Film Lessons: Early Cinema for Historians of Science

OLIVER GAYCKEN, **Devices of Curiosity: Early Cinema and Popular Science**. New York: Oxford University Press, 2015. Pp. xii + 272. ISBN 978-0-19-986070-8. £19.99 (paperback).

SCOTT CURTIS, **The Shape of Spectatorship: Art, Science, and Early Cinema in Germany**. New York: Columbia University Press, 2015. Pp. xv + 400. ISBN 978-0-231-13403-3. £24 (paperback).

Despite much excellent work over the years, the vast history of scientific filmmaking is still largely unknown.[1] Historians of science have long been concerned with visual culture, communication and the public sphere on the one hand, and expertise, knowledge production and experimental practice on the other. Scientists, we know, drew pictures, took photographs and made 3-D models.[2] Rather like models, films could not be printed in journals until the digital era, and this limited their usefulness as evidence.[3] But that did not stop researchers from making movies for projection at

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[1] For recent reviews: Jean-Baptiste Gouyon, 'Science and film-making', *Public Understanding of Science*, 2016, 25, pp. 17–30; David A. Kirby, 'Film, radio, and television', in Bernard Lightman (ed.), *A Companion to the History of Science*, Chichester: John Wiley & Sons, 2016, pp. 428–441. See also Rima D. Apple and Michael W. Apple (eds.), 'Screening science', a special section of *Isis*, 1993, 84, pp. 750–774; Gregg Mitman, *Reel Nature: America's Romance with Wildlife on Film*, Cambridge, MA: Harvard University Press, 1999; Alison Griffiths, *Wondrous Difference: Cinema, Anthropology, and Turn-of-the-Century Visual Culture*, New York: Columbia University Press, 2002; Tim Boon, *Films of Fact: A History of Science in Documentary Films and Television*, London: Wallflower, 2008; David A. Kirby, *Lab Coats in Hollywood: Science, Scientists, and Cinema*, Cambridge, MA: MIT Press, 2011; Joshua Malitsky and Oliver Gaycken (eds.), 'Science and documentary', a special issue of *Journal of Visual Culture*, 2012, 11, pp. 237–399; Janina Wellmann (ed.), 'Cinematography, seriality, and the sciences', a special issue of *Science in Context*, 2011, 24, pp. 311–464.

[2] For example, Soraya de Chadarevian and Nick Hopwood (eds.), *Models: The Third Dimension of Science*, Stanford: Stanford University Press, 2004; Jennifer Tucker, *Nature Exposed: Photography as Eyewitness in Victorian Science*, Baltimore: Johns Hopkins University Press, 2006; Nick Hopwood, *Haeckel's Embryos: Images, Evolution, and Fraud*, Chicago: University of Chicago Press, 2015.

[3] For example, James Strick, 'Swimming against the tide: Adrianus Pijper and the debate over bacterial Flagella, 1946-1956', *Isis*, 1996, 87, pp. 274–305, p. 304.

conferences as well as in lecture halls, museums and other public venues, not to mention for breaking down into individual frames for analysis. Historians of science are more likely to be found in the library, archive or museum than the darkened screening room, and much work is still needed to demonstrate major effects of cinema on scientific knowledge. Film may have taken as long to change science as other areas of social life, but one can begin to glimpse important ways in which 'image machines' (cameras, projectors and the like) were beginning to mediate between backstage experimental work and more public demonstration even around 1900.[4]

This essay reviews two recent books by film historians that explore different aspects of the intersection of cinema and science during that key period in the history of visual culture when the first mass audience also came routinely to see halftone illustrations and X-ray photographs.[5] Together covering England, France, Germany, and the United States, Oliver Gaycken's *Devices of Curiosity* (2015) and Scott Curtis's *The Shape of Spectatorship* (2015) invite historians of science to reconsider visual displays in relation to the power and limitations of moving images and the machines that made and projected them. Reviewing the books against the backdrop of a nascent historical field of 'science and cinema', I aim to encourage historians of science to watch more movies, engage more seriously with film history and start thinking about cinema as a potentially vital part of our stories after 1895.[6] Just as

[4] Simon Schaffer, 'Transport phenomena: Space and visibility in Victorian physics', *Early Popular Visual Culture*, 2012, 10, pp. 71–91, p. 71.
[5] Hopwood, *Haeckel's Embryos*, p. 146. See also Solveig Jülich, 'Media as modern magic: Early x-ray imaging and cinematography in Sweden', *Early Popular Visual Culture*, 2008, 6, pp. 19–33.
[6] Film and medicine is comparatively better served. For recent reviews: Christian Bonah and Anja Laukötter, 'Moving pictures and medicine in the first half of the 20th Century: Some notes on international historical developments and the potential of medical film research', *Gesnerus*, 2009, 66, pp. 121–146; Tim Boon, 'Medical film and television: An alternative path to the cultures of biomedicine', in Mark Jackson (ed.), *Oxford Handbook of the History of Medicine*, Oxford: Oxford University Press, 2011, pp. 617–634. See also Martin Pernick, *The Black Stork: Eugenics and the Death of 'Defective' Babies in American Medicine and Motion Pictures Since 1915*, Oxford: Oxford University Press, 1996; Ulf Schmidt, *Medical Films, Ethics and Euthanasia in Nazi Germany: The History of Medical Research and Teaching Films of the Reich Office for Educational Films/Reich*

Curtis has pushed film historians to take 'science lessons', so more historians of science, having become proficient with books and models, should consider taking film lessons, too.[7]

Gaycken and Curtis are historians of 'early cinema', a seemingly bland term that in fact denotes a specific period from 1895 to around 1913, when narrative 'feature' films began to take over as the dominant form. Since the landmark 1978 meeting of the *Fédération Internationale des Archives du Film* in Brighton garnered public support for the preservation of highly flammable nitrate film, scholars have reimagined the earliest years of cinema as a time when the moving image as such, not the story it told (or did not tell), was the main event.[8] Tom Gunning's influential 1986 essay on the 'cinema of attractions' decisively shifted the teleological understanding of early cinema from a primitive stage of what became dominant later to a historicised understanding of a distinctive and fully realised, though to us foreign culture.[9] Both students of Gunning, Gaycken and Curtis are leading practitioners in this rewardingly exotic, if somewhat ghettoized domain of film history. Historians of science, and not just those immersed in the years around 1900, should get to know it better.

An oft-repeated story of the public debut of cinema in the basement of a Paris café on 28 December 1895 has George Méliès, the great fantasist of early film, offering to purchase a cinematograph from Antoine Lumière. Lumière, Gaycken explains, replies that his invention is not for sale; it is a 'scientific curiosity' with no commercial future (p.3). For Gaycken, who teaches English at the University of

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Institute for Films in Science and Education, 1933-1945, Husum: Matthiesen, 2002; Kirsten Ostherr, *Medical Visions: Producing the Patient Through Film, Television and Imaging Technologies*, Oxford: Oxford University Press, 2013.

[7] See Scott Curtis, 'Science lessons', *Film History*, 2013, 25, pp. 45–54.

[8] André Gaudreault, *Film and Attraction: From Kinematography to Cinema*, Urbana: University of Illinois Press, 2011, p. 99.

[9] Tom Gunning, 'The cinema of attractions: Early cinema, its spectator and the avant-garde', *Wide Angle*, 1986, 8, pp. 63–70.

Maryland, the keyword curiosity denotes the scientist's (intellectual and morbid) curiosity about the natural world as well as continuities with the venerable cabinet of curiosities. By underscoring the multiple modern and archaic valences of the word, Gaycken usefully moves the debate over techniques of visualisation on from bodily discipline and social control, on the one hand, and the hegemony of mechanical objectivity, on the other.[10] Through a series of striking case studies, he shows how mechanically produced moving images reenchanted nature with scientific magic.[11] Gaycken's titular devices include not only mechanical cameras and projectors, but also methods of producing new kinds of optical illusions such as slow motion, magnification and time-lapse.[12]

Devices of Curiosity is divided into five chapters. The first two chart the rise of what Gaycken calls the 'popular-science film' through the Charles Urban Trading Company's key collaborators: F. Martin Duncan and Percy Smith.[13] Smith, a former civil servant who introduced innovations such as time-lapse and animated maps, also wrote detective stories, a genre to which Gaycken returns in the final chapter.[14] A third chapter examines the films produced from around 1910 in France by the companies Pathé, Gaumont, and Éclair, beginning with those by the medical researcher and pioneering microcinematographer Jean Comandon.[15] Chapter Four

[10] Lisa Cartwright, *Screening the Body: Tracing Medicine's Visual Culture*, Minneapolis: University of Minnesota Press, 1995; Lorraine Daston and Peter Galison, *Objectivity*, New York: Zone Books, 2007.
[11] See also Solveig Jülich, 'Media as modern magic: Early x- ray imaging and cinematography in Sweden', *Early Popular Visual Culture*, 2008, 6, pp. 19–33.
[12] On the significance of optical illusions in Victorian science: Iwan Rhys Morus, 'Illuminating illusions, or the Victorian art of seeing things', *Early Popular Visual Culture*, 2012, 10, pp. 37–50. On early botanical time-lapse films: Oliver Gaycken 'The secret life of plants: Visualizing vegetative movement, 1880–1903', *Early Popular Visual Culture*, 10, 2012, pp. 51–69.
[13] On Charles Urban: Boon, *Films of Fact*, pp. 7–32.
[14] For a discussion of animation techniques in relation to modelling: Oliver Gaycken, '"A living, developing egg is present before you": Animation, scientific visualization, and modeling', in Karen Beckman (ed.), *Animating Film Theory*, Durham: Duke University Press, 2014.
[15] See also Hannah Landecker, 'Microcinematography and the history of science and film', *Isis*, 2006, 97, pp. 121–132; Béatrice de Pastre and Thierry Lefebvre (eds.), *Filmer la science, comprendre la vie: Le cinema de Jean Comandon*, Paris: Centre national de cinématographie, 2012; Jimena Canales,

shifts to the United States, and George Kleine's 'educational motion picture films', an eclectic collection that Gaycken likens to a modern cabinet of curiosities. In something of a departure, the final chapter examines Louis Feuillade's crime film serial *Fantômas* (1913) to identify stylistic affinities with popular-science films and a shared preoccupation with modern science and technology.

Gaycken takes readers on a vivid and often entertaining tour of fascinating and previously little-known films, several of which have recently been rescued from archival obscurity and made available on DVD and online for convenient repeat viewing.[16] Duncan's *The Cheese Mites* (1903), for example, shows a gentleman, played by the naturalist-filmmaker himself, comically reacting in astonishment to a magnified view of his infested lunch. Recently published on YouTube by the BFI, this is a humorous trick film as well as microcosmic nature documentary; it inspired other films, including a parody using windup mechanical beetles. But Gaycken's most striking example of the fluidity of genres and tensions between them is Percy Smith's *The Acrobatic Fly* (1910). Also available online, the film stars a fly that appears to juggle various objects, when in fact it is tied on its back and merely attempting to walk. Reminiscent of the flea circus, the film stretched credibility, and critics initially dismissed it as a clever fake until a strategic screening at the Royal Photography Society garnered legitimacy. The insect returns in Chapter 4 in *The Fly Pest* (1909), '"the most educational as well as the most revolting motion picture film that has ever been exhibited anywhere"', according to one review (p. 148). This film evoked fascination and wonder (for example, at the marvellously magnified structures of the fly's intricate mouthparts), even as it tested the limits of public decency.

'Dead and alive: Micro-cinematography between physics and biology', *Configurations*, 2015, 23, pp. 235–251.

[16] Relevant DVD collections published by the BFI include *Science is Fiction: Jean Painlevé* (2007) and *Secrets of Nature: Pioneering Science and Nature Films* (2010). See also the Wellcome Library's moving image and sound collection: https://www.youtube.com/user/WellcomeFilm.

Framed in terms of the keyword intertextuality, Gaycken's study convincingly shows how early cinema was in continual dialogue with older representational techniques such as the magic lantern show, illustrated science magazines and satirical cartoons.[17] Some historians, however, might take issue with his decision to isolate the 'popular-science film' as a distinct genre. Though he takes pains to justify his choice of terminology, the category does seem to run into trouble at times, perhaps especially when we learn that Comandon's films were first exhibited to elite scientific and medical audiences. Nevertheless, Gaycken has succeeded admirably in recovering a vast and little-studied commercial industry at the edges of research and entertainment and his efforts ought to make it more difficult for historians of late- and post-Victorian science to ignore the circulation of moving images in the wider cultural marketplace.[18]

In *The Shape of Spectatorship* Curtis is also concerned with the decades before World War I, but he focuses on Imperial Germany, and is less concerned with science as public culture than with communities of experts, research programmes and experimental systems. Whereas Gaycken thematises cinema's power to stimulate public wonder and curiosity, Curtis marries the archaeological project of excavating the wealth of nontheatrical, or 'useful', films made for a range of purposes other than commercial entertainment with the sorts of questions that historians and sociologists of science like to ask about expertise, disciplinary agendas, and research programmes.[19] Curtis wants to know how cinema was variously embraced or rejected

[17] For the case of evolution: Oliver Gaycken, 'Early cinema and evolution', in Bernard Lightman and Bennett Zon (eds.), *Evolution and Victorian Culture*, Cambridge: University of Cambridge Press, 2014, pp. 94–120.

[18] For a recent survey of print that also discusses radio and television, but mentions film only in passing and even then does not mention any film made before the 1930s: Peter J. Bowler, *Science for All: The Popularization of Science in Early Twentieth-Century Britain*, Chicago: University of Chicago Press, 2009.

[19] On 'useful' cinema: Vinzenz Hediger and Patrick Vonderau (eds.), *Films that Work: Industrial Film and the Productivity of Media*, Amsterdam: Amsterdam University Press, 2009; Charles R. Acland and

as the solution to problems confronted by members of different professional communities. Case by case, he explores the 'intimate and complex relationship' between technologies, users, and their projects (p. 2).

The Shape of Spectatorship explores in four chapters cinema's encounters with laboratory science, clinical medicine, educational reform, and aesthetic theory. Director of the programme in communication at Northwestern University in Qatar and president of Domitor, the international society for the study of early cinema, Curtis presents this structure as roughly mirroring the trajectory of early cinema, 'from its roots in scientific research to its early bids for acceptance as an art form' (p. 2). Though experimental analysis and public display were entangled from the start, and perhaps rather more than either Gaycken or Curtis let on, Curtis's richly contextualised case studies underscore the heterogeneity of early cinema and the variety of ends to which film was put beyond the entertainment industry.[20] Collectively they demonstrate how different groups of experts engaged with or avoided the new image machines.

The first chapter, on science, is the most directly relevant to readers of this journal. Following a discussion of Henri Bergson's cinematic philosophy of science, it focuses not on spectatorship, as later chapters do, but on what Curtis calls 'inscription', in the cinematographic study of human motion, Brownian motion and cellular growth. The second chapter explores medical filmmaking, including the use of still and moving images in clinical research and in diagnostics. It contrasts expert modes of viewing with elite diagnosis of film's distracting flicker as one of the most threatening ills of modern society. Film reformers, as we learn in Chapter 3,

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Haidee Wasson (eds.), *Useful Cinema*, Durham, NC: Duke University Press, 2012; Devin Orgeron, Marsha Orgeron, and Dan Streible (eds.), *Learning with the Lights Off: Educational Film in the United States*, Oxford: Oxford University Press, 2012.

[20] On the entwinement of science and spectacle before cinema: Iwan Rhys Morus, 'Seeing and believing science', *Isis*, 2006, 97, pp. 201–210.

attempted to fashion film screenings for educational use that would conform to methods of visual instruction and observational training as well as models of aesthetic contemplation and ideological goals. Chapter 4 revisits an influential debate over cinema's challenge to literary values from the perspective of art theorists who valued aesthetic contemplation. Curtis concludes by calling for a more 'tactile' approach to filmmaking and the management of venues, audiences, and discourses.

Curtis's first exhibit of cinematic science is an example of chronophotography, the late nineteenth-century technique of visualising motion strongly associated with Étienne-Jules Marey and Eadweard Muybridge.[21] Leipzig physiologists Wilhelm Braune and Otto Fischer, who built on Marey's work to publish influential studies on 'the human gait' between 1889 and 1904, painstakingly abstracted the photographic material they produced into equations, tables, graphs and finally a three-dimensional model. His second and third exhibits are of Marburg physicist Max Seddig's attempt to confirm Albert Einstein's theory of Brownian motion using chronophotographic images of microscopic particles affected by molecular activity, and of Heidelberg anatomist Hermann Braus, who changed his mind about how nerve cells grow because of filmic evidence.[22] Curtis uses the three cases to show how different kinds of scientists used film differently, in accordance with divergent research agendas: Braune and Fischer produced analysable still images; Seddig was after the precision measurement of time intervals; and Braus wanted a temporal record of growth. The camera was a flexible research tool.

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[21] For chronophotography see Marta Braun, *Picturing Time: The Work of Etienne-Jules Marey (1830-1904)*, Chicago: University of Chicago Press, 1992; Laurent Mannoni, *The Great Art of Light and Shadow: Archaeology of the Cinema*, Exeter: University of Exeter Press 2000; Thierry Lefebvre, Jacques Malthête, and Laurent Mannoni (eds.), *Sur les pas de Marey: Science(s) et cinéma*, Paris, L'Harmattan/Sémia, 2004; Virgilio Tosi, *Cinema Before Cinema: The Origins of Scientific Cinematography*, London: British Universities Film and Video Council, 2005; Jimena Canales, *A Tenth of A Second: A History*, Chicago: Chicago University Press, 2009.

[22] See also Charlotte Bigg, 'Evident atoms: Visuality in Jean Perrin's Brownian motion research', *Studies in History and Philosophy of Science*, 2008, 39, pp. 312–322; Curtis, 'Science lessons'.

The Shape of Spectatorship, as Curtis admits, 'concentrates on the *correspondence between* film form and discipline, rather than the *impact* of form *on* that discipline' (p. 14, original emphasis). Likewise, Gaycken's project does not ask whether film transformed the production of scientific knowledge about the natural world. Investigating how cinema shaped science would be a logical next step for anyone curious about scientists' engagement with film. The two books reviewed here provide a good place to start and suggest several potentially fruitful avenues of research. For one thing, and along the lines of Curtis's concluding call for a tactile historiography, it would be helpful to know more about scientific cinema's technologies, which, for the most part remain black boxed by both authors.[23]

Historians of science are well equipped for a more sustained analysis of technologies in use.[24] The cine camera, like Nicolas Rasmussen's electron microscope, which was also used to make movies, might be given a starring role in a more materialist history of scientific filmmaking.[25] Historical ethnographies of experimental analysis and public demonstration would do much to shed light on the entanglements of laboratory science and cinematic display at the turn of the twentieth century and beyond.[26] Importantly, they would tell us about not only the promises of film, but also the constraints imposed by new and only partially flexible technologies. As it stands, while both authors treat early cinema as heterogeneous and malleable, they take the hardware more or less for granted. We do not learn much about the

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[23] For differently technological approaches to film history: Deac Rossell, 'Demolition d'un mur: The social construction of technology and early cinema projection systems', *Early Popular Visual Culture*, 2014, 12, pp. 304–341; Brian R. Jacobson, *Studios Before the System: Architecture, Technology, and the Emergence of Cinematic Space*, New York: Columbia University Press, 2015.
[24] David Edgerton, *The Shock of the Old: Technology and Global History Since 1900*, London: Profile, 2006.
[25] For example, Heidi Felix, Gisela Haemmerli, and Peter Sträuli, *Dynamic Morphology of Leukemia Cells: A Comparative Study by Scanning Electron Microscopy and Microcinematography*, Berlin: Springer, 1978; Nicolas Rasmussen, *Picture control: The electron microscope and the transformation of biology in America, 1940-1960*, Stanford: Stanford University Press, 1997.
[26] For example, Iwan Rhys Morus, 'Seeing and believing science', *Isis*, 2006, 97, pp. 201–210; Schaffer, 'Transport phenomena'.

labour that surely went into making cinematography the right tool for the job; film appears on the scene, more or less intact and ready to go. Historians of science might investigate how scientist-filmmakers were constrained by the limitations of particular innovations or how research programmes and commercial agendas drove technological change.

Yet we are given some tantalising hints of a still-hidden history. From Gaycken we learn that Smith kept detailed records of expenses for stock and equipment, and it would be good to know more about the financial side of the story. Gaycken mentions in passing that Comandon and Pathé jointly filed a patent for a modified apparatus, and Curtis notes that early motion picture equipment was expensive, cumbersome, and sufficiently difficult to adapt that only the wealthiest and most resourceful laboratories could afford them. The material and economic dimensions of the story of science and cinema await their historian.[27]

Finally, it is worth emphasising that while histories of 'early cinema' typically end around the start of World War I, there is no good reason for historians of science to follow suit. It seems likely that use of the moving image in knowledge production intensified in later decades. The early promise of X-ray cinematography, as Curtis tells us, was realised only in the 1930s, and leading American child psychologists, anatomists, and sexologists independently turned to filmmaking in the mid-twentieth century.[28] In West Germany, the *Encyclopaedia Cinematographica* maintained an international reference collection of scientific films from 1952 to 1994, and by the

[27] On business historical approaches to science, technology and medicine: See Jean-Paul Gaudillière, 'The pharmaceutical industry in the biotech century: Toward a history of science, technology and business? *Studies in History and Philosophy of Biological and Biomedical Sciences*, 2002, 32, pp. 191–201; David Edgerton, 'Time, money, and history', *Isis*, 2012, 103, pp. 316–327.

[28] Scott Curtis, '"Tangible as Tissue": Arnold Gesell, infant behavior, and film analysis', *Science in Context*, 2011, 24, pp. 417–442; Emily K. Wilson, 'Ex utero: Live human fetal research and the films of Davenport Hooker', *Bulletin of the History of Medicine*, 2014, 88, pp. 132–160; Donna J. Drucker, *The Machines of Sex Research: Technology and the Politics of Identity, 1945-1985*, Dortrecht: Springer, 2014, pp. 45–67.

1970s the BBC had become adept at 'revealing aspects of the natural word that had previously escaped scientists' attention.'[29]

'Movie making', as a pair of cell biologist recently put it, 'is now a ubiquitous experimental tool that biologists use alongside more traditional techniques such as molecular biology and biochemistry.'[30] Yet, we do not have a clear picture of how biology or other sciences were affected (or not) by the democratisation of filmmaking and viewing technologies—from cheaper 16mm film stock and portable projectors to digital capture and handheld screens.[31] Today, computational 'movie analysis tools' are freely available online, while leading journals encourage authors to submit 'video data' for e-publication.[32] Scientific films are used in teaching and for public engagement, archived on YouTube and appropriated as 'found footage' by artists (not to mention historians)—activities which feed back into the research process.[33] A sensitivity to the seemingly boundless transaction between backstage analysis and public display, liberated from the disciplinary bounds of 'early cinema', is something else that historians of science can bring to the table. *Bon cinema!*

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[29] For *Encyclopaedia Cinematographica*: Gouyon, 'Science and film-making', p. 21. For the BBC: Timothy Boon and Jean-Baptiste Gouyon, 'The origins and practice of science on British television', in Martin Conboy and John Steel (eds.), *The Routledge Companion to British Media History*, London: Routledge, 2015, pp. 470–483, p. 480.
[30] Brian M. Stramer and Graham A. Dunn, 'Cells on film: The past and future of cinemicroscopy', *Journal of Cell Science*, 2015, 128, pp. 9–13.
[31] Haidee Wasson, 'Electric homes! Automatic movies! Efficient entertainment!: 16mm and cinema's domestication in the 1920s', *Cinema Journal*, 2009, 48, pp. 1–21; Wasson, 'Suitcase Cinema', *Cinema Journal*, 2012, 51, pp. 148–152.
[32] Stramer and Dunn, 'Cells on film', p. 12.
[33] For a discussion of science historical filmmaking: Peter Galison, 'Visual STS', in Annamaria Carusi, Aud Sissel Hoel, Timothy Webmoor, and Steve Woolgar (eds.), *Visualization in the Age of Computerization*, New York: Routledge, 2014, pp. 197–225.