of publications, as this chapter now moves on to demonstrate. Brewster's revision and significant enlargement of his treatise in 1858 both responded to and helped to cultivate the revived craze for 'kalleidoscopism' first seen in the late 1810s. It found a receptive audience; by this time

[41] See Ralph Hyde, 'Myrioramas, Endless Landscapes: The Story of a Craze', *Print Quarterly* 4.21 (December 2004).
[42] S. Dragonetti, 'Mordan's Chromapolygon, or Harlequin Patch-Work Maker', *The Mechanic's Magazine* (24 February 1838), p. 353.

numerous other visual and philosophical instruments had reached the popular market and created an ecology of optical media. They were commonly used to demonstrate scientific principles and to amuse and entertain viewers, child and adult alike. Optical gadgets were certainly spectacular and delightful, but they were always underpinned by a new discovery; their visual display signified something beyond itself and educated in a particular physiological or technical principle: persistence of vision devices, for example, made visible the interdependency of the eye and brain (as I consider in Chapter Four), and the kaleidoscope explored the science, geometry, and aesthetics of the reflection and refraction of coloured light.

Importantly, then, this material visual culture educated through perception. The Polytechnic Institution's catalogue for 1845 made clear its aim was 'to afford to the inquirer the means of obtaining a general knowledge of the processes by which the wonders of art and manufacture are produced' which would be 'explained and assisted by ocular demonstration'.[43] Brewster's treatise generously employs illustrations and uses language accessible to the general reader to describe the composite parts, mathematical specifications, operation, and application of the kaleidoscope, and in this way accompanied the instrument in manner similar to the aims of institutions like the Polytechnic. Users could experiment with the device while being guided by the principles Brewster was explaining in his text: after reading of the history of the device, readers were instructed to try filling the end cell with miscellaneous items and taught how to best direct light into the aperture to achieve the best results, what external objects might give the greatest animation using a telescopic lens, and how to combine the kaleidoscope with other technologies.

[43] 'Royal Polytechnic Institution Catalogue for 1845', p. 5. Item ref. RPI 3/5, University of Westminster Archives, London, UK.

Equally, in its emphasis on the value of the kaleidoscope to the work of designers and artists, and in the connections it makes to contemporary theories of sensory affect and synaesthesic harmonies (considered below), the treatise offers technical knowledge *and* intellectual speculation on the kaleidoscope's importance as a philosophical instrument, and points towards a further context for its popularity: contemporary theories and the practical application of colour harmony and pattern expounded in works such as Owen Jones's widely-read *Grammar of Ornament* (1856)—and evidenced clearly in his design of the Crystal Palace—and George Field's publications on the aesthetics and technological management of colour design. This chapter now moves on consider the wide uptake of kaleidoscopic metaphors in a variety of texts, fictional and non-fictional, as a consequence of the device's renewed popularity, then shows that Brewster's promotion of the kaleidoscope as a tool for the design and creation of harmonious arrangements of colour and form made it directly relevant to works by two Pre-Raphaelite artists, William Holman Hunt and Dante Gabriel Rossetti.

Composing Form

In a letter to James Watt, Brewster related that 'the forms *created* by the instrument out of abstract disorder succeed each other in varieties which are literally infinite'.[44] The stress placed on the device's capacity to create new forms, to construct order from 'abstract disorder', renders it a technology premised on *making* rather than replicating. Emphasizing this in his revised treatise, Brewster states that the 'fundamental principle' of the device was to fashion symmetrical forms 'by successive reflexions into one perfect whole' (18). The kaleidoscope's angled mirrors fractured a view into slices but its key appeal lay in the recomposition of these elements into a new and unified view premised on an integration of

[44] Brewster to Watt, letter dated 22 March 1817, James Watt and Family Papers, MS 3219/4/53/18; emphasis in original.

the many (the miscellany of items in the glass cell) into one (the patterned arrangement).[45] Its cohesive process of making parts into wholes was achieved by the successive inversion and reflection of forms, as an article on its construction in *Blackwood's Edinburgh Magazine* detailed:

> it is demonstrable, that a symmetrical and beautiful pattern cannot be produced by the repetition of any single form.… The principle of the Kaleidoscope therefore is, to produce symmetry and beauty by the creation and subsequent multiplication of *compound forms*, each of which is composed of a direct and an inverted image of a single form.[46]

This alternating process of reflection and inversion enabled the kaleidoscopic visual field to be more than a replicating display: form was repeated *and* transposed to produce a composite image which was both like and unlike its original. Its technology splintered the simple mirror reflection and importantly reordered this data to create a new output.

Charles Baudelaire drew on its operational principle of the assimilation and creative transformation of stimuli in his famous likening of the urban artist-flâneur to 'a kaleidoscope gifted with consciousness'.[47] Focusing on the painter Constantine Guys, the essay (first published 1863, just after Brewster's revised treatise), depicts this 'observer, philosopher, flâneur' as an anonymous 'man of the crowd' in order to discuss more broadly the perceptual encounters and methods of creative expression in the mid-nineteenth-century urban environment (4). Baudelaire's figure

[45] Noel Gray is one of few critics to draw attention to the kaleidoscope's anti-fracturing aesthetic. See 'The Kaleidoscope: Shake, Rattle and Roll', *Continuum: The Australian Journal of Media & Culture* 6.2 (1991), 154-162.

[46] 'Description of the Patent Kaleidoscope', *Blackwood's Edinburgh Magazine* 3.14 (May 1818), 121-123 (p. 121).

[47] Charles Baudelaire, 'The Painter of Modern Life', in *The Painter of Modern Life and other Essays*, trans. and ed. by Jonathan Mayne (London: Phaidon Press, 1964), 1-40 (p. 9). Further references are to this edition and placed parenthetically in the text. For discussion of the term 'flâneur' see *The Flâneur*, ed. by Keith Tester (London: Routledge, 1994) and Anke Gleber, *The Art of Taking a Walk: Flanerie, Literature, and Film in Weimar Culture* (Princeton: Princeton University Press, 1999). The flâneur was associated with new urban arcades; made from new huge sheets of plane glass, their architectural spectacle could be said to offer a kind of giant kaleidoscope through which one could perambulate. In fact, the glass panes of the rebuilt Crystal Palace erected at Sydenham were described as giving 'a kaleidoscope effect of light and colour' to the space below. See 'The London Crystal Palace', *The Morning Chronicle* (27 November 1858), p. 5.

> enters into the crowd as though it were an immense reservoir of electrical energy. Or we might liken him to a mirror as vast as the crowd itself; or to a kaleidoscope gifted with consciousness, responding to each one of its movements and reproducing the multiplicity of life and the flickering grace of all the elements of life. He is an 'I' with an insatiable appetite for the 'non-I', at every instant rendering and explaining it in pictures more living than life itself, which is always unstable and fugitive. (9-10)

An important distinction emerges in this passage: the figure is not viewing the city as if he were *looking through* a kaleidoscope, but rather *is like* the instrument itself; he is 'gifted' with a compositional method akin to the operation of a kaleidoscope. Thus, the artist-as-kaleidoscope moves responsively among the crowd, collecting observations (much like the kaleidoscope user assembles miscellaneous pieces in the device's cell) ready to be reproduced and reordered. He is a system of sensory capture, assimilating and arranging the 'flickering grace of all the elements of life' into artworks which seem 'more living than life itself'. The passage indicates that although life is 'always unstable and fugitive', when transposed through the kaleidoscopic lens of the artist it becomes more easily apprehended and is 'render[ed] and explain[ed]'.

Helen Groth writes that the kaleidoscope 'was synonymous with experiment and perceptual instability rather than mastery' and that Baudelaire's citation 'inflected this surrender to instability with a cosmopolitan hue'; similarly, Jonathan Crary asserts that here the device is 'figured as a machine for the disintegration of a unitary subjectivity'.[48] However, this chapter's attention to the process of composing forms in the kaleidoscope shows the instrument signifies not visual instability or disintegration but rather a mastery of sensory data and perceptual stability. Writing on Baudelaire's essay, Dana Brand describes the imagination of the flâneur as 'passive and undiscriminating'. She contends that 'it is not confused by multiplicity because it has no predisposition in favour of unity.

[48] Groth, 'Kaleidoscopic Vision', pp. 223, 219; Jonathan Crary, *Techniques of the Observer* (1990; Cambridge, Mass.: MIT Press, 1992), p. 113.

It becomes as unstructured as the modern metropolitan environment through which it moves'.[49] Yet the kaleidoscope's mechanical operation made the device (and thus Baudelaire's artist figure) very much predisposed to the creation of unity. The constant reordering and amalgamation in its display gestures towards a visual environment which continually enacts structure: the artist is not 'as unstructured' as the metropolis through which he moves but rather, like the kaleidoscope, composes order from the data of his surroundings.

Such critical assertions do not fully engage with the controlled manual operation of the instrument and thus propose a passive spectator lacking the agency which Baudelaire's account, and the device's hand-operated mechanism, point towards. For Deborah Parsons, as the artist-flâneur walks through the city he is 'bombarded by the vivid spectacle around him' and becomes 'something of a passive figure' bewildered at the urban environment.[50] Conversely, by paying attention to the physical manipulation of the device it is clear that Baudelaire's likening of the artist to a perceptual kaleidoscope renders him anything but passive. Although he 'watches the river of life flow past him', he then 'absorbs' this sensory data 'all pell-mell' in order to produce a new composition (11). We find Guys

> bending over his table, darting on to a sheet of paper the same glance that a moment ago he was directing towards externals things, skirmishing with his pencil, his pen, his brush, splashing his glass of water up to the ceiling, wiping his pen on his shirt, in a ferment of violent activity, as though afraid that the image might escape him. […] And the external world is reborn upon his paper, natural and more than natural, beautiful and more than beautiful […]. All the raw materials with which the memory has loaded itself are put in order, ranged and harmonized […]. (12)

The artist darts, skirmishes, and splashes in an act 'of violent activity'. The 'raw materials' gathered through visual encounter are 'loaded' into his memory (recalling the user of a

[49] Dana Brand, *The Spectator and the City in Nineteenth-Century American Literature* (Cambridge: Cambridge University Press, 1991), p. 5.
[50] Deborah Parsons, *Streetwalking the Metropolis: Women, the City, and Modernity* (Oxford: Oxford University Press, 2000), p. 22.

kaleidoscope loading its cell) then actively 'reborn' upon the page through a process of ordering, arranging, and harmonizing, just as the kaleidoscope's mirrors reflect back to the eye a new composition based on a reordering of reflection with each rotation.

That the kaleidoscope was considered a technological composer of visual order can be further seen in an earlier (albeit unfavourable) review of J. M. W. Turner's *Mercury and Argus* (1836). 'He has robbed the sun of his birthright to cast shadows', the reviewer claims. 'Whenever Nature shall […] make trees like brooms' and set 'this green earth […] off with the brightest blues that no longer keep their distance; […] and when human eyes shall be happily gifted with a kaleidoscope power to patternize all confusion, and shall become Ophthalmia proof, then will Turner be a greater painter than ever the world yet saw'.[51] The elements of Turner's canvas for this reviewer are unfortunately lost in a tumble of colour, which might only be saved by a metaphorical perceptual kaleidoscope which would 'patternize all confusion' and make intelligible forms out of disorder, recalling Brewster's letter to Watt.

We find a similar use of the device in John Herschel's essay 'On Sensorial Vision', first read at the Leeds Philosophical and Literary Society in September 1858 (five months after the publication of Brewster's revised treatise). Herschel's topic is 'the involuntary production of visual impressions' which appear to move across the perceptual field as gradually enlarging coloured geometrical patterns. Drawing on his own experience, these form 'a kind of dazzle in the eyes, immediately followed by the appearance of a very beautiful and perfectly regular and symmetrical […] pattern'. Visualized as a form of 'geometrical spectra', they lead Herschel to question their origins: 'Where does the pattern

[51] [John Eagles], 'The Royal Academy Exhibitions', *Blackwood's Edinburgh Magazine* 40.252 (October 1836), 543-557 (p. 551). John Gage notes that in Turner's marginalia to his edition of Goethe's *Theory of Colours*, he had written 'kaleidoscope' against a passage of light displaced into colours when directed through a prism. There was also reference to the device 'scattered throughout his lectures of 1818' – these were his Royal Academy lectures on perspective. Indeed, Turner travelled to Edinburgh 1818 at height of the kaleidoscope's initial wave of popularity and met with Brewster's friend and fellow writer on optics, John Thomson. See *Colour in Turner: Poetry and Truth* (London: Studio Vista, 1969), pp. 122-124.

itself or *its prototype in the intellect* originate? Certainly not in any action *consciously* exerted by the mind, for both the particular pattern to be formed and the time of its appearance are not merely beyond our will and control, but beyond our knowledge'. Herschel surmises that 'it may be suggested that there is a kaleidoscopic power in the sensorium to form regular patterns by the symmetrical combination of casual elements', such elements not being spontaneously created but rather 'familiar […]—their reproduction being an act, not of invention, but of memory'. Here he is drawing on the kaleidoscope as a metaphor of the mind's capacity to make sense of impressions and sensory data, and to recall and represent information in an ordered and systematic way.[52] Where Groth has the kaleidoscopic denote a 'visual field that perpetually oscillates on the verge of dissolution', in the examples above the kaleidoscope is used to signal comprehension, regularity, and the imposition of order.[53]

Variations on a Theme

Herschel's geometrical spectra cannot be impressions made upon the retina, such as from staring at a light source, he surmises, because of their movement. They are described as 'changing from instant to instant, hardly giving time to apprehend [their] symmetry before being replaced by another; that other, however, not being a sudden transition to something totally different, but rather a variation on the former'.[54] The display of the kaleidoscope too was premised not on *radical* newness or *absolute* transformation but on sequential variation. To return to Baudelaire's use of the term, when Guys is in the process of 'darting on to a sheet of paper the same glance that a moment ago he was directing towards externals things', the resulting composition necessarily contains only those things

[52] John Herschel, 'On Sensorial Vision', *Familiar Lectures on Scientific Subjects* (London: Alexander Strahan, 1866), pp. 400-418 (pp. 406-12; emphasis in original).
[53] Groth, 'Kaleidoscopic Vision', p. 229.
[54] Herschel, 'On Sensorial Vision', p. 408.

which were perceived in the urban crowd. This simulates the kaleidoscope's mechanical operation: nothing new can enter its display once the cell has been loaded. A selection of blue and yellow glass pieces will, for example, only produce variants of blue and yellow patterns, making its perceptual experience invulnerable to interruptions or deviations by being productively confined to a core set of elements. It might usefully be understood as operating under a principle of alternation. Each new visual patterning is an alternate and in this way offers stability without the threat of an aberrant digression.

Robert Brudenell Carter (an ophthalmic surgeon and author of a popular treatise on the eye) uses this metaphorical sense of the kaleidoscopic in his survey of the 'character book' genre published in *Household Words*. Carter stressed that the genre's organising principle was that of 'the kaleidoscope of human nature […] rudely shaken':

> The same thoughts inspire, the same passions darken, the same clouds envelope, the heart of man now, and in all past ages. The progress of science and the arts has changed the character of the objects that surround the human race, but the new objects excite the same ideas as their precursors, and hold the same relative position towards each other. The railway train can suggest nothing to us that the stagecoach did not suggest to our fathers. [55]

The kaleidoscope's inability to offer a visual deviation once its apparatus—the cell filled with items—is operational illustrates Carter's point that newness exists on a spectrum of previously established modes of experience, and even inventions, such as the railway, cannot intervene and offer a truly new experience. That Carter should pick the development of transport technologies as an example of a kaleidoscopic spectrum of sameness is interesting and draws attention to a key example of the century's copresence of old and new. Such a spectrum of alternates has recently been discussed by Ruth Livesey in an essay which focuses on the stage- and mail-coach as exploring and inscribing 'alternative modernities' to the railway in the 'near-historical fiction' of Charlotte Brontë.

[55] Robert Brudenell Carter, 'Character Books', *Household Words* 17.423 (1 May 1858), 469-474 (p. 471).

Considering what it might mean for fiction 'to write through (and of)' the older but still present technology of the stagecoach in the era of burgeoning railway track, Livesey writes that 'To remain within older technological frames in an era of innovation is not to go backward or remain stuck, but can instead imply going forward along a different track'.[56] 'Going forward along a different track' was exactly the mechanical model of the kaleidoscope: the 'alternative' transportation technology addressed by Livesey reflects Carter's assertion that the two modes (stagecoach and railway) suggest nothing new but in fact operate as a simple shake of the kaleidoscope, its new combinations (or 'different tracks') composed from the same core items or ideas.

The inability of its mechanical system to offer visual deviation once its apparatus was operational meant that it offered a sense of regulated surprise. Its display offered new combinations in a finite and controlled visual environment. Indeed the kaleidoscope's reflecting views were more likely to signal a lack of diversification and topical sameness, as in a review of Anthony Trollope's *The Eustace Diamonds* (1871): 'His instrument is always the kaleidoscope', the author comments, noting the presence of 'the old familiar troupe' of stock characters. Although allowing that 'this particular permutation of the old materials is effective enough', the review's faint praise is damning: Trollope's novel is a mere version, a 'permutation' of 'stock' elements rearranged into something different like the variegating display of a kaleidoscope.[57] A review of George Eliot's *Adam Bede* (1859) in *The Era* takes up the same metaphor, describing that 'the episode of 'little Emily' [has] risen to our minds during the perusal of these volumes, but, of course, it is the kaleidoscope in a new turn; there *are* differences in the pattern, and we must not quarrel

[56] Ruth Livesey, 'Communicating with *Jane Eyre*: Stagecoach, Mail, and the Tory Nation', *Victorian Studies* 53.4 (Summer 2011), 615-638 (pp. 615-616). See also Jonathan Grossman's study *Charles Dickens's Networks: Public Transport and the Novel* (Oxford: Oxford University Press, 2012) for a reading of the 'nexus of stagecoach and locomotive as part of a single transformation' of transport technologies (p. 4).
[57] 'Novels of the Week', *The Athenaeum* (26 October 1872), 527-528 (p. 527).

with the glass beads for so often turning up again'.[58] The 'little Emily' alluded to here must surely be Dickens's unfortunate character in *David Copperfield* (1849-50) who, in certain ways, shares a trajectory with Hetty Sorel. This similarity of topic is figured as if it were a glass bead in a kaleidoscope, circulating and being reconfigured in different works. Even the material form of the book was characterized by this trope of regulated surprise: a review of a large illustrated volume on knighthoods and decorations of honour observes that 'it forms a table book, gay as an album, whereof the turning of leaves is as the shaking of the beads in a kaleidoscope'.[59]

Isobel Armstrong writes that in addition to the kaleidoscope's spectacular function of 'creat[ing] a glittering, prismatic rearrangement of coloured particles' it 'also thematizes the limits of experiment and change'.[60] It does so, I argue, through the structural restriction of new elements entering its display. Objecting to Crary's take on the device's 'industrial delirium',[61] Armstrong's reading usefully halts such spiralling infinity. For Rick Rylance, the kaleidoscope's visual environment of regulated progression usefully exemplifies the growth of psychology as a discipline:

> the multivocal nature of its development […] has more in common with those bountiful Victorian inventions that emphasize organized multiplicity than with the smooth linear sequences expounded in the traditional disciplinary historiography. I have in mind instruments such as the kaleidoscope, […] designed to represent, in a controlled way, the flux of possibilities.[62]

Embodying both multiplicity *and* organization, the kaleidoscope, like a discipline in formation, displays a 'flux of possibilities' circulating in 'a controlled way'. We see a similar employment of the kaleidoscope's operational model in Charles Dickens's *Barnaby Rudge* (1841), in which alcohol and the fatigue of an active mind ('Thinking

[58] 'Literature', *The Era* (6 March 1859), p. 10.
[59] 'The Literary Examiner', *The Examiner* (1 May 1858), p. 276.
[60] Armstrong, *Victorian Glassworlds*, p. 342.
[61] Crary, *Techniques*, p. 116.
[62] Rick Rylance, *Victorian Psychology and British Culture 1850-1880* (Oxford: Oxford University Press, 2000), p. 15.

begets, not only thought, but drowsiness occasionally') combine to provoke a 'tendency' of mind in the locksmith, Varden, liable to

> mingle up present circumstances with others which have no manner of connection with them; to confound all consideration of persons, things, times, and places; and to jumble his disjointed thoughts together in a kind of mental kaleidoscope, producing combinations as unexpected as they are transitory.[63]

Relying on the kaleidoscopic model of regulated surprise, the passage stresses that only the 'combinations' are 'unexpected'; the contents (the 'persons, things, times, and places') are all known to Varden. His mind acts as a 'mental kaleidoscope', combining and recombining familiar elements into memories which, although transient, are comprised of a 'jumble' of thoughts akin to the core elements circulating in the device's cell.

This operational effect of composing new variations from a stock of items meant that, as John Plunkett writes, the kaleidoscope (among other optical devices) was used to metaphorically 'materialis[e] cognitive processes' and particularly 'to figure the way that consciousness was always creating new perceptions by making fresh connections out of the impressions it receives'.[64] In this way, it was the ideal device for G. H. Lewes to draw on in describing the multiplicity of tasks which the same neural elements could fulfil. He writes that

> like the pieces of coloured glass in a kaleidoscope, which fall into new groups, each group having its definite though temporary form, […] the elements constitute really a continuous net-work of variable forms […]. Each action demands a definite group of neural elements, as each geometric form in the kaleidoscope demands a definite group of pieces of glass; but these same pieces of glass will readily enter into other combinations and in like manner the muscles active in Respiration are also active in Laughing, Coughing, &c., though differently innervated and co-ordinated.[65]

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[63] Charles Dickens, *Barnaby Rudge*, ed. by Gordon Spence (London: Penguin, 1986), pp. 70-71.
[64] John Plunkett, 'Optical Recreations in Victorian Literature', in *Literature and the Visual Media*, ed. by David Seed (Cambridge: D. S. Brewer, 2005), pp. 1-28 (p. 1, 10).
[65] G. H. Lewes, *Problems of Life and Mind: Second Series: The Physical Basis of Mind* (London: Trübner and Co., 1877), p. 155.

Lewes illustrates the compositional operation of and connection between the mental and the physical using the kaleidoscope as a comparative example: the items in a kaleidoscope 'readily enter into' new combinations just as neural elements, 'in a like manner', could provoke a range of muscular responses. As Laura Otis comments, this passage understands the nervous system 'as a network in which each element was connected to every other cell', but importantly Lewes emphasises the *motility* of these interconnecting elements: their formations are 'continuous' and 'variable'.[66] Another contemporary metaphor of physiological functioning likened the nervous system to a vast telegraphic web or network but here we see that the operational and spectacular model of the kaleidoscope usefully opposes the immutable structure fundamental to the telegraphic metaphor and instead enables Lewes to present a sophisticated theorization of a dynamic physiological system in which kinetic multifunctionality was central.[67]

In comparing the actions of neural elements and muscles to the mobile items contained within the popular kaleidoscope, Lewes could engage non-specialist readers in his description of physiological processes. S. T. Coleridge had earlier noted this benefit of the kaleidoscopic metaphor in his *Logic*: foregoing, as does Lewes, a detailed description of the instrument, he confidently asserts that 'my readers' recollections will present the delights of a kaleidoscope at its first introduction better than I can dramatise them'.[68] He writes that the kaleidoscope is 'an instrument well calculated to suggest thoughts' and in

[66] Laura Otis, *Networking: Communicating with Bodies and Machines in the Nineteenth Century* (University of Michigan Press, 2001), pp. 74-75. Otis also comments that Lewes objected to the temptation to synecdochically take the nerve cell as a controlling centre; he 'acknowledged that nerve cells existed, but he did not believe that anyone could attribute the function of an entire system to any one part of it. […] [T]he nervous system could be understood only as an organic whole. No individual element of it could take credit for its activities, which could be carried out only be the entire system' (p. 74). This lack of hierarchical control and dissemination of function is itself mimicked in the kaleidoscope, in which all elements are reflected equally and accord only to the logic of the mirror's angles.

[67] For more on the telegraphic metaphor see Otis, *Networking*, pp. 22-25. Otis notes that Lewes objected to the nerves-as-telegraph metaphor and the idea of nerves as 'passive conductors' which made them seem 'lifeless and inactive' (p. 73).

[68] S. T. Coleridge, *The Collected Works: Logic*, ed. by J. de la Jackson, 23 vols (London: Routledge & Kegan Paul and Princeton: Princeton University Press, 1981), VIII: 163. Jackson's 'Introduction' traces Coleridge working on the *Logic* across the late 1810s and early 1820s, concurrent with Shelley's identification of 'kalleidoscopism' (pp. xxxiii-lxvii).

addressing the composition of sense impressions (specifically that of the sense of sight) draws on the functioning of the device to ask 'can we in a particular instance detect or separate the share contributed by the mind itself, though, as in the kaleidoscope, we may have had it satisfactorily demonstrated how large a portion of all that we behold is given by the organ or machine itself[?]'.[69] Although the viewer is aware that the kaleidoscope's display (or any visual sense perception) is generated by a 'machine' (or physiological system), the extent of each part's responsibility in this perception is almost impossible to determine. Coleridge use of the kaleidoscope as metaphor for the processing of sensory impression pivoted on its duel qualities of enchantment and comprehension. Further, both his and Lewes kaleidoscopically-inflected descriptions reveal a confidence that their reader will be familiar with the structure and operation of the device and will therefore regard its display as a wilfully manipulated system of production reliant on a multitude of parts.

Spectacular Travel in 'My Spanish Kaleidoscope'

The display of animation provoked by each twist of the kaleidoscope's lens also encouraged a sense of volitional imaginative movement, dramatized in a short story published in *Household Words* a year after Brewster's revised treatise. Walter Thornbury's 'My Spanish Kaleidoscope' (1859) is part travel narrative, part speculative riff on the imagination-enhancing properties of Victorian optical gadgets. The narrator, travelling around Spain, describes looking through the markets of Andalusia for 'curiosities' and 'supernatural trifles' and buys the 'treasure' of a 'simple kaleidoscope'. It is one of the crude, pirated versions, made of tin and covered with paper, but at its end is 'the little dark jeweller's shop of jingling glass tumbling about inside in a sort of harlequin

[69] Coleridge, *Logic*, p. 134.

puzzle of dazzling colours'.[70] The device appeals to the narrator's nostalgia for childhood pastimes ('The fact is, I am still a boy at heart, and like what I liked as a boy, particularly cricket, hardbake, foxhunting, the *Times*, marbles, and kaleidoscopes') yet even as a childhood toy it offered a pleasure beyond visual spectacle:

> on those wet days in London, when as a child I used to rummage in my toy cupboard […]. I used always to fall back to that untiring, delicious, magical kaleidoscope—the optical wonder that did not set me to dissect light, or settle scientific laws, but made me an artist's colourman. (566)

The kaleidoscope's satisfaction lay in its ability to provide the narrator's younger self with an opportunity to create as if an 'artist's colourman'. As we saw earlier for Baudelaire's artist-flâneur, the kaleidoscope figures as a constructive tool of pictorial composition and visual harmony. Unlike other toys which aimed to replicate experiments and demonstrate scientific principles (featured so regularly in popular magazines such as *The Boy's Own Paper*), the kaleidoscope offered the young narrator playful creativity over dissection, the wonder of making and manipulating instead of abiding by abstracted scientific laws.

For the adult narrator, the kaleidoscope is used 'when I am in the mood, and have taken my medicinal sherry tonic'; in this state, the device produces 'a new scene and a new province'—it is, like his intoxicant, a spur to the imagination, and provokes delight not simply for its geometrical patterning but for its power as a consciousness-altering mechanism. Its display suggests 'a whole volume of travels' (566) around Spain, the ten narratives of which are arranged in demarcated sections entitled 'Shakes', each scene resulting from a manipulation of the kaleidoscope's mechanism. The narrator invites the reader to 'look in at the little doorway every time I shake it' and chides our imagined gathering: 'stand aside, and don't breathe upon the glasses; […] I shake the instrument lightly in my right hand, thus; you hear the glass jingle—there is no deception, no

[70] Walter Thornbury, 'My Spanish Kaleidoscope', *Household Words* 19.477 (14 May 1859), 565-570 (p. 565). Further references will follow parenthetically in the text.

deception—look in […], I shake, and they change' (566).[71] This is similar to the narrator's description of the Time Traveller's first voyage in H. G. Wells's later novel, *The Time Machine* (1895): beginning its 'interminable voyage', the narrator confirms of the Time Machine: 'We all saw the lever turn. I am absolutely certain there was no trickery'.[72] In so clearly describing the device's mechanical operation the narrator emphasizes the kaleidoscope's lack of deception (seen too in Sara Coleridge's letter)—the only deceit being that which is performed willingly by the imagination of the narrator and his readers.[73]

With each rotation comes a new arrangement suggestive of a virtual snapshot. The narrator describes how 'I shake the kaleidoscope again, and the scene changes to Leon' where 'I see the great whirlpools of corn, […] I see the pastures […], I see the tepid trout-steams' (567). Such visions are not always projected at random into the narrator's imagination. We read that he 'must on to Gallicia' before the third shake confirms 'yes, this is Gallicia', a process repeated in the next shake: 'Now for the Asturias […] and, hey presto, with my kaleidoscope to the Asturias' (568). The 'optical trickery' that Joy Sperling charges the kaleidoscope with posits a viewer duped by its display as by a visual illusion, akin to the spectator subjected to 'the alchemy of the smoke and mirrors of the phantasmagoria'.[74] Yet the phantasmagoria's technology was deliberately hidden from view to increase the viewer's delighted fright and as a visual experience is far removed

[71] The narrator acts in this passage like a showman, displaying the visual and imaginative illusion while simultaneously directing his readers (or audience) in how that illusion is being enacted. We might think here of prominent figures such as John Barnard and Albert Smith, active as showmen-lecturers at their own panoramic displays. See Richard Altick *The Shows of London* (Cambridge, Mass.: Harvard University Press, 1978), pp. 473-478.

[72] H. G. Wells, *The Time Machine*, ed. by Patrick Parrinder (London: Penguin, 2005), p. 9. In her 'Introduction', Marina Warner notes that Wells's novel 'transposed mere mental voyaging into an actual vehicle […]. It translates a faculty of mind – projective imagination – into an actual piece of technology, and embodies it physically in time and space' (p. xiv). Thornbury's tale can be seen as an important predecessor of this figuration of imaginative voyaging as a type of manipulable technological hardware.

[73] See Peter Garratt, 'Moving Worlds: Fictionality and Illusion after Coleridge', *Literature Compass* 9.11 (2012), 752-763.

[74] Joy Sperling, 'Multiples and Reproductions: Prints and Photographs in Nineteenth Century England: Visual Communities, Cultures, and Class' in *A History of Visual Culture*, ed. by Jane Kromm and Susan Benforado Bakewell (Oxford and New York: Berg, 2010), pp. 296-308 (p. 301).

from the handheld and manually operated kaleidoscope. Its own 'trickery' is clearly displayed: users opened its mechanism to add items to the end cell and were active in creating its reflecting pattern through the twisting of the mirrored tube against the lens.

Further, the home-assembly of pirated kaleidoscopes, such as those shared between Sara Coleridge and her neighbours and among the Shelley circle in Italy, made clear (painfully so in Byron's case) the device's mechanical constitution: in a letter Byron relates that '[John Murray] has left in Chancery Lane *all* my *books*—everything in short except a damned—something-(SCOPE). I have broke the glass & cut a finger in ramming it together'.[75] As Thornbury's tale of imaginative agency demonstrates, the manual operation of the performed 'shake' points towards the user's awareness of the device's visual 'trickery', something drawn on by the narrator of George Eliot's 1859 novella *The Lifted Veil*: 'Our sweet illusions', he observes, 'are half of them conscious illusions, like effects of colour that we know to be made up of tinsel, broken glass, and rags', echoing Brewster's suggestion for what to place in the glass cell of the kaleidoscope ('iron or brass wire, lace, beads, cut pieces of glass' (71)).[76] An important aspect of the kaleidoscope's appeal (and indeed of most of the devices discussed in this thesis) was the transparency of its mechanical process and the agency it granted its operator and spectator: its spectacle was necessarily interactive, and enabled users to imaginatively manufacture views to their particular taste.

Making Visual Harmonies

Brewster's treatise repeatedly emphasizes the pleasure of manually composing a kaleidoscopic display to suit individual tastes and how the instrument was thus

[75] Letter to John Cam Hobhouse, dated 11 November 1818. *Byron's Letters and Journals*, ed. by Leslie A. Marchand, 12 vols (London: John Murray, 1973-1994), VI, p. 183, qtd. in Groth, 'Kaleidoscopic Vision', p. 228.
[76] George Eliot, 'The Lifted Veil', in *The Lifted Veil and Brother Jacob*, ed. by Sally Shuttleworth (London: Penguin, 2001), p. 30.

fundamentally a producer of harmonic, mobile, colour arrangements. Such enjoyment is often overlooked in modern critical appraisals which focus on the kaleidoscope as a producer of visual dazzle, metaphorically denoting a destabilized visual field in which the eye was inundated and overwhelmed by disordered sense data.[77] Yet its ever-transforming pattern was a key part of its appeal. Brewster boasts that its 'continued […] sensation of pleasure' could 'render cheerful […] many a dull and solitary hour' by offering an 'unceasing variety of entertainment', which, far from dizzying its spectator, could be soothing and restorative: 'we have heard of many cases', he recounts, 'where the tedium of severe and continued indisposition has been removed' by using the device (158-9).

The philosopher Alexander Bain, writing a year after the publication of Brewster's revised treatise, identified too a 'general craving of the senses for variety'. 'The mind is revulsed by an abrupt termination', he writes, and the visual sense in particular desires a harmonious variety of 'easy transition[s]' (we are reminded here of Herschel's similar claim) which he likens to the effect of cadence in music. An example of that which gives 'pleasure by the alternation of the excitement and repose of the eye' is seen in 'mosaic work, the patterns of a design, or the petals of a flower'—all of which rely on a 'regularity of repetition [which] is highly grateful to the eye'.[78] Such examples recall the use Brewster asserts for his kaleidoscope as a mechanical tool for the creation of unified harmonious patterns, and indeed Bain draws on this to illustrate his point: 'Sir David Brewster's invention of the Kaleidoscope, showed that shapes in themselves very irregular, might by repetition form a whole, or a total, pleasing to the eye'.[79] Such repetitive variety, which I

[77] Groth asserts that 'the kaleidoscope incarnates the affective impact on the eye inundated by the random stimuli of urban life'. See 'Kaleidoscopic Vision in Late Victorian Bohemia: George Sims's Social Kaleidoscope', in *Media, Technology, and Literature in the Nineteenth Century: Image, Sound, Touch*, ed. by Colette Colligan and Margaret Linley (Surrey: Ashgate, 2011), pp. 91-104 (p. 96).
[78] Alexander Bain, *The Emotions and the Will* (London: John W. Parker & Sons, 1859), p. 261.
[79] Bain, *The Emotions and the Will*, p. 264.

have termed regulated surprise, 'serv[es] as auxiliary to the comprehension of meaning and the impressiveness of the feelings to be conveyed'.[80]

A further aspect of its appeal was in its presentation of pleasing combinations of colour. Items to be placed in the object-box or looked at through the viewer should be chosen deliberately to compose an image which gives a 'superior effect'. Brewster cautions the user not to 'indiscriminately adopt' a selection of objects but pay attention to the 'union of different tints' which might be produced. Experimentation is encouraged by utilizing varying tints of a single colour which, he writes, will allow 'the most chaste and delicate patterns' to be produced, ideal for 'those eyes which suffer pain from the contemplation of various colours [and] are unable to look without uneasiness upon a pattern' (74). He adds a table of 'harmonic colours' with their ideal ratios as a guide 'to enable any person to find what colours harmonize with each other' (71-2). The colour pairings given in his table are drawn on in an undated watercolour by William Holman Hunt of the view down a kaleidoscope (see fig. 16), as John Gage has identified.[81]

[80] Bain, *The Emotions and the Will*, p. 261.
[81] John Gage, *George Field and His Circle: From Romanticism to the Pre-Raphaelite Brotherhood* (Cambridge: Fitzwilliam Museum, 1989), p. 65.

Figure 16. William Holman Hunt, *Kaleidoscope*, c.1860. Pencil and watercolour sketch. 17.8 cm x 13.4 cm. Copyright Victoria and Albert Museum, London, UK.

Hunt's sketch records a view down a kaleidoscope. It depicts a background of hexagonal shapes overlaid with reflected shapes and colours which are repeated three times around an axis of kaleidoscopic reflection. Gage considers the piece an exercise in 'searching for a rational principle of colour harmony as applied in pattern' and dates it from the period when Hunt was working on *The Finding of the Saviour in the Temple*

(1860) as both pieces evidence a 'concern with repeated decorative patterns'.[82] No other representations of kaleidoscopic views are found in Hunt's work, yet this small (130x98mm), detailed appraisal of a kaleidoscope's display demonstrates the utilization of its particular perceptual experience as both a technique for composition and a resource for the sketch's subject, and evidences an interest in the device's function as a mechanical tool for producing symmetrical and harmonious arrangements of colour and form.

The painting uses three of Brewster's twelve harmonious groupings: 'deepest red' and 'blue and green equally mixed' (found in the central tripartite shapes); 'greenish yellow' and 'pale violet' (seen in the outer circular forms); and 'orange' with 'blue' (combined in the top right arrangement) (72). The three primary colours dominating Hunt's watercolour were central to colour theories in this period—Owen Jones's design for the Crystal Palace is a key example—and discussed at length by the chemist and colour technician George Field in his *Chromatography; or a Treatise on Colours and Pigments* (1835). Field's book was influential, going through ten revised editions, and an abridged version was published as *Rudiments of the Painters' Art, or a Grammar of Colouring* in 1850 which Hunt acquired in 1856.[83] With Brewster's revised treatise being published two years later, it seems likely that Hunt's painting dates from around this time, revealing a new context in which we find kaleidoscopic forms and colour patterns.

The visual art of the Pre-Raphaelites has been associated with types of nineteenth-century optical technology, and particularly that of photography. Discussing the 'radical optical fidelity' of their style, Lindsay Smith cautions that

> Critics align conditions of photographic exactitude with microscopic detail in discussion of Pre-Raphaelite technique […]. However, such references to microscopic clarity elide precisely those culturally specific relationships of Pre-

[82] Gage, *George Field*, p. 65.
[83] Gage, *George Field*, p. 33.

> Raphaelitism with innovative optical devices. […] In short, critics, ironically, have sought analogues in the wrong instruments, in the microscope and the camera.[84]

Taking the stereoscope as such an overlooked 'innovative optical device', she persuasively demonstrates that both 'Pre-Raphaelitism and stereoscopy articulate a newly arousing depth of field' and makes the extended point that Pre-Raphaelite work often 're-inscribes the illusionism of depth'.[85] Particularly, the use of perceptual dimensionality in John Everett Millais's *The Woodsman's Daughter* (1850-1) 'foregrounds both the position of a Victorian stereoscopically-empowered beholder and the agency of depth of field'.[86] Drawing on William Bell Scott's account of his visit in 1849 to Hunt's studio, in which Scott explains that 'history, genre, mediaevalism, or any poetry or literality, were allowable as subject, but the execution was to be like the binocular representations of leaves that the stereoscope was then beginning to show', Smith suggests that innovative perceptual modes like stereoscopy were 'a precedent for Pre-Raphaelite painting rather than an analogy made after the event'.[87] The interaction of viewer and subject which this encourages, and the painting's harnessing of an active perceptual experience—that of seeing three-dimensionally—extends our reading of the Pre-Raphaelite's engagement with contemporary developments in optics and visual technology. Indeed it may have been Hunt's friendship with Scott which piqued his interest in the kaleidoscope: born in Edinburgh in 1811, Scott grew up during the 'kalleidoscopism' craze of the 1820s and would have been well-placed to discuss or even demonstrate the instrument to Hunt. As his sketch of a kaleidoscope display evidences, the stereoscope was not the only optical

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[84] Lindsay Smith, 'The Elusive Depth of Field: Stereoscopy and the Pre-Raphaelites' in *Pre-Raphaelites Re-Viewed*, ed. by Marcia Pointon (Manchester: Manchester University Press, 1989), pp. 83-99, (pp. 84-85). Smith has in mind Alan Bowness's 'Introduction' to *The Pre-Raphaelites* (London: Tate, 1995).

[85] Smith, 'The Elusive Depth of Field', pp. 84-85.

[86] Smith, 'The Elusive Depth of Field', p. 92. As per the present chapter's reading of Brewster's writing on the kaleidoscope, Smith's essay addresses Brewster's publication of a treatise on the stereoscope, arguing its importance in terms of the 'rhetoric of legitimacy' it lends the device as it 'forges for the discourse of optics new contextual relationships' between technological innovation, art, and theories of perception. See pp. 87-89.

[87] Lindsay Smith, *Victorian Photography, Painting and Poetry. The Enigma of Visibility in Ruskin, Morris, and the Pre-Raphaelites* (Cambridge: Cambridge University Press, 1995), p. 100.

device to draw the attention of the Pre-Raphaelites: the kaleidoscope's mechanical production of symmetrical line and harmonious colour was also the subject of stylistic experiment by Hunt and, as I address below, his contemporary Rossetti.

Hunt's visual record of a kaleidoscopic view is structured around a net of hexagonal shapes. Where the corners of each hexagon meet the pattern is inverted and reflected three times, a visual effect produced specifically by the triangular polycentral kaleidoscope, also known, as Roget's article on the device for the *Encyclopaedia Britannica* relates, as a 'hexascope' (see fig. 17). This comprised three inclined mirrors at an angle of sixty degrees which subdivided the view into three repeating sections whose symmetry, Roget writes, was 'most conspicuous with reference to the centre' at which each hexagonal side met.[88] Brewster similarly observes that 'in instruments of this kind the reflected images are arranged around several centres' (105).

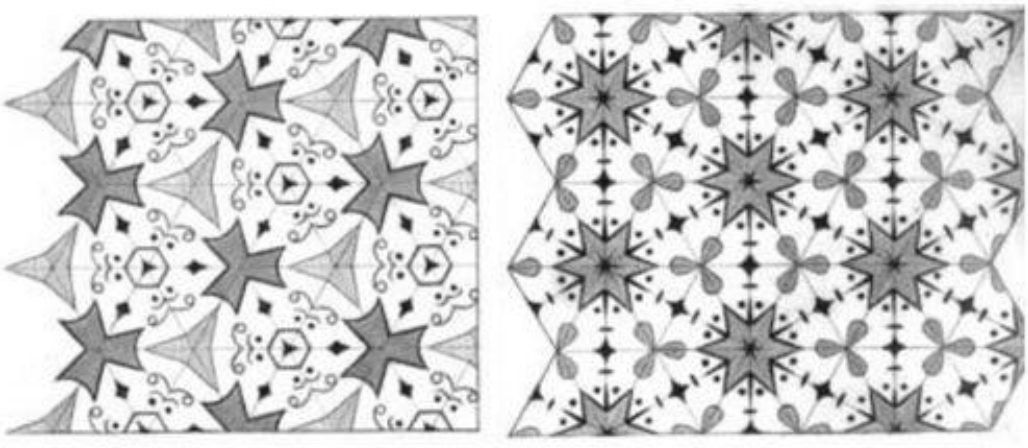

Figure 17. Hexagonal pattern seen through a 'hexascope' kaleidoscope. Roget, 'Kaleidoscope', Plate XCIII.

A second and previously unacknowledged example of hexagonal kaleidoscopic patterning can be identified in the blue-tiled background of Rossetti's *The Blue Bower* (1865). The background of this painting provides a remarkable depiction of the all-over

[88] Roget, 'Kaleidoscope', p. 168.

patterning seen through the device and its reflected symmetrical forms are clearly influenced by the kaleidoscope's angled mirrors.

Figure 18. Dante Gabriel Rossetti, *The Blue Bower* (1865). Oil on canvas. 84 x 70.9cm. With kind permission of The Henry Barber Trust, © The Barber Institute of Fine Arts, University of Birmingham, UK.

The painting's central female subject, dressed in sumptuous and vibrantly-coloured fabrics, is placed centrally within a bower of trailing passion flowers with her hands placed on a Japanese koto. Behind her head, and occupying almost half the canvas, is a background composed of hexagonal blue tiles featuring a white prunus blossom motif. The vivid background is immediately striking for its 'all blue' colouring, as Rossetti described it, and the distinctive honeycomb formation of the repeating tiles which spread across and beyond the edges of the canvas, mimicking the kaleidoscope's all-encompassing view of patterns which seem to endlessly rotate out of the field of vision.[89]

Critics have pointed towards the mid-Victorian interest in Oriental design as providing the inspiration for the painting's distinctive background, and indeed Rossetti was a keen collector of such pieces.[90] Described by his brother, William Rossetti, as having a 'passion for blue china', he competed with James McNeill Whistler for the most extensive and striking collection.[91] Linda Merrill comments that this painting forms 'Rossetti's own homage to Chinese porcelain'.[92] Two months before beginning *The Blue Bower*, Rossetti wrote to James Anderson Rose: 'I saw your blue china […] the other evening. That dragon bottle is the gem of your collection and a real stunner'.[93] Indeed, one of the pieces Rossetti bought during this period was a pair of 'sumptuous hawthorn-pots with covers' for £120.[94] The particular blue and white vine pattern of *The Blue Bower* originates from a type of Chinese ginger jar—Rossetti coined these 'hawthorn pots'—

[89] *The Letters of Dante Gabriel Rossetti*, ed. by Oswald Doughty and John Robert Wahl, 4 vols (Oxford: Clarendon Press, 1965-1967), II, p. 552.
[90] For an overview, see Stacey Pierson, *Collectors, Collections, and Museums: the Field of Chinese Ceramics in Britain, 1560-1960* (Bern: Peter Lang, 2007), p. 64.
[91] Quoted in Linda Merrill, *The Peacock Room. A Cultural Biography* (New Haven: Yale University Press and Washington, D. C.: Smithsonian Institution, 1998), p. 60.
[92] Merrill, *The Peacock Room*, p. 61.
[93] Rossetti, *Letters*, II: 543.
[94] Merrill, *The Peacock Room*, p. 170. One of the pots remains, and is currently displayed at the National Trust property Cragside (although without any reference to its ownership history).

which recur in his midcentury paintings.[95] In the watercolour *Woman Combing Her Hair* (1864), the female subject sits beside a white vase painted with a blue bird. However, Rossetti reproduced this painting a year later (the same year as he painted *The Blue Bower*) under an identical title and added a second vase: beside the white vase sits a small hawthorn pot of vivid blue overlaid with the distinctive white prunus blossom motif. Later, his 1867 portrait of Mrs F. R. Leyland, *Monna Rosa*, features a large identical blue hawthorn pot containing pale pink roses.

Figure 19. Dante Gabriel Rossetti, *Monna Rosa* (1867). Oil on canvas. 57 x 40.7cm. Private Collection.

[95] Julian Trueherz, Elisabeth Prettejohn and Edwin Becker, *Dante Gabriel Rossetti* (London: Thames & Hudson, 2003), p. 234.

However, in *The Blue Bower* the vessel's design is abstracted and flattened into repeating lacquered tiling as if perceived through a kaleidoscope (all sense of texture or depth would be lost in its glassy reflective surface, a representation which contrasts with the sumptuousness of the sitter's hair and clothing). In focusing on the Oriental patterning scholarship has overlooked the importance and uniqueness of each hexagonal tile being differentiated by a thick white border—it is not a feature of the pots' design. Their function on first glance is to signify a backdrop composed of segmented individual tiles, as opposed to a wallpaper, for example. These, I propose, signify the mirrored lines of reflection organising the kaleidoscope's display into a hexagonal structure, as seen in Hunt's watercolour, and at their intersection form an evident centre of symmetry around which the pattern is thrice repeated, as Roget and Brewster noted. In the corner of each white border Rossetti places a small additional detail—a blue and white flourish—which is inverted and reflected three times, further emphasizing the kaleidoscopic mirroring of each tile. These thick white lines depict the fixed lines of reflection around which the kaleidoscopic pattern turns. Although a repetitious pattern, each tiled iteration is turned at a slightly different angle and represents the continual twisting of the lens against the mirrors as the kaleidoscopic view steadily rotates to offer incremental variations of its pattern.[96]

Paul Spencer-Longhurst comments that the tiles of Rossetti's painting 'correspond to no Oriental prototypes' but that '[p]erhaps coincidentally, the effect produces star-like patterns'.[97] However, when we consider the popularity of Brewster's device at the

[96] The motif of the repeating figure depicted as if seen through the kaleidoscope's incrementally modifying display is notable in two further works spanning the late-nineteenth to early-twentieth century. Edward Burne-Jones's *The Golden Stairs* (1880) and Marcel Duchamp's *Nude Descending a Staircase, No. 2* (1912) are both concerned with harmonies of shade and music, and make use of a jolting temporality to render successive movements of the female figure; their subjects are repeated multiple times across the canvas, each with a slightly shifted position, mimicking the fractional changes of the same core element made possible by rotating the kaleidoscope's mirrored display.

[97] Paul Spencer-Longhurst, *The Blue Bower: Rossetti in the 1860s* (London: Scala, 2000), pp. 10-11.

midcentury and Hunt's sketch of a view down a kaleidoscope featuring identical hexagonal netting and a motif of thrice-reflected patterning, it is clear that Rossetti is deliberately combining the contemporary fashion for Chinese design with the operation and perceptual experience of looking through a kaleidoscope. It draws directly on the operation and patterned display of the kaleidoscope, and its harmonious pairings of colour (blue tiles, blue cornflowers; green fabric, trailing foliage; shades of yellow and auburn) reference the device as a tool for composing harmonious colour palettes.

More than coincidentally creating a geometrical star-like patterning, as Spencer-Longhurst claims, the systematically structured background productively contrasts with the central female subject and enables the painting to simultaneously exhibit states of inertia and mobility. I have previously noted the opposition between the tactile appeal of the sitter's garments and the background's glassy, kaleidoscopically-flattened hawthorn pots; a further opposition is found in the stillness of the sitter and the implied motion of the tiled display. The model, Fanny Cornforth, holds the gaze of the observer captive while the hexagonal tiles behind evidence the slow rotation of a kaleidoscope, suggesting a continual movement off the canvas and outwards in a steadily renewing pattern. The kaleidoscopic tiles speak back to the meaning of the painting's title: the bower proliferates around the sitter, creating an encasement, just as the viewer looking into a kaleidoscope finds his entire visual field overtaken by endlessly repeating symmetrical forms—a bower for the eye. Additionally, the steady circular hand-rotation of the kaleidoscope's display is picked out by the gentle arc of the koto's black bridges and the sitter's poised fingers indicate their readiness to manipulate the instrument's strings, allowing Rossetti to layer his painting with further instances of stillness and motion, and the moment of potentiality between these two states. The blue tiles then, offer more than a vibrant and fashionable backdrop: their kaleidoscopic mirroring draws attention to the medium of the canvas as a

flattening, mediating device, analogous to the kaleidoscope itself, but also offers a sense of mobility, animation, and renewal which we see echoed in the training passion flowers and in the dynamic potential of the unplucked strings.

The geometric emphasis of the painting is noted by J. B. Bullen, who describes this as 'a painting whose ostensible subject is the art of music, but which is essentially a carefully organized combination of shapes and colours'.[98] Frederic George Stephens, a member of the Pre-Raphaelite Brotherhood and art editor of *The Athenaeum*, likewise deemed Rossetti's painting 'most original': it is like a 'lyrical poem', he writes in a review of 1865, 'which aims at effect quite as much by means of inherent beauty and melodious colouring as by the mere subject, which is superficial'.[99] The painting's effect upon the 'spectator's cognizance' is found in its 'chromatic harmony', a multi-sensorial appeal expressed in the language of the review: the blue finds its 'highest and most powerful key-note' in the cornflowers and the black bridges of the instrument form 'sharp notes'.[100] Earlier in the century George Field had drawn attention to the 'gradations and successions' of colour, tint, and hue in painting which could form, he writes, an 'infinite sequence […] so analogous to the melody of musical sounds, that we have not hesitated to call them *the melody of colours*'.[101] The kaleidoscope was an important technology for its ability to manifest a sequential, transformative display of such 'melodious colouring' or 'chromatic harmony'. Brewster's treatise is clear that it could 'excite sentiments and ideas with as

[98] J. B. Bullen, 'Rossetti, Dante Gabriel (1828–1882)', *Oxford Dictionary of National Biography*, Oxford University Press, 2004; online edn, May 2011. [http://www.oxforddnb.com/view/article/24140, accessed 2 June 2013]
[99] F. G. Stephens, 'Mr. Rossetti's Pictures', *The Athenaeum*, 1982 (21 October 1865), 545-546 (p. 545).
[100] Stephens, 'Mr. Rossetti's Pictures', p. 546.
[101] George Field, *Chromatics; or, The Analogy, Harmony, and Philosophy of Colours* (1817; London: David Bogue, 1846), p. 19. In the catalogue which accompanied the most recent international exhibition of Pre-Raphaelite works ('Pre-Raphaelites: Victorian Avant Garde', Tate Britain, 12 September 2012 - 13 January 2013), Tim Barringer notes that in *The Blue Bower*, 'Both iconographically and formally, Rossetti explores the parallel between musical and visual harmonies, a theme already present in *The Blue Closet*'. See *Pre-Raphaelites: Victorian Avant-Garde*, ed. by Tim Barringer, Jason Rosenfeld, and Alison Smith (London: Tate Publishing, 2012), p. 168. *The Blue Closet* (1857) interestingly also makes use of a blue tiled backdrop but these are squared and lack the hexagonal structure and pleating repetition of the kaleidoscopically-patterned tiles lining *The Blue Bower*.

much vivacity as those which are excited by musical composition' (159). As Rossetti's painting achieved for Stephens, the affective potential of the kaleidoscope's 'combinations of fine forms, and ever-varying tints' offered, Brewster writes, 'a pleasure as intense and as permanent as that which the finest ear derives from musical sounds' (159).

In painting a background which was stylistically kaleidoscopic Rossetti's work evidences the value and importance of Brewster's device to considerations of mechanical pattern-making, the aesthetics of repetition, and theories of the multi-sensory experience of visual and aural harmonies. That the kaleidoscope could appeal across these sensory fields encouraged Brewster to claim that it should be viewed as a nineteenth-century 'ocular harpsichord'. Described in 1725 by Jesuit mathematician Louis-Bertrand Castel, the ocular harpsichord was a large instrument requiring illumination from five hundred candles (likely the reason it was rarely exhibited) which consisted of numerous coloured glass panes which illuminated when a corresponding harpsichord key was pressed, giving a spectacle which harmoniously combined sound and vision. Brewster places his device as the ocular harpsichord's more effective successor: 'those who have been in the habit of using a correct Kaleidoscope, furnished with proper objects, will have no hesitation in admitting that this instrument realizes, in the fullest manner, the formerly chimerical idea of an ocular harpsichord' (158-9). Thomas L. Hankins and Robert Silverman point out that the importance of the ocular harpsichord for Castel was in the 'sequence and harmony of the notes' it created: pleasure was derived from a particular arrangement of successive and corresponding sounds and colours.[102] Some decades after Brewster's treatise was published, Siegfried Kracauer would describe the cinema as 'a total artwork of effects,

[102] Thomas L. Hankins and Robert Silverman, *Instruments and the Imagination* (Princeton: Princeton University Press, 1995), p. 74.

[…] an optical and acoustic kaleidoscope'.[103] However, Kracauer's connection between the cinema and kaleidoscope, and theorization of the 'total' experience these media forms were able to present had in some fundamental ways been considered by Brewster himself. Although not, of course, aware of the notion of the cinematic, Brewster did speculate on the potential offered by his device to produce a similarly 'total artwork' which encompassed animated visual effects, corresponding harmoniously with music and sound, and produced under directorial control.

A Cinematic Kaleidoscope?

The kaleidoscope's display offered more than a sensational visual spectacle. Its endlessly renewing symmetry and vivid colour arrangements encouraged extensive metaphors of 'kalleidoscopism' in many fields across the nineteenth century precisely because of its production of a structured framework upon which colour and form could be collated, reordered, and unified to produce an original composition of comprehensible and cohesive sensory appeal. Further, its rotating display offered a sense of dynamism and mobility—forming an ideal metaphor for the kinetic neural elements in Lewes—which could visualize a progressive movement from one variation to the next, as seen in the sequence of narrative 'shakes' in 'My Spanish Kaleidoscope'. Brewster recognised this application and explained how the device could be modified to enhance its narrative appeal by offering a succession of connected views: 'I have sometime constructed a long object-plate, like the slider of the magic lantern, in which combinations of all the principal harmonic colours followed one another in succession, and presented to the eye a series of brilliant visions' (75). This long glass slide operated like a crude strip of film passed in front of the kaleidoscope's aperture, enabling it to offer a sequential spectacle in which the

[103] Siegfried Kracauer, 'The Cult of Distraction: On Berlin's Picture Palaces', in *The Mass Ornament: Weimar Essays*, ed. and trans. by Thomas Y. Levin (Cambridge, Mass.: Harvard University Press, 1995), pp. 323-328 (p. 324).

'aerial tracery of light and evanescent forms' would progressively move into new permutations. Further, the velocity of this patterning could be adjusted by 'varying the direction of the motion across the angular aperture'. Brewster explains that 'forms and colours may be made to succeed each other' and by the 'skilful combination of these passing visions […] the mind may derive a degree of pleasure far superior to that which arises from the immediate impression which they make upon the organ of vision', emphasizing that when used in this way the kaleidoscope could be more than a device for registering a variety of separate and static patterns. Its arrangements could be arranged successively into a harmoniously combined sequence, and offer an affective narrative: 'dull and gloomy masses, moving slowly before the eye, excite feelings of sadness and distress; […] lively colours, are capable of inspiring us with cheerfulness and gaiety' (159-60). The importance of combination, sequence, and speed, and the connection between motion and affect demonstrates the complexity of Brewster's device; often overlooked in studies of nineteenth-century optical and moving-image technology, the kaleidoscope is actually one of the century's first technological producers of visual motion.

In a remarkable passage discussing the potential of the device as an audio-visual technology, Brewster evokes the cinema as we are familiar with it (that is, as a visual display projected to an audience and accompanied by sound):

> [The kaleidoscope's] combinations of colours and forms may be adapted to a piece of music, and their succession exhibited on a screen by means of the electric, or lime-ball […]. Similar forms in different colours, and in tints of varying intensity, losing and resuming their peculiar character with different velocities, and in different times, might exhibit a distinct relation between the optical and the acoustic phenomena simultaneously presented to the senses. Flashes of light, coloured and colourless, and clouds of different depths of shadow, advancing into, or emerging from the centre of symmetry, or passing across the radial lines of the figure at different obliquities, would assist in marking more emphatically the gay or gloomy sounds with which they are accompanied. The slight idea of the effects

> which might be expected from an ingenious piece of mechanism for creating and combining the various optical phenomena, and exhibiting them in connexion with musical sounds, may be obtained by a single observer, who looks into a fine Kaleidoscope, firmly fixed upon a stand, and produced with his two hands all the variations in form and colour which he can effect by such inadequate means, and which he considers appropriate to the musical piece that accompanies them. (160-161)

Brewster speculates that the kaleidoscope's patterning could be deliberately set to a musical accompaniment and projected for an audience to enjoy. In doing so, its operator (figured as a kind of kaleidoscopic director) could adjust the speed of each rotational pattern change, select appropriate colours, and control the timing of each arrangement. This would encourage a correspondence between sequential optical and auditory stimuli and offer a spectacular experience which stretched beyond an appeal to the visual sense solely. That it was speculatively designed to produce technological displays of moving images for the pleasure of the spectator importantly places the kaleidoscope within the category of 'pre-cinematic' devices, yet critical historiography rarely mentions the device, focusing predominantly on the panorama, slide projection, photography, and the experiments in chronophotography of the 1870s.[104]

This chapter responds to Elizabeth Carlson's recent call for the significance of mirror technologies to such historiographical categorizations. Carlson writes on the large-scale architectural mirrors which began to feature in exhibitions and shopping arcades and persuasively makes the case that 'mirrors directly influenced the style, subject-matter, and experience of watching early moving pictures, and should be seen as a significant proto-cinematic phenomenon'.[105] She draws initially on the sheet mirrors which composed 'The

[104] As discussed in my 'Introduction', relevant histories include *A History of Pre-Cinema*, ed. by Stephen Herbert, 2 vols (London: Routledge, 2000); Laurent Mannoni, *The Great Art of Light and Shadow: Archaeology of the Cinema*, trans. and ed. Richard Crangle (Exeter: University of Exeter Press, 2001); and Leo Enticknap, *Moving Image Technology: From Zoetrope to Digital* (London: Wallflower Press, 2005).
[105] Elizabeth Carlson, 'Reflections to Projections: The Mirror as a Proto-Cinematic Technology', *Early Popular Visual Culture* 9.1 (2011), 15-35 (p. 15).

Palace of Illusions', an architectural exhibition at the 1900 Paris Exposition. Measuring twenty-three feet high by ten feet wide, Carlson demonstrates that this space created a 'performative proto-cinematic adventure', giving observers an interactive real-time viewing experience with a life-sized screen reflecting the movements of each spectator.[106] In the same way, she goes on to state that earlier examples of architectural mirrors in cafes, arcades, and department stores equally created a moving-image spectacle that looked ahead to cinema, explaining that these mirrors 'framed these scenes, creating moving compositions. This new visibility of the body [upon] mirrored surfaces pictured random social interactions, exhibiting what once seemed to be private acts on a screen for public view.' The mirror in Carlson's argument becomes a 'virtual screen' that could create 'real moving images that the Cinématographe could only simulate'. Newly mirrored urban environments created an animated spectacle by 'cast[ing] reflections of the viewer as he or she strolled down the street, in real time. The mirror framed these scenes, creating moving compositions'.[107]

One such mirrored kaleidoscopic environment was constructed by Dickens in order to bring real time movement more easily under his gaze, as he describes in a letter to Mrs Fields: 'I have put five mirrors in the Swiss chalet (where I write) and they reflect and refract in all kinds of ways the leaves that are quivering at the windows, and the great fields of waving corn, and the sail-dotted river'.[108] In devising an environment bordered by planes of angled mirrors, Dickens converted his chalet into a walk-in kaleidoscope which could present to his sight the liveliness of the natural landscape outside. Carlson's approach to film history and her refreshing willingness to consider objects of the nineteenth century which, although not directly cinematic, surely contributed to a visual

[106] Carlson, 'Reflections to Projections', p. 17.
[107] Carlson, 'Reflections to Projections', pp. 20-22.
[108] Letter dated 25 May 1868. *The British Academy/Pilgrim Edition of the Letters*, ed. by Margaret Brown, Graham Storey, Kathleen Tillotson, 12 vols (Oxford: Oxford University Press, 2002), XII, p. 119.

culture of the mediated moving image expands how we think about the history of cinema and paves the way for a consideration of other technologies previously neglected by the critical history. In this way, my argument for the significance of the kaleidoscope within this grouping follows Carlson's similar resituation of the mirror by demonstrating that its visual environment of variable speeds of motion, its ability to be directly manipulated by the viewer, and the potential of projecting the kaleidoscopic view to an audience of spectators marks it as an important object within both the history of nineteenth-century visual culture and of animated spectacle. The kaleidoscope intervenes in and expands the categorization of pre-cinematic technologies and alerts us to the variety of popular moving image devices available to spectators many decades before the cinématographe reached audiences. Attending to the prevalence of Brewster's device and to moments of literary, visual, or physical 'kalleidoscopism' (such as Dickens's chalet) enables such examples to be newly read as contributions to the history of mediated moving images.

Just as its display performed constant circulation, the term 'kaleidoscopic', too, circulated easily as metaphor, analogy, and stylistic design beyond its Romantic origin and across the fields of Victorian fiction, journalism, physiological science, the fine arts, philosophy, and technological visual spectacle. Although basic in mechanism (evidenced by the number of homemade devices), its visual display prompted a sense that a variety of experiences—artistic composition, memory, neural functioning, imaginative transport, sensory response—might be described using its structured but fundamentally adaptive patterning. It served as a widely-understood example to denote the processes of collation, ordering, and restructuring, and composing, harmonizing and adjusting—processes enacted simultaneously within the kaleidoscope's viewfinder and by its operator's manipulating hands. Reliant upon a conjunction of visual abstraction with physical manipulation, it pointed ahead to those devices which would similarly produce an image,

through the labour of the hand, which was *not there*: like the kaleidoscope, persistence of vision devices were premised on making the invisible, of the simultaneity of mechanical operation and virtuality. Users of both forms of media laboured at the device in order to produce a display which had no physical, tangible existence, its abstracted forms produced only through principles of science which the inventors of such instruments utilized in order to both delight and instruct.

CHAPTER FOUR

Writing the Image: Durable Memory and Revolving Perception in Persistence of Vision Devices

Opening *Adam Bede* (1859), the narrator defines our position as 'reader' (although 'watcher' may be more relevant) and theirs as writer-seer who, 'with this drop of ink at the end of my pen', will 'reveal […] visions of the past'; 'I will show you the roomy workshop of Mr Jonathan Burge', they confidently assert.[1] This, then, is a narrator who has already seen the subject of their story. Visions previously witnessed will be revealed and re-presented in ink. The confident assertion of visual guidance imparted from writer to reader, shower to observer, continues throughout the narrative of Eliot's text. 'Let me take you into that dining-room, and show you the Rev. Adolphus Irwine', they advise, later explaining that by 'putting our eyes close to the rusty bars of the gate, we can see the house well enough' and pre-emptively agreeing with our silent assumption outside Hall Farm that 'Yes, the house must be inhabited, and we will see by whom' (49, 65). We quickly get the sense that this narrator has peeked through the Farm gates and peeringly put their 'face to one of the glass panes in the right-hand window' at least once, if not many times, before (65).

It should not then come as a surprise to find this narrator adding their familiarity and, importantly, remembered detail to a scene. From the perspective of the traveller arriving in Hayslope and surveying the 'pleasant land' from a high vantage beyond the

[1] George Eliot, *Adam Bede*, ed. by Carol A. Martin (Oxford: Oxford University Press, 2008), p. 5. Further references are to this edition and follow parenthetically in the text.

Green, we learn that 'High up against the horizon were the huge conical masses of hill, […] not distant enough to be clothed in purple mystery, but with sombre greenish sides visibly specked with sheep, whose motion was only revealed by memory, not detected by sight' (16).[2] Here, the planes of this landscape, the 'conical masses' and 'greenish sides', are described by the narrator exactly as they would appear to the eye of the traveller: not distant enough for the scene to fade into layers of single-hued silhouettes, he is also not near enough for colour to be accurately identified or for the hills to lose their abstract quality and become more than just shape and form. If this passage gives the reader a clear indication of exactly how, pictorially, the landscape appeared to a specific observer at a specific moment, it also incorporates information added by the narrator from their past experience of being within and looking onto this same scene. The sides of the hills are 'visibly specked with sheep' but these specks are stationary: their 'motion was only revealed by memory'. Here we witness the narrator's drop of ink revealing visions of the past. From such a distant vantage the living animation of the sheep cannot be 'detected' by the eye, rendering them mere specks, yet the narrator adds their motion from memory—perhaps they have previously walked through Hayslope's pastures or looked across the landscape at closer range—and embellishes the scene in an act of narratorial one-upmanship ('He might have seen other beauties in the landscape if he had turned a little in his saddle and looked eastward', our perceptive guide intimates (17)). Endowing the scene with animation not through inference but through recalled memory, the narrator displays early on in this novel the deployment and benefit of durable, remembered impressions. In

[2] Writing on this figure of the traveller in *Adam Bede*, particularly in relation to the context of large-scale static panoramas and their encouragement of a surveying, almost 'virtual' perspective, Alison Byerly argues that 'novelists borrowed from these popular cultural forms descriptive techniques and rhetorical gestures that position the reader or viewer as a kind of traveller' and contends that the visitor to Hayslope is figured as a hypothetical onlooker, or proxy for the reader, within the (virtual, readerly) landscape of the novel. See Part I of *Are We There Yet? Virtual Travel and Victorian Realism* (Ann Arbor, MI: University of Michigan Press, 2012). Developing this, I stress the important role of the narrator here in adding personal memory: we look not through the traveller's eyes, as if clear apertures across Hayslope, but rather stand behind this figure, looking at him looking, and simultaneously learn of further details in the scene from the narrative voice. We are closer, I argue, to the narrator than the traveller here.

this instance, Eliot both presents the view of Hayslope to her reader as it appeared at a precise time and from a single perspective, and also offers an amalgamated image of the scene which draws on perception and memory: *seeing* through the eyes of the traveller, we experience what Hayslope looks like, and *knowing* through the durable memories stored in the mind of the narrator, we have a deeper understanding of the landscape beyond that which can be provided by the eye.

The narrative method employed here recalls William Carpenter's assertion in *Principles of Human Physiology* (1842) that 'the Visual power is susceptible of extraordinary improvement'. Through the 'habitual direction' of visual attention to the 'effects produced upon our consciousness by the impressions transmitted to the Sensorium from the Eye […], the mental rather than the corporeal vision' can undergo improvement. Such a process is evident in the improving addition of recalled motion (gained through habitual or prior perception) to Hayslope's distant hills, which although insensible to the corporeal eye can be transmitted to the reader through the mental vision of the text's narrator. Carpenter goes on to illustrate this process:

> Thus the Seaman who makes-out the 'loom of the land' where the landsman can discern nothing but an indefinite haze above the horizon, or who can distinguish the size, rig, and course of a vessel, which the landsman can but see as a formless speck, does so in virtue of the aptitude of his mind for receiving suggestions from minute indications, such as pass unnoticed by those who have not been accustomed to form their ideas upon the same kind of experiences. And the Microscopist who is constantly on the outlook for the various forms of organic structure with which his mind is familiar, discerns these without difficultly or hesitation, where an ordinary observer sees nothing but a confused jumble of tissue.[3]

The traveller to Hayslope, and the unfamiliar reader, see only such a 'formless speck' in the distant scenic landscape, yet, as evidenced in the familiarity of Carpenter's seaman and

[3] William Carpenter, *Principles of Human Physiology*, 9th edn, ed. by Henry Power (London: J. & A. Churchill, 1881), p. 758.

microscopist with their environment, the role of *Adam Bede*'s narrator is to notice, suggest, and recompose the 'structure with which his mind is familiar', and in doing so to bring order and recognition where only an 'indefinite haze' or 'confused jumble' is visible to 'ordinary' bodily sight. The experienced narrative eye relies on durable memory and its recall to render the undetectable sights of a long perspective newly appreciable: the motion of sheep living upon the hill. The opening of *Adam Bede* illustrates a perceptual process in which the mind does not understand its perception of an object purely through the initial contact of the eye and the thing seen; instead, ocular vision (Carpenter's 'ordinary observer') must co-operatively work alongside the mind to procedurally recall, supply, and reinstate previously associated memories (or sense data) in order to more fully and ably perceive.

The collaboration of the mental and optical involved in the process of 'writing the image'—to memory, and to the page—is central to this chapter's analysis of durable visual impressions and the reproduction of remembered information as a way to bring a sense of animation and vitality to fictional representation (such as the addition of remembered movement to Hayslope's grazing sheep).[4] Focusing on technologies which relied on what was then understood as the persistence of vision, it considers aspects of visual persistence (such as where impressions were made and stored, and the imagined depth and duration of their imprint) and discusses the implications for literary representations of perception, memory, the nature of recall and repetitive memory, and the potential for perceptual disorientation brought about by the blending of past and present

[4] I take my terms here from an essay on persistence of vision seen using a zoetrope (an instrument I discuss further later in this chapter), by Carpenter, who is explicit that the 'whole class of remarkable effects' offered by this visual phenomenon should be understood as both '*optical*, but partly (as will hereafter be shown) *mental'*. 'Interesting alike to the philosopher and the mere wonder-seeker', persistence of vision devices demonstrate particularly the 'mental combination of two or more sets of sensory impressions'. William Carpenter, 'On the Zoetrope and its Antecedents', *The Student and Intellectual Observer of Science, Literature, and Art* 1 (1868), 427-444 (pp. 427, 438). Emphasis added.

impressions.[5] Moving images in this chapter's discussion function as a way to understand and witness the thoughts of characters: to understand through metaphor how their mind is moving (its processes, actions, and turns of thought), the repetition of ideas, and to discover which events are impressed deep enough to return, bidden or unbidden, as significant memories in the life of a character. Casting a character's mind as a revolving zoetrope wheel fulfils a similar end to that which Jonathan Farina discusses in his work on Charles Dickens's extravagant use of 'as if' to describe character. ''As if' imagines access to foreclosed perspectives', he writes. This 'combination of imaginative, sympathetic speculation and disavowal of speculation' works to 'animate or personify material reality with invisible, inaccessible agency' and is, he argues, the 'fundamental syntax of Dickensian characterization'.[6] We should think of the linguistic use of terms and experiences associated with moving image technologies as a further strategy used to convey and give access to the 'foreclosed perspectives' of characters' psychological experience, perceptions, and cognitive processes.

The shared knowledge between author and reader of the operation and display of devices such as the phenakistiscope and zoetrope allows a particular language to be used that opens up a mental landscape to the reader and supports their imaginative work in constructing an understanding of each character. For example, Dorothea's experiences in Rome, or Hetty's infatuation with Arthur Donnithorne in Eliot's work is seen afresh by paying attention to the use of terms associated with durable impressions and their action

[5] Work on psychology, the history of cognition and its representation in Victorian literature is a flourishing field; see particularly Jenny Bourne Taylor, *In the Secret Theatre of Home: Wilkie Collins, Sensation Narrative, and Nineteenth-Century Psychology* (London and New York: Routledge, 1988); Sally Shuttleworth, *Charlotte Brontë and Victorian Psychology* (Cambridge: Cambridge University Press, 1996); Rick Rylance, *Victorian Psychology and British Culture 1850-1888* (Oxford: Oxford University Press, 2000); Nicholas Dames, *The Physiology of the Novel: Reading, Neural Science, and the Form of Victorian Fiction* (Oxford: Oxford University Press, 2007); Peter Garratt, *Victorian Empiricism* (Madison: Farleigh Dickinson University Press, 2010); Vanessa Ryan, *Thinking without Thinking in the Victorian Novel* (Baltimore: Johns Hopkins University Press, 2012); Anne Stiles, *Popular Fiction and Brain Science in the Late Nineteenth Century* (Cambridge: Cambridge University Press, 2012).

[6] Jonathan Farina, 'Dickens's 'As if': Analogy and Victorian Virtual Reality', *Victorian Studies* 53.3 (Spring 2011), 427-436 (p. 429).

upon physiological functioning; likewise, the short passage in Dickens's *Dombey and Son* (1846-8) describing Captain Cuttle's worry about his missing friend Sol Gils gains new depth when we read how affecting Sol's mysteriously sealed letter is not simply upon Cuttle's psychology but upon the fibres of his eye. Reading the representational strategies at play in these works in relation to physiological theories of persisting impressions or revolving, repetitious images gives us new insight into the operation of characters' minds and the importance of particular memories, and importantly allows us to understand cognition as a dynamic process: moving images allow minds to be imagined in action, as sensitive, responsive systems which are constantly reacting to external and internal stimulus—and indeed re-reacting, as this chapter goes on to show.

Temporal Afterimages

In 1823, the Czech physiologist Jan Evangelista Purkyně used the term 'afterimage' to describe the visual trace which appeared to remain perceptually present to the eye even after its external referent had passed out of view.[7] These illusive but persisting images were significant to studies of sensory perception and the connections between eye and brain, matter and memory. As Daniel Pick comments, they 'undoubtedly bore witness to something; but what? If it was a verifiable experience, it was not simply the record of present stimulus. It brought into focus the temporal aspect of observation and the ambiguous relationship of external and internal processes'.[8]

In the early nineteenth century, a growing body of scientific work was addressing the physiology of vision and investigating the physical makeup of the eye itself, advancing previous work which had given focus to the external transmission of light. Retinal afterimages were central to these studies for their presentation of 'an optical experience

[7] Nicholas Wade, *A Natural History of Vision* (Cambridge, Mass.: MIT Press, 1998), p. 159.
[8] Daniel Pick, 'Stories of the Eye', in *Rewriting the Self*, ed. by Roy Porter (London: Routledge, 1996), pp. 186-202 (p. 188).

that was produced by and within the subject' which, as Jonathan Crary notes, 'allowed one to conceive of sensory perception as cut from any necessary link with an external referent'.[9] Fundamental to this burgeoning field of optical research was the manipulation of stimuli and subsequent measurement of sensory response—investigations which were both enabled by and publicly demonstrable through new technological mechanisms.[10] New instruments and methods enabled the testing and measurement of visual temporality and persisting images, and the increasingly experimental nature of the research being undertaken allowed the eye to be manipulated in response to controlled stimuli: it was possible to see the process of seeing, and to quantify perceptual reaction in a way not before appreciated.[11]

In Nicholas Wade's estimation, the third decade of the nineteenth century firmly marked the shift from an observational to an experimental optics in which stimulus control, behavioural measurement, and mechanical instruments were increasingly used to explore and assess the functioning of visual perception.[12] Such investigations often methodologically relied upon self-experimentation and led to new understandings of subjective states and responses. Jutta Schickore's excellent work on German and British

[9] Jonathan Crary, *Techniques of the Observer* (1990; Cambridge, Mass.: MIT Press, 1992), p. 98.
[10] The origins of sensory measurement were of course found much earlier than the nineteenth century. Work by the English scientist Francis Glisson in 1672 on irritability of the nerves was followed by Albrecht von Haller and Théophile Bordeu who saw the body as an 'organic interior'—in contrast to earlier explanations of the body as a rigid mechanical system operating under causal laws—which 'possessed dynamic forces and impulses', was energetic, and whose continuous activity was driven by a network of highly sensitive nerve and muscle fibres (Sergio Moravia, 'From Homme Machine to Homme Sensible: Changing Eighteenth-Century Models of Man's Image', *Journal of the History of Ideas* 39.1 (1978), 45-60 (pp. 58-59)). For further on this, see Theodore M. Brown, 'From Mechanism to Vitalism in Eighteenth-Century Physiology', *Journal of the History of Biology* 7.2 (1974), 179-216; Karl M. Figlio, 'Theories of Perception and the Physiology of Mind in the Late Eighteenth Century', *History of Science*, 13 (1975), 177-212; Paul Goring, *The Rhetoric of Sensibility in Eighteenth-Century Culture* (Cambridge: Cambridge University Press, 2005); Stephen Gaukroger, *The Collapse of Mechanism and the Rise of Sensibility: Science and the Shaping of Modernity, 1680-1760* (Oxford: Oxford University Press, 2010); and Ildiko Csengei, *Sympathy, Sensibility and the Literature of Feeling in the Eighteenth Century* (Basingstoke: Palgrave Macmillan, 2012).
[11] Crary contends that 'the introduction of temporality as an inescapable component of observation' was equally important to the study of afterimages in this period, linking the body, observation, and temporality as inseparable components of the same subjective process. *Techniques*, p. 98.
[12] Wade, *A Natural History of Vision*, p. 4.

traditions of scientific investigation shows that although there were many 'significant' differences in approach, both shared common 'epistemological concerns': to 'establish the nature and reliability of knowledge acquisition in experience'.[13] 'Sensory physiology […] falls squarely into the domain of this reflexive enterprise of self-understanding', Schickore writes, which through a reliance on self-experimentation aimed to shed light on 'the causal relations between the stimuli and the organic responses'.[14] Focusing on the work of Purkyně and Johannes Müller, her study makes the point that their experimentations have often been misleadingly labelled as 'subjective sensory physiology' whereas what was most significant was their elucidation of 'the relation between sensations and their objective causes'. Importance was placed not simply on how the human sensory system operated but how it *reacted* to external phenomena: studying the interaction with and effect of objective stimuli was the key aim. 'The experiments were to link introspectively experienced sensations with the conditions that brought them about', Schickore argues.[15] Effect was studied over internal operation, and thus it became increasingly important to be able to accurately manipulate and measure subjective responses as this provided previously unavailable data on the impact of external stimuli on the body's sensory systems.

One new category of instrument which enabled the manipulation and measurement of visual operation were those technologies broadly referred to as persistence of vision devices. They were invented in part as a way to investigate and publically demonstrate the afterimages Purkyně had named, and the resulting cognitive composition of multiple images into one animation, but their history is also entwined with developments in the experimental investigation of physics, particularly through figures such as P.M. Roget,

[13] Jutta Schickore, 'Misperception, Illusion, and Epistemological Optimism: Vision Studies in Early Nineteenth-Century Britain and Germany', *British Journal for the History of Science* 39.3 (Sept 2006), 383-405 (p. 384).
[14] Schickore, 'Misperception, Illusion, and Epistemological Optimism', pp. 386-388.
[15] Schickore, 'Misperception, Illusion, and Epistemological Optimism', p. 389.

Joseph Plateau, Michael Faraday, and Charles Wheatstone, as this chapter goes on to explain.[16] Such technology saw perception fused more appreciably with cognition; as Wade and Dieter Heller write, 'It could be said that the development of sensory physiology and experimental psychology was as dependent on these devices as biology had been upon the microscope'.[17] New instruments such as the stereoscope, chronoscope, and stroboscope (and indeed the variety of other 'scopes common to the stroboscope which relied upon the persistence of vision) experimented with the manipulation of sensory response to controlled stimuli and could quantify reaction in a way not before appreciated, and make visible and measure miniscule intervals of time and fractional movements through space. Wade and Heller continue that

> Up until this time, psychology was lacking the equivalent of the biologists' specimen collection. That is, there existed a body of observations concerning phenomena that could be experienced in the natural environment, but there was little in the way of controlling or manipulating the conditions under which they could be seen. The various scopes made this possible. […] Psychology started to collect its specimens, as biology had done at an earlier period.[18]

The Victorian study of optics was particularly marked by its use of technological instruments for both the investigation of phenomena and the simultaneous gathering of data, or 'specimens', which helped underpin new theories about the increasingly physiological and indeed psychological operations of perception (the combination of the optical and the mental, exemplified in the opening of *Adam Bede*, discussed above). Technologies like the thaumatrope, zoetrope, and phenakistiscope revealed aspects of

[16] That persistence of vision was not, therefore, confined simply to one branch of scientific investigation—that of optical research—meant that knowledge about its operation and the devices by which one might experience durable images was fairly widespread in a public marketplace eager to display, promote, and discover the latest scientific and technological advances (especially those which had a spectacular appeal). For a good overview of popular science see Iwan Rhys Morus, *When Physics Became King* (Chicago: University of Chicago Press, 2005) and *Science in the Marketplace: Nineteenth-Century Sites and Experiences*, ed. by Aileen Fyfe and Bernard Lightman (Chicago: University of Chicago Press, 2007).

[17] Nicholas Wade and Dieter Heller, 'Scopes of Perception: The Experimental Manipulation of Space and Time', *Psychological Research* 60 (1997), 227-237 (p. 228).

[18] Wade and Heller, 'Scopes of Perception', p. 235.

visual experience not sensible to unmediated perception. They worked by the manual operation of a disk, or drum, lined with successive images which, when spun and seen through a series of equally rotating apertures, presented an animated, repetitive sequence which gave the illusion of motion occurring upon a single spot. Along with being popular optical toys, they allowed for the investigation, manipulation, and demonstration of a key principle of visual perception: the duration of impressions and subsequent apprehension of moving images through time and space.

Experiment and Display: The Technologies of Visual Persistence

The phenomena of visual impressions appearing to linger as active perceptions after their external referent had disappeared has been discussed in writings on optics since antiquity. Anecdotes from Aristotle and Seneca describe seeing a shooting star with a burning tail streaming behind, and Alhazan and Isaac Newton both wrote on the example of a flaming stick which, when spun quickly, gave the appearance of a glowing circle of fire: 'looking at such a flame', Alhazan wrote, 'will find it extended through the interval along which it moves, which interval will be many times larger than the flame's magnitude. For sight can perceive an object's size or position or motion only after a measurable interval of time'.[19] Here Alhazen notes not just the phenomena of visual persistence but the possibility that this might be temporally quantified, that it might be possible to measure the time difference between when the object is presented to sight and when its image finally leaves one's perception. In an early attempt to make a precise measurement of this effect, the physicist Chevalier D'Arcy constructed a machine with rotating arms, to which were affixed glowing coals.[20] His experiments in the 1760s attempted to calculate the duration of visual persistence by measuring the velocity of the spinning coal but his crude

[19] A. I. Sabra, *Theories of Light from Descartes to Newton* (London: Oldbourne, 1967), p. 348. See also Chapter Four of Wade, *A Natural History of Vision* for relevant extracts, especially pp. 194-200.
[20] Wade and Heller, 'Scopes of Perception', p. 230.

method did not offer any consistent or detailed results. It was not until the early nineteenth century when a number of physicists and physiologists across Europe, building on such work, were able to produce the theoretical and experimental conditions and technological devices by which more accurate measurements of durable images could be made.[21]

In a paper published in 1825 but first read in 1824, P. M. Roget described what he termed the 'curious optical deception' which occurred when viewing the rotating spokes of a wheel through vertical apertures. Looking through the vertical slats on a window blind at a carriage rolling past, he noted that the wheel's spokes appeared curved instead of straight. Although puzzled by 'the difficulty of detecting its real cause', this illusion was 'irresistible' and 'exceedingly striking'.[22]

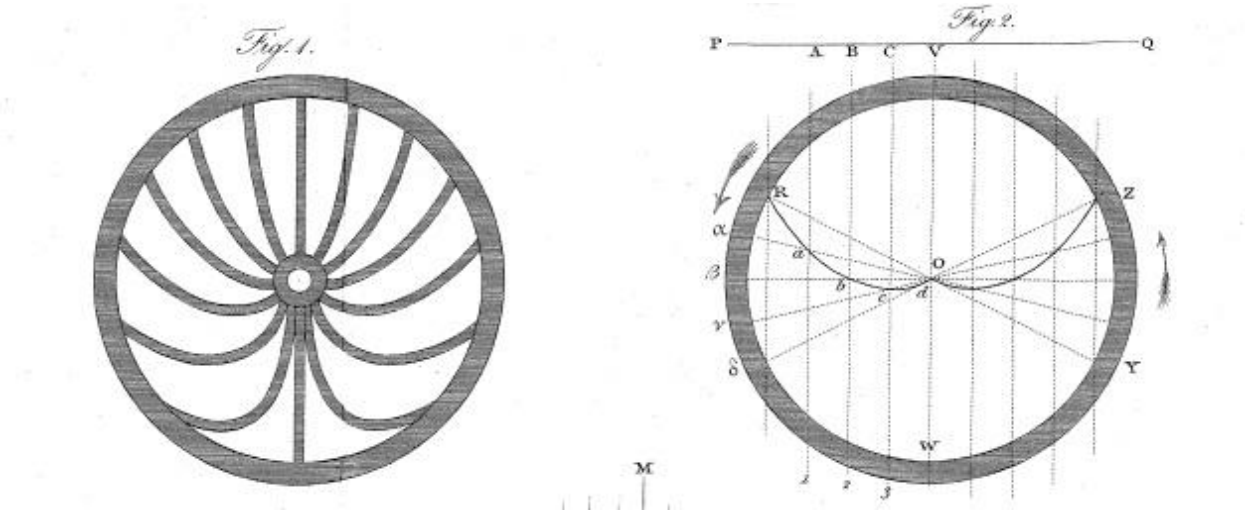

Figure 20. Roget's illustration of the curved spoke phenomena. 'Explanation of an optical deception', p. 141.

In observing this phenomenon, Roget realized that when viewed without the apertures of the vertical window blinds, the wheel appeared to simply rotate and its moving spokes were seen as they appear when stationary—as straight lines. Viewed through the blinds

[21] See Jimena Canales, *A Tenth of a Second: A History* (Chicago: The University of Chicago Press, 2009) for a particular focus on the psychophysical measurement of reaction time, lag, and the temporality of cognition in the nineteenth century. Chapter 5, on photographic capture and the development of cinematography, provides an especially pertinent background to this thesis chapter.
[22] P. M. Roget, 'Explanation of an optical deception in the appearance of the spokes of a wheel seen through vertical apertures', *Philosophical Transactions of the Royal Society of London* 115 (1825), 131-142 (p. 131).

however, the apertures cut into this smooth perception. As each partial visual impression (seen through each gap in the blind) persisted to the eye, this caused each block, or frame, of perception to be remade into a new collaged entity, thus producing the visual perception that the spokes were blurring into each other and appearing as curved lines. What the eye was actually seeing when it looked at the wheel through vertical apertures was a combined animation of different parts of the spokes joined together. As Roget explained, 'the deception in the appearance of the spokes must arise from the circumstances of separate parts only of each spoke being seen at the same moment; the remaining parts being concealed from view by the [vertical] bars. The portions of one spoke, thus seen separately, might possibly connect themselves with portions of the two adjoining spokes, and so on, forming by their union a curved image made up on parts from different successive spokes'.[23]

Roget undertook further research on this phenomenon. He experimented with a disc in place of a carriage wheel, and made a single straight mark upon the disc. When set to rotate and seen through vertical apertures, a further 'curious deception' occurred: the single mark appeared numerous, as if the disc was illustrated with a number of lines, 'their number being determined by that of the bars [of the window blind] which intervene between the wheel and the eye'. This led Roget to speculate that 'several portions of one and the same line, seen through the intervals of the bars, form on the retina the images of so many different radii': the image of the single mark was persisting to the observer's vision and as the disc continued to rotate behind the apertures new impressions were continually made, leading to the illusion of many marks being present upon the disc. Roget makes the connection here to the known phenomenon described above of a lit coal spun in a circle presenting as single continuous line of light—'namely, that an impression

[23] Roget, 'Explanation of an optical deception', pp. 134-135.

made by a pencil of rays on the retina, if sufficiently vivid, will remain for a certain time after the cause has ceased'—and, with reference to the initial carriage wheel illusion, explains that 'if the impressions made by these limited portions of the several spokes follow one another with sufficient rapidity, they will, as in the case of the luminous circle [...], leave in the eye the trace of a continuous curved line; and the spokes will appear to be curved, instead of straight'.[24]

Roget realized his 'optical deception' might offer a way to more accurately measure the duration of retinal impressions initially attempted by D'Arcy. He ended his article with the observation that 'The velocity of the apparent motion of the visible portions of the spokes is proportionate to the velocity of the wheel itself; but it varies in different parts of the curve: and might, therefore, if accurately estimated, furnish new modes of measuring the duration of the impressions of light upon the retina'.[25] Later work relied upon Roget's initial investigations and developed further techniques to experiment on and measure the processes of motion perception, and in doing so opened the study of this aspect of optics to a broader public fascinated to learn of the physiological science behind this apparent 'deception' of the eye through technological apparatus.

Chitra Ramalingam's work on early nineteenth-century science's fascination with 'fixing transience' in order to better analyse seemingly invisible phenomena such as electricity, light rays, and acoustic vibrations sheds light on the overlapping histories of optics, technology, science, and spectacle during this period.[26] She describes that 'for the first time, scientists sought to see, represent, and analyse what occurred in tiny intervals of time. The central problem was how to take the flickering spectacle of moving reality and

[24] Roget, 'Explanation of an optical deception', pp. 135-136.
[25] Roget, 'Explanation of an optical deception', p. 140.
[26] Chitra Ramalingam, 'Fixing Transience: Photography and other Images of Time in 1830s London', in *Time and Photography*, ed. by Jan Baetens, Alexander Streitberger, and Hilde van Gelder (Leuven: Leuven University Press, 2010), pp. 3-26 (p. 3). See also Soraya de Chadarevian, 'Graphical method and discipline: self-recording instruments in nineteenth-century physiology', *Studies in the History of Philosophy of Science* 24.2 (1993), 267-291.

turn it into a static record for sober and steady analysis; that is, how to take movement and turn it into an image', to make a dynamic event 'leave behind a fixed trace on a sensitive surface, through its action in time'.[27] In the process of breaking down and visibly capturing individual and minute spatiotemporal movements, mechanisms were invented which also allowed these same static images to be re-animated into displays of moving images. These investigations were being undertaken by two physicists working closely together during the 1820s and 1830s, Michael Faraday and Charles Wheatstone. Their aim was to reveal to the eye the structure of normally invisible energies and to understand how the forces of electricity, magnetic fields, and optical and acoustic vibrations acted upon and through matter. To do this, they needed to devise a way to mimic visual perception in order to better understand how the eye registers movement in the visual field. Ramalingam writes that Faraday 'had begun to suspect that events that seemed to the eye to begin and end at the same moment might actually take some imperceptible but very real amount of time' and set about investigating 'their hidden temporal structure'.[28] In particular, he was experimenting with the electric spark and trying to ascertain whether the spark was a continuous line of electricity or a series of intermittent jolts which only *appeared* to the eye to travel as an unbroken force.[29] This led he and Wheatstone to create and experiment with various mechanisms premised on current understandings of optics: driven in part by Roget's recent and notable publication, the phenomenon of durable of visual impressions was particularly useful to their research.

Faraday and Wheatstone worked on two imaging practices—dust figures and retinal afterimages—before turning to the newly discovered techniques of William Fox Talbot's light-sensitive chemical emulsion for fixing transient images as a photograph to

[27] Ramalingam, 'Fixing Transience', pp. 3-4.
[28] Ramalingam, 'Fixing Transience', p. 7.
[29] See also Ramalingam's unpublished thesis, *A Science of Appearances: Vision, Visualization, and Experimental Physics in Victorian England* (Cambridge, Mass.: Harvard University, 2009) which takes the visualization of the electric spark as its central focus.

understand how force moved through space and in time. Dust figures (made by layering sand on a flat surface, a technique first used by Ernest Chladni in the eighteenth century) were useful for representing the effects of electrical sparks or acoustic vibrations. The sand moved into particular patterns of straight or curved lines and heaped arrangements depending on the strength and longevity of each spark or vibration. As Ramalingam writes, 'Although the event which caused it was a slippery dynamic phenomenon which unfolded through time, what the dust figure left behind was a static, spatial pattern, and could be examined at leisure. It could also be reproduced and disseminated on paper through drawings and engravings'.[30] A crucial finding of these experiments which would impact upon understandings of visual perception was that the sand did not simply form a stable pattern but rather was continuously moving, being made and remade into new configurations—it was just that the human eye was not able to perceive these minute and swift movements. Faraday explained that 'the heaps were not constant, but were raised and destroyed with each vibration of the plate'.[31] He emphasized in his notes that the changes in the heaped dust particles 'occur in such rapid succession that the eye cannot distinguish them'.[32] Their stasis was just an appearance, belying an environment of constant dynamism and change (a finding which impacted upon their study of the movement of force, particularly of the electric spark). Crucially, Faraday was able to visualize these movements by injecting dark smoke into the air or covering the sand in oily water: the

[30] Ramalingam, 'Fixing Transience', p. 6.
[31] Michael Faraday, 'On a Peculiar Class of Acoustic Figures, and on Certain Forms Assumed by Groups of Particles upon Vibrating Elastic Surfaces', *Philosophical Transactions* (1831), 299-340 (p. 328).
[32] Michael Faraday, *Faraday's Diary: Being the Various Philosophical Notes of Experimental Investigation Made by Michael Faraday*, ed. by T. Martin, 7 vols (London, 1932), I: 333, qtd. in Ryan Tweeny, 'Stopping Time: Faraday and the Scientific Creation of Perceptual Order', *Physis* 29 (1992), 149-164, p. 155. Seneca had much earlier made a similar observation on the bright tails of shooting stars: 'Our sight does not discern their passing but believes the entire path is on fire wherever they fly. The speed of their transit is so great that its stages are not observable. Only the movement as a whole is grasped […] because the slowness of our vision does not follow the successive instants of its flight but sees at the same instant where it started and where it ended'. Erasmus Darwin too wrote on this phenomena with a close attention to how light persists in our perception with such a duration that the lowering of the eyelid does not affect our perception of daylight: 'So we many times in an hour cover our eye-balls with our eye-lids without perceiving that we are in the dark; […] in this case the muscular motion of the eye-lid is performed quicker than the perception of light can be changed for that of darkness'. See Wade, *A Natural History of Vision*, p. 194, 196.

sand movements made the smoky air appear as ever-moving coils and the oiled water showed visible currents.[33]

Working alongside Faraday, Wheatstone realized that the optical phenomena of durable retinal impressions, or afterimages, would greatly assist this research, as it 'enable[s] us to submit to inspection' events which were normally invisible to the unaided eye.[34] Wheatstone's interest in the science of optics, in particular persisting visual effects, and desire to form 'a more complete theory of vision' led him to translate, abridge, and publish the work of European and particularly German physiologists and natural philosophers which, he claims, 'have been hitherto locked up in the repositories of foreign scientific literature' and had gone 'entirely unnoticed' in the British study of optics. Two essays published in the early 1830s set out, amongst his own research, excerpts from the work of Purkyně, Johann Wolfgang von Goethe, Müller, and Joseph Plateau.[35] All studied the durability of visual impressions, ocular physiology, and the perception of motion—subjects which were increasingly becoming critical areas of research for Faraday and Wheatstone. Many of the investigations undertaken were dependent on mechanisms which could visually display the phenomena under study: where Faraday used the Chladni dust figures, Purkyně had been experimenting on durable impressions using the undulations of liquid on a sounding plate as his illustrative method.

[33] Ramalingam, 'Fixing Transience', p. 9.
[34] Charles Wheatstone, 'Description of the kaleidophone, or phonic kaleidoscope; A new philosophical toy, for the illustration of several interesting and amusing acoustic and optical phenomena', *Quarterly Journal of Science, Literature, and Art*, 23 (1827), 344-351, in Wade, *Brewster and Wheatstone on Vision*, pp. 205-212 (p. 211.
[35] Charles Wheatstone, 'Contributions to the Physiology of Vision, no. I', *Journal of the Royal Institution* 1 (1830), 101-117, in Nicholas Wade, ed., *Brewster and Wheatstone on Vision* (London: Academic Press, 1963), pp. 248-62 (p. 249). See also 'Contributions to the Physiology of Vision, no. II', *Journal of the Royal Institution* 1 (1831), 534-537, in Nicholas Wade, ed., *Brewster and Wheatstone on Vision* (London: Academic Press, 1963), pp. 262-4.

Wheatstone's 'kaleidophone' provided another method.[36] It was able to visualize different vibratory waves of sound, and thus 'renders obvious to the common observer what has hitherto been confined to the calculations of the mathematician'.[37] Wheatstone attached variously sized rods to a circular board and placed a luminous glass bead on top of each rod. When the rods vibrated due to low- or high-pitched sounds, 'the entire track of each orbit is rendered simultaneously visible by causing it to be delineated by a brilliantly luminous point, and the figure being completed in less time that the duration of the visual impression, the whole orbit appears as a continuous line of light'.[38] Like Faraday's heaped dust piles and the electric spark, the eye was unable to distinguish the beginning and end of such a miniscule movement through space and time and instead saw a continuous image of either a static dust heap or a continuous line drawn by light.

Roget and Wheatstone's publications on the optical phenomenon of durable visual impressions offered a context in which to further explore the visualization of seemingly invisible and transient forces, and led Faraday to work closely on this aspect of perception. He published an essay in 1831 on what he termed this 'peculiar class of optical deceptions' and, in collaboration with Wheatstone, lectured on this topic at the Royal Institution.[39] His essay begins with an anecdotal experience of observing large cogged wheels rotating at a lead mill, appealing to his readership with the relevance and everyday occurrence of visual persistence. Watching the wheels, Faraday relates that if a single

[36] Thomas Young had earlier performed a similar experiment in which wire wrapped around a piano string and placed in direct sunlight would track and make clearly visible the vibration of the string. See Young's 'Outline of experiments and enquiries respecting sound and light', *Philosophical Transactions of the Royal Society of London* 90 (1800), 87-112.

[37] Wheatstone, 'Description of the kaleidophone', p. 205. See Shelley Trower's *Senses of Vibration: A History of the Pleasure and Pain of Sound* (London: Continuum, 2012) for an excellent history of vibratory technologies and the range of sensory, and physiological, response.

[38] Wheatstone, 'Description of the kaleidophone', p. 206.

[39] Ramalingam, *A Science of Appearances*, pp. 74-88. Their 'Friday Evening Discourses' communicated and promoted new scientific findings to a wider audience than the readers of elite scientific publications, and made generous use of spectacle and demonstration techniques to investigate the visualization of auditory vibrations and electrical force. For further on Faraday at the Royal Institution see Chapter 1 of Iwan Rhys Morus, *Frankenstein's Children: Electricity, Exhibition, and Experiment in Early-Nineteenth-Century London* (Princeton: Princeton University Press, 1998), pp. 13-42.

wheel is seen moving, the cogs appear blurred, yet if one wheel is rotating immediately in front of another, the cogs appeared stationary. When 'visually superimposed, there appeared a fixed wheel', Faraday writes.[40] As per Roget's earlier experimental observation of the curved spokes, if intermittent obstacles were placed between the moving object and the observer (in Roget's case the vertical blind slats, in Faraday's the front-most cogged wheel), the individual and successive impressions appeared to persist upon the retina and fused into a new, illusory image.

Although Faraday was making new discoveries about the hidden life of matter and force,[41] it was almost impossible to fully explain his findings simply in published writing. As Ramalingam explains, 'There was a constant tension between Faraday's mode of representation and its referent. His papers were accompanied by static images of the [dust] patterns, but his goal was to show that these images of seemingly enduring static structure actually marked a dynamic and complex movement, with a repeating temporal microstructure'.[42] Faraday needed to find a way to demonstrate his findings using real-life examples of minute movements, and so devised a small-scale replica of the cogged wheels he had seen in operation at the lead mill. This enabled him to bring his findings to life, and demonstrated the impact of visual persistence on the perception of motion in a far more effective way than diagrams or illustration. Faraday encouraged readers to build their own mechanism for seeing this phenomenon (see fig. 21), acknowledging that ocular experiment was likely to better convey his findings than reading a description: 'All these effects may be simply exhibited by cutting out two equal pasteboard wheels without rims,

[40] Michael Faraday, 'On a Peculiar Class of Optical Deceptions', *Journal of the Royal Institution of Great Britain*, 1.2 (February 1831), 205-223 (p. 210).
[41] Around the same time, the Danish physicist Hans Christian Ørsted was also using the Chladni technique of creating dust patterns to study the relationship between sound, light, and electrical waves and magnetic fields and he, along with Faraday, made extremely important discoveries about electromagnetism from this research. See Chapter 21 of Dan Ch. Christensen, *Hans Christian Ørsted: Reading Nature's Mind* (Oxford: Oxford University Press, 2013).
[42] Ramalingam, 'Fixing Transience', p. 10.

passing a pin as an axis through each [...]. The varied appearances produced by varying the motion of the wheel and grate, both in direction and velocity, will be better understood from a few easy experiments than from any description'.[43]

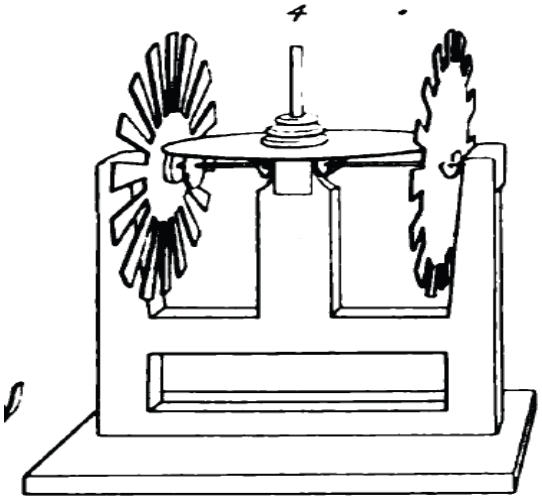

Figure 21. Faraday's cogged wheel device. 'On a Peculiar Class of Optical Deceptions', p. 1.

Beyond simply reciting his findings, in his lectures Faraday actively illustrated the phenomenon of persisting visual impressions with operational displays of large-scale mechanical models (such as the cogged wheel device), simultaneously explaining and exhibiting his experimental research.[44] He was even able to project the rotating wheels and their effects onto a large screen.[45] The *Literary Gazette* reported that 'Mr. Faraday availed himself of a magic lantern, for the purpose of shewing a series of deceptions, as produced by shadows', making his lectures a spectacular display of showmanship and blending his scientific investigations with the world of optical shows and performances.[46] This was further supported by the availability of smaller models which the audience were encouraged to try for themselves after the lecture, much as the large metropolitan venues of popular science exhibited mechanical contrivances for the consultation of their visitors:

[43] Faraday, 'On a Peculiar Class of Optical Deceptions', p. 216.
[44] For a good overview of these lectures, see Ramalingam, *A Science of Appearances*, pp. 79-85.
[45] Faraday, 'On a Peculiar Class of Optical Deceptions', p. 219.
[46] 'Royal Institution', *The Literary Gazette: A Weekly Journal of Literature, Science, and the Fine Arts* 732 (29 January 1831), 74-75 (p. 74).

one review comments that 'upon the table and in the library were other kinds of wheels and forms, some marked with dark lines, some coloured, and all tending to produce variations of the appearance. […] We anticipate that a very popular and philosophical toy will be produced upon these phenomena'.[47] The reviewer was correct in their prediction: instruments similar to those displayed after Faraday's lecture began to be used to more thoroughly investigate visual perception whilst also being developed as philosophical toys by optical commodity manufacturers, as the phenomenon of creating and understanding animated images using the technical manipulation of persisting retinal afterimages became an increasingly popular pastime and fruitful area of scientific study.

Hand-Held Optical Commodities

One of the first such instruments was the thaumatrope. Although its inventor is debated (Roget and Sir John Herschel are often named),[48] it was fully described and popularized by John Ayrton Paris in his 1827 book, *Philosophy in Sport Made Science in Earnest*, which sought to explain various scientific discoveries and inventions through the fictional narrative of a Mr. Seymour. In Chapter Eighteen, Seymour gives the young boy Tom a lesson in natural philosophy using the thaumatrope to demonstrate how the eye might be subject to optical trickery. Briefly offering a background on persistence of vision, Seymour describes the device as a 'wonder turner' and exhibits it in operation using various round cards on which are printed, front and back, half of an illustration: one side might show a cage, and the other a bird; a laughing face swiftly becomes a weeping one, and so on.[49]

[47] 'Royal Institution', p. 75.
[48] See Tom Gunning, 'Hand and Eye: Excavating a New Technology of the Image in the Victorian Era', *Victorian Studies* 54.3 (Spring 2012), 495-515 (pp. 498-499).
[49] John Ayrton Paris, *Philosophy in sport made science in earnest: being an attempt to illustrate the first principles of natural philosophy by the aid of the popular toys and sports* (London, 1827), pp. 337-354.

Figure 22. Mr. Seymour demonstrating the thaumatrope. Paris, *Philosophy in Sport*, p. 337.

Writing on the thaumatrope as an important example of a 'fabricated' image, Crary asserts that it made clear 'the rupture between perception and object': users made and observed an image which did not exist anywhere in reality.[50] These are issues I explore further in Chapter Five, when I address the physical manipulation of optical devices and their unique presentation of an image which has no physical, tangible existence—what Tom Gunning has recently called the first 'technological image'.[51]

More sophisticated devices were manufactured in the 1830s which incorporated apertures (using the method of Roget's vertical blind) and were able to offer a fully animated sequence, rather than the simply combined image of the thaumatrope.[52] Inspired by Roget and Faraday's findings, in 1832 a Belgian physicist, Joseph Plateau, created what he would later term the phenakistiscope which made use of a similar arrangement to that of Faraday's cogged wheels.[53] Plateau had the chance to examine Faraday's device in Brussels and was struck by the illusion of the back cog appearing stationary even though

[50] Crary, *Techniques*, p. 106.
[51] Gunning, Hand and Eye', p. 498.
[52] For an overview, see Laurent Mannoni, *The Great Art of Light and Shadow: Archaeology of the Cinema* (Exeter: University of Exeter Press, 2000), pp. 201-247.
[53] At the same time Plateau was developing his device, the Austrian scientist Simon Stampfer was independently, also following the research of Roget and Faraday, devising his own 'stroboscopic discs' on much the same principle.

both were being quickly spun. Reasoning first that it would be more entertaining to have an illustrated figure or object on the cog, he then drew on the phenomena of persisting afterimages to create a much more sophisticated mechanism which could not only display illustrations but was able to perceptually animate whole sequences:

> If, in place of only having identical figures, we arrange it such that in following the series of figures, they pass gradually from one form or position to another, it is clear that each of the sectors, whose image in the mirror successively occupies the same place in relation to the eye, will carry a figure which differs slightly from that which preceded it; such that, if the speed is great enough for all these successive impressions to join up with each other and not so great that they become confused, one will believe that one sees each little figure gradually changing.[54]

Plateau's resulting device made use of two discs joined on a spindle, with one containing a small number of apertures (often twelve to sixteen) cut into the outer circumference, and the other containing a similar number of individual illustrations depicting a sequence of movement—a game of leapfrog, or couples dancing, for example (see fig. 24).

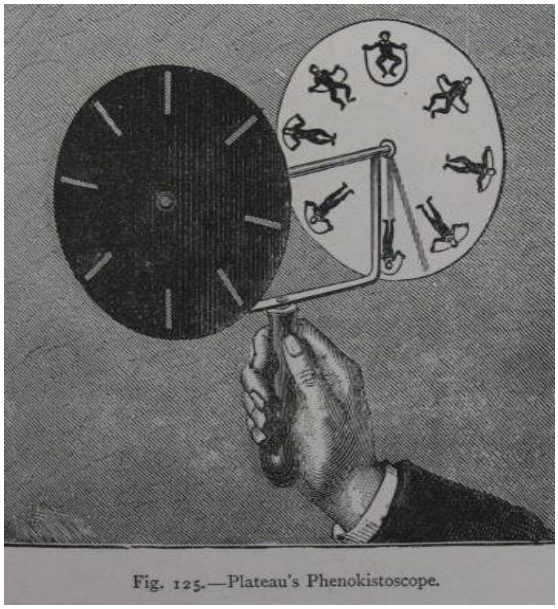

Figure 23. The phenakistiscope. Gaston Tissandier, *Popular Scientific Recreations* (London: Ward, Lock and Co, n.d. [c.1880]), p. 123. The Bill Douglas Cinema Museum, University of Exeter, UK. Item number 42637.

[54] Joseph Plateau, 'Sur un Nouveau Genre d'Illusions d'Optique', *Correspondance Mathématique et Physique* 6 (Brussels, 1833), pp. 365-368, qtd. in Mannoni, *The Great Art*, p. 215.

When viewed in reflection using a mirror, users would see the figures appear animated. 'One sees with surprise', Plateau comments, 'all these little dancers turning around, with the direction of their pirouette depending on the speed and direction of the rotation of the disc'.[55]

Laurent Mannoni's history of cinema describes how Plateau gifted Faraday with a prototype of his phenakistiscope in 1833 at a meeting in London. From here, the device gained popular appeal as it was passed from person to person and was then developed as a commercial gadget by Rudolph Ackermann of 96 The Strand under the names 'phantasmascope' and 'fantascope', alluding to the spectral quality of its illusory animated display.[56] With the basic mechanism were sold multiple discs containing various different subjects, enabling users to swap designs for newer sequences of motion.

Figure 24. Set of five Ackermann fantascope discs, 1833. The National Media Museum, Bradford, UK. Object number 1934-140.

[55] Plateau, 'Sur un Nouveau Genre d'Illusions d'Optique', qtd. in Mannoni, *The Great Art*, p. 216.
[56] Mannoni, *The Great Art*, p. 220.

Advertisements for 'Ackermann and Co.'s Fantoscope, or Optical Delusions' appeared in the local newspapers of Hull, Ipswich, Leicester, Manchester, Oxford, Preston, and in London's *The Morning Chronicle* in 1833. For 12 shillings, one could purchase 'a Series of Cards, which, when revolved before a looking-glass, reflect Figures, Animals, and other objects in full motion, with perfect truth to Nature'. The advert acknowledges this as 'the original invention of Professor Plateau of Brussels, which was exhibited with so much interest at the late British Association [for the Advancement of Science] held in Cambridge', making the device's scientific background a key part of its appeal to purchasers keen to try out the latest, and authentic, developments in scientific technology.[57] A later modification of the phenakistiscope was described in an article published in *The Mechanic's Magazine* (1843). Here, Mr Naylor of Newcastle upon Tyne claimed to be able to project the moving pictures seen through a phenakistiscope disk by combining the technology of this device with the magic lantern (the modification required a glass disk with transparent painted illustrations, instead of the phenakistiscope's usual cardboard discs).[58]

A limitation of the regular, non-projecting phenakistiscope was that it could only be viewed by one person at a time. The zoetrope improved upon this, allowing its illusion of motion to be viewed by many spectators (see fig. 25 for an example). Invented in 1834, the zoetrope was a hollow drum containing small apertures along its top section with a removable strip of sequential images placed at its base. The drum was spun by the hand of the viewer who, when looking into the drum through the apertures, would see the images

[57] *The Manchester Times and Gazette* 5.262 (Saturday October 26 1833), p. 1. Thomas Talbot Bury, a lithographer and architect who worked under August Charles Pugin, published a book of illustrated phenakistiscope discs in 1833 (*Fantascope* (Ackermann and Co, 1833)). His discs were also available to purchase in sets; the National Media Museum, Bradford has three portfolios containing five, six, and eight discs (object numbers 1937-701, 1972-19, and 1954-329 respectively).
[58] T. W. Naylor, letter in *The Mechanic's Magazine* 1027 (15 April 1843), p. 319, qtd. in Mannoni, *The Great Art*, p. 223.

animated into one relatively smooth sequence of movement. Users could buy different strips of illustrations or even create their own.

Figure 25. 'The Wheel of Life Polka', Music Sheet for the Pianoforte by Emile Ettling, Robert Cocks and Co., London. The Bill Douglas Cinema Museum, University of Exeter, UK. Item number 50440.

Figure 26. Victorian zoetropes. The Bill Douglas Cinema Museum, University of Exeter, UK. Item numbers 69010 and 69110.

The device was first developed by the British mathematician William George Horner and described in his article, 'On the Properties of the Daedaleum, a new Instrument of Optical Illusion' (1834). Horner called his creation the 'daedaleum' but it was not commercially manufactured or sold until 1867, when it was renamed the 'zoetrope' by the American developer William Lincoln and sold in Britain by H. G. Clarke and the London Stereoscopic and Photographic Company. Because of its relatively late reintroduction to Britain, most of the discussion and literary quotations which follow in this chapter of revolving, spinning, or whirling disks refer specifically to instruments like the phenakistiscope, which were manufactured and consumed by the public throughout the mid-nineteenth century. However, the zoetrope remains a key device in the history of Victorian persistence of vision, and will be covered briefly here.

Horner's article makes clear the value of his daedaleum over Plateau's phenakistiscope: it offers 'all the interesting illusions of the phantasmascope, but capable of being performed without a mirror or any second instrument, and of being displayed to

unlimited numbers at once'.[59] Citing the investigations and public demonstrations of Roget and Faraday, the device 'has rendered an instructive experiment highly popular', Horner writes.[60] It was through optical commodities such as the thaumatrope, phenakistiscope, and the zoetrope that scientific discoveries about perception were being in turn discovered by a wider public of adults and children alike. A pamphlet by H. G. Clarke advertising the zoetrope illustrates an entire family crowding around the device, keen to see its spectacle, and combines description of its mechanical operation with the underlying scientific principles which produce the perceptual experience of seeing animated images.

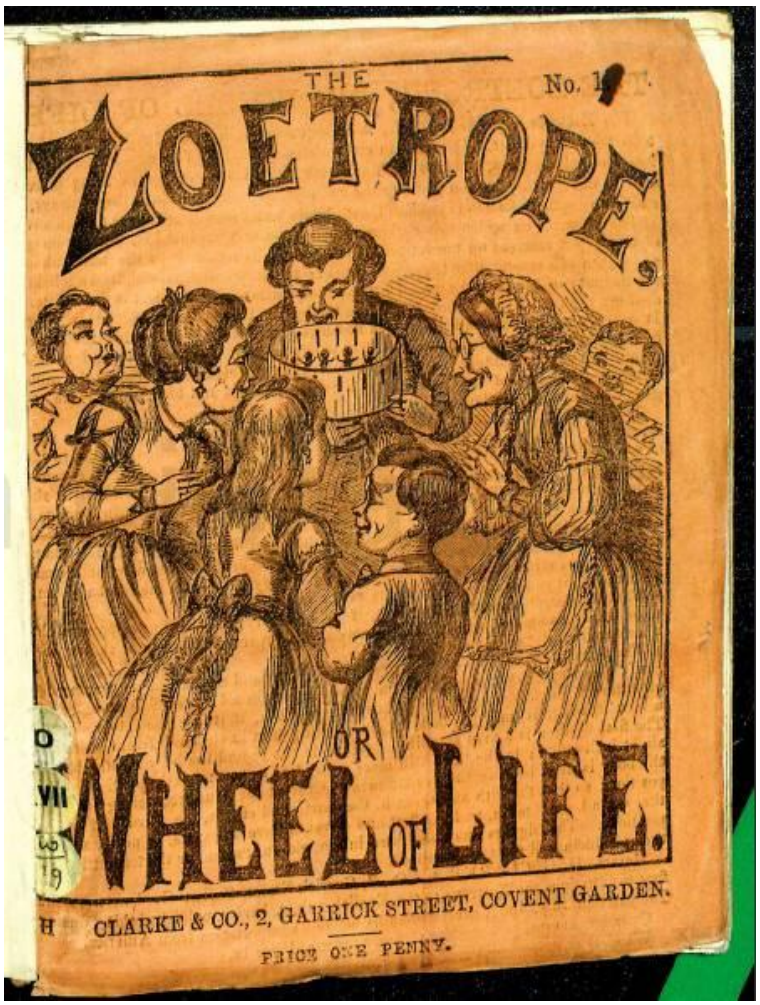

Figure 27. Front cover of H. G. Clarke's pamphlet.

[59] W. G. Horner, 'On the Properties of the Daedaleum, a new Instrument of Optical Illusion', *London and Edinburgh Philosophical Magazine and Journal of Science* 4.19 (January 1834), 36-41 (p. 36-7).
[60] Horner, 'On the Properties of the Daedaleum', p. 36.

It explains that once

> a rotary motion [is] given to the cylinder, on looking through the openings, a surprising optical illusion is produced, each figure being seen in motion as though alive. […] The principle on which this curious optical illusion is produced is, that the image of any object received on the retina, or optic nerve, is retained on the mind about the eighth of a second after the object causing the impression is withdrawn; being the memory of the object, consequently the impression of one object is not obliterated ere the next figure is brought before the eye by the revolution of the cylinder. It is easy to understand from this how the illusion is produced; the figures being drawn in the various attitudes they would assume if in motion, and as the revolution of the cylinder is made in less than the eighth of a second, the mind retains the memory of the image seen between each slit and blends the whole together in apparent motion.[61]

The pamphlet also contains two foldout strips of sequential images which Clarke instructs should be cut out and placed into the drum. Alternatively, as the zoetrope's principle 'is capable of almost endless variety', users are invited to create their own illustrated strips: 'any ingenious person may easily draw for himself a series of humorous figures in all conceivable attitudes, by attending to the following simple instructions:—Thus, if it is wished to represent a man bowing, it may be done by representing him in eleven different attitudes', and when the zoetrope's drum was in operation the separate illustrations would fuse together to form a moving image.[62]

It was not just zoetrope strips which could be homemade to suit individual tastes; a late-Victorian biography of the physicist and mathematician, James Clerk Maxwell, recounts how as a boy he would spend his time designing and creating phenakistiscope discs. During his school years, Maxwell and his older cousin Jemima found scientific optical toys such as the phenakistiscope 'a source of endless amusement' and set about making their own illustrated animations of cows jumping, dogs chasing rats, circus horses

[61] *The Zoetrope, or Wheel of Life* (H. G. Clarke and Co., London [c.1867]), n. p. British Library General Reference Collection 8715.aaaa.45.
[62] *The Zoetrope, or Wheel of Life*, n. p.

with their rider jumping through a hoop, cog-wheels moved by a pendulum, tadpoles swimming away from the centre of the disc, and so on.[63] Maxwell would later set a Cambridge tripos question on the physics of the phenakistiscope, showing that his early enjoyment of its animated display did not wane in adulthood but in fact encouraged a serious engagement with the physics of its operation.[64]

The phenakistiscope remained popular throughout the nineteenth century but the reintroduction of the renamed zoetrope in the 1860s encouraged a further development of hand-held and projecting persistence of vision devices. One such was the praxinoscope, invented by Charles-Émile Reynaud and patented in Britain on 13 November 1877. Mechanically similar to the zoetrope and still utilising the paper strip of illustrations, instead of looking through a series of spinning apertures the praxinoscope drum had a central core of twelve mirrors forming a polygon in which the viewer, once the drum had been spun (by hand, or, after 1880, by electric motor), could see the illustrations smoothly animated. Mannoni emphasizes an interesting aspect of this device: many praxinoscopes allowed the user to secure a candle above the cage of mirrors, enabling it to be used in the dark, anticipating the darkened auditorium of the later cinematic spectacle and the viewing practices still associated today with this type of visual entertainment.[65]

Later modifications to the praxinoscope were Reynaud's 1879 creation of the *praxinoscope-théâtre*, a box in which the praxinoscope could be housed and whose lid contained a cut-out aperture (see fig. 28).

[63] Lewis Campbell and William Garnett, *The Life of James Clerk Maxwell* (London: Macmillan and Co., 1882), p. 37-38.
[64] Iwan Rhys Morus, 'Illuminating Illusions, or the Victorian Art of Seeing Things', *Early Popular Visual Culture* 10.1 (2012), 37-50 (p. 42). Morus also covers in detail the display of persistence of vision devices at venues for the dissemination of popular science.
[65] Mannoni, *The Great Art*, p. 368.

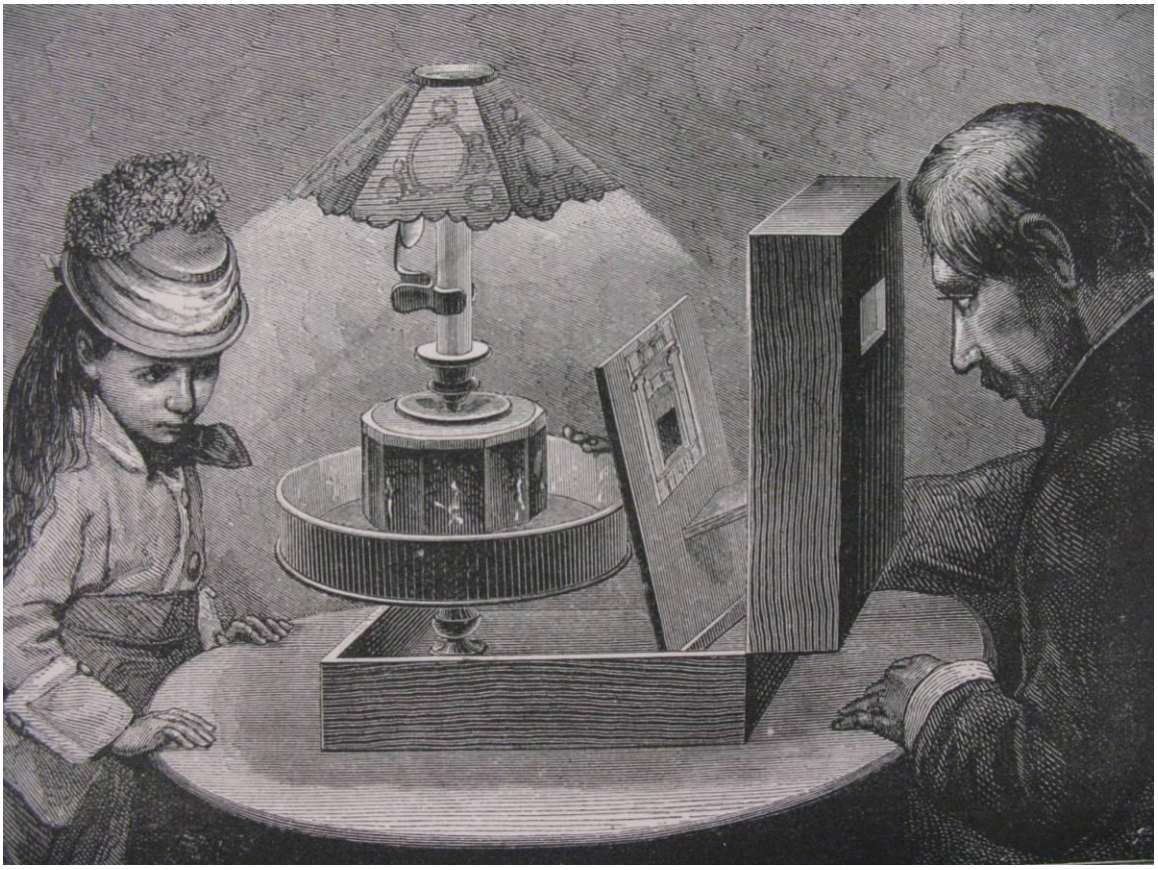

Figure 28. The *praxinoscope-théâtre*. Tissandier, *Popular Scientific Recreations*, p. 127.

Lined up between the lid's aperture and the praxinoscope mirrors was a board which contained the representation of a miniature stage, replete with illustrated curtains and a proscenium arch. Interchangeable illustrated strips provided background scenery, and when looking through the aperture the viewer would see a theatre stage, scenery and inside this the moving pictures of whatever strip was placed inside the praxinoscope, creating a miniature theatrical experience of animated images.

Persistence of vision was also a staple of large-scale optical shows and demonstrations. In an 1872 sketch of the Great Hall of London's Royal Polytechnic Institution (the RPI, discussed in more detail in Chapter One), two very large zoetrope drums can be seen attached to opposite sides of the upper balcony rails. These are labelled with the caption 'WHEEL OF LIFE' and their illustrations are of a series of facial expressions.

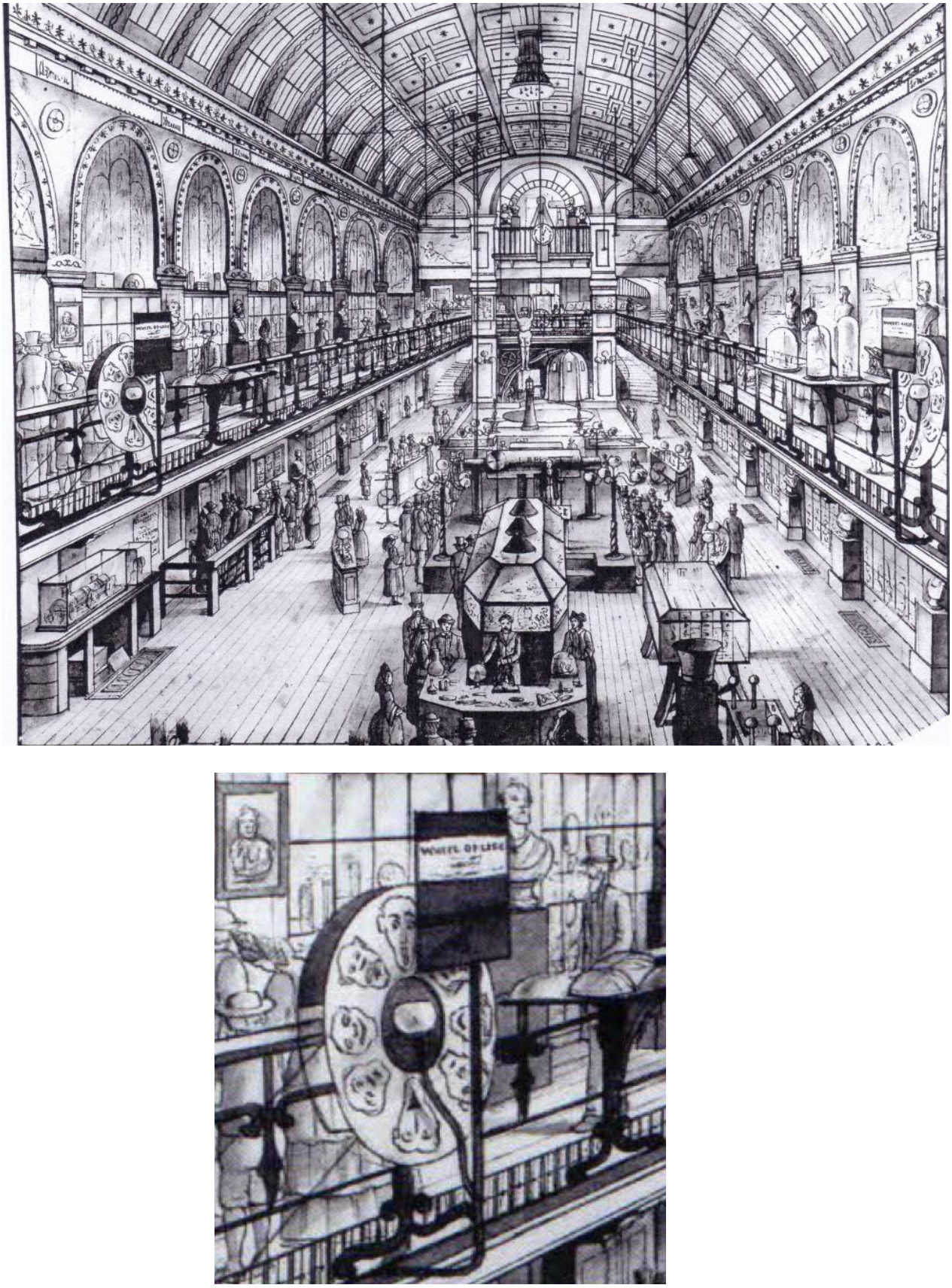

Figure 29. Illustration and detail of the Great Hall, showing the large ‘wheel of life’. A. Cadman, reproduced in Brenda Weeden, *The Education of the Eye: History of the Royal Polytechnic Institution, 1838–1881* (Cambridge: Granta Editions, 2008), p. 95.

An article in *The Figaro* recounts that the 'large Zoetrope' we see on the balcony was actually automatically powered by the steam engine in operation in the Great Hall—this would surely have been quite an exciting prospect compared to the usual smaller, hand-operated devices.[66] Commentary in *Punch* gently mocks the amount of operational technology in the RPI's exhibition hall: 'People of weak nerves should venture very cautiously into the Polytechnic Institution. For, at first entrance, there is such a whirlwind of machinery in full action—wonderful things going up, and coming down, and turning round all at once, that the mere view of them, acting through the retina, might well addle the brains of ordinary visitors'.[67] The RPI hosted a series of lectures through the 1870s by J. L. King on optics (covering particularly 'the refraction of light, dissolving view apparatus, oxyhydrogen microscope, the composition of light, spectrum analysis, persistence of vision, [and] Darker's oxyhydrogen kaleidoscope') during which a phenakistiscope in operation was projected upon the lecture hall's large screen, 'showing all the various and beautiful patterns'.[68]

The phenomenon of persistence of vision was not just appreciated at the level of indulgent spectacle, as King's educational lectures show. John Henry Pepper, the showman-lecturer I discussed in Chapter Two, gave a lecture in 1868 (a year after the zoetrope was popularized in Britain) on Faraday's 'optical experiments with cogged wheels'—this was precisely the experiment outlined in Faraday's essay 'On a Peculiar Class of Optical Deceptions' and the subject of his broader research into the physics of movement and physiological optics. During the lecture, Pepper demonstrated the

[66] [Aglen A. Dowty], 'Smiff at the Polytechnic', *The Figaro* (21 February 1874), p. 3, in miscellaneous newspaper clippings file, reference RPI/4/1, University of Westminster Archives, London, UK.
[67] 'The People's Hand-Book To The Polytechnic Institution', *Punch* (26 Aug 1843), p. 91. We might think here of Dickens's description in *Hard Times* (1854) of Stephen leaving work after the factory bell has rung the end of the shift: 'standing in the street, with the old sensation upon him which the stoppage of the machinery always produced - the sensation of its having worked and stopped in his own head'. *Hard Times*, ed. by Kate Flint (London: Penguin, 1995), p. 69.
[68] RPI Programme January-July 1873, and July-December 1875, reference RPI/3/9 and RPI/3/13, University of Westminster Archives, London, UK.

phenakistiscope and the 'zoetrope, or wheel of life' to audiences at the RPI by projecting their display onto the large screen; in doing so, he 'showed how we were indebted to Mr. Faraday for the pretty toy known as the 'wheel of life''.[69] (This commonly-used title for the zoetrope is important—it features prominently on the front cover of figures 25 and 27, both of which illustrate or advertise a zoetrope—and I will return to it in my discussion of Dickens below.) A year later, a larger exhibition was hosted which, again, illustrated Faraday's experiments, this time of his illumination of an electric spark. A review of the display in *All the Year Round* recounts that

> in the darkened theatre at the Polytechnic, the long flash lights up the room and the audience with the peculiar lurid glare so well known as an effect of brilliant lightning at night, and displays the features and action of every one present. But it is curious to note that, the flash being of instantaneous duration only, it allows no *motion* to be seen. We should think, if guided by our consciousness alone, that the flash lasted an appreciable time; but this would be an error, due to the persistence of the impression on the eye, after the flash itself had ceased. If the room be made perfectly dark, and if the spectators all raise their arms and wave their hands to and fro as quickly as they can, the flash will display the position of the arms, but not the movements of the hands. *While the flash lasts, the hand has no time to move*, and is consequently seen, as if motionless, in the position in which the flash finds it. It is in contemplation to exhibit the same effect in a more complete way by affixing a picture to a revolving disc. When the disc revolves so rapidly that no outlines of the picture can be distinguished by means of any ordinary light, they will be perfectly seen in a darkened room by the light of the flash.[70]

The reviewer draws attention to the stroboscopic effect capable of being achieved by alternating between illumination and darkness, and discusses the temporality of vision which this experiment makes appreciable. Citing persistence of vision as the underlying explanation, the piece makes clear the interlinking of spectacle, science, and physiological optics and works to popularize this aspect of visual perception to its wide readership.

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[69] Anonymous and untitled newspaper clipping, reference RPI/4/1, University of Westminster Archives, London, UK.
[70] 'Playing with Lightning', *All The Year Round* (29 May 1869), 617-620 (p. 620).

Dickens's immersion in his role as editor has been well-documented, and from the inclusion of this detailed article we can assume he was at the least conversant with the subject under review, and most likely very interested in its content.[71] No record exists (that I have been able to find, at least) of Dickens's use persistence of vision devices but the scientific emphasis in the review above and the breadth of reference to durational visual impressions in his fiction (which I go on to discuss below) tell us that he, like many others (his contemporary readers included), certainly had a broad understanding of the underlying scientific principles of afterimages and their technological manipulation into a sequence of visual animation.[72] As John Plunkett and Jill A. Sullivan's recent work on the exhibition of science, particularly optical science, has shown, the display of new technologies of vision was not limited to large-scale magic lantern shows in the metropolitan capital but rather included the demonstration of various smaller devices (from the microscope to the zoetrope) beyond London and across many different regions. They focus on 'informal sites such as charity fetes, bazaars, and soirées' and argue that such spaces 'play[ed] a crucial part in the examination of when, where, and how individuals and groups were most likely to experience the expanded scope of nineteenth-century visuality'.[73]

Plunkett and Sullivan emphasize a crucial point about these smaller, local gatherings: audiences were often able to interact freely with the instruments on display, unlike the audience of a touring panorama or magic lantern show. This gave these events a

[71] See particularly John Drew, *Dickens the Journalist* (Basingstoke: Palgrave Macmillan, 2003).
[72] Here, I follow Adelene Buckland who argues that to build an understanding of Dickens's engagement with science (particularly, in her case, evolutionary and geological science) we should be open to the 'range of sites in which 'science' took place', such as periodical culture, illustrations, and learned societies—all sites in which display and visuality were of central importance. 'Recovering Dickens's engagement with the scientific culture of his day, then, requires immersion in that visual culture', she contends. *Novel Science: Fiction and the Invention of Nineteenth-Century Geology* (Chicago and London: The University of Chicago Press, 2013), pp. 248-249.
[73] John Plunkett and Jill A. Sullivan, 'Fetes, Bazaars, and Conversaziones: Science, Entertainment, and Local Civic Elites' in *Popular Exhibitions, Science and Showmanship, 1840-1910*, ed. by Joe Kember, John Plunkett, and Jill A. Sullivan (London: Pickering & Chatto, 2012), pp. 41-60 (p. 46).

'multi-sensory appeal' and 'encouraged an active, hands-on relationship with the science on show'.[74] It is precisely this interactivity which I discuss in Chapter Five, but for now it is important to note that this recent archival work uncovers and makes a strong case for the nineteenth-century public's expanded access to a range of optical instruments and the increased understanding of their scientific operation as a consequence. It helps to explain popular fiction's incorporation of language associated with moving-image devices and supports my argument that the understanding of such references was shared between author and reader alike, leading to an enhanced reading of characterization and mental experience, as I go on to discuss.

Layers of Durable Images

In his essay, 'On A Peculiar Class of Optical Deceptions', Faraday, taking as his subject the phenomena of simultaneously persisting impressions, described that 'The schoolboy experiment of seeing both sides of a whirling halfpenny at the same moment,—the appearances produced by the thaumatrope, […] are all effects of this kind; two or more distinct impressions, or sets of impressions, being made upon the eye, but appearing to the perception as one'. He explained that 'The eye has a power, as is well known, of retaining visual impressions for a sensible period of time […]. Although to the mind occupied by an object, it [the eye] is still open, for a large proportion of time, to receive impressions from other sources; for the original object looked at is not in the way to act as a screen, and shut out all else from sight; the result is, that two or more objects may seem to exist before the eye at once, being visually superimposed'.[75] Once an impression has been made it appears to linger in the eye which, however, is able to continue receiving impressions from other sources. In this way, as Faraday describes, perceptions appear 'visually superimposed'.

[74] Plunkett and Sullivan, 'Fetes, Bazaars, and Conversaziones', p. 48. See also Martin Hewitt's chapter in this collection for further.
[75] Faraday, 'On A Peculiar Class of Optical Deceptions', pp. 210-211.

Dickens uses this visual layering to illustrate the persistence of thought and its overwhelming effect upon the mind. Captain Cuttle in *Dombey and Son* has in his possession a mysterious packet, left to him by his good friend Sol, with instructions that it should not be opened for a year. The idea of its undisclosed contents pervades his thought, an influence which Dickens chooses to depict by turning to the similar, lingering experience of the durable, unshakable visual impression. Near the expiry of the packet's stated term, the narrative describes that Cuttle 'began to look at it, of an evening, with feelings of mystery and uneasiness':

> He merely brought it out, at a certain stage of his first evening pipe, laid it on the table, and sat gazing at the outside of it, through the smoke, in silent gravity, for two or three hours at a spell. Sometimes, when he had contemplated it thus for a pretty long while, the Captain would hitch his chair, by degrees, farther and farther off, as if to get beyond the range of its fascination; but if this were his design, he never succeeded: for even when he was brought up by the parlour wall, the packet still attracted him; or if his eyes, in thoughtful wandering, roved to the ceiling or the fire, its image immediately followed, and posted itself conspicuously among the coals, or took up an advantageous position on the whitewash.[76]

The scene is in one sense quite fantastical: the packet's mystery captivates Cuttle, and try as he might he seems unable to shake the dread appeal of its contents. He gives the packet remarkable visual attention, gazing at it for up to three hours; no wonder, then, that its 'fascination' still holds even when he physically removes himself to the side of the room. By then, the physical imprinting of light rays upon the sensitive surface of the retina has seared the image so intensely that it recurs across the visual field for a finite length of time: even his looking directly into the fire was not enough to burn the prior fixed impression from his sight. Further, the packet's outline has impressed itself on his perception to such an extent that even when Cuttle removes his eyes from the object and

[76] Charles Dickens, *Dombey and Son*, ed. by Alan Horsman (Oxford: Oxford University Press, 2008), p. 574.

looks around the room, he finds its image has printed itself upon his field of vision as a durable impression which automatically follows the line of his sight.

That the persisting image itself appears to move around the room is a further aspect of this phenomenon found in contemporary writing on physiological optics. In 1823, Charles Bell explained that if we 'let the eyes be fixed upon an illuminated object, until the retina be fatigued […], the figure of the object will continue present to them'. Further, he writes that 'by an exertion of the voluntary muscles of the eyeball the body seen will appear to change its place, and *it will, to our feeling, assume different positions according to the muscle which is exercised*'.[77] Shortly after this, Müller described how persistent afterimages can 'change their relative position to our own bodies with movement of the eyes; [whereas] imaginary images maintain a fixed position with respect to our own space with every movement of the closed eyes'.[78] That the image of the packet moves relative to Cuttle's own roving, 'wandering' eye as a superimposed figure identifies this vision as physiological in nature rather than imaginary or spectral. Dickens turns to the durable, imprinted afterimage to render the bruising effect of Cuttle's emotive reaction as a physiological change capable of persisting to his perception after the initial referent is out of sight; in using such a physically affecting metaphor, Dickens illustrates the literal persistence of the packet in Cuttle's mind.

If the durability of impressions upon the memory, rendered as a retinal afterimage, signal lingering unease for Cuttle, for Pip in *Great Expectations* (1860-1) they function as an important method of detection. After Molly leaves Jaggers's office, Pip relates that

> she remained before me as plainly as if she were still there. I looked at those hands, I looked at those eyes, I looked at that flowing hair; and I compared them with other hands, other eyes, other hair, that I knew of […]. I looked again at those

[77] Charles Bell, 'On the Motions of the Eye, in Illustration of the Uses of the Muscles and Nerves of the Orbit', *Philosophical Transactions*, 113 (January 1823), 166-186 (p. 178). Emphasis in original.
[78] Johannes Müller, *Über die phantastischen Gesichtserscheinungen* (1826), p. 72, qtd. in Wade, *Natural History of Vision*, p. 169.

> hands and eyes of the housekeeper, and thought of the inexplicable feeling that had come over me when I last walked—not alone—in the ruined garden, and through the deserted brewery. I thought how the same feeling had come back when I saw a face looking at me, and a hand waving to me from a stage-coach window; and how it had come back again and had flashed about me like Lightning, when I had passed in a carriage—not alone—through a sudden glare of light in a dark street. I thought how one link of association had helped that identification in the theatre, and how such a link, wanting before, had been riveted for me now […]. And I felt absolutely certain that this woman was Estella's mother.[79]

Molly's image persists in Pip's vision as if her physical form had remained in front of his eyes, and the duration of its impression allows him to look again—almost virtually—at her features and to map this observation onto past visual experiences, resulting in the realization that Molly is Estella's mother. This realization occurs as a 'flash' or 'sudden glare' of light, recalling the intense exposure of the retina to light. Such moments of flashing light are also found in the operation of persistence of vision devices: it is what Rosalind Krauss calls the 'pulse—a kind of throb of on/off on/off' or 'dilated instantaneity' of their mechanism which creates the illusion of visual motion.[80] Further, these durable pinpoints of visual memory combine to make a chain, described as physically 'riveted' in Pip's mind, of images cooled from fluid transience into hard, permanent links of association. The violence of the language used here gestures towards the uncomfortable textual description of visual persistence in scientific writing—the physical imprinting of light rays upon the sensitive surface of the retina searing an image so intensely it recurs across the visual field for a finite length of time—and recalls the insistent following of Cuttle's packet even as his eyes 'roved' (the term insinuating a hysteria of the eye) across the room: even his looking directly into the fire was not enough to burn the prior fixed impression from his sight.

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[79] Charles Dickens, *Great Expectations*, ed. by Charlotte Mitchell (London: Penguin, 1996), pp. 390-391.
[80] Rosalind Krauss, 'The Im/Pulse to See', in *Vision and Visuality*, ed. by Hal Foster (Seattle: Bay Press, 1988), pp. 51-78 (pp. 51, 53).

Earlier in the novel Pip's concentrated thoughts on Miss Havisham and Estella results in him 'descrying traces' of them 'all over the prospect, in the sky and in the water'.[81] As in Cuttle's unshakable impression of the packet, Pip's mental focus is rendered as a visual manifestation which persists within his entire perceptual field. In *Bleak House* (1852-3), George's preoccupied mind causes a similar episode. 'A whirling head has Mr George that night when he lies down in the state-bed of his brother's house', the narrative describes, alerting us to the cyclical and repetitive nature of his thoughts (a motion which mirrors the spin of a phenakistiscope disc or zoetrope drum). This causes him 'to see the images of his nieces (awful all the evening in their floating muslins) waltzing, after the German manner, over his counterpane'.[82] Remembered images endure in George's thoughts so much that they appear as if apparitions, repeatedly presenting themselves to his line of vision as he lays in bed.[83]

The stress on circularity can be seen too in George Eliot's work. In *Daniel Deronda* (1876) Grandcourt's thoughts are described as being 'like the circlets one sees in a dark pool, continually dying out and continually started again by some impulse from below the surface. The deeper central impulse came from the image of Gwendolen'.[84] The cognitive action of his recurrently presented thoughts results from a deep 'impulse' (similar to the repeating zoetropic 'pulse' identified by Krauss above) which, through its durability, works to contain his thoughts upon one subject, Gwendolen. She too experiences a cyclical persistence of thought, brought about by her significant meeting with Lydia Glasher at the Whispering Stones: 'That unhappy-faced woman and her children—Grandcourt and his relations with her—kept repeating themselves in her

[81] Dickens, *Great Expectations*, p. 110.
[82] Charles Dickens, *Bleak House*, ed. by Stephen Gill (Oxford: Oxford University Press, 2008), p. 881.
[83] For further on the link between spectral apparitions and the scientific background of Victorian visuality, see Srdjan Smajić, *Ghost-Seers, Detectives and Spiritualists: Theories of Vision in Victorian Literature and Science* (Cambridge: Cambridge University Press, 2010).
[84] George Eliot, *Daniel Deronda*, ed. by Terence Cave (London: Penguin, 1995), p. 319.

imagination like the clinging memory of a disgrace, and gradually obliterated all other thought, leaving only the consciousness that she had taken those scenes into her life'.[85] The knowledge of Grandcourt's past endures in her memory and, as we saw in the marring impression of Sol's packet upon Cuttle's perception, persists to such an extent that its repetition becomes embedded or 'taken' into her consciousness. Deronda later remarks of Gwendolen that 'she is a creature who keeps strong traces of anything that has once impressed her'; the stress on circularity and repetition in these examples shows that not only can impressions be made to linger in the memory and appear as a visual manifestation, their temporal durability renders them liable to continually return as a reprinting impression.[86]

Deep Impressions and the Structure of the Retina

If an image was thought to persist within the visual field due to its physical impression upon the retina, we can infer that as well as exhibiting a temporal duration, each impression might assume a spatial imprinting too. This is seen in fictional representations of persisting afterimages and enduring visual memories: an impression has a physicality, and is durable precisely because of its deep imprinting upon the body. In Charlotte Brontë's *Jane Eyre* (1847), Jane's childhood friend Helen Burns chides her sensitivity at Mrs Reed's unkindness, commenting on 'how minutely you remember all she has done and said to you! What a singularly deep impression her injustice seems to have made on your heart! No ill-usage so brands its record on my feelings'.[87] The 'deep impression' left upon Jane is compared to the violence of a physical branding, so severe and enduring are its effects. Approaching her marriage to Grandcourt, Gwendolen in *Daniel Deronda* experiences a 'disturbing' sense that 'she was doing something wrong' and is plagued by a

[85] Eliot, *Daniel Deronda*, p. 312.
[86] Eliot, *Daniel Deronda*, p. 404.
[87] Charlotte Brontë, *Jane Eyre*, ed. by Margaret Smith (Oxford: Oxford University Press, 2008), p. 58.

'mingling of dimly understood facts with vague but deep impressions, and with images half real, half fantastic' which centre upon her broken promise to Lydia Glasher and Deronda's opinion of the imminent marriage.[88]

A further example of 'deep impressions' occurs again in Eliot's fiction but is explicitly connected to contemporary understandings of the physiology of the eye and the perceptual process. During Dorothea's honeymoon to Rome in *Middlemarch* (1871-2), the narrator asserts that though the 'weight of unintelligible Rome might lie easily' on some, forming only a 'background', Dorothea 'had no such defence against deep impressions'. The spectacle of the city, its 'basilicas, palaces and colossi' and 'long vistas of white forms', forces itself upon her perception and makes a deep impression. Dorothea's experience, then, lies counter to those for whom the city forms a mere 'brilliant picnic', a set of sights to be sampled but which are ultimately unaffecting. Instead, sights of the city, particularly its 'ruins [...] set in the midst of a sordid present',

> at first jarred her as with an electric shock, and then urged themselves on her with that ache belonging to a glut of confused ideas which check the flow of emotion. Forms both pale and glowing took possession of her young sense, and fixed themselves in her memory even when she was not thinking of them, preparing state associations which remained through her after-years.[89]

Impression urges itself here with the force of an electric shock and specifically visual forms (identifiable as so by being as 'pale and glowing') possess her sensing mind and fix themselves in her memory for a quantifiable period of time: here then is the result of her 'deep impressions'.

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[88] Eliot, *Daniel Deronda*, p. 354. Work by Andrea Goulet highlights further instances of the retina—its structure, operation, and metaphorical use—in late nineteenth-century fiction. See 'Retinal Fictions: Villiers, Leroux, and Optics at the Fin-de-siècle', *Nineteenth-Century French Studies* 34.1 and 2 (Winter 2005), 107-119 and her book *Optiques: The Science of the Eye and the Birth of Modern French Fiction* (Philadelphia: University of Pennsylvania Press, 2006).

[89] George Eliot, *Middlemarch*, ed. by David Carroll (Oxford: Oxford University Press, 2008), p. 181. The focus on physiological response in this passage is noted by Sally Shuttleworth, who comments on the 'tendency of Dorothea's mind to flow in a unified current', a tendency exemplified in the 'urge' and 'glut' of ideas which impress themselves upon her mind. *George Eliot and Nineteenth-Century Science: The Make-Believe of a Beginning* (Cambridge: Cambridge University Press, 1984), pp. 162-163.

The structure of the retina, as understood at this period, might help to illustrate how an impression could be imaginatively rendered as 'deep'. Opposing previous analogical models of the eye as a mirroring instrument (akin to the camera obscura in which external images were transposed onto an inner, retinal screen), early nineteenth-century microscopic research into the anatomy and operation of the eye had shown that far from a flat surface designed for neutral imaging the retina consisted of numerous nervous fibres, cells, cones, and rods composed into multiple layers. Its structure was a common subject of experiment and debate (David Brewster and Mary Griffith argued over its function as a 'seat' or 'organ' of vision in the pages of the *Philosophical Magazine* during 1834)[90] and G. H. Lewes's *The Physiology of Common Life* (1859) devotes a section to its composition and operation. Lewes provides an illustrated cross-section of its layers and depicts it as a nervous body *through* which sensory information is transmitted to the optic nerve. He refutes the idea that the retina is a sensitive 'surface' which can be understood as an 'analogue of the photographer's iodised plate', collecting visual impressions as completed pictures to be transmitted to the brain. Rather, he describes how 'the retina is transparent as glass. The rays of light will consequently pass *through* it, as through glass. […]. A moment's consideration will now make it evident that images cannot be formed on the retina, as they are on the receiving screen of a camera lucida'. For light to travel through the retina, here imagined as a medium of transmission, we must assume that the visual impression has not only a property of duration but also of spatial depth, reinforcing its imprint with each layer it passes through. Although Lewes denies the image is formed *on* the retina, we might usefully say it is formed *in* the retina.[91]

[90] See especially Mary Griffiths, 'Observations on the Vision of the Retina', *The London and Edinburgh Philosophical Magazine and Journal of Science* (April 1834), 43-46 and David Brewster, 'On the Influence of successive Impulses of Light upon the Retina', *The London and Edinburgh Philosophical Magazine and Journal of Science* (April 1834), 241-245.

[91] Katherine Inglis argues that around 1850 there emerged a new interest in not just looking at the eye but looking *into* it (and specifically at the 'newly visible living retina') informed by the development of

Lewes cites an experiment undertaken by Lehmann in 1857 in which the optic nerve was removed. After twenty days, Lehmann found that 'only the layer of optic nerve fibres had degenerated' (this was expected, as they were ganglionic (a grouping of nerve cells) and unable to survive when disconnected from the nerve centre) and concluded that the retina's cells could not therefore be ganglionic but were instead 'connective tissue'. Lewes explains that through this connective tissue 'the nerve-fibre is said to pass downwards from the inner surface of the retina to the pigment layer'. This was thought to be a layer of black pigment behind a tissue of retinal cells, and it is this, Lewes argues, which is affected by light rays: the dark surface absorbs the rays and its temperature is raised. He concludes 'This change of temperature acts upon the inner layer of the retina, the rods and cones; which in turn stimulates the Neurility of the outer layer, the fibre of the optic nerve; and this Neurility awakens the Sensibility of the optic ganglion, which may or may not awaken the brain'.[92] In this understanding of the physiology of visual perception, sensory information passes into and then continues *through* a variety of tissues and nerve fibres, finally effecting a physical change in the temperature of cells before being transmitted to the brain (a method Isobel Armstrong evocatively describes, in relation to Herman von Helmholtz's writing on this, as a 'discontinuous pointillism that requires synthesis'—pointillism forming an apt counter to the understanding of visual perception as a straightforward transmission of a completed image from retina to brain).[93] It is clear that according to this understanding visual perceptions must persist temporally within the body and thus necessarily possess a sense of spatial depth as they traverse the

ophthalmology as a scientific and instrument-driven practice. See 'Ophthalmoscopy in Charlotte Brontë's *Villette*', *Journal of Victorian Culture* 15.3 (December 2010), 348-369.

[92] G. H. Lewes, *The Physiology of Common Life*, 2 vols (Edinburgh and London: William Blackwood & Sons, 1860), II: 331-334.

[93] Isobel Armstrong, *Victorian Glassworlds: Glass Culture and the Imagination, 1830-1880* (Oxford: Oxford University Press, 2008), p. 293.

retina's structure—here then the 'deep impressions' which fix themselves in Dorothea's memory.

One result of such a physical imprint is that the impression not only endures for a finite time but its captured presence is able to be repeated and redisplayed, as *Middlemarch*'s narrator goes on to describe:

> Our moods are apt to bring with them images which succeed each other like the magic-lantern pictures of a doze; and in certain states of dull forlornness Dorothea all her life continued to see the vastness of St. Peter's, the huge bronze canopy, the excited intention in the attitudes and garments of the prophets and evangelists in the mosaics above, and the red drapery which was being hung for Christmas spreading itself everywhere like a disease of the retina.[94]

The 'deep impressions' of Rome which were 'urged' upon Dorothea and 'fixed' in her memory, as described above, resurge at particular moments as a series of moving, successive visual images, brought on by a particularity of mood. Here, it is the sight of Bernini's sculpted bronze canopy, the mosaic in the dome above, and the vast space of St. Peter's which return as a procession of visual impressions which Dorothea 'continued to see'. For Kate Flint, this episode is indicative of 'the way in which memories return not only when they are deliberately hunted down, but return unbidden, just as if they have been stored away as visual resources'.[95] A similar lack of volition is highlighted too in Jill L. Matus's reading: in Rome Dorothea experiences a 'mental shock', she writes, resulting in 'the return of the pictures beyond conscious recall'. She stresses that in this passage Eliot represents the operation of memory as a 'magic technology […] that produces a ghostly and marvelous parade of images succeeding each other in states of slightly altered

[94] Eliot, *Middlemarch*, p. 182. Peter Garratt concentrates on this passage for its representation of the 'overstimulation of the visual sense' and connects the 'blurring of mind and world' experienced by Dorothea to Lewes's theories of the 'psychological conditions of looking'. See *Victorian Empiricism*, pp. 112-115, 123.

[95] Kate Flint, *The Victorians and the Visual Imagination* (Cambridge: Cambridge University Press, 2000), p. 144.

consciousness', as if Dorothea is experiencing a 'dream or trance'.[96] However, Eliot's explicit reference to the retina and the emphasis on imprinted 'deep impressions' frequently recurring all point towards a more physiological, and indeed optical, reading of what Dorothea experiences in Rome. That her memories return as a *moving succession* of images points towards understandings of persisting visual impressions (described in scientific writing as a routine and universally-experienced phenomenon), rather than a rendering of memory as 'magical' or 'ghostly'. Roget's exploration of visual duration remarks that:

> When the impressions are very vivid, another phenomena often takes place; namely, their subsequent recurrence, after a certain interval […]. The same impression will, after a certain time, recur, and again vanish; and this phenomenon will be repeated at intervals […]'.[97]

Perceptual impressions, as described here, are not transient reactions to a passing world of sensation (and neither do they indicate an altered state of consciousness, as in Matus's reading); rather, impressions can alter and become encoded within the body as if occupying spatial depth.

The recurrence of these impressions is not arbitrary but instead prompted by particular states of consciousness or types of mood. Later in the novel, we read that scenes of Featherstone's funeral 'always afterwards came back to [Dorothea] at the touch of certain sensitive points of memory, just as the vision of St. Peter's at Rome was inwoven with moods of despondency'.[98] The stress on particular states of mind reviving such 'deep impressions' is closely aligned to Lewes's theory of persistent 'residua'.[99] In *Problems of*

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[96] Jill L. Matus, *Shock, Memory and the Unconscious in Victorian Fiction* (Cambridge: Cambridge University Press, 2009), pp. 53-54.
[97] P. M. Roget, *The Bridgewater Treatises. Treatise V: Animal and Vegetable Physiology*, 2 vols (1834), II, p. 369.
[98] Eliot, *Middlemarch*, p. 305.
[99] See particularly *Problems of Life and Mind. Third Series: The Study of Psychology*, 2 vols (1879; Boston: Houghton, Osgood, and Company, 1880) II: 50-60. Garratt writes that Lewes 'steadfastly refuses to concede that impressions and sensations merely subside or pass away. They leave traces of themselves in the form of

Life and Mind (1874-9) he writes, 'A sensation or perception once produced, may of course be reproduced by a recurrence of the original conditions; […] the original feeling is registered in the organism as a modification, and whenever this neural tract which was originally in action, is again excited, the old feeling will be reinstated'.[100] A particular sensation or perception (a 'deep impression') might effect a modification which would then be capable of reproducing and reinstating that original feeling at similar such moments, a process made apparent in Dorothea's returning visions of Rome and Featherstone's funeral at moments of low mood. Sensation and perception pass from objective stimuli to subjective state through a process of temporal and spatial imprinting upon the body in question: what is first external is drawn into the sensing body to become embedded as a subjective, internally *reproducible* impression. For Gwendolen in *Daniel Deronda*, the words of Lydia Glasher's letter 'kept repeating themselves, and hung on her consciousness with the weight of a prophetic doom. […] The words had nestled their venomous life within her, and stirred continually the vision of the scene at the Whispering Stones'.[101] Michael Davis, reading Eliot's work in relation to contemporary developments in physiological psychology, contends that her novels incorporate many such moments in which 'a new mental habit, gained in experience, becomes a solid, permanent part of the self'. In a discussion of the courtship between Hetty Sorel and Arthur Donnithorne in *Adam Bede*, Davis writes that 'Eliot's language can be read as gesturing towards, without directly describing, the possible permanent physical chances in the brain which may accompany such a change in the individual's sense of self […]'.[102] Although I go on to explore Hetty's mental experience in relation to visual persistence in the next section,

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mental residue, which then plays a part in shaping the course of future sensory excitements'. See *Victorian Empiricism*, pp. 121-126 for more on Lewes and Spencer's theories of inferential or acquired perception.

[100] Lewes, *Problems of Life and Mind. First Series: The Foundations of a Creed*, 2 vols (London: Trübner & Co., 1874), I, p. 148.

[101] Eliot, *Daniel Deronda*, p. 424.

[102] Michael Davis, *George Eliot and Nineteenth-Century Psychology* (Aldershot: Ashgate, 2006), pp. 30, 34.

Davis's contextualization here supports my reading that memory is increasingly represented as a kind of visual imprinting, a series of 'deep impressions', which are imagined as both durational and spatial, and this spatiality is described as a physical manifestation within the body; in drawing imaginatively on the idea of retinal afterimages, the writing of mental experience in the mid-nineteenth century incorporates new terminology based on contemporary optical research and its technologies.

Seeing Again: Revolving Minds

This chapter has so far explored instances of durable visual images—their literal occurrence and the metaphorical language associated with persisting impressions—in fictional accounts of memory, cognitive operation, and visual experience, and demonstrated how the physiological understanding of afterimages and the connection between eye and brain (as investigated by Roget, Faraday, Plateau and others) was increasingly incorporated into literary language. In this section, I develop this argument by focusing further attention on the repeatability of these 'deep impressions', just as Dorothea 'continued to see' a series of images of Rome. I show how the experience of 'seeing again' is related not only to the physiological explanations of the persistence of vision but also to the popular hand-operated devices which demonstrated this optical phenomenon, such as the phenakistiscope and zoetrope. Fiction draws on the mechanism and operation of this technology to render the animation of minds in action, of thought taking place, and to dramatize the longevity of particular memories.

The reproducible nature of persisting visual impressions is often referred to as a 'revolving vision', gesturing towards a metaphorical rendering of the mind as a space through which visual traces could endlessly repeat as if illustrations fixed upon a disc or drum spun quickly on its axis. Yet, as in Faraday's explanation quoted earlier (that the eye

could ‘retain visual impressions’ whilst also being able to ‘receive impressions from other sources’, meaning that ‘two or more objects may seem to exist before the eye at once, being visually superimposed’), the eye remains open to receive new impressions from other sources, resulting in a simultaneous layering of residual and present visions, real and virtual. In *Middlemarch*, Mary Garth takes pleasure in sitting alone, and ‘fond of her own thoughts […] sat to-night revolving, as she was wont, the scenes of the day’ which passed as ‘illusions under [her] eyes’; after seeing Macbeth performed, the titular character of Dickens’s *David Copperfield* (1849-50) walked from the theatre ‘revolving the glorious vision all the way; […] [he] sat revolving it still, at past one o’clock, with [his] eyes on the coffee-room fire’. Copperfield’s eyes are open (he walks home and prepares ‘porter and oysters’) yet he is simultaneously repeating mental visions of the play just witnessed.[103] Mrs Sparsit in *Hard Times* (1854) is also able to combine two modes of vision, actual and mental. She ‘sat at her window all day long looking at the customers coming in and out, watching the postmen, keeping an eye on the general traffic of the street’ yet was ‘revolving many things in her mind’, just as *Little Dorrit*’s (1855-7) Arthur Clennam ‘revolved the old thoughts and suspicions’ which ‘blended themselves with the duties he was mechanically discharging’.[104] The narrator of *Middlemarch* draws our attention specifically to the simultaneity of Dorothea’s present perceptual activity and vivid, remembered episodes: ‘As she sat waiting in the library, she could do nothing but live through again all the past scenes which had brought Lydgate into her memories. […] These thoughts were like a drama to her, and made her eyes bright, and gave an attitude of suspense to her whole frame, though she was only looking out from the brown library on

[103] Eliot, *Middlemarch*, pp. 294-295; Dickens, *David Copperfield*, ed. by Nina Burgis (Oxford: Oxford University Press, 2008), p. 279.
[104] Dickens, *Hard Times*, p. 209; Dickens, *Little Dorrit*, ed. by Stephen Wall and Helen Small (London: Penguin, 1998), p. 270.

to the turf and the bright green buds which stood in relief against the dark evergreens'.[105] In these examples, the persisting impression is not just a static afterimage (as in the superimposed outline of Sol's packet upon Cuttle's field of vision) but a lucid virtual animation (a 'drama' of scenes for Dorothea) of repeating memories or thoughts—a kind of mental zoetrope—which operates simultaneously alongside regular perception.

During the courtship of Hetty Sorrel and Arthur Donnithorne in *Adam Bede*, the strength of Hetty's emotional attachment and romantically-preoccupied thoughts manifests as a persistent, and indeed repeating, visual impression. An aptly-titled chapter takes us into 'Hetty's World', in which 'a face and a presence [is] haunting her waking and sleeping dreams'. We learn that Arthur's 'soft glances had penetrated her'; his 'eyes […] had found a ready medium in Hetty's silly little imagination, whereas Adam's could get no entrance through that atmosphere' (91). Beyond the 'medium' or 'atmosphere' of her imagination, the effect of Arthur's impression plays out: 'For three weeks, at least, her inward life had consisted of little else than living through in memory the looks and words Arthur had directed towards her—of little else than recalling the sensations with which she heard his voice outside the house, and saw him enter'. Her mental life consists of actively 'living through' the remembered conversations, and, importantly, the mental images (his 'looks') of their time spent together. We should note that Hetty lives 'through' such images and does not replay them as scenes to be observed; she is virtually abstracting herself to an imaginative present comprising not static remembered images but living episodes (we might think here of the modern metaphor of 'replaying' events in our head, in which memory is imagined as filmed footage which can be rewound and repeated (the technology of film and video players informing the language of 'rewinding' and

[105] Eliot, *Middlemarch*, p. 716.

'replaying')—Hetty's 'living through' provides a similar metaphorical function which stresses animation over stasis).

Even when engaging in romantic speculation, Hetty's imagination operates by a process of repetition: 'instead of retracing the past, [she] was busy fashioning what would happen to-morrow […] and what he would say to her to make her return his glance – a glance which she would be living through in her memory, over and over again, all the rest of the day, […] her head filled with pictures of the morrow' (92). The narrator stresses Hetty's conscious role in activating and sustaining such cyclical imaginings (her 'busy fashioning'). However, as her story and courtship with Arthur progresses towards its fateful end, the repeating circular track of pictures which her imagination produces becomes less volitional: 'her poor narrow thoughts, no longer melting into vague hopes, but pressed upon the chill of definite fear; repeating again and again the same small round of memories—shaping again and again the same childish, doubtful images of what was to come' (331). Fear constricts her thoughts and reduces them to the 'same small round' (gesturing towards the spinning disk or wheel), instead of her earlier active 'shaping' of future scenes. The lack of control associated with persisting visions and the spinning devices which made this illusion apparent is engaged with further in this chapter; here, we should notice that repeating mental visions are put to metaphorical use to signal a pleasurable overwhelming of everyday thought with remembered and speculative romantic scenes but also the preying of doubt, hopelessness and fear, brought about by unfortunate circumstances, which works to narrow thought: the revolving, repeating scenes of imagination and memory are not always a pleasurable mental experience.

The Disorientation of Blended Perceptions

With Hetty's contrasting experiences in mind, we turn now to another way fiction presented visual motion and retinal afterimages: as a distressing, overwhelming, and uncontrollable experience in which the perceptual blending of past and present becomes mentally unsustainable. In the following incident in Dickens's *Dombey and Son*, references to durable images and the technological operation of persistence of vision devices is utilized to register a sense of disorientation and perceptual confusion – motion overwhelms, gives unreal visions, and persisting images disrupt the possibility of regular sense perception.[106]

Being pursued at speed by Mr Dombey, Carker decides to return to England from France rather than risk 'being hunted in a strange remote place'.[107] He travels first to Paris by an 'old phaeton' (a four-wheeled carriage usually led by two or more horses). As Jonathan Grossman describes in his study of *Charles Dickens's Networks* (2012), the very earliest nineteenth-century coaches did not make use of any form of wheel suspension (they were capable of 'breaking a man alive upon the wheel', as Dickens writes in 'Early Coaches').[108] Description of Carker's journey suggests that his transport is likely of this type: the carriage 'scatter[s] the dust and dirt like a spray' and sets off with 'clatter and commotion' (811). His conveyance is not, however, particularly fast, meaning he is able to take a good look at each scene as he passes and results in the impressions becoming thoroughly imprinted upon his consciousness. This continuous stacking of durable impressions gained throughout the journey blend together, overwhelming him and

[106] For more on nineteenth-century theories of the psychological blending and fusion of past and present impressions and perceptions, particularly in the work of Hegel, Goethe, Schelling, and Herbart, see Crary, *Techniques*, pp. 98-102. He considers how observation was increasingly thought to be the 'play and interaction of forces and relations, rather than as the orderly continuity of discrete stable sensations conceived by Locke or Condillac' (p. 100).

[107] Dickens, *Dombey and Son*, p. 811. Further references are to the edition cited earlier in the chapter and follow in parenthesis.

[108] Jonathan Grossman, *Charles Dickens's Networks: Public Transport and the Novel* (Oxford: Oxford University Press, 2012), pp. 16-17. See 'Early Coaches', *Sketches by Boz*, 2 vols (London: Macrone, 1836), II, pp. 171-181 (p. 171).

producing a disorientating experience of mental anguish which mirrors his turmoil and fear at being 'hunted' by Dombey.

To the hurried and anguished mind of the 'fugitive', the tumultuous experience of travelling is echoed in his thoughts: 'Nothing clear without, and nothing clear within' (811). Carker sees objects in the landscape 'dimly descried' and 'merging into one another'; 'shifting images' of 'the lamps, gleaming on the medley of horses' heads, jumbled with the shadowy driver, and the fluttering of his cloak, made a thousand indistinct shapes, answering to his thoughts'. Simultaneous with these indistinct sights, and interspersed with the noises of his journey, Carker's memories return as hazy images: 'Shadows of familiar people, stooping at their desks and books, in their remembered attitudes; strange apparitions of the man whom he was flying from, or of Edith; repetitions in the ringing bells and rolling wheels, of words that had been spoken […]'. He struggles to retain a correct grasp on his present situation, and experiences 'a confusion of time and place, making last night a month ago, a month ago last night'. In his anguish, he finds that 'he could not separate one subject of reflection from another, sufficiently to dwell upon it, by itself, for a minute at a time'. Like the blended animation of the phenakistiscope or zoetrope, individual frames, or memories, cannot be separated from each other; images 'floated in his brain; but nothing was distinct' (812).

The overwhelmingly visual nature of his mental confusion and anguish is emphasized further some pages on and, combined with the trope of circularity, points more firmly towards an engagement with the physiological experience of persistence of vision. The narrative describes that

> The monotonous ringing of the bells and tramping of the horses; the monotony of his anxiety, and useless rage; the monotonous wheel of fear, regret, and passion, he kept turning round and round; made the journey like a vision, in which nothing was quite real but his own torment. […] It was a fevered vision of things past and

> present all confounded together; of his life and journey blended into one. […] Of old scenes starting up among the novelties through which he travelled. (816-817)

His distressed mental state is rendered as a series of moving cyclical visions which revolve 'round and 'round' as if in a 'wheel' and create a 'fevered vision' composed simultaneously of scenes from his past and present, registering both the action of persistence of vision devices and their underlying scientific basis of the blending of images which perceptually endure after their presentation to the eye. Plateau, writing about persistence of vision devices, states confidently that 'if several objects […] are presented one after the other to the eye in very brief intervals and sufficiently close together, the impressions they produce on the retina will blend together without confusion'.[109] However, such is the amount of visions impressed upon both his retina and simultaneously recalled from memory in that he is unable to distinguish one image from the next, present sights from past. This disordering of regular, functioning perception runs counter to the examples discussed above, in which visual persistence signifies the importance of memory or the fixation upon a particular thought, and demonstrates the agility with which Dickens's exploits this optical phenomenon.

Although Carker 'seem[ed] to take no notice of the actual objects he encountered', they nonetheless persist durably in his mind as he still experiences 'a wearisome exhausting consciousness of being bewildered by them, and having their images all crowded in his hot brain after they were gone' (817), an experience which leaves him 'unable to comprehend the points of time and place in his journey' and feeling as if he had travelled 'between two brawling streams of life and motion' (818).[110] His perception

[109] Joseph Plateau, *Dissertation sur quelques propértiés des impressions*, thesis submitted at Liège, May 1829, qtd. in Crary, *Techniques*, p. 109.

[110] We might think here of G. H. Lewes's theory of the reception and processing of sensory data: 'each stimulation leaves behind it a tremor which does not immediately subside', and the 'lingering effect of an impression enables a comparison to be made with a new impression'. Carker's mental state allows no such systematic comparison to be made between each perceptual impression. As Garratt writes of Lewes's theory here (in a reading particularly relevant to Dickens's description of Carker), 'Though this sounds orderly, it threatens chaos; not only is the visual sense being constantly stimulated by its environment in ways not even

performs like a mental zoetrope, the overlaid impressions crowding in his brain after their physical referent has passed from view. 'The whole hurried vision of his journey […] was constantly before him all at once' (819), the narrative describes. These durable impressions linger throughout his journey and beyond, as the narrative repeats the same refrain over a number of pages. What is initially described as the 'monotonous ringing of the bells and tramping of the horses' and 'monotonous wheel[s] of the carriage' is condensed into a repeating mantra: 'still the same monotony of bells and wheels, and horses' feet, and no rest' appears on page 817; three times on page 818 we read of 'the monotony of bells and wheels and horses' feet'; and finally 'the monotony of bells and wheels, and horses' feet, and no rest' is described on page 819. In describing Carker's journey, Dickens's uses the language and scientific ideas of contemporary moving-image technologies to imaginatively render Carker's psychological state, and then imprints upon the page a repeating, durable refrain to impress this visual persistence as a very real optical trace within the text itself. Finding the same idea circulating and repeating, as readers we undergo something of the same psychological experience as Carker, and are unable to shake the sense of having previously experienced that particular arrangement of text.

Achieving the 'Right Perception' in the 'Whirling Wheel of Life'

Persisting visions and durable impressions could signal the importance of certain objects, thoughts, or perceptual encounters, as in the experiences of Cuttle and Dorothea, but they could also denote the mind's inability to correctly process sensory data; for Carker, they signal his mental distress and the inability to achieve a sense of the 'right' perception. A more explicit reference is made in Dickens's *Little Dorrit.* I noted above that the zoetrope

consciously registered, but the complex accretion of impressions creates a whirl of interactions and adjustments between present sensations and revived associational traces'. *Victorian Empiricism*, p. 121. Garratt is quoting Lewes, *Problems of Life and Mind. Third Series: The Study of Psychology*, 2 vols (London: Trübner & Co., 1879), II, p. 305.

was commonly referred to as the 'wheel of life' in advertisements and other printed materials, such as H. G. Clarke's pamphlet on the device and the front cover of a sheet of piano music. Histories of persistence of vision devices often give 1867 as the date when the zoetrope was made commercially available in Britain, after an initial appearance in 1834.[111] This has led to the assumption that the zoetrope was not widely available, or indeed widely understood or recognized, before the late 1860s. However, in the May 1857 serial of *Little* Dorrit, Dickens makes a reference to the 'whirling wheel of life' a decade before it is thought that the zoetrope entered the public market, suggesting that zoetropes might have been displayed or for sale much earlier or that the device had in fact continued to be produced in some form following its invention by Horner in 1834.

Arthur Clennam is musing on how Amy Dorrit 'had influenced his better resolutions' when the narrator remarks: 'None of us clearly know to whom or to what we are indebted in this wise, until some marked stop in the whirling wheel of life brings the right perception with it.[112] The phrase 'wheel of life' is not, of course, specific to the zoetrope. However, in the mid-Victorian period it specifically connoted one particular moving-image technology. The narrative suggests that while the wheel (the drum of the zoetrope) is animated, a clarity of thought cannot be achieved. Only when the whirling ceases is the 'right perception' presented. However, this runs counter to the purpose of the device. When the wheel of the zoetrope was whirling, the technology was functioning as it was designed to do, and its display was able to show the small animation for which it was known; this, then, is surely the 'right' perception. The narrator of *Little Dorrit*, however, implies that it is only when the device is going *against* its correct operation—that is, when it is stopped—that the 'right perception' becomes apparent. This right perception would be

[111] See, for example, Laurent Mannoni, Donato Pesenti Campagnoni, and David Robinson, *Light and Movement: Incunabula of the Motion Picture, 1420-1896* (Pordenone, Le Giornate del Cinema Muto, 1995), p. 214 and Olive Cook, *Movement in Two Dimensions* (London: Hutchinson and Co., 1963), p. 127.
[112] Charles Dickens, *Little Dorrit*, p. 689.

of stasis, as the viewer would only be able to look through one aperture and see a single illustration. In this example, then, the animation of the persistence of vision device, although acting correctly in relation to its technological purpose, actually offers a perception which is somehow 'wrong'—something also witnessed in the description of Carker's disordered and feverish moving perceptions. This small reference to the 'whirling wheel of life' indicates firstly that Dickens, like Eliot, was aware of the language associated with such devices and their advertising and was confident that his readers would share in his understanding, and secondly (and most importantly) that he was able to use this shared visual vocabulary of persisting imprinted impressions and chaotically whirling visions for multiple ends: to signal the importance of certain thoughts and the operation of memory, and to dramatize moments of dysfunctional perception and mental disorientation.

That the 'right perception' can only be bought about by a 'marked stop' in the 'whirling wheel of life' is also important. This stoppage could only be brought about by physical manipulation. The spinning of the zoetrope wheel was contingent on the hand of the user who could spin the drum quickly, slowly, or stop the device as they chose. Instead of the 'whirling wheel' in this passage coming to a gradual halt as a result of its own waning motion, it is stopped abruptly and deliberately. The 'marked stop' hints at mindful volition and physical agency and suggests that the 'right perception' can only be brought about by a conjunction of perceptual and bodily action. This joint effort by hand and eye is intrinsic to the operation of all persistence devices, and to the kaleidoscope, suggesting that the Victorian visual culture of moving images might be productively analysed using more recent theories of haptic perception to better understand the period's engagement with perception as a tactile, physically engaged, and cross-sensory phenomenological process, which I explore in the final chapter.

CHAPTER FIVE

Seeing Spatially: Tactile Technology and the Mobility of the Eye

This chapter begins with a list: to feel heat and pressure; to pin, fasten, arrest, and hit; fix, follow, hold, release; drop, fire, search, screw; bite, strike, wander, fly; pierce, steal, nail, catch; direct, follow, speak, and roam. These are just some of the actions and capabilities of the eye as it is rendered in the fiction of the three authors under discussion throughout this thesis, Brontë, Dickens, and Eliot. Such a list confounds our expectations: it seems more a property of the hand to nail an object, to pierce, strike, pin, or catch; the legs which wander, roam, and follow; and the skin which feels heat and pressure. Yet as this chapter will explore, all these sensations and functions contribute to a uniquely tactile representation of visual experience in the period's fiction.

We notice too that these actions all involve the eye in motion. The perceptual experience being illustrated through such descriptive terms is one marked by action, mobility, and the interactivity of sight with its environment. The perceiver's eyes, carrying out these actions, are thoroughly embedded within a sensory landscape which is temporal, dimensional, textural, and, most importantly, tactile. They describe the eye as it operates in real-time, offering a linguistic rendering of perception as it is carried out, moment by moment. Just as references to persistence of vision encouraged a sense of reading the mind in motion, so the examples discussed in this chapter offer readers an understanding of the *feeling* of perception in action.

Visual perception is evocatively caught up in this period with issues of tactility and agency and, as scholarship on the interoperability of the senses demonstrates, can no

longer adequately be described as a process of pure opticality. This chapter identifies a specifically Victorian conception of the 'eye-as-hand' and discusses how the organ of sight operates haptically—by taking on proprioceptive characteristics of the skin or body in space—in the writing of the period. If we take haptic perception broadly to mean the experience and gathering of sense data through touch, then what I'm attempting to draw out through identifying such characteristics of the eye is a kind of inversion; I pay attention to moments of 'perceiving haptically', that is, a mode of visual communication in which the eye itself takes on characteristics of the skin, hand, or body in space.

Of haptic perception, Laura Marks writes that 'distant vision gives way to touch, and touch reconceives the object to be seen from a distance. Optical visuality requires distance and a centre, a viewer acting like a pinhole camera. In a haptic relationship our self rushes up to the surface to interact with another surface'.[1] This model runs counter to the notion that Victorian vision was predominantly concerned with surveillance and sites of passive, spectacular stasis, as earlier chapters of this thesis have discussed. Instead, my focus on the language of moving-image technologies and—specifically in this chapter—on the necessity of a manipulating hand to create their animated display uncovers examples in Victorian fiction which figure the eye moving through and around its environment as if its sensory action, that of sight, was able to manifest as a physical entity capable of just the sort of intimate, surface interaction described by Marks. Vision is figured in texts as quite literally *felt*, both by the looker and the looked-at, and it works to extend critical notions of the Victorian spectacular beyond a simply optical experience.

In tracing the visual feelings of the tactile eye this chapter suggests that one important context for this corporeal interface between eye and environment can be found in popular optical technologies of animation which were manually-operated. A

[1] Laura U. Marks, *Touch: Sensuous Theory and Multisensory Media* (Minneapolis: University of Minnesota Press, 2002), p. xvi

manipulating hand was essential to their operation: only by twisting a lens, cranking a handle, or spinning a drum could their display of motion be brought into being. In considering their need for touch and manipulation, I contend that the authority of the screen—that external, inaccessible apparatus so crucial to the panoramic, and later cinematic, aesthetic—gives way to a new emphasis on tangible mechanisms and procedural operation. Challenging the 'dissociation of touch from sight' which Jonathan Crary finds in the nineteenth century, this chapter finds the opposite of his 'autonomization of sight' and 'breach between tangibility and visuality' in which vision was isolated and abstracted.[2] Discussing the 'stereoscope […], phenakistiscope and other nonprojective optical devices', Crary argues that such devices all 'required the corporeal adjacency and immobility of the observer'.[3] However, I show that by attending to the operational process and mechanism of such visual spectacles we see that in fact they relied on corporeal *inclusion* and the *mobility* of the observer. Compared to larger, metropolitan spectacles popular in the early nineteenth century, such as the panorama and diorama, in which viewers attended a purpose-built auditorium and sat or stood removed from the mechanical operation of the show, domestic magic lanterns, dissolving slides, kaleidoscopes, and persistence of vision devices gave a physically intimate visual experience and required that the viewer also perform the function of operator, incorporating both the eye and hand in the production of moving images.

This chapter begins by exploring the tension at the heart of such technologies between the material and the immaterial: their requirement of physical manipulation and uniquely tactile operation was countered by their creation of an image which did not exist as a tangible, evidentially 'real' object. The movement of a dissolving slide cannot be grasped, its protean view never captured by anything other than the eye; likewise the

[2] Jonathan Crary, *Techniques of the Observer* (1990; Cambridge, Mass.: MIT Press, 1992), p. 19.
[3] Crary, *Techniques*, p. 129.

sequential animation seen through the zoetrope's apertures, or the twisting symmetry seen in the kaleidoscope's mirrors. Comprised always of a collage of individual frames, visual motion is a technological and cognitive illusion which exists only at the point of making—yet the hand is fundamental to its coming-into-being. It is this composite sensory experience of interwoven sight and touch which this chapter explores, finding in Victorian fiction a similar model of visual experience which is as tactile as it is visual: as noted above, the eye takes on physical characteristics and vision is physically *felt*. Then, I move on to consider the interoperability of the senses in the nineteenth century, combining two recent 'turns' in scholarship, material and sensory studies. The tactility of visual motion combines the study of the 'thingness' of objects, particularly those which are operable, with a consideration of the sensory affect and phenomenological experience *of* those objects. Technology and the senses cannot be separated: the materiality of sensation easily folds into the sensation of materiality, especially in devices which were predicated on the mutual dependence of physical manipulation and sensory illusion.

I offer a brief context of the theoretical framework of haptic perception, discussing what is meant by ideas of the haptic eye, before moving on to explore in depth moments of 'visual feeling' in the authors under consideration. Discussion is organised around discrete actions of haptic perception, such as fixing eyes, eyes which explore depth, wandering eyes, and the non-verbal communication between eyes which grasp and strike upon each other. This linguistic move away from the spectacular, surveying gaze encourages instead a reading of perception as an intimate, communicative interface between characters. It proposes a model not of surveillance but of sociability, in which the mobile eye weaves connections between characters and emphasises the inhabited, spatial texture of a literary world through an attention to the process of perceiving, and how it *feels* to see and be seen.

Virtual Animation and Making the 'Invisible' Image

Part of the appeal of the visual devices discussed in this thesis was their nature as a hand-held and hand-operated technology. Users were involved in their operation and could make sense of the process behind the spectacle. This phenomenological engagement with process and the awareness of mechanical or physical production was, of course, not specific to optical gadgets. The 1851 Great Exhibition, for example, made a focal point of precisely this. As Thomas Richards writes, the display of various manufactured items (and indeed the display of ongoing manufactur*ing*) at the Crystal Palace 'did not isolate production from consumption; to the contrary, it successfully integrated the paraphernalia of production into the immediate phenomenal space of consumption. News article after news article reminded viewers that the things they were seeing had been produced'.[4] A guidebook for visitors to the Great Exhibition instructed readers 'to look, and wonder, and question, and learn – aye, here they will discover the marvellous rapidity with which instruction and knowledge is conveyed by the eye and the finger – by the organs of sight and feeling'.[5] Here, then, we see the same conjunction of senses, the tactile and the optical, working in operational tandem, which viewers experienced in moving-image technologies.

When users spun the phenakistiscope disk, twisted the kaleidoscope's mirrored tube, or whirled the wheel of the zoetrope, although the animated display presented to the viewer was perceptually commanding, even enthralling, it did not exist anywhere in reality as a tangible, graspable product. As Virginia Woolf would later evocatively write of the

[4] Thomas Richards, *The Commodity Culture of England: Advertising and Spectacle 1851-1914* (Stanford: Stanford University Press, 1990), p. 10.
[5] [Robert Askrill], *The Yorkshire Visitors' Guide to the Great Exhibition, and Also to the Principal Sights of London* (Leeds: Joseph Buckton, 1851), p. 5, qtd. in Richard Bellon, 'Science at the Crystal Focus of the World', in *Science in the Marketplace: Nineteenth-Century Sites and Experiences*, ed. by Aileen Fyfe and Bernard Lightman (Chicago: University of Chicago Press, 2007), pp. 301-335 (p. 323).

cinema, its pictures were 'real with a different reality'.[6] All these devices manufactured images which could be seen but not felt: they were, in this sense, early incarnations of a virtual image.[7] However, paradoxically, to make this insubstantial image depended very much on the physical manipulation of the user's hand in order to create and sustain a seemingly 'existing' display of visual motion. Moving image technologies relied upon a concoction of the real and unreal, the tangible and virtual. (Steve Connor has written that the 'nineteenth century was itself characterized by a strange collaboration of the ponderous and the imponderable, the dense and the nebular'.[8]) The labour of the hand in spinning, cranking, or twisting an apparatus resulted in a visual display which was, in one sense, invisible: it did not exist, except to the eye. We might think here of the work of the reader in physically 'operating' a book in order that the eye and imagination might create its invisible world. Such fictional landscapes—and here I am talking both of those conjured up in the reading of fiction and those displayed through the aperture of animation devices—relied upon the tactility of motor operation and muscle sense to come into 'invisible' being.[9]

As Tom Gunning has written, persistence of vision devices gave the experience of 'seeing something which was 'not there'. […] By means of an afterimage we paradoxically see an object even in its absence'.[10] This 'invisible seeing' was unique to the

[6] Virginia Woolf, 'The Cinema' [1926], in *Selected Essays*, ed. by David Bradshaw (Oxford: Oxford University Press, 2008), pp. 172-176 (p. 172).
[7] For more on nineteenth-century virtuality, see Peter Otto, *Multiplying Worlds: Romanticism, Modernity, and the Emergence of Virtual Reality* (Oxford: Oxford University Press, 2011) and Alison Byerly, *Are We There Yet? Victorian Realism and Virtual Reality* (Ann Arbor, MI: University of Michigan Press, 2013).
[8] Steve Connor, *The Matter of Air. Science and the Art of the Ethereal* (London: Reaktion, 2010), p. 121.
[9] We might think of the animation produced as a 'force-effect', in Brian Massumi's words. Just as Michael Faraday's electric spark worked to visualize the movement of electrical energy, Massumi explains that 'Force is infraempirical. No scientist has ever observed a force. […] Only force-effects are visible. […] Newton did not see gravity. He felt its effect'. *Parables for the Virtual: Movement, Affect, Sensation* (Durham, NC: Duke University Press, 2002), p. 159.
[10] Tom Gunning, 'The Play between Still and Moving Images: Nineteenth-Century "Philosophical Toys" and Their Discourse', in *Between Stillness and Motion: Film, Photography, Algorithms*, ed. by Eivind Røssaak (Amsterdam: Amsterdam University Press, 2011), pp. 27-44 (pp. 27-28). See also 'Hand and Eye: Excavating a New Technology of the Image in the Victorian Era', *Victorian Studies* 54.3 (Spring 2012), 495-515, in which Gunning coins the term 'technological image' to describe this mediated, manipulated,

nineteenth-century experience of moving-image technologies, as was its simultaneous conjunction with an apparatus which depended on physical manipulation to bring its 'not there-ness' into being. Victorian animations were therefore inherently tactile, and their interface of hand, eye, brain, and apparatus offered an opposing experience of technological spectacle than those more passive visual displays which foregrounded spectatorship, surveillance, and observation (such as large-scale panoramas). Isobel Armstrong, discussing new models of physiological vision in this period, evokes the tactility and physical play which these devices commanded when she comments that 'seeing by touch displaces the notion of the passively received image on the retina and substitutes for it the process of experiment with data'.[11]

The tactile involvement of the intervening hand was also necessarily in controlling the speed at which such devices operated—an aspect crucial to the 'correct' viewing of their display. A zoetrope wheel spun clumsily or too slowly would fail to produce a smooth animation and its user would merely see each illustration as an individual image, jolting along. Spun too quickly and the animation would whirl uncontrollably into a blur (we might think here of the mental distress experienced by Carker in *Dombey and Son*, expressed in his inability to distinguish afterimages from present perceptions as all external sights fold into an overwhelming distortion of the real), or the device might even topple, fall, or break. The correct functioning of these devices was, then, contingent on a knowledgeable and assured physical direction.

With this operational tactility came an awareness that the persistence of vision device's rotation was always threatening to slow to a stop, breaking the desired illusion. The hand had to wait, poised to spin again, for the moment when the stroboscopic effect

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'invisible' display which simultaneously creates an effect and demonstrates how that effect is created (p. 498).

[11] Isobel Armstrong, *Victorian Glassworlds: Glass Culture and the Imagination, 1830-1880* (Oxford: Oxford University Press, 2008), p. 334.

began to break down and lose its illusory appeal. Users were asked to delight in the creation of visual motion while remaining vigilant to the inevitable moment when the hand was once more required to intervene. Likewise, the kaleidoscope's operational model necessitated constant control from the hand of the viewer, rotating the device and controlling the speed of its display. One variation could be rolled into the next as quickly or as slowly as desired and at no point did its speed or visual display become separate from the physical action of the manipulating hand. As Mary Ann Doane has eloquently written on these philosophical toys, 'The image of movement itself was nowhere but in the perception of the viewer'; it was 'immaterial, abstract'. However, 'the tangibility of the apparatus and the materiality of the images operated as a form of resistance to this abstraction, assuring the viewer that the image of movement could be produced at will, through the labor of the body'. In contrast to earlier spectacular shows in which ghouls and spectres appeared to 'jump out' or 'fly' at audiences through the ingenious use of projected images upon hidden, transparent screens, Doane rightly asserts that 'The optical toy is anti-phantasmagoric in this respect—it does not hide the work of its operation but instead flaunts it'.[12]

Sensory Systems: Perspectives on Victorian Touch and Vision

The 'flaunting' of mechanism in favour of optical illusion, combined with the need for physical manipulation, offered a sensory experience beyond that of vision alone; optical devices were never purely visual, but incorporated sight *and* touch at every moment of their use. The recent 'sensory turn' in Victorian scholarship has seen a number of studies engage with the history of sensory experience, either taking a single sense (such as John M. Picker's *Victorian Soundscapes* (2003), Janice Carlisle's *Common Scents:*

[12] Mary Ann Doane, 'Movement and Scale: Vom Daumenkino zur Filmprojektion', in *Apparenturen bewegter Bilder, Kulture, und Technik*, vol. 2, ed. by Daniel Gethmann (Munster: LIT, 2006), pp. 123-137, qtd. in Gunning, 'The Play Between Still and Moving Images', p. 33.

Comparative Encounters in High-Victorian Fiction (2004), *Reading Victorian Deafness* (2013) by Jennifer Esmail, and Jonathan Reinarz's *Past Scents: Historical Perspectives on Smell* (Illinois: University of Illinois Press, 2014)) or considering the interconnection of the senses as part of a larger sensory system, offered by William A. Cohen's *Embodied: Victorian Literature and the Senses* (2009). Notably, Cohen's study considers a range of techniques through which 'literary characters are imagined to be embodied' and questions 'the means by which the effect of such immaterial, psychological depth is produced: surprisingly, through the depiction of physical substance, interaction, and incorporation'.[13] This incorporation of sensory data into the thinking, feeling character marks the body, he argues, as 'a sensory interface between the interior and the world, as a process of flux and becoming'.[14]

Considerations of interface and a focus on process over moments of resolution are key aspects of this chapter, however, my reading differs from Cohen's in one particular respect. In his discussion of Dickens, Cohen alights upon the image of keyhole as a channel for information, making the bodily interior and its sensory organs penetrable; he connects this to the sense of sight and of hearing, arguing that eyes and ears, like a keyhole, are spaces through which sensory information might pass. In contrast, I read the visual sense as enacting and participating in frictional encounters more redolent of a tactile exchange *between* than a flow of information *through* a sensory organ.[15] The visual sense is represented as an active participant in its environment, moving imaginatively beyond the confines of the body to gather sensory data and communicate haptically. If for Cohen

[13] William A. Cohen, *Embodied: Victorian Literature and the Senses* (Minnesota: University of Minnesota Press, 2009), pp. xi-xii. See also his 'Faciality and Sensation in Hardy's *The Return of the Native*', *PMLA* 121.2 (March 2006), 437-452.
[14] Cohen, *Embodied*, p. xiii.
[15] Cohen's most recent work does, however, attend to the tactile 'rubbing' and interchange between man and nature; see 'Arborealities: The Tactile Ecology of Hardy's Woodlanders', *19: Interdisciplinary Studies in the Long Nineteenth Century* 19 (2014), 1-19.
[http://www.19.bbk.ac.uk/index.php/19/article/viewFile/690/1014; accessed 4 November 2014].

the eye is a static inlet, in the Victorian texts under discussion here the eye is figured as a wandering tactile surface, endowed with agency and mobility.

Developing the study of material culture and object theory (what Jennifer Sattaur has surveyed as the study of 'thinking objectively'),[16] recent critical work has emphasised the phenomenological implications of various technologies which required physical operation, and has specifically linked this to the interoperability of the senses. Elizabeth Edwards has drawn attention to photography's 'demand' of a 'physical engagement' with the body in order to be brought into being. Photographs as objects are 'intrinsically active in that they are handled, touched, caressed', she writes.[17] Luisa Calè and Patrizia Di Bello's essay collection *Illustrations, Optics and Objects in Nineteenth-Century Literary and Visual Cultures* (2010) offers essays on Wordsworth's tinted glasses, the violence of Medusa's glances (imagined as 'blows' in Shelley's poem 'On the Medusa of Leonardo da Vinci in the Florentine Gallery'), the materiality of illustrated books, and the temporal dislocation of photography. Their Introduction asserts the importance of studying 'the tangible qualities of media' for a deeper engagement with 'embodied modes' of visuality, and note, importantly, that the nineteenth century uniquely witnessed 'the coming together of the conceptual and the manual in an act of seeing that is also a grasping, or handling'.[18] Arguing that Crary's notion of visual embodiment extends only as far as 'a set of eyes and their neurological connections', their collection demonstrates that

> the experience of looking—whether reading texts or enjoying pictures—is never *just* visual, but it is also tactile, kinaesthetic, fully embodied, and affected by the material properties of the objects we do our looking and reading with. [Practices

[16] Jennifer Sattaur, 'Thinking Objectively: An Overview of 'Thing Theory' in Victorian Studies', *Victorian Literature and Culture* 40 (2012), 347-357.
[17] Elizabeth Edwards, 'Grasping the Image. How Photographs are Handled', in *The Book of Touch*, ed. by Constance Classen (Oxford and New York: Berg, 2005), pp. 421-425 (p. 422).
[18] Luisa Calè and Patrizia Di Bello, 'Introduction: Nineteenth-Century Objects and Beholders', in *Illustrations, Optics and Objects in Nineteenth-Century Literary and Visual Cultures*, ed. by Luisa Calè and Patrizia Di Bello (Basingstoke: Palgrave Macmillan, 2010), pp. 1-24 (pp. 1, 4). See also Deirdre Coleman and Hilary Fraser's edited collection *Minds, Bodies, Machines, 1770-1930* (Basingstoke: Palgrave Macmillan, 2011).

> of vision] are always imbricated in a phenomenological, multi-sensorial world [which] disturb[s], deflect[s]s, or indeed augment[s] the experiences we have come to describe as *visual*.[19]

Following this work, I argue that the presentation of perception in literary texts is directly and explicitly affected by 'the objects we do our looking with': specifically, moving-image technologies encouraged a sense that seeing was absolutely entwined with the motion of the hand, making the eye a kind of proprioceptive sense, able to range, roam, and feel its way around an external environment.

Abbie Garrington, whose work on modernist texts argues that early-twentieth-century writing was particularly involved with haptic perception (I address this further below), contends that 'discernible within this scholarly field [studies of the sensuous in culture] is a shift from the distant to the proximal senses'.[20] However, my focus on the language of nineteenth-century sensory experience shows that vision and touch might not always confer readings of distance and proximity, respectively. Instead, I draw out the textual expression of the intimacy of vision, and its sensuous exploration of the seen environment. As David Howes has written, 'critiques of the dominance of sight tend to remain within the realm of vision and rarely consider what alternatives to hypervisualism might lie within other sensory domains, or emerge from combining the senses in new ratios'.[21] The mid-Victorian texts I go on to consider present a multi-sensory way of knowing and understanding in which one particular sensory input is not given dominance—a 'new ratio' of sensory sharing also being employed quite literally in the period's many moving-image technologies which relied on an operational union of the eye and hand.

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[19] Calè and Di Bello, 'Introduction', pp. 4-5.
[20] Abbie Garrington, *Haptic Modernism: Touch and the Tactile in Modernist Writing* (Edinburgh: Edinburgh University Press, 2013), p. 47.
[21] David Howes, *Sensual Relations: Engaging the Senses in Culture and Social Theory* (Michigan: University of Michigan Press, 2003), p. xiii.

Sensations of Sight

'We see very much by the aid of our fingers', G. H. Lewes writes in *Sea-Side Studies* (1858), discussing why types of mollusc are unable to form a correct perception of an image: although their pigmented and sensitive skin registers the same changes in temperature as the human retina does on looking at a variously coloured scene (it is this which creates the sensation of perception, he writes), 'the optical conditions for the formation of an image are absent':

> An indefinite sensation, resulting from the change of temperature is all that they can perceive. Nay, even where their eyes constructed so as to form optical images, there is little doubt that vision, in our human sense, would still fail them, owing to the absence of the necessary combination of tactile sensation's with sensations of light.[22]

Here, as Isobel Armstrong describes, 'Lewes argues for a phenomenological understanding of sight, anticipating Helmholtz'. 'Molluscan vision is not seeing but feeling', she writes, whereas, as Lewes points out, human vision is seeing *and* feeling.[23] Along with Lewes and Helmholtz, other philosophical and psychological studies were similarly theorizing the capabilities of and relationship between touch and vision in the mid-nineteenth century.[24] Alexander Bain pays particular attention to this in *The Senses and the Intellect* (1855). Touch, he writes, is of a 'higher' order than the senses of taste or smell, being 'not a simple sense, but a compound of sense and motion'. It is 'not merely a

[22] G. H. Lewes, *Sea-Side Studies at Ilfracombe, Tenby, The Scilly Isles, & Jersey* (London: Blackwood, 1858), p. 353.
[23] Armstrong, *Victorian Glassworlds*, p. 334. See also her essay 'The Microscope: Mediations of the Sub-Visible World' in *Transactions and Encounters: Science and Culture in the Nineteenth Century*, ed. by Roger Luckhurst and Josephine McDonagh (Manchester: Manchester University Press, 2002), pp. 30-54 (p. 42).
[24] Philosophical consideration of the role of touch in the creating and interpretation of visual perception was not, of course, specific to the nineteenth century (although this was the period when developments in understanding the physiology of the body enabled rapid progress to be made in more fully understanding the relationship between the external world and the body's sensory systems). Across the seventeenth and eighteenth century, the problem known as 'Molyneux's question' was debated by thinkers such as Locke, Berkley, Condillac, and Diderot. Scholarship has amply covered this history: see Michael J. Morgan, *Molyneux's Question. Vision, Touch, and the Philosophy of Perception* (Cambridge: Cambridge University Press, 1977); Jessica Riskin, *Science in the Age of Sensibility: The Sentimental Empiricists of the French Enlightenment* (Chicago and London: The University of Chicago Press, 2002); and Mark Paterson, *The Senses of Touch: Haptics, Affects, and Technologies* (Oxford: Berg, 2007), particularly Chapter Three.

knowledge-giving sense, as they all are, but a source of ideas and conceptions of the kind that remain in the intellect and embrace the outer world' (much as the observation of visual motion was a composite of internal, cognitive processing and external, bodily operation).[25]

Referring to the 'muscle sense' first discussed by Charles Bell,[26] he states early on that it is 'well admitted' that 'the feelings connected with the movements of the body, or the action of the muscles, have come to be recognised as a distinct class, differing materially from the sensations of the five senses'.[27] This 'distinct' sense of muscular movement (that which is so crucial in theories of haptic perception, as I address below) combines with the sense of sight to produce a fuller sensory experience: 'The feelings arising from Sight alone make only one class of these sensations: the combination of optical and muscular states gives birth to the most various and interesting department of feelings connected with vision'.[28] Bain is positing a model of vision (understood here as more than simply seeing) which could contain a multitude, a whole 'department', of feelings which result from the combination of optical sights and muscular states. Likewise, we find multiple aspects of 'felt' vision in Victorian fiction, as different types of muscular movement (catching, grasping, following, roaming, penetrating) combined with the sense of sight, as I go on to show.

This tactile sense of muscularity is a consequence of the mobile, almost tangible way vision operates. 'The eye is kept constantly at work upon the surrounding scene', Bain describes, 'following the outlines and windings of form, as these extend in every

[25] Alexander Bain, *The Senses and the Intellect* (London: John W. Parker, 1855), p. 171.
[26] Bell proposes, 'I shall first enquire, if it be necessary to the governance of the muscular frame, that there be a consciousness of the state or degree of action of the muscles?', and concludes that 'it appears the muscle has a nerve in addition to the motor nerve'. See 'On the Nervous Circle Which Connects the Voluntary Muscles with the Brain', *Philosophical Transactions* 116 (1826), 163-173 (pp. 167, 170). For an excellent overview of its nineteenth-century history, see Roger Smith, ''The Sixth Sense': Towards a History of Muscular Sensation', *Gesnerus* 68.2 (2011), 218-271.
[27] Bain, *The Senses*, p. 67.
[28] Bain, *The Senses*, p. 233.

direction'. The eye is imagined to spatially trace form, much as a feeling hand might. Visual perception operates not as a single glance (as in the model of the eye as a camera obscura, open to an external scene which is reflected back to the vision, whole and intact) but as a 'cohering and storing up' of many views in 'succession'; evoking the persistence of vision, Bain extends this to argue that the eye feels its way around a landscape as if a muscular entity, following the contours of form and texture, and then creates a picture from these tactile composites.[29] What he calls these '*complex sensations* of sight' result 'from the combination of optical effect with the feeling of movement arising out of the muscles of the eyeball'. 'Sensations of sight', he writes, 'are compounded of visual spectra and muscular feelings. A visible picture is, in fact, a train of rapid movements of the eyes, hither and thither, over luminous points, lines, and surfaces', and it is this mobile and highly tactile understanding of the process of seeing which is represented in mid-Victorian fiction.[30] The eye, driven by the surrounding musculature, operates as any other bodily appendage, bound with nerve and muscle, would.

Haptic Perception

In attending to the often physical representation of visual activity in the Victorian novel, I do not want to suggest that vision *becomes* tactile or that the sensory experiences of touch and vision are conflated into one, but rather that the literature under consideration presents a multimodal experience in which functions and properties are *shared between* sensory operations, and that sight in particular takes on characteristics beyond that usually associated with visual perception. Representations of the eye in action show that it is endowed with the capability to figuratively move around an environment, and to act upon

[29] Bain, *The Senses*, p. 247.
[30] Bain, *The Senses*, pp. 239, 350 (emphasis in original).

other objects in a way which is normally associated with the force and tactility of the hand; Victorian perception, then, can be understood to—at times—operate haptically.

Theorizations of the haptic sense developed at the end of the nineteenth century, but critics point towards Bell's discussion in the 1820s of a 'muscle sense' and of Henry Charles Bastian's work on kinaesthesia in 1880 when tracing its history. Indeed, by 1890 John Shaw Billington included the term 'haptic' in *The National Medical Dictionary*, writing that it 'pertain[s] to touch, tactile' and is 'in current use in […] medical literature'.[31] The late-nineteenth-century writings of Alois Riegl, a curator of textiles and art historian, helped to define the term and bring it into further use throughout the twentieth century. He described two kinds of visual experience: the optical, which delivers a survey or account of distinguishable objects in deep space; and the haptic, which feels its way along or around a world conceived of as an infinitely variable surface, alert to texture rather than outline. Riegl spoke of a 'haptic' (with its etymology, *haptein*, meaning 'to fasten') rather than a 'tactile' look, because he did not want this look to be understood as a literal touching.[32] His theory derived from Adolf von Hildebrand's 1893 work *The Problem of Form in the Visual Arts*. Hildebrand wrote of 'near' and 'distant' views, whereas Riegl used the distinction of 'haptic' and 'optic'. As Margaret Iversen explains: 'One mode of vision, the near or haptic, is analogous to the sense of touch […]. The distant or optic view, on the contrary, takes in a synoptic survey

[31] See particularly Mark Paterson, 'Movement for Movement's Sake? On the Relationship Between Kinaesthesia and Aesthetics', *Essays in Philosophy* 13.2 (2012), 471-497 and Abbie Garrington, 'Touching Dorothy Richardson: Approaching *Pilgrimage* as a Haptic Text', *Pilgrimages: A Journal of Dorothy Richardson Studies* 1 (2008), 74-96 (p. 76).

[32] Riegl developed his theory of haptic looking in *Problems of Style: Foundations for a History of Ornament* [1893], trans. Evelyn Kain (Princeton: Princeton University Press, 1993); and *Late Roman Art Industry* [1901], trans. Rolf Winkes (Rome: Giorgio Bretschneider Editore, 1985). The explanation of his choice of terminology occurs in an essay of 1902, 'Late Roman or Oriental?', trans. Peter Wortsman, in *German Essays on Art History*, ed. by Gert Schiff (New York: Continuum, 1988), 173–190 (p. 190). Gilles Deleuze and Félix Guattari, discussing pattern in nomad art in 'The Smooth and the Striated', write that ''Haptic' is a better word than 'tactile' since it does not establish an opposition between two sense organs but rather invites the assumption that the eye itself may fulfil this nonoptical function'. *A Thousand Plateaus: Capitalism and Schizophrenia*, trans. by Brian Massumi (London: The Athlone Press, 1988), p. 492.

of objects in space'.[33] Drawing on Riegl's framework, the surveying, distant 'optic' view can be thought of as that offered by technologies such as the panorama and other static spectacles which do not involve a proximate relation to their spectator. The near, or 'haptic' view, however, connotes the tactile, textural, and sensuous view found in those technologies which demand a physical relationship based on bodily manipulation: moving-image technologies.

The haptic sense is not just the sense of touch, of pure tactility, or of the hand alone: it is of the pull into and from the environment present in any perceptive activity, of touch in relation to the body's sense of its own movement through space (kinaesthesia), and of the force, or effort, exerted in its positioning and mobility—and indeed in the resistance to its movements (proprioception). We might then think of 'the haptic' or 'haptic feedback' as the body engaging with its environment; not just associated with the tactility of material objects, it concerns the phenomenology of existing as a living, mobile being within a specific space. Its Greek etymology, Giuliana Bruno notes, tells us that 'haptic means 'able to come into contact with''. In her study of the relationship between space, film, and the haptic sense, she offers a concise and provoking definition:

> As a function of the skin, then, the haptic – the sense of touch – constitutes the reciprocal con*tact* between us and the environment, both housing and extending communicative interface. But the haptic is also related to kinesthesis, the ability of our bodies to sense their own movement in space. […] This book considers the haptic to be an agent in the formation of space. […] Here, the haptic realm is shown to play a tangible, *tact*ical role in our communicative sense of spatiality and motility, thus shaping the texture of habitable space and, ultimately, mapping our ways of being in touch with the environment.[34]

Bruno places emphasis on activity: the haptic is concerned with contact, interface, and communication. Information gathered and shared haptically is done so through an

[33] Margaret Iversen, *Alois Riegl: Art History and Theory* (Cambridge, Mass.: MIT Press, 1993), p. 9.
[34] Giuliana Bruno, *Atlas of Emotion: Journeys in Art, Architecture, and Film* (London and New York: Verso, 2002), p. 6 (emphasis in original).

interface of body and environment, and for this fundamentally 'communicative' endeavour, mobility through space is necessary. It is precisely this which we see in the movement of the eye around the imagined landscape of the novel, and it is through the frictional interface, or rubbing, of eyes upon eyes that (often wordless) communication occurs. Following Bruno, this chapter understands the haptic as a 'vast, relational space', a phenomenological mode which 'connects sense to place'.[35] In emphasizing the 'relational' nature of tactile vision in the mid-Victorian texts I draw on, Bruno's assertion that hapticism marks a 'theoretical shift from the optic to the haptic—and from sight to site' proves extremely pertinent. The physicality mobility of the eye, and its connection to the manipulating hand in the visual devices I have been discussing, reconceives the visual field as precisely that: an imagined space through which vision can figuratively move.[36]

The relation between haptic perception and moving images has only been discussed in studies of twentieth-century cinema.[37] However, the stereoscope has drawn attention from nineteenth-century critics for its particular intertwining of vision and touch, technology and phenomenal experience, and as such it offers a good example of the nineteenth-century haptic.[38] Addressing the stereoscopic viewing of photographs of sculpture—their original mass reimagined optically in three dimensions—John Plunkett writes that 'the stereoscope gave photography a new haptic, material dimension', summarizing that 'the sculptural quality of stereoscopy is part of its refiguring of the Victorian sensorium, and, more particularly, exemplifies the way that the device shifted

[35] Bruno, *Atlas of Emotion*, pp. 6, 255.
[36] Bruno, *Atlas of Emotion*, p. 255.
[37] For more on haptic theory and cinema, see Bruno, *Atlas of Emotion*, pp. 255-268 for a thorough overview, and also Noël Burch, 'Building a Haptic Space' in *Life to Those Shadows*, trans. Ben Brewster (Los Angeles: University of Californian Press, 1990), pp. 162-185; Vivian Shoback, *The Address of the Eye: Phenomenology of Film Experience* (Princeton: Princeton University Press, 1992); and Antonia Lant, 'Haptical Cinema', *October* 74 (1995), 45–73.
[38] Bain, writing in 1855, noted the particularly tactile, and indeed kinaesthetic, vision offered by the stereoscope: 'When the two eyes view the perspective of a street, there is brought up the idea of a certain amount of walking exertion or other locomotive measurement as part of the perception thence arising. The two eyes looking at a footstool bring up in like manner ideas of greater or less remoteness of the parts'. Bain, *The Senses and the Intellect*, p. 383.

conceptions of the relationship between vision and touch'. In fact, the 'tangibility' of stereoscopy was its 'principal attraction, and, as such, emphasises the period's own desire for an embodied visuality'.[39] This same desire can also be registered in the use and literary representation of moving-image technologies, as I go on to demonstrate. Plunkett's article productively places the stereoscope within both its popular and scientific context, examining the debates being staged within scientific publications (particularly by David Brewster and Charles Wheatstone) about the functioning of binocular vision and dimensional perception. In this way, he argues, 'rather than the stereoscope being part of a rupture with the enlightenment tradition of geometrical optics [as Crary has it], the device became the subject of conflicting interpretations from two scientific camps, which had antithetical explanations of binocular vision and spatial perception'.[40] Such work places nineteenth-century optical devices within the same philosophical context as Molyneaux's question (see note 25 above), and connects visual technology to debates over physiology, phenomenal experience, and the interoperability of the senses.

In considering the 'haptic dimension' of the stereoscope, in which viewers saw dimensional depth, Plunkett turns to the writings of Oliver Wendall Holmes, inventor of a variety of stereoscope in 1860. 'The mind feels its way into the very depths of the picture', Holmes wrote, continuing that 'we clasp an object with our eyes, as with our arms, or with our hand, or with thumb and forefinger, and then we know it to be something more than surface'. As Plunkett summarizes, 'For Holmes, the stereoscope demonstrated that sight

[39] John Plunkett, 'Feeling Seeing': Touch, Vision and the Stereoscope, *History of Photography* 37.4 (2013), 389-396 (pp. 389-390). See also Patrizia Di Bello's article in the same special edition ('The Sculptural Photograph in the Nineteenth Century, ed. by Di Bello): 'Multiplying Statues by Machinery': Stereoscopic Photographs of Sculptures at the 1862 International Exhibition', 412-420, and Plunkett's earlier chapter 'Depth, Colour, Movement: Embodied Vision and the Stereoscope', in *Multimedia History: From the Magic Lantern to the Internet*, ed. by James Lyons and John Plunkett (Exeter: University of Exeter Press, 2006), pp. 155–172.
[40] Plunkett, 'Feeling Seeing', p. 390.

had a sensuous aspect that had previously been assigned to touch'.[41] Holmes' deep, clasping eye is found throughout later theorizations on the haptic sense; in Claude Gandleman's words, 'The optical eye merely brushes the surface of things. The haptic, or tactile eye, penetrates depth, finding its pleasure in texture and grain'.[42] There are many instances in the mid-Victorian texts discussed later in this chapter of the penetrating eye, or of the eye which could figuratively wander to its subject, clasping it as if by hands and arms. Further, as Laura Marks writes, haptic looking 'is a labile, plastic sort of look, more inclined to move than to focus'.[43] Extending work on the haptic stereoscope (which offered a static picture), moving-image devices provide an excellent contextual background from which to study the delving, textural eye endowed with spatial movement which is evident in the play of visual perception between characters in Brontë, Dickens, and Eliot. For David Trotter, stereoscopy 'involves the visualisation of tangibility'. Conversely, I show that optical devices of animation offered a tangibility of visualization which was particularly explored in the fictional representation of vision.[44]

The Haptic in Literature: Touching Eyes, Seeing Hands

Almost all considerations of haptic perception and literature focus on the modernist period (quite understandably, as hapticism was in the process of being fully theorized at this time). Abbie Garrington contends there is a 'fundamental connection between artistic and literary output and the haptic sense during this time'.[45] In her recent study, she argues that 'the haptic […] is a peculiarly modernist matter' and can be defined as 'a set of somatic experiences […]—a set undergoing a crucial phase of adaptation and theorisation in the

[41] Oliver Wendell Holmes, 'The Stereoscope and the Stereograph', in *Soundings from the Atlantic* (Boston: Ticknor and Fields, 1864), pp. 124-165 (pp. 148, 142), qtd. in Plunkett, 'Feeling Seeing', p. 394.
[42] Claude Gandleman, *Reading Pictures, Viewing Texts* (Indianapolis: Indiana University Press, 1991), p. 5.
[43] Marks, *Touch: Sensuous Theory and Multisensory Media*, p. 8.
[44] David Trotter, 'Stereoscopy, Modernism, and the Haptic', *Critical Quarterly* 46.4 (2004), 38-58 (p. 48).
[45] Abbie Garrington, 'Touching Texts: The Haptic Sense in Modernist Literature', *Literature Compass* 7.9 (2010), 810-23 (p. 814).

modernist period'.[46] Garrington finds 'an unprecedented level of interest' and a clear 'orientation toward the haptic in the literature of the modernist period'. She 'consider[s] the technological and social changes of the modernist period and seek[s] to establish their contribution to a renewed interest in matters haptic'.[47] Behind this 'renewed' modernist concern with hapticism lies the Victorian interest in matters of sensory physicality, expressed particularly in the language of perception.

Looking specifically at Thomas Hardy's poetry, Marion Thain has argued for the value of 'reading Hardy phenomenologically'.[48] Although finding what she terms his 'poetics of touch', her analysis pushes beyond reading for touch as a single sensory experience; for reasons similar to those stated by Riegl in his preference for the 'haptic' over the 'tactile', she explores 'a poetry that enacts what it is like to experience the world physically and immediately, rather than to decode it intellectually through the windows of the eyes. This is to recognize the phenomenological character of Hardy's poetry, which is as much concerned with recording the touch or 'impress' of the world as its appearance: it responds to a combined tactile and visual experience'.[49] Although taking into account the mid-century interest in the dense materiality of bodies and things, Thain focuses upon the philosophical context in which Hardy was writing, and does not consider the contemporary experiences which might have provided precisely this 'combined' sensory experience of tactility and vision. Extending Thain's scholarship by identifying a specific context in those optical devices which provided visual animation through the conjunction of physiology, cognitive process, and bodily manipulation, leading to a vision which was both physical yet intangible, this chapter offers the first attempt to bring together sensory theory and the phenomenal study of moving-image technology in a Victorian context.

[46] Garrington, *Haptic Modernism*, pp. 16, 19.
[47] Garrington, *Haptic Modernism*, p. 17.
[48] Marion Thain, 'Hardy's Poetics of Touch', *Victorian Poetry* 51.2 (Summer 2013), 129-145 (p. 129).
[49] Thain, 'Hardy's Poetics of Touch', p. 130.

The eye in mid-Victorian fiction is intimate with its subject; it is wielded as if a corporeal instrument. Representations of characters looking or being looked at in the novels of Dickens, Brontë, and Eliot describe the organs of sight as if they were endowed with the physical and agential properties of a reaching, grasping, and mobile hand. The sections below address five particular aspects of this visuality tactility: eyes that catch, fix, or attach to their object of vision; eyes that penetrate and the physical *feeling* of such visual piercing; the striking of sight upon its object; wandering, roaming, or following eyes; and the wordless communication between characters enabled by a collision of gazes. Each type of action requires that the eye be imagined as a mobile instrument of vision, able to operate as a force within the surrounding environment. Eyes in the mid-Victorian novel are not simply portals or apertures from which to survey out or look in. Instead, they appear to physically reach out and touch, hold, or penetrate into their object of vision with a movement relevant to the feeling being expressed.

Fixing Vision

Instances of the eye fixing or holding its object do not appear with any regularity in Eliot's work, and in Brontë's they are minimal: in *Jane Eyre* (1847), Jane's cousin Diana 'riveted a searching look on her brother's face'[50] and Lucy Snowe, the protagonist-narrator of *Villette* (1853) describes the somewhat uncomfortable attention paid to her by the surveilling eye of Madam Beck, the school's director: 'I found myself an object of study: she held me under her eye; she seemed turning me round in her thoughts'.[51] In Brontë's

[50] Charlotte Brontë, *Jane Eyre*, ed. by Margaret Smith (Oxford: Oxford University Press, 2008), p. 357.
[51] Charlotte Brontë, *Villette*, ed. by Margaret Smith and Herbert Rosengarten (Oxford: Oxford University Press, 2008), p. 76. For more on *Villette* and visual surveillance, see particularly Sally Shuttleworth, ''The Surveillance of a Sleepless Eye': The Constitution of Neurosis in *Villette*', in *One Culture: Essays in Science and Literature*, ed. by George Levine (Madison: University of Wisconsin Press, 1987), pp. 313-338 (see also Chapter 10 in her later full-length study, *Charlotte Brontë and Victorian Psychology* (Cambridge: Cambridge University Press, 1996) for a reworking of this); Joseph A. Boone, 'Depolicing *Villette*: Surveillance, Invisibility, and the Female Erotics of 'Heretic Narrative'', *NOVEL: A Forum on Fiction* 26.1

and Eliot's works, we more often find instances of the eye roaming its surroundings, or being the subject of a penetrating or striking glance, as I go on to discuss below. However, in Dickens's representations of the eye and its capabilities, we find many examples of the visual sense rendered able to reach out and touch or hold its object.

Louisa looks at Gradgrind 'fixedly' before decidedly 'removing her eyes from him'; the impact of Mrs Snagsby 'fix[ing]' her eyes upon Mrs Snagsby 'fearfully disconcert[s]' him and 'strikes him dumb'; Edith looks at Florence, 'her brilliant eyes intent upon her face, until Florence raising her own, she, in her turn, withdrew her gaze, and turned it on the ground'.[52] This 'fixing' eye could have quite violent attributes: in *Dombey and Son* (1846-8), we read that Mrs Skewton's 'glance of fire was bent downward upon [Edith]' and that Rob 'nailed' his eyes upon Mr Carker.[53] Mrs Pipchin, the stern boarding-house keeper of Paul Dombey's youth, had 'a hard grey eye, that looked as if it might have been hammered at on an anvil without sustaining any injury'.[54] Description of her 'hard grey eye' occurs a further three times (pp. 147, 148, and 149), complimenting and deepening the description of her constitution which, in spite of her need 'to be coaxed sleep by the soporific agency of sweet-breads', was 'made of such hard metal'.[55] In focusing description specifically on her eyes, Dickens goes beyond generic description of her character by enabling readers to imagine specifically how she perceives and how it might feel to be looked at by her 'hard' eyes. Similarly, *Villette*'s Lucy Snowe reinforces the watchful and sharp-eyed nature of Madame Beck in retelling how, when

(Autumn 1992), 20-42; and Sandro Jung, 'Curiosity, Surveillance and Detection in Charlotte Brontë's *Villette*', *Brontë Studies* 35.2 (2010), 160-171.

[52] Charles Dickens, *Hard Times*, ed. by Kate Flint (London: Penguin, 1995), p. 102; Charles Dickens, *Bleak House*, ed. by Stephen Gill (Oxford: Oxford University Press, 2008), p. 483; Charles Dickens, *Dombey and Son*, ed. by Alan Horsman (Oxford: Oxford University Press, 2008), p. 448.

[53] Dickens, *Dombey and Son*, pp. 458, 330.

[54] Dickens, *Dombey and Son*, p. 105.

[55] Dickens, *Dombey and Son*, p. 145.

saying a final goodbye to M. Paul, 'her eye graz[ed] me with its hard ray like a steel stylet'.[56]

In these instances, the eye is compared to an object which could directly feel, touch, and impact upon things in the external environment. However, the converse scenario is also presented: objects are able to strike upon the sensate eye. 'To Let' signs 'glare' at Pip in *Great Expectations* (1860-1), and in Eliot's *The Mill on the Floss* (1860) Tom Tulliver is 'startled' by a sign in a shop-window, advertising an upcoming sale of property: 'the words 'Dorlcote Mill' in large letters on a hand-bill, [were] placed as if on purpose to stare at him'.[57] In Dickens's *Hard Times* (1854), Mr. Bounderby, suspecting that Stephen Blackpool had a part in the robbery of Coketown Bank, draws up a placard calling for Stephen's apprehension and with the offer of a reward: 'he had the whole printed in great black letters on a staring broadsheet; and he caused the walls to be posted with it in the dead of night, so that it should strike upon the sight of the whole population at one blow. […] Many ears and eyes were busy with a vision of the matter of these placards, among turning spindles, rattling looms, and whirling wheels, for hours afterwards'.[58] The impact of Bounderby's text 'strikes' the eyes of the onlookers and, in the manner of a persisting retinal image, remains present to their vision for 'hours' afterwards.

The outwardly-feeling eye is also used to signal to the reader pivotal moments in a plot: here, the activity of one's eyes can wordlessly reveal important clues or information which cannot be spoken aloud. (We might think of this in relation to the way modern films

[56] Brontë, *Villette*, p. 481. Katherine Inglis has undertaken excellent work in drawing out the scientific and optical context of such references in this novel. Arguing that most scholarship on the novel pays attention to the social construction of vision rather that the operation of the *eye* as a physical part of the body, her recent article looks particularly at ophthalmology and its instruments, including the stylet. See 'Ophthalmoscopy in Charlotte Brontë's *Villette*', *Journal of Victorian Culture* 15.3 (2010), 348-369.
[57] Charles Dickens, *Great Expectations*, ed. by Charlotte Mitchell (London: Penguin, 1996), p. 173; George Eliot, *The Mill on the Floss*, ed. by Gordon S. Haight (Oxford: Oxford Worlds Classics, 2008), p. 233.
[58] Dickens, *Hard Times*, p. 248.

are able to play with chronology to reveal certain aspects of the unfolding tale to viewers, or to narrative voices which reveal important details in an aside to readers to keep them one step ahead of a character's actions.) When Guppy, in *Bleak House* (1852-3), asks Lady Dedlock if she knows of an Esther Summerson, Lady Dedlock's 'eyes look at him full'. As he starts to ask directly about the similarity between Esther's countenance and a portrait of Lady Dedlock he has recently seen, we learn that she 'removes her eyes from him no more. [..] All this time, her eyes never once release him', signalling wordlessly her profound concern at Guppy's inferring questions.[59] Later, getting to her feet in church for the arrival of 'the great people', Esther's description of first seeing Lady Dedlock emphasizes the importance of the occasion by its attention to the meaningful activity of their eyes:

> Shall I ever forget the rapid beating at my heart, occasioned by the look I met as I stood up! Shall I ever forget the manner in which those handsome proud eyes seemed to spring out of their languor and to hold mine! It was only a moment before I cast mine down—released again, if I may say so—on my book; but I knew the beautiful face quite well in that short space of time.[60]

Earlier, Esther describes herself as 'certain to encounter [Guppy's] eyes when I least expected it, and, from that time, to be quite sure that they were fixed upon me all the evening. […] So there I sat, not knowing where to look—for wherever I looked, I knew Mr Guppy's eyes were following me'.[61] Although the narrative here does not reveal all, the movement and play of eyes—their fixing, holding, releasing, and following—in these passages alerts us to and helps to weave connections between these characters and their incremental secret discoveries which become crucial as the plot unfolds.

[59] Dickens, *Bleak House*, pp. 428, 431.
[60] Dickens, *Bleak House*, p. 268.
[61] Dickens, *Bleak House*, p. 184.

Wielding the Gaze: Skin Deep

That the play of eyes works to create and reinforce a wordless connection between characters is also apparent in the way a character's eyes are described as penetrating or piercing into another's. Just as the eye is imagined to physically reach out and fix upon its subject, it could also explore deep into its surroundings, not just fixedly looking upon but first striking and then *entering into* another's eyes. The commonly used phrase of 'feeling someone's eyes watching us' is pertinent here, particularly in the work of Brontë and Eliot: vision is *felt* upon the body, as if the result of a tactile touch than the imagined impress of a watchful, penetrating eye.

The development of the relationship in *Villette* between Lucy Snowe and M. Paul, a fellow teacher at Madame Beck's school, often hinges on moments of intensely visual interaction. Early in the novel, Lucy withdraws into a classroom overlooking the garden to read quietly and alone:

> I commenced reading. Just as the stilly hum, the embowering shade, the warm, lonely calm of my retreat were beginning to steal meaning from the page, vision from my eyes, and to lure me along the track of reverie, down into some deep dell of dreamland—just then, the sharpest ring of the street-door bell to which that much-tried instrument had ever thrilled, snatched me back to consciousness.
>
> Now the bell had been ringing all the morning, as workmen, or servants, or *coiffeurs*, or *tailleuses*, went and came on their several errands. Moreover, there was good reason to expect it would ring all the afternoon, since about one hundred externes were yet to arrive in carriages or fiacres: nor could it be expected to rest during the evening, when parents and friends would gather thronging to the play. Under these circumstances, a ring—even a sharp ring—was a matter of course: yet this particular peal had an accent of its own, which chased my dream, and startled my book from my knee.
>
> I was stooping to pick up this last, when—firm, fast, straight—right on through vestibule—along corridor, across carré, through first division, second division, grand salle—strode a step, quick, regular, intent. The closed door of the first classe—my sanctuary—offered no obstacle; it burst open, and a paletôt and a

> bonnet grec filled the void; also two eyes first vaguely struck upon, and then hungrily dived into me.[62]

Startled by a particular ringing of the bell, Lucy's reverie gives way to an urgency of moment-by-moment description; her thoughts and actions unfold for the reader as she hears the approaching step of M. Paul, mapped through the corridors of the school, before he finally comes to a halt at the doorway of her 'sanctuary'. The charged culmination is a striking of eyes, as his sight finds its object and then 'hungrily dived' within—his searching gaze here figured as a consuming, penetrative force. We might compare the action of M. Paul's eyes to those of Graham's, a childhood friend and doctor in Villette who acts as a brother to Lucy during her time on the Continent: '*his* lips let fall no caustic that burned to the bone; *his* eyes shot no morose shafts that went cold and rusty and venomed through your heart'.[63]

Despite Lucy's sharp attack on M. Paul's caustic glances, such moments of silent communication, signalled by instances of profoundly tactile and affective *looking*, alert us to the growing bond between them. Overwhelmed by the constancy with which she is observed at the school—predominantly by Madame Beck—Lucy is nonetheless intrigued by the attention paid to her by M. Paul, the 'new […] male spy':

> As I said before, I was sitting near the stove, let into the wall beneath the refectory and the carré, and thus sufficing to heat both apartments. Piercing the same wall, and close beside the stove, was a window, looking also into the carré; as I looked up a cap-tassel, a brow, two eyes, filled a pane of that window; the fixed gaze of those two eyes hit right against my own glance: they were watching me. […]
>
> This was a strange house, where no corner was sacred from intrusion, where not a tear could be shed, nor a thought pondered, but a spy was at hand to note and to divine. And this new, this out-door, this male spy, what business had brought him to the premises at this unwonted hour? What possible right had he to

[62] Brontë, *Villette*, p. 133.
[63] Brontë, *Villette*, p. 223.

> intrude on me thus? No other professor would have dared to cross the carré before the class-bell rang. M. Emanuel took no account of hours nor of claims […].[64]

As we saw in the disruption of Lucy while reading in the classroom, again M. Paul's eyes strike upon hers. Here, though, her own gaze matches his: their eyes physically 'hit right against' each other.[65]

Brontë's earlier work evidences the same interest in describing character relations in terms of their intimate, and often quite violent, visual communication. The male narrator of *The Professor* (published posthumously in 1857), a novel concerned with much of the same themes as the later *Villette*, foreshadows the intense and purposeful perceptual activity of M. Paul. Initially believing he may be beginning a romantic relationship with Zoraïde Reuter, the headmistress of the school at which he teaches, William Crimsworth's hopes are crushed when he secretly observes her discussing his infatuation with her soon-to-be-husband, M. Pelet. Feeling 'feverish and fiery' and unable to sleep, Crimsworth confronts Zoraïde the next morning in a characteristically brutish manner, employing only his eyes to indicate his knowledge of the situation and, as he tries throughout the novel, to claim the upper hand once more:

> She had held out her hand to me—that I did not choose to see. She had greeted me with a charming smile—it fell on my heart like light on stone. I passed on to the estrade, she followed me; her eye, fastened on my face, demanded of every feature the meaning of my changed and careless manner. 'I will give her an answer', thought I; and, meeting her gaze full, arresting, fixing her glance, I shot into her eyes, from my own, a look, where there was no respect, no love, no tenderness, no gallantry; where the strictest analysis could detect nothing but scorn, hardihood, irony. I made her bear it, and feel it; her steady countenance did not change, but her colour rose […]. She stepped on to the estrade, and stood close by my side;

[64] Brontë, *Villette*, p. 231.
[65] Inglis argues that such moments of 'retinal attack' contribute to the novel's 'lexicon of perforation'. 'Ophthalmoscopy in Charlotte Brontë's *Villette*', p. 356.

> she had nothing to say. I would not relieve her embarrassment, and negligently turned over the leaves of a book.[66]

The 'demands' that Zoraïde's eyes make of Crimsworth's are countered by his stern, answering gaze: he first 'arrests' then 'shoots' a cold look directly into her eyes which she is made to 'bear' and 'feel', the colour rising to her face indicating—again wordlessly—the effect of Crimsworth's visual repost. Through such perceptual collisions, communication can happen. The tactile eye is thus interactive: it feels its way around the world of each fiction, fixing upon, arresting, striking, and shooting looks its subject.

The feeling borne by the receiver of such a mobile, tangible gaze is an equally important aspect to consider. Here, the eye-as-feeler is reversed to show the feeling *of* vision. For the young Jane Eyre, this is a particularly affecting experience. Required to stand aloft from her peers on a stool at Brocklehurst's school as a form of punishment, Jane narrates the intense vulnerability she feels, describing how she 'felt their eyes directed like burning-glasses against my scorched skin'.[67] Her position of heightened visibility magnifies the feeling of being observed and renders the other girls' eyes as if they were optical instruments trained upon her skin. In Eliot's *Daniel Deronda* (1876), Gwendolen undergoes a similar experience of watchful eyes causing a sensory feeling of heat. At the opening of the novel, Deronda muses over Gwendolen, asking himself whether his want to 'look again' at her was 'felt as coercion' or a 'longing in which the whole being consents'. While this 'inward debate' is going on, his 'arrested' attention lends to his eyes a 'growing expression of scrutiny' as he continues to 'follow' the movement of her figure.[68] It is this visual scrutiny which Gwendolen feels. Looking around the room, we read that

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[66] Charlotte Brontë, *The Professor*, ed. by Margaret Smith and Herbert Rosengarten (Oxford: Oxford University Press, 1998), p. 95.
[67] Brontë, *Jane Eyre*, p. 66.
[68] George Eliot, *Daniel Deronda*, ed. by Terence Cave (London: Penguin, 1995), pp. 7, 9-10.

> in the course of that survey her eyes met Deronda's, and instead of averting them as she would have desired to do, she was unpleasantly conscious that they were arrested – how long? […] She felt the orbits of her eyes getting hot, and the certainty she had (without looking) of that man still watching her was something like a pressure which begins to be torturing. […] She controlled her muscles, and showed no tremor of mouth or hands. Each time her stake was swept off she doubled it. Many were now watching her, but the sole observation she was conscious of was Deronda's, who, though she never looked towards him, she was sure had not moved away.[69]

Her eyes, 'arrested' by Deronda's own, feel his gaze as a physical heat. Here, the eyes take on properties associated only with the skin. This becomes felt as an almost violent 'pressure'; later, she is described as 'still wincing' under his 'measuring gaze'.[70] The close focus upon the 'orbits' of the eyes, and upon the tremor of muscles, offers us an intensely realized impression of the feeling of being observed by a gaze which is wielded as if it were a physical appendage, able to apply pressure to its subject as a hand might. Likewise, Gwendolen's eyes themselves are rendered as sensitive as the rest of the body; no longer apertures or enablers of pure perception, they appear as sensitive as the organ of skin.

The eye could also penetrate depth, as well as touch upon the 'feeling skin' of another's eye. In Dickens's *Bleak House*, Mrs Snagsby's 'look' enters Mr Snagsby's 'eyes, the windows of his soul, and searches the whole tenement', her metaphorically penetrating gaze causing her husband to 'cower and droop'.[71] St. John Rivers in *Jane Eyre* causes a similar effect. His eyes are 'difficult to fathom' because 'he seemed to use them rather as instruments to search other people's thoughts, than as agents to reveal his own'. When Jane is asked the whereabouts of her family or friends, Diana and Mary Rivers show 'no suspicion in their glances', only 'curiosity'. However, St. John 'leaned over the

[69] Eliot, *Daniel Deronda*, p. 10-11.
[70] Eliot, *Daniel Deronda*, p. 13.
[71] Dickens, *Bleak House*, p. 382.

table and required an answer, by a second firm and piercing look'.[72] Whereas St. John's penetrating eyes are an unwelcome intrusion, Rochester's are not. Earlier in the novel, when Jane is working as a governess to Adèle and living at Thornfield, she takes pleasure in observing Rochester unnoticed, at a party he is hosting:

> without looking at me, he took a seat at the other side of the room, and began conversing with some of the ladies. No sooner did I see that his attention was riveted on them, and that I might gaze without being observed, than my eyes were drawn involuntarily to his face; I could not keep their lids under control: they would rise, and the irids would fix on him. I looked, and had an acute pleasure in looking. […] He was talking, at the moment, to Louisa and Amy Eshton. I wondered to see them receive with calm that look which seemed to me so penetrating: I expected their eyes to fall, their colour to rise under it; yet I was glad when I found they were in no sense moved.[73]

Jane closely watches Louisa and Amy for any physical signs that Rochester's 'penetrating' look is affecting them, but finds them both unmoved; this behaviour is contrary, we are led to infer, to Jane's own reaction of lowered eyes and a deepened colour. Again, this model of perception moves beyond surveillance and observation and is imagined as a haptic force which can first look at and then *within* its subject, causing a physiological reaction (heat, pressure, colour) based on the sensitivities of touch.

Wandering Eyes

This section moves on to consider the spatial mobility of the eye, rendered as if a physical, manipulable appendage able to move through its environment. Alexander Bain's theory that the eye operates by ranging over the contours of a visual field (discussed above) supports the idea that vision and tactility are intimately connected to landscape and mobility, and that the muscular feeling of vision informs our sense of spatial awareness. 'An object moving away from the eye in a straight line would give us a changing

[72] Brontë, *Jane Eyre*, p. 346.
[73] Brontë, *Jane Eyre*, p. 174-5.

sensation', he writes, 'no less than an object moving across the field of view. An object moving obliquely, that is receding or approaching, while going across the view, would give a complex feeling embodied in the movements of the eye and head'. Not only does the fundamental movement of the head, following the line of vision, encourage a sense of mobile, *felt* vision, so too does the stretch and flex of the eye's musculature: 'By means of the movements of the eye, we acquire impressions of the visual expanse or apparent magnitude. This visual expanse of bodies is determined by the range or *sweep* of the eye in passing over their whole extent, or by the fractions of the field of view that they take it. […] The different degrees of movement and tension of the muscles that make the sweep are distinctly felt'.[74]

One result of this is that the eye can act as a literal detecting body, moving around a scene and seeking out information as if a muscled, sensate body. Ronald Thomas has explored the new visual technologies available to assist in police detective work (such as the mug shot, magnifying glass, and the preservation of a scene with the photographic negative) but in the following instances the eye is not a tool for visual detection but rather the investigating body itself.[75] In *Bleak House*, Guppy attempts to find the letters owned by Nemo and to this end he and Tony Weevle descend on Smallweed's shop to investigate. On entering, they engage in small talk but this does not stop their eyes becoming immediately active in carrying out their search around the premises:

> Mr Guppy's eye follows Mr Weevle's eye. Mr Weevle's eye comes back without any new intelligence in it. Mr Guppy's eye comes back and meets Mr Smallweed's eye. That engaging old gentleman is still murmuring, like some wound-up instrument running down. […] Mr Smallweed has run down again,

[74] Bain, *The Senses*, pp. 243-245 (emphasis added).
[75] Ronald Thomas, *Detective Fiction and the Rise of Forensic Science* (Cambridge: Cambridge University Press, 2003).

> while Mr Weevle's eye, attended by Mr Guppy's eye, has again gone round the room and come back.[76]

While Smallweed murmurs like a wind-up (and then wound-down) toy, their eyes move around the room, seeking for the whereabouts of the important documents. Later, searching the Dedlock's library for evidence of handwriting, the detective Bucket's eye is described as 'taking a pigeon-flight round the room' before finally 'alight[ing] upon a table where letters are usually put as they arrive'. Once his eye has retrieved this information, only then do we read that his body moves as he 'draws near and examines the [handwritten] directions'.[77]

In Eliot's *Middlemarch* (1871-2), there is often description of the movement of character's eyes around the room and across other characters' bodies or clothing. In contrast to my earlier discussion of eyes which fix or strike upon each other, these wandering eyes do not reveal deeper aspects of the relationships between characters, or provide wordless indicators of significant moments in the plot. They operate as a textual equivalent (or indeed precursor) of the filmic close-up: providing such detail about the physical motion of a character's eyes adds to our reading of them as active, living beings, and helps to dramatize their movements as characters within the 'virtual' word of the novel's environment. Reclining in an 'easy-chair by the fire', we learn that Lydgate's 'eyes rambled over the columns of the 'Pioneer'', the movement of his eyes matching his languorous mood. A conversation between Mrs Bulstrode and Rosamond is accompanied by detailed attention to their simultaneous perceptions: 'Mrs Bulstrode's eyes, which were rather fine, rolled round that ample quilled circuit [of Rosamond's bonnet], while she spoke. […] Rosamond's eyes were also roaming over her aunt's large embroidered collar'. Later, desperate to gather information on the wellbeing of her husband, Mrs Bulstrode questions Mrs Hackbutt who, in her 'determina[tion] not to make the slightest allusion to

[76] Dickens, *Bleak House*, pp. 586-587.
[77] Dickens, *Bleak House*, p. 745.

what was in her mind' spends the conversation fidgeting; she 'rubbed the back of one hand with the palm of the other held against her chest, and let her eyes ramble over the pattern on the rug'.[78]

James Chandler has recently studied a similar movement of wandering eyes in the work of Joseph Conrad, and links this directly to the contemporary burgeoning of early cinema and cinematic techniques. His book—which digs into the 'archaeology' of sentiment and sympathy in cinema by turning to eighteenth- and nineteenth-century modes of literary spectatorship, of who is looking at whom and how—analyses a scene in Conrad's *Lord Jim* (1900) in which 'Jim's eyes, wandering in the intervals of his answers [in the courtroom] […] met the eyes of the white man. The glance directed at him was not the fascinated stare of the others. It was an act of intelligent volition'. This, he argues, marks a 'sudden and surprising shift in narrative perspective', from the 'omniscient frame narrative' to 'a kind of cinematic 'eye-line match'—a movement of shot/reverse-shot'. He continues that this is 'not a moment influenced by cinematic style [as this technique] in classical narrative cinema would not be developed for another decade or two. Rather, Conrad has effectively produced his own early-twentieth-century turn on the sentimental mode in a further anticipation of that system'.[79] Yet, as the examples in this chapter have so far shown, Victorian fiction offers its own much earlier version of the 'cinematic eye-line match'. This representation of eyes which have physical heft and impact stems from the collusion of the tactile and visual in those devices which would go on to play their own role in the history of cinema; using Chandler's term, we might think of this as an 'anticipation' of an 'anticipation'. Stepping away from such teleological knots, however, what is clear is that although the wandering, striking eyes in Conrad might not be

[78] George Eliot, *Middlemarch*, ed. by David Carroll (Oxford: Oxford University Press, 2008), pp. 436, 277, 704.
[79] Joseph Conrad, *Lord Jim*, ed. by Cedric Watts and Robert Hampson (Harmondsworth: Penguin, 1986), p. 62, qtd. in James Chandler, *An Archaeology of Sympathy: The Sentimental Mode in Literature and Cinema* (Chicago and London: The University of Chicago Press, 2013), pp. 317-318.

influenced by cinematic techniques, they do certainly have a precedent in the tactile visions of Victorian descriptions of perception.

An even closer observation of the movement of the eye is offered to readers of Brontë's *The Professor*. In a description of Zoraïde Reuter's exceptional powers of observation, M. Pelet tells Crimsworth that 'the eyelid will flicker, the light-coloured lashes be lifted a second, and a blue eye, glancing out from under the screen, will take its brief, sly, searching survey, and retreat again'.[80] This level of detail reveals to the reader not just that Zoraïde is a keen watcher but it creates a textual close-up and tells us, step by step, how her observation is physically enacted. Her eye figuratively becomes a mobile body able to move within its environment to collect information, just as Bucket's eye, above, could 'fly' around the room in search of its object. In *Jane Eyre*, St. John's eye could 'leave' and wander around the room. Watching him reading, Jane relates that 'Thus engaged, he appeared, sitting in his own recess, quiet and absorbed enough; but that blue eye of his had a habit of leaving the outlandish-looking grammar, and wandering over, and sometimes fixing upon us, his fellow-students, with a curious intensity of observation: if caught, it would be instantly withdrawn; yet ever and anon, it returned searchingly to our table'.[81] St. John's furtive eye strays and then retreats when discovered, and Brontë's specific description endows it with a firm sense of physicality and movement.

Once loosened from their bodily bonds, eyes which wander are also seen to 'follow' the movements of other characters. In *Middlemarch*, Jonah Featherstone 'followed [Mary Garth] with cold eyes' and when she moves into the kitchen, he

[80] Brontë, *The Professor*, p. 79. Reading the 'the tactile, sadistic gazes' of Zoraïde Reuter, Nicholas Dames has argued that 'evaluative […] gazes are used to achieve mastery' in this novel, connecting this 'mixture of the tactile and visual' to 'phrenological practice, in which visual examination could often be supplemented by the use of calipers or direct application of the hands'. This interest in 'visual vulnerability' is extended in the work of Katherine Inglis, cited earlier in this chapter, but whereas their work depends on a dynamic of the masterful observer and vulnerable observed, I stress instead the communicative aspects of tactile visuality, arguing that participants in such visual exchanges are often equally endowed with a visual capability to seek out and transmit information. See *Amnesiac Selves: Nostalgia, Forgetting, and British Fiction, 1810-1870* (Oxford: Oxford University Press, 2001), pp. 108-109.
[81] Brontë, *Jane Eyre*, p. 396.

continued 'to follow her with detective eyes'.[82] Mr Carker in Dickens's *Dombey and Son*, described as a 'smooth, sleek watcher', surreptitiously follows the eye of Dombey around the room, keeping pace with Dombey's glance:

> [Carker] directed a sharp glance and a sharp smile at Mr. Dombey as he spoke, and a sharper glance, and a sharper smile yet, when Mr. Dombey, drawing himself up before the fire, in the attitude so often copied by his second in command, looked round at the pictures on the walls. Cursorily as his cold eye wandered over them, Carker's keen glance accompanied his, and kept pace with his, marking exactly where it went, and what it saw. As it rested on one picture in particular, Carker hardly seemed to breathe, his sidelong scrutiny was so cat-like and vigilant, but the eye of his great chief passed from that, as from the others, and appeared no more impressed by it than by the rest.[83]

The picture upon which Dombey's eye rests is one which bears a striking resemblance to Edith, Dombey's second wife and the subject of his conversation with Carker. Unknown to Dombey, Carker is planning to help Edith flee her unhappy marital home, and the clues to his deceptive character appear in the description of his 'sharp' seeking gaze. Wily and 'cat-like', readers are made aware of his double nature by discovering the 'vigilant' movements of his eyes in tracking Dombey's, while he—simultaneously in conversation—agrees to act as Dombey's 'confidential agent'.[84]

Not only was the eye described as able to wander, roam, and follow others around a room, it was imagined to venture out into the landscape of the novel too. Arriving at Thornfield, Jane Eyre looks out of her window at the estate and its surroundings:

> There were the two wings of the building; there was the garden; there were the skirts of Lowood; there was the hilly horizon. My eye passed all other objects to rest on those most remote, the blue peaks; it was those I longed to surmount; all within their boundary of rock and heath seemed prison-ground, exile limits. I traced the white road winding round the base of one mountain, and vanishing in a gorge between two; how I longed to follow it farther! […] My vacations had all

[82] Eliot, *Middlemarch*, p. 286.
[83] Dickens, *Dombey and Son*, pp. 625-627.
[84] Dickens, *Dombey and Son*, p. 628.

> been spent at school, […] I had had no communication by letter or message with the outer world: school-rules, school-duties, school-habits and notions, and voices, and faces, and phrases, and costumes, and preferences, and antipathies—such was what I knew of existence. And now I felt that it was not enough; I tired of the routine of eight years in one afternoon. I desired liberty; for liberty I gasped; for liberty I uttered a prayer.[85]

In this important and frequently discussed scene, Jane's striving for independence, knowledge, and experience of the world is communicated not just in the narrating of her 'desires' and 'prayers' for liberty, but in the calmly seeking eye which metaphorically 'passes' across the landscape to rest upon and trace the contours of the surrounding topography. Unable herself to roam out over the heath and distant peaks, the eye fulfils this action for her, becoming the equivalent of a travelling body experiencing the natural surroundings beyond her place of work. As Bain comments, 'There is a distinct emotional sensibility in the feeling of distance, more especially of remote distance. A far object exalts the muscular feeling of the eye, and is a source of lively pleasure:—the pleasure of muscular tension in muscles peculiarly sensitive'.[86]

Later, when Jane takes decisive action to abandon Thornfield on discovering the secrets of Rochester's past, her mobile eye aids her search for shelter when she finds herself lost on the moors: 'My glazed eye wandered over the dim and misty landscape. I saw I had strayed far from the village: it was quite out of sight. […] My eye still roved over the sullen swell and along the moor-edge, vanishing amidst the wildest scenery, when at one dim point, far in among the marshes and the ridges, a light sprang up'. As Jane ventures towards the light, it becomes a 'whiteish object' then reveals itself as the 'silhouette of a house'—the house is that of the Rivers; Jane's haptic eye saves her from starvation on the moor and, ultimately, sets in motion her return to Rochester.[87] Bruno's

[85] Brontë, *Jane Eyre*, p. 85.
[86] Bain, *The Senses*, p. 243.
[87] Brontë, *Jane Eyre*, pp. 330-1.

work registers a connection between travel, landscape, and perception. 'During the eighteenth century', she writes, 'the production of travel discourse began to grow and took on a variety of forms, from literary to visual and spatial configurations. Journey poems, view paintings, and garden views were among the new forms of shared spatiovisual pleasure. They combined a sensualist theory of the imagination with the touch of physicality'.[88] Although certainly not touristic, Jane's visual roaming registers the spatiality of the surrounding landscape. Although her view from Thornfield's window and across the moor could be described as a panoramic survey (it conforms to this model: a single observer in a privileged visual position, overlooking a vast and distant expanse) her eye does not appraise the scene from a distance but immediately reaches out and enters into an imagined dimensional scene which is textured, massy, and evocative of physical sensations. This is the haptic eye in action, spatially roving in order to collect phenomenal data.

'Voiceless Speech': Visual Collision as Communication

The final capability of the eye which this chapter concentrates on is its ability to communicate wordlessly. In the frictional moment of collision, glances that penetrate, strike, or fix upon other eyes are able to transmit meaning visually, leading to communion in which both parties silently understand what has been 'spoken'. Here there is a further mingling of senses: through the haptic gaze, eyes meet and then transmit information as a kind of 'visual language' which can be read and interpreted. 'So much had the Captain expressed in his eye', we read of Captain Cuttle in Dickens's *Dombey and Son*, it was 'as if he had expressed his sentiments with the utmost elaboration'.[89] Crimsworth in Brontë's *The Professor* describes how his pupils 'had given up giggling and whispering to each

[88] Bruno, *Atlas of Emotion*, p. 171.
[89] Dickens, *Dombey and Son*, p. 248.

other, and no longer ventured to utter pert speeches in my presence; they now only talked to me occasionally with their eyes, by means of which organs they could still, however, say very audacious and coquettish things'.[90]

A conversation between Jane and Rochester, early in their relationship, demonstrates the dual modes—speech and sight—at play in their communications. 'For what I yet may know', Rochester says to Jane, 'you may be no better than the rest; you may have intolerable defects to counter-balance your few good points', to which she responds 'And so may you'. This, of course, turns out to be quite prescient, but immediately as she says this, Jane describes that 'My eye met his as the idea crossed my mind: he seemed to read the glance, answering as if its import had been spoken as well as imagined:—'Yes, yes, you are right'', he responds. What Jane thinks is transmitted to Rochester via their meeting eyes; he is able to 'read' her glance. He continues that 'Nature meant me to be, on the whole, a good man, Miss Eyre […] and you see I am not so. You would say you don't see it; at least I flatter myself I read as much in your eye (beware by-the-by, what you express with that organ, I am quick at interpreting its language)'.[91] Here, Rochester is explicit that Jane's organ of sight has its own 'language' which can be interpreted.[92]

Later, just as Rochester and Jane are about to be married, her intent and happy focus causes a particular blindness to anything beyond her husband-to-be: 'I know not whether the day was fair or foul; in descending the drive, I gazed neither on sky nor earth: my heart was with my eyes; and both seemed migrated into Mr. Rochester's frame'. Jane's

[90] Brontë, *The Professor*, p. 99.
[91] Brontë, *Jane Eyre*, p. 135.
[92] My focus here on reading the 'language' of the eye complements work which studies other mediums of expression, specifically enabled by the body, such as physiognomy and phrenology. The novel's many references to these pseudo-sciences has been well-documented and debated in the scholarship of both Brontë's writing and of Victorian scientific culture more widely. See particularly Sally Shuttleworth, *Charlotte Brontë and Victorian Psychology* (Cambridge: Cambridge University Press, 1996), pp. 57-70; Dames, *Amnesiac Selves*, pp. 76-125; and Lucy Hartley, *Physiognomy and the Meaning of Expression in Nineteenth-Century Culture* (Cambridge: Cambridge University Press, 2005).

besotted heart is described as being 'with' her eyes: what she sees, she loves. As in the examples given earlier in this chapter of eyes piercing or entering into their subject, her amorous eyes are figured as a force so powerful they seem to 'migrate' haptically into Rochester's body: the force of her keening eyes penetrates his physical frame. They do so in order to engender an empathetic understanding between the two, and a sharing of information. 'I wanted to see the invisible thing on which, as we went along, he appeared to fasten a glance fierce and fell', Jane explains; 'I wanted to feel the thoughts whose force he seemed breasting and resisting'.[93] By figuratively migrating her eyes into his body, by becoming close enough to see through his eyes, Jane hopes to share in his sight and to '*feel*' his thoughts.

In *Dombey and Son*, Florence and her father, Dombey, whose relationship is fraught and troublingly uncommunicative, unknowingly engage in a profound moment of slipped communication in which 'speaking eyes' take over the role of direct speech:

> It was enough for Florence to sit there, watching him; turning her eyes towards his chair from time to time; watching him with her thoughts, when her face was intent upon her work. […] What would have been her thoughts if she had known that he was steadily regarding her; that the veil upon his face, by accident or by design, was so adjusted that his sight was free, and that it never wandered from her face an instant. That when she looked towards him, in the obscure dark corner, her speaking eyes, more earnest and pathetic in their voiceless speech than all the orators of all the world, and impeaching him more nearly in their mute address, met his, and did not know it! That when she bent her head again over her work, he drew his breath more easily, but with the same attention looked upon her still—upon her white brow and her falling hair, and busy hands; and once attracted, seemed to have no power to turn his eyes away![94]

Florence and Dombey, sitting in the same room but equally unavailable to each other, are nevertheless deeply interested in each other: Florence watches her father while Dombey has designed a way to observe his daughter without her knowing. In their 'voiceless

[93] Brontë, *Jane Eyre*, p. 287.
[94] Dickens, *Dombey and Son*, p. 531.

speech', Florence's 'impeaching' and 'speaking eyes' meet the keen gaze of her father without knowing. Describing this as a 'yielding moment', the narrator comments that 'Some simple eloquence distinctly heard, though only uttered in her eyes' offered Dombey the 'passing thought' that 'he had a happy home within his reach'—this, however, he is unable to create.[95] Yet the episode is perhaps the most touching moment between Dombey and his daughter because of the tenderness of their colluding eyes; both want to share and communicate openly with each other, and create the loving household which 'passes' in Dombey's thoughts, and this shared desire is indicated in the matched movements of their eyes. What this visual activity indicates is that even though they are unable to talk easily, they are, nonetheless, expressing themselves keenly, evidenced in Dickens's stress on the highly communicative terms 'speaking', 'speech', and 'impeaching'.

We are reminded here of Sergei Eisenstein's linking of Dickens's prose with the film style of D. W. Griffith through the intimacy of the close-up in both. What Eisenstein calls the 'mechanics' of Dickens's composition and its relation to later narrative film techniques is found, he argues, in his episodic development of characters, irregular chronology (characters are 'rubbed from view at the most critical moment', then brought back into the plot just as suddenly 'between the separate links of the parallel secondary plot'), and, crucially, his emphasis on viewpoint and perspective brought about by a close focus on the movement of characters' eyes.[96] This focus often takes the form of a textual version of filmic montage, in which a cut to the eyes of a character and would be spliced into the main scenes of a plot. Montage, Eisenstein writes, is 'not merely a means of producing effects' but operates 'above all as a means of *speaking*, a means of *communicating* ideas […]'.[97] What we might call Dickens's 'textual montage' of cutting

[95] Dickens, *Dombey and Son*, p. 532.
[96] Sergei Eisenstein, 'Dickens, Griffith, and the Film Today', in *Film Form: Essays in Film Theory*, ed. and trans. by Jay Leyda (London: Dennis Dobson, 1951), pp. 194-255 (pp. 201-6).
[97] Eisenstein, 'Dickens, Griffith, and the Film Today', p. 245 (emphasis in original).

back and forth between the main scenes of a novel and close-ups of characters' active eyes likewise offers a further, earlier form of unspoken communication.

Reading into Visual Spaces

In his study of film direction, Steven Katz notes that the cinematic technique of closely cutting to a character's look holds a 'powerful suggestiveness' which 'helps explain film's love-affair with winks, glances, stares, tears, squints, glares, and the whole range of language that the eyes command':

> A look can tell us that an object out of frame is of interest, and it can tell us in which direction the object is located. In the same way that the focal length of the lens and the angle of the camera can place the viewer in a definite relationship with the subjects on the screen, the eye-line of a subject clearly determines spatial relations in the scene space'.[98]

This is precisely what Victorian fiction achieves in textual form, with its insistence on giving close-ups of the eye's glancing movements around the novelistic space. It offers, most obviously, a greater understanding of each character but importantly it also works to enhance a reader's visualization of the scene of the novel as an inhabited, dimensional environment. As Jane Eyre's eye gazes longingly across hills, moors, and wooded landscapes, Brontë's textual conjuring of Thornfield (its isolated surroundings and Jane's lonely placement) is strengthened for her readers. Likewise, Inspector Bucket's detecting eye points readers towards objects of interest within the 'frame' of the novel, as Katz has it. We are used to following the eyes of film characters: we understand the language of film style as it directs us to look towards a particular person or thing of interest, to scan a nearby scene, or range across a wide-angle shot—and it is this same 'visual language' which we find in the earlier imaginative environment of the Victorian novel. Driven by the visual manipulation of tactile technologies, specifically those which were predicated on

[98] Steven Katz, *Film Directing Shot by Shot: Visualizing from Concept to Screen* (Los Angeles, CA: Michael Wiese Productions, 1991), p. 123.

the eye and hand working together, textual looking becomes just as evocative, insinuating, and embodied as it will be represented in cinematic techniques many decades later.

In fact, this attention to the connective glances of characters features in Riegl's theories of the haptic aesthetic, particularly in his study of *The Dutch Group Portrait* (1902). As Iversen summarizes, for Riegl 'the sense of form is further extended to include the arrangement of the figures, their postures, *the direction of their gazes*, and their peculiar quality of attentiveness'.[99] 'In Dutch group portraits', she writes, 'the figures are held together not by subordination to a dominant figure but by their rapt attention, and the spectator is encouraged to enter imaginatively into the scene, closing its circle'.[100] We might think here of the 'dominant figure' as a guiding narrative perspective, telling us what is happening in a particular scene and directing our attention. Instead, as in Riegl's theory, the textual emphasis on minute eye movements, and on the direction of a character's wielded gaze, encourages instead a 'circle' of spectatorship which recognises the reader as *placed within* the imaginative landscape of the novel, instead of observing from an external distance. *Adam Bede* (1859) demonstrates this particularly: 'Let me take you into that dining-room, and show you the Rev. Adolphus Irwine', the narrator suggests.

> The room is a large and lofty one, with an ample mullioned oriel window at one end; the walls, you see, are new […]. You suspect at once that the inhabitants of this room have inherited more blood than wealth, and would not be surprised to find that Mr Irwine had a finely-cut nostril and upper lip; but at present we can only see that he has a broad flat back and an abundance of powdered hair. […] He will perhaps turn round by-and-by, and in the mean time we can look at that stately of lady, his mother.[101]

Here, beyond endowing characters with a tactile gaze which can search, fix, and wander around, Eliot endows the *readers'* eye with a physicality which enables it to imaginatively *enter into* and be placed *within* the very scene her text evokes. The detail of this

[99] Iversen, *Alois Riegl*, p. 8 (emphasis added).
[100] Iversen, *Alois Riegl*, p. 43.
[101] Eliot, *Adam Bede*, pp. 49-50.

placement—we stand behind Mr Irwine at 'present', tantalizing us with the prospect of further movement to come—is exceptional, and supports the reader as a locomotive presence within the landscape of the novel.

Some pages on, we are offered the same chance to inspect Hall Farm:

> Yes, the house must be inhabited, and we will see by whom; for imagination is a licensed trespasser: it has no fear of dogs, but may peep in at windows with impunity. Put your face to one of the glass panes in the right-hand window: what do you see? A large open fireplace, with rusty dogs in it, and a bare-boarded floor […]. And what through the left-hand window? Several clothes-horses, a pillion, a spinning-wheel […].[102]

We are led by the eyes to look at specific parts of this scene, but importantly, this is encouraged not just as a direction of the gaze, but as a specific positioning of the eye as a physical, inhabited, and embodied presence: 'peep in', 'put your face' to the right side, then the left. Here, even the reader's eyes are imagined as mobile appendages with nervous and motor capabilities; the tangibility of vision is stressed not just between characters but between reader and scene. Likewise, Brontë, opening a chapter in *Jane Eyre*, instructs the reader to

> fancy you see a room in the George Inn at Millcote, with such large figured papering on the walls as inn rooms have; such a carpet, such furniture, such ornaments on the mantelpiece, such prints […]. All this is visible to you by the light of an oil lamp hanging from the ceiling, and by that of an excellent fire, near which I sit in my cloak and bonnet; my muff and umbrella lie on the table, and I am warming away the numbness and chill contracted by sixteen hours' exposure to the rawness of an October day.[103]

Jane as narrator is pictured here sitting by the fire and while this scene has drawn attention for its theatrical arrangement, what is important, and often overlooked, is the emphasis on the tactility of the surroundings—the detail given to the wallpaper, carpet, furniture, and so on—and to the haptic feel of the scene: the lamp shedding light, the spatial arrangement

[102] Eliot, *Adam Bede*, p. 65.
[103] Brontë, *Jane Eyre*, p. 93.

of the table, and the warming fire all encourage a fully sensory engagement with this scene, rather than a purely spectatorial understanding, as a theatrical reading (with its format of separating audience and action) suggests.[104] Iversen summarizes that 'Riegl thought that the central problem confronting the painter of group portraits was that of finding a means of uniting the group without diminishing the inwardness of its members. […] The motionless figures must somehow be brought into relation with one another'.[105] As I have demonstrated in this chapter, the haptic, mobile eye, and a text's concentration on the intimacy of grasping, penetrating, and following gazes, brings motion to the represented characters and unites them in a dimensional, relational space which also works to conserve and indeed illuminate their interior life.

Hand-held optical gadgets of the moving image are important for what their mechanical structure and operation reveals about the Victorian interactivity of hand and eye, tactility and visuality, particularly as it is imagined in representations of visual perception in the novel. In drawing attention to this technological, and indeed physiological, history, I have shown that fictional representations of the look and the eye itself imagine perception as an amalgamation of sensory experience—sight and touch, the optical and muscular. My examples point towards a Victorian understanding of what would later be theorized as haptic perception, in which the eye could be wielded, move through space, and act upon something with the intimacy of a felt encounter, and in doing so could communicate wordlessly through the medium of touch. This tactile representation of perception moves away from spectacularity and cinematic apertures and instead offers a reading of visual culture in the novel which stresses interface, movement, and the intimacy of perceptual sociability.

[104] Renata Kobetts Miller discusses this scene, arguing that Brontë employs here a 'theatrical figure of speech'. 'Imagined Audiences: The Novelist and the Stage', in *A Companion to the Victorian Novel*, ed. by Patrick Brantlinger and William B. Thesing (Oxford: Blackwell, 2002), pp. 207-224 (p. 207).
[105] Iversen, *Alois Riegl*, p. 99.

Conclusion, or, Towards the Galloping Horse

Alexander Bain, in *The Senses and the Intellect* (1855), writes that 'nearly all the pleasures of muscular movement […] may be experienced in the *spectacle* of moving objects'. He is writing about the 'compound' sense of touch and motion, the 'muscular sense', which he identifies as playing a large role in visual perception, as I discussed in Chapter Five. He continues that

> The massive, languid feeling of slow movement, the excitement of a rapid pace, the still higher pleasure of a waxing or waning speed, can all be realized through the muscles of the eye and head. The slow procession, the gallop of a race-horse, the flight of a cannon-ball, exhibit different varieties of the excitement of motion.[1]

We might easily mistake this for a modern article exploring some future incarnation of a virtual reality game which allowes its user to feel physical feedback. What Bain is getting at is the *feeling* of watching movement; he is trying to formulate and express the psychological and physiological excitement (in a sensory sense) brought about by different speeds, seen by the eye but registered, nonetheless, as a physical experience. Watching, for Bain, is not a mere visual partaking in a spectacle which is presented to the eye only, and importantly it is motion which spurs his theory. Mobile spectacles demand a deeper engagement from their viewer, they ask that one considers, simultaneous with sight, the varieties of and modulations between languor, rapidity, waxing, waning, galloping, and flying—states which are inherently connected to our body, to the *feeling* of speeding up or slowing down. Motion brings this awareness to our senses, and to our visual sense perhaps above all.

[1] Alexander Bain, *The Senses and the Intellect* (London: John W. Parker, 1855), p. 241.

It is intriguing that Bain cites the galloping horse as one example of a spectacle of rapid visual movement which might 'exhibit' the 'excitement of motion', for this image would later become the hallmark of the late-nineteenth-century generation of scientists, photographers, psychologists, and cinematographers who developed, innovated, and reconceived the persistence of vision animation devices which had been so popular in the middle decades of that century, and whose lingering, cognitively layered images had provoked new terms for describing emotion, memory, recall, and the process of thought in some of the most widely-read writers of fiction. Two pages later, Bain picks up again on this iconic trope, used now to illustrate the front cover of books and exhibition catalogues devoted to the chronophotographers:

> The gallop of a horse is a series of moving pictures that leave a trace behind them, and are revived as such. The motions that constitute the carriage and expression of an animal or a man, demand particular movements of the eye in order to take them in, and store them up among our permanent notions. […] Many of the aspects of the external world impress themselves upon the moving apparatus of the eye. The waves of the sea, the drifting of clouds, the fall of rain, the waving of the trees under the wind, the rushing of water, the darting of meteors, the rising and setting of the sun, are all mixed impressions of spectacle and movement.[2]

Calling the eye itself a 'moving apparatus' (and indeed, physiological science was increasingly finding that its composition and operation, its particular entwining of cells, fluids, muscles, and nerves, fitted precisely this description), Bain draws on examples of movement which he calls 'mixed impressions', suggesting that in observing their spectacle the visual sense takes in a 'series' of impressions, or 'moving pictures', which leave a persistent 'trace' that is 'stored up'. Here, Bain is using the language associated with the experiments and technologies which sought to demonstrate the persistence of vision and as such his thinking is founded in the optical science and technological developments of the early to mid-nineteenth century. Yet although his work is indebted to this context, it looks

[2] Bain, *The Senses*, p. 243.

forward (almost uncannily) to the photographic experiments Eadweard Muybridge and others would later go on to undertake.

Bain's reference to the vision of a galloping horse being a series of moving pictures anticipates the photographs which resulted when Muybridge was tasked in 1872 by Leland Stanford to demonstrate the exact position of a horse's hooves when in motion: did all four lift from the ground, or did one remain? In rigging up multiple photographic cameras Muybridge was able to show that the former occurred.[3] Beyond settling a bet, the experiment (and many others like it afterwards) created a set of images which showed precisely the 'series' of pictures Bain's work evocatively describes. The work of Muybridge, Étienne-Jules Marey, and a number of other chronophotographers across the 1870s-90s (all working in different fields and with different ends) evidenced a desire, as Esther Leslie has recently put it, to 'break down movement', to draw out of movement the unseeable stillness of which it is comprised and to pictorially show 'time arrested and time in flow'.[4]

Marey's spectacular over-printed images of the flight of birds, or of the human body dancing, stretching, and leaping, would have keenly interested Bain, so much do they make manifest the persistent traces of images which his ideas of perception were tending towards. The scientific research undertaken in this area in the late-nineteenth century, and the technologies which were developed to accompany and demonstrate its findings, built on the burgeoning culture of animation found in the mid-Victorian period. Muybridge's 'zoopraxiscope' takes its name from two technologies discussed earlier in this thesis, the zoetrope and praxinoscope, and combined the flickering vision of the zoetrope, the glass mirrors of the praxinoscope, and the projection of Charles-Émile Reynaud's *Théâtre*

[3] See the work of Marta Braun, especially her excellent *Picturing Time: The Work of Étienne-Jules Marey* (Chicago: The University of Chicago Press, 1992), for a stimulating history of chronophotography.
[4] Esther Leslie, 'Loops and Joins: Muybridge and the Optics of Animation', *Early Popular Visual Culture* 11.1 (2013), 28-40 (p. 36). See also the rest of this special issue devoted to the work of Muybridge, and edited by Stephen Herbert.

Optique (a short-lived projecting praxinoscope) to throw images of captured stillness onto a screen at such a rate that they, like the illustrated strip of a zoetrope, cognitively blended together to reproduce the very movement which his serial photographs dissected. As this thesis has shown, this period inculcated an incredibly productive and innovative visual culture surrounding the creation and mediation of moving images, to which physicists, engineers, inventors, writers, artists, and commentators all contributed. Being able to physically make an image 'move' was an intensely novel experience which we find reflected upon in the writing of the period. Indeed, many of the terms associated with these new modes of visual animation—dissolving, melting, being kaleidoscopic, persisting—were directly incorporated into the language of works of fiction, as indeed were explicit references to the technologies which created these effects: thoughts become visions which 'pass before' or are projected outside a character's mind; distraction lends one the bearing of a spectator at a diorama; thoughts, memories, and images move kaleidoscopically in the mind, turning again and again on the same core subjects; and memory and imagination can persist to such an extent that their traces might return again and again in an animated, disorientating whirl, just like the spun figures in a zoetrope, or wheel of life. This novel culture, of seeing, making, and writing about some of the first instances of technological visual animation, of course paves the way for chronophotography and in turn cinematography, but as I have argued throughout this thesis, the knowledge of and desire for '*something in motion*', as Dickens so clearly terms it, was an exceptionally important part of the cultural imagination of the Victorians, and its linguistic traces can be found throughout some of the period's most well-known and widely read works.

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