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Eozoön canadense, Loc. Côté St. Pierre on the Ottawa River, Photographed by Mr. Thomas Weston of Geological Society of Canada,” Honeyman Historical Collection, Geology Records, Nova Scotia Museum, Halifax, NS. Image courtesy of Tim Fedak.

Introduction: Special Issue

Photography: Science, Technology and Practice

Joan M. Schwartz

At a meeting of the Manchester Photographic Society in early March 1856, Rev W. J. Read explained to a rapt audience how photography stood in a “threefold relation with Science:”¹

It may render help as a safe and ready means of Illustration and Record....; or it may become a principal agent in extending our knowledge, and be used as a means of Remark and Discovery; or it may exert a kind of reflex influence upon Science which may be spoken of apart from its immediate connexion with it.”² Citing examples from studies of organic and inorganic structures, Read noted the “impetus which it has given to scientific as well as to practical Optics,” and elaborated on the potential of photography to be pressed into the service of Ethnography, Anatomy, Organic Structure & Botany, Zoology, Entomology, Geology, Astronomy, Meteorology, and Magnetism.³

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Read expounded on photography's value for producing detailed and reliable illustrations of engineering works in progress, models and machinery, patterns and designs, maps and plans, and mechanical drawings and for the depiction of "any elaborate arrangement of apparatus ... for Chemical Lectures ... the mounting of Astronomical and other instruments, and the general arrangement of the Observatory, the Laboratory, and even the Study."⁴

In these and other ways, photography came to be part of the way in which the luminaries of Victorian science saw and explored the world. Experimentation with the properties of light and lenses and the darkening of silver salts by such prominent nineteenth-century scientists as Alexander von Humboldt, John Herschel, David Brewster, Humphry Davy, Jean-François Dominique Arago, Joseph-Louis Gay-Lussac, and Jean-Baptiste Biot played a key role at the dawn of photography, but interest in the place of photography within scientific pursuit and technological advance has been overshadowed by art historical and curatorial concerns. As Elizabeth Edwards has observed, "Photography's default history is told as art—it shouldn't be."⁵

However, with postmodern shifts in critical writing, scholarly attention has turned to photographic practices and multiple "histories of photographs."⁶ This is where the history of science and technology can offer a critical disciplinary perspective on the motivations, methods, and activities at the intersection of nineteenth-century science and photography. The new medium changed ways of doing and thinking about science in the nineteenth century, and much remains to be explored, based both on the survival of original images and on documentary evidence of their creation, circulation, and use. Historians of science and technology have much to add to, and gain from, this recent scholarly turn.⁷

This special issue—which emerged from the session "Perspectives on Regionalism and Photography in Nineteenth-Century Canada," at the 2019 CSTHA conference in Halifax—point to some of the ways in which photography threads through the history of science and technology. At a basic level, we can investigate photography as science and as technology, with a focus on developments in chemistry and processes, optics and equipment, and their overlap, as knowledge of the properties of light, lenses, and light-sensitive materials evolved. We can explore the role that photographs have played in science and in technology, in an effort to discern how and when cameras and camera-made images were employed to produce data for both qualitative and quantitative analysis within scientific pursuits and technological applications. Coming from another angle, we can look critically at photography of science and of technology as a way to document scientific pursuits and technological applications, from laboratory set-ups to bridge-building. Related but not overtly scientific are landscape views and studio portraits collected or published as illustrations, to satisfy popular curiosity about the appearance of places and people that have figured large in the historiography of science and technology. The papers gathered here touch upon, and raise questions about, the place of photography in these and other avenues of historical inquiry.

Since its inception, *Scientia Canadensis* has published a number of substantive research articles on the processes or applications of photography within the history of science and technology.⁸ Most recently, Brendan Cull discussed an early photographic experiment

in botanical illustration and its presentation as part of the Canadian displays at the 1867 Exposition universelle in Paris, and Blair Stein examined the use of aerial photography at Trans-Canada Airlines between 1945 and 1955.⁹ Photographs were part of research by Cindy Stelmackowich into the “the layered and gendered stories of culturally diverse trailblazing Canadian women scientists.”¹⁰ And Jenna Smith used annual reports and photographs as primary sources to examine how the Ontario Provincial Board of Health constructed a specific image of its efforts to educate the public on disease and health through visual display.¹¹ In his “Exhibition Note: Lines in the Ice at the British Library,” Philip Hatfield pointed out how

photography and film have been used to enthrall viewers, define knowledge, and, perhaps most importantly, express control over the polar regions. The power of photography and film to communicate with large audiences and present events within the frame as irrefutable “ocular truth” means that these media had, and continue to have, a wide impact on how people perceive the Arctic.¹²

Indeed, photographs of receding ice caps and diminishing ice floes are now summoned as powerful visual evidence to buttress arguments about climate change, just as NASA’s Earthrise and other views from space of our terraqueous globe have been utilized to promote the need for planetary unity in the face of global environmental crises.¹³

In his 2011 “artifact biography” of the Theratron Junior—“a sleek green radiotherapy machine”—David Pantalony excavated narratives of Canadian innovation, science, commerce, labour, aesthetics, and patient experience from photographs produced by the National Film Board of Canada. He concluded: “The lessons from careful artifact studies are readily clear—we are missing opportunities by taking for granted the most familiar items on our museum floors.”¹⁴ Pantalony’s caveat extends equally to the most familiar items on our museum floors or in our public and private archives—photographs—and we are, indeed, missing opportunities for their study as primary sources in the history of science and technology.

Yet, with these and a few other exceptions, photography has not figured large in reviews and research articles in *Scientia Canadensis*,¹⁵ and has even been employed to very different ends. For example, in his review of Richard Jarrell’s *The Cold Light of Dawn: A History of Canadian Astronomy* (1988), Arthur E. Covington writes, “The account is sometimes overwhelming, but is fortunately enlivened by the author’s general reflections and comments and by the inclusion of thirty-one photographs.”¹⁶ However, elsewhere, in his “Some Recollections of the Radio and Electrical Engineering Division of the National Research Council of Canada, 1946-1977,” Covington clearly demonstrates the documentary value of photographs for communicating equipment design and use. Thus, while photographs are often employed to “enliven” text, they can do far more when they are returned to and understood in the context(s) in which they were taken and initially circulated. Indeed, as “working objects in their own time,”¹⁷ photographs performed a range of functions in the history of science and technology: from data collection for measurement and analysis, to documentation of instruments and experiments, to illustration of people, places, and things in publications, as well as the science and technology of photographic processes and practices. Work remains to be done on the nature, role, and influence of photography in the history of science and technology in Canada. *Scientia Canadensis* offers an obvious venue for such an exploration.

The Essays

The essays that follow approach the topic of “photography: science, technology, and practice” from different directions and demonstrate the thematic breadth and methodological reach of the topic. My own essay “Photography: Science, Technology, and Practice in Nineteenth-Century Canada” surveys some of the applications of photography within the realms of science and technology in nineteenth-century Canada. It approaches the history of photography, based on surviving images, on references to photography in newspapers, and on published texts, some illustrated with original albumen prints or photographically based illustrations. The essay aims to open lesser known photographic sources and practices to scrutiny by those expert in the histories of scientific disciplines that anticipated photography’s utility and tested, promoted, or embraced its use.

John Osborne, a cultural historian of the medieval Mediterranean, presents the use of magnesium light by Canadian photographer Charles Smeaton to photograph wall paintings in the Catacombs of Rome.¹⁸ Osborne’s research reveals both the art historical and technological significance of Smeaton’s widely disseminated, but largely unheralded work. Reproduced in the massive art historical publications of John Henry Parker, Smeaton’s photographs were created using newly available, commercially produced magnesium wire to supply light in the Catacomb’s underground spaces—otherwise accessible only by candle light—where the art of the early church lay beyond the capacity of wet collodion photography.

Drawing on visual materials, patent records, and foundational work by Teresa McIntosh, Kate Addleman-Frankel highlights the contributions of Canadian engraver, inventor, and publisher William Augustus Leggo (1830-1915) to the invention of half-tone printing technology. Addleman-Frankel’s commentary on the Leggotype is part of the much larger story of the rise of photo-mechanical reproduction and the growth of photography as a form of visual communication. Yet, the several pictorial publications of Leggo and his Montreal-based partner George-Édouard Desbarats (1838-1893) continue to be little known outside Canada and are regularly overlooked by scholars writing on the origins and rise of mass media.

In her examination of dry-plate manufacturing, Shannon Perry provides the business context and economic incentives for the development of the photographic industry, and addresses the Canadian chapter of the broader historical development of the technology that revolutionized photography as a social practice. Using nineteenth-century periodicals and archival sources, Perry traces the development of dry-plate manufacturing from small-scale hand production to large-scale factory-based industry. The adoption of dry-plates and their impact on the nature and pursuit of photography is well known, but few have explored the business of dry-plate production or questioned the origins of the very materials that enabled new and increased uses of the medium. Perry’s study adds to our understanding of the commercial side of technological progress that underpinned practical, social, and demographic changes in the history of photography.

A complement to Blair Stein’s 2018 *Scientia Canadensis* essay on aerial views, Dirk Werle, a remote sensing geoscientist and environmental consultant, advocates for early aerial photography as a valuable source of geospatial information for historical and

environmental research. His investigation into the use of vertical air photos produced on a 1921 survey over the St. Croix River boundary between St Stephen, NB, and Calais, Maine, highlights early twentieth-century cultural-industrial landscapes long vanished from the site. Werle claims the early 1920s constitute a tentative yet pivotal period for the adoption of aerial photography as a surveying and mapping tool and mark the embryonic beginnings of remote sensing in Canada.

Marthe Fjellestad addresses the use of photography on three expeditions in the Arctic during the First Polar Year (IPY-1) in 1886, and brings to light the work of Nova Scotia-born George Rice, the photographer on the American expedition to Lady Franklin Bay. As Fjellestad notes, this was not the beginning of photography in, of, or related to the north. Indeed, daguerreotypes of Sir John Franklin and his crew were taken in 1845, some of which subsequently circulated as engravings in the *Illustrated London News* and in *Gleason's Pictorial Drawing Room Companion*. A decade later, John Powles Cheyne photographed and published a series of stereoscopic views of the Franklin relics that Sir Leopold McClintock brought back to England in 1859. Motivated more by art than science, the work of Boston photographers John B. Dunsmore and George B. Critcherson, who accompanied the expedition of American marine and landscape artist William Bradford, appeared in Bradford's lavish 1873 publication *The Arctic Regions*. Two years later, amateur photographers Thomas Mitchell, paymaster on HMS *Discovery*, and George White, Assistant Engineer on HMS *Alert*, produced over 100 photographs on the last British Polar Expedition under the command of Sir George Strong Nares.¹⁹ Meticulously labelled by place, date, latitude, and longitude, many of the photographs were taken under the most challenging of conditions and tested the limits of prevailing photographic technology. While the photographs discussed by Fjellestad lack the historical caché and aesthetic appeal of some of these earlier images, IPY-1 was the first time that photography was incorporated—albeit in very different ways and on such a scale—into systematic study of the Arctic.

In her essay, “Seeing, Saving, and Remembering Barnardo’s Children: Technologies of Access and Preservation in Historical Research,” media historian Nina Lager Vestberg examines the historical and contemporary use of visual technologies to document, promote, and recall the child migration scheme that sent as many as 118,000 “Home Children” from Britain to Canada between 1869 and 1948. She addresses the initial role envisioned by Thomas Barnardo for analogue photographs, the meaning of such photographs for Home Children, and the value of online digital surrogates for their descendants. Throughout Vestberg’s essay, there are resonances between the “orphani- zation” of the destitute children scooped up by Barnardo’s charitable organization and the plight of Indigenous children in Canada forcibly removed from their families and placed in residential schools, both according to purportedly benevolent and mutually beneficial government schemes to “civilize” and thus improve their lives.²⁰ At the heart of Vestberg’s research are the anticipated benefits and ultimate shortcomings of visual technologies of preservation and transmission for community archives, and their relative value for memory and meaning-making in analogue and digital form.

The larger issue of where photographic records of science and technology are preserved suggests that there is work to be done in both the history of photography and

the history of science and technology on the circulation of knowledge about imaging technologies, and their geographical spread and practical adoption in Canada in the nineteenth century. Such a task links archives, art, and science to the perspective explained in Geoff Belknap's essay on the photography holdings of the National Science and Media Museum in Bradford, England, one of the world's premier collections dedicated to the science and technology of photography. Touching upon the importance of institutional practice and curatorial process, his commentary focuses specifically on the collection at the National Science and Media Museum in England, but carries lessons for researchers unaware of, but at the mercy of, changing mandates, acquisition policies, and disciplinary perspectives. Belknap's discussion of the museum's evolving collecting policies, digitization initiatives, and public interface points to some of the affordances and constraints of research in analogue and digital photo archives.

Contexts and Meanings

In response to the fundamental questions, "How does scientific knowledge travel, and where is it preserved?" the essays in this issue demonstrate that photography is part of the answer. Work by James Secord, Scott Montgomery, Alison Martin, and others on the mobility and translation of knowledge suggests that historians of science and technology might profitably look more closely at the pursuit of photography in the globalization of knowledge as well as the globalization of photography in pursuit of knowledge.²¹ While we can ask how photographs were produced and made meaningful, and how information about the science and technology of photography circulated and to what effect, such an inquiry requires more than expanded disciplinary focus. Ultimately, the ways in which photographs are viewed, valued, and employed as primary sources are contingent upon where they are kept and seen—that is, in the public and private institutions where they are arranged and described, preserved and made accessible, studied and exhibited.

Archives, libraries, museums, and galleries shape where and how research in the history of science and technology is conducted. Consider, for example, the National Gallery of Canada's exhibition and accompanying edited book of essays *Beauty of Another Order: Photography in Science*.²² To what degree did museum-goers have their viewing experience filtered through the lens of an institution renowned for its fine art collections? How would the same exhibition have been received had it been displayed across town at the Canada Science and Technology Museum? Would the wall texts and captions have addressed the same issues, provided the same information, reached the same audiences? And in a world moving more and more to online access, how are photographs scanned, described, and made available as digital surrogates by different collecting institutions with different mandates and different priorities shaped by and for different user-publics? Are we going about digitization initiatives with "eyes wide shut," demanding access to more and more images online, but oblivious to the fact that more access can mean less context that, in turn, restricts online research capabilities?

In 1997, Larry Schaaf's *Records of the Dawn of Photography: Talbot's Notebooks P and Q* prompted one reviewer to observe, "It is a curious fact that in recent years cultural historians of science and technology have done very little research on the early nine-

teenth-century origins of photography.”²³ Since then, scholars interested in the power of photography as a social, scientific, and technological practice have pried open potential synergies between the history of photography and the history of science and technology. And technology, as Ursula Franklin explained in 1995, “is essentially practice: the means by which we do things.” Pointing to writing as a means that “separates the message from the messenger, “ Franklin observed that

The ability to separate message from messenger, sound from speaker, and picture from depicted, together with the speed with which information is transferred, has created a reality in which the manipulation of space and time has become one of the driving forces behind a new and complex way of doing things. ... Collectively and individually, and in light of broader implications, we need to think about how much of society is determined by a different way of doing things, by the dictates of new technologies.²⁴

Franklin’s assertion underpins the aim of this special issue of *Scientia Canadensis* to draw attention to photography as a technological practice, which extended the powers of human observation across time and space and, in doing so, ushered in a new era of doing things.

With few exceptions—here, I think of Warren de la Rue’s photographs of the surface of the Moon and Harold Edgerton’s experiments in high speed photography—the vast majority of photographs taken for scientific or technological reasons have received relatively little scholarly attention from historians of photography.²⁵ Empirical research and big questions remain. As Mitman and Wilder point out, photography (and subsequently film) “created new types of records that altered notions of historical, legal, and scientific evidence; changed interactions among scientists and their subjects; and challenged the very construction and meaning of the archive.”²⁶ If photography furnished a new way to gather data and supply documentation, how then, we might ask, at a very basic level, did photography, as a technology of image production and visual communication, change the nature of scientific evidence, the mobilization of scientific knowledge, and the perception of scientific engagement? And, what, if anything, might the Canadian experience and the perspective of historians of science and technology contribute to such inquiry?

Endnotes

- 1 Read’s paper, “On the Applications of Photography,” was subsequently published in the society’s journal *Photographic Notes*. *Journal of the Photographic Society of Scotland and of the Manchester Photographic Society* 1, No. 9 (August 1856): 127-131; 1, No. 12, 1 (October 1856): 184-185; 1, No. 13 (October 1856): 201-204.
- 2 Read, “On the Applications of Photography,” 130.
- 3 Read, “On the Applications of Photography,” 185, 201.
- 4 Read, “On the Applications of Photography,” 204.
- 5 Elizabeth Edwards, “Photography’s default history is told as art – it shouldn’t be,” *The Conversation*, 23 February 2015. <https://theconversation.com/photographys-default-history-is-told-as-art-it-shouldnt-be-37734>
- 6 John Tagg, *The Burden of Representation: Essays on Photographies and Histories* (Amherst, MA: The University of Massachusetts Press, 1988); Abigail Solomon-Godeau, *Photography At The Dock: Essays on Photographic History, Institutions, and Practices* (Minneapolis: University of Minnesota Press, 1991); Richard Bolton, *Contest of Meaning: Critical Histories of Photography* (Cambridge, MA: MIT Press, 1992).

- 7 Kelley Wilder, *Photography and Science* (London: Reaktion, 2008); Mirjam Brusius, Katrina Dean, and Chitra Ramalingam, eds., *William Henry Fox Talbot: Beyond Photography* (New Haven: Yale UP, 2013); Gregg Mitman and Kelley Wilder, eds., *Documenting the World: Film, Photography, and the Scientific Record* (Chicago: University of Chicago Press, 2016); Sarah Kate Gillespie, *The Early American Daguerreotype: Cross-Currents in Art and Technology* (Cambridge, MA: The MIT Press, 2016).
- 8 Diana Pedersen and Martha Phemister, “Women and Photography in Ontario, 1839-1929: A Case Study of the Interaction of Gender and Technology,” *Scientia Canadensis* 9, no. 1 (1985): 27-52; Jacqueline McIsaac, “Cameras in the Countryside: Recreational Photography in Rural Ontario, 1851-1920,” *Scientia Canadensis* 36, no. 1 (2013): 5-31; Guy Gaudreau and Micheline Tremblay, “Technique de mise en pages, crise économique et journalisme d’opinion : Le Courrier de Saint-Hyacinthe de 1920 à 1938,” *Scientia Canadensis* 36, no. 2 (2013): 37-62.
- 9 Brendan Cull, “Early Canadian Botanical Photography at the Exposition universelle, Paris, 1867,” *Scientia Canadensis* 39, no. 1 (2017): 27-50; Blair Stein, “‘One-Day-Wide’ Canada: History, Geography, and Aerial Views at Trans Canada Air Lines, 1945-1955,” *Scientia Canadensis* 40, no. 1 (2018): 19-43.
- 10 Cindy Stelmackowich, “Cultivating Knowledge about Canadian Women Scientists through Seminars, Objects, and Exhibitions,” *Scientia Canadensis* 41, no. 1 (2019): 55-65.
- 11 Jenna Murdock Smith, “Next Stop, ‘Sunshine Station’: The Ontario Provincial Board of Health and the Exhibition of Tuberculosis, 1908-1929,” *Scientia Canadensis* 34, no. 2 (2011): 67-96.
- 12 Philip Hatfield, “Exhibition Note: Lines in the Ice at the British Library,” *Scientia Canadensis* 38, no. 1 (2015): 72-85; quote 82-3.
- 13 Denis Cosgrove, “Contested Global Visions: One-World, Whole-Earth, and the Apollo Space Photographs,” *Annals of the Association of American Geographers* 84, no. 2 (June 1994): 270-294.
- 14 David Pantalony, “Biography of an Artifact: The Theratron Junior and Canada’s Atomic Age,” *Scientia Canadensis* 34, no. 1 (2011): 51-63.
- 15 By comparison, a search on “photography” in *Isis* pulls up 1,275 book reviews and 374 research articles.
- 16 Arthur E. Covington, “Some Recollections of the Radio and Electrical Engineering Division of the National Research Council of Canada, 1946-1977,” *Scientia Canadensis* 15, no. 2, 1991: 155-175; Arthur E. Covington, review of *The Cold Light of Dawn: A History of Canadian Astronomy* by Richard A. Jarrell, Toronto, University of Toronto Press, 1988, in *Scientia Canadensis* 13, no. 1, 1989: 67-69.
- 17 Michel Frizot, ed., *A New History of Photography* (Köln: Könemann, 1998) 12.
- 18 See John Osborne and Peter Smeaton, *Out of the Studio: The Photographic Innovations of Charles and John Smeaton at Home and Abroad* (Montreal: McGill-Queen’s University Press, 2022).
- 19 *Illustrated London News*, 13 September 1851; *Gleason’s Pictorial Drawing Room Companion*, 18 October 1851; William Bradford, *The Arctic Regions. Illustrated with Photographs Taken on an Art Expedition to Greenland; With Descriptive Narrative by the Artist* (London: Sampson Low, Marston, Low and Searle, 1873); Captain Francis L. McClintock, RN, *The Voyage of the “Fox” in the Arctic Seas: A Narrative of the Fate of Sir John Franklin and His Companions* (London: John Murray, 1859); for stereoscopic photographs of the Franklin Relics recovered by McClintock in 1859, see the Scott Polar Research Institute website: <https://www.freezeframe.ac.uk/category/photos-stereoscopic-photographs-of-the-franklin-relics>; Captain Sir George S. Nares, RN, *Narrative of a Voyage to the Polar Sea During 1875-6 in H.M. Ships ‘Alert’ and ‘Discovery’* (London: Sampson Low, Marston, Searle & Rivington, 1878).
- 20 Similar photographs were taken at residential schools in the United States and Australia as evidence of the positive transformation that order and discipline brought to aboriginal children through government and church assimilation efforts. Photographs are now integral to the efforts of The Legacy of Hope Foundation and The National Centre for Truth and Reconciliation (NCTR) to maintain archives and websites dedicated to promoting healing and fostering reconciliation. There are currently 18,945 archival descriptions for photographs on the NCTR website: <https://archives.nctr.ca/Photographs> (accessed 28 March 2022).
- 21 James A. Secord, “Knowledge in Transit,” in Dagmar Schäfer, Angela N. H. Creager, eds., *Studies 11: The History of Science in a World of Readers* (Berlin: Max Planck Institute for the History of Science, 2019). Online at: <https://www.mprl-series.mpg.de/media/studies/11/7/studies11chap07.pdf> (accessed 7 April 2022); Scott

- Montgomery, *Science in Translation: Movements of Knowledge through Cultures and Time* (Chicago: University of Chicago Press, 2002); Alison E. Martin, *Nature Translated: Alexander von Humboldt's Works in Nineteenth-Century Britain* (Edinburgh: Edinburgh University Press, 2018).
- 22 Ann Thomas, ed., *Beauty of Another Order: Photography in Science* (New Haven: Yale University Press, 1997).
- 23 Iwan Rhys Morus, review of Larry J Schaaf, *Records of the Dawn of Photography: Talbot's Notebooks P and Q* (Cambridge: Cambridge University Press, 1996) in *Isis* 88, no. 2 (1997): 353.
- 24 Ursula M. Franklin, *The Ursula Franklin Reader: Pacifism as a Map* (Toronto: Between the Lines, 2006) 237.
- 25 This is a generalization, and the exceptions include the work of Mirjam Brusius, Chitra Ramalingham, Kelley Wilder, Jennifer Tucker, Ann Thomas, and Marvin Heiferman, to name a few.
- 26 Gregg Mitman and Kelley Wilder, eds., *Documenting the World: Film, Photography, and the Scientific Record* (Chicago: University of Chicago Press, 2016) 1. In 2017, the MIT Museum mounted the exhibition Images of Discovery: Communicating Science through Photography as an opportunity for visitors “to experience photography as a tool for communicating about—and inspiring a passion for—science and technology.” See <https://mitmuseum.mit.edu/exhibition/images-discovery-communicating-science-through-photography> (accessed 7 April 2022).