IEEE History Center

ISSUE 119, July 2022

After having offices at Rutgers University and Stevens Institute of Technology, the IEEE History Center has returned to the IEEE Operations Center in Piscataway. Read more about the Center's peripatetic past inside.

SIGNALS FROM THE DIRECTOR

Dr. Michael Geselowitz, Senior Director, IEEE History Center

As the global pandemic enters a new phase, there are many changes around the world and at IEEE. As you can see from the cover, the History Center has completed its return to the IEEE Operations Center in Piscataway, NJ, USA. This location will facilitate our cooperation with other IEEE units, such as Standards.

In another example, we have begun working with the IEEE Foundation on celebrating their 50th anniversary in 2023. Our new offices will also make our use of the IEEE Archives more efficient. As international travel continues to recover and more cultural institutions like museums reopen, we hope to build up

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HOW CAN THE HISTORY CENTER HELP YOU?
A Handy Guide to Some of Our Programs and Contacts

Engineering & Technology History Wiki: **https://ethw.org/Main_Page**

List of dedicated IEEE Milestones: **https://ethw.org/Milestones:List_of_Milestones**

How to Propose an IEEE Milestone: **http://ieeemilestones.ethw.org/Milestone_Guidelines_and_How_to_Propose_a_Milestone**

Milestone proposals in process: **http://ieeemilestones.ethw.org/Milestones_Status_Report**

Oral History Collection: **https://ethw.org/Oral-History:List_of_all_Oral_Histories**

REACH Program (free online materials for teaching the history of technology): **https://reach.ieee.org/**

History Events Calendar: **https://www.ieee.org/about/history-center/events.html**

Support for scholars:

Fellowship in the History of Electrical and Computing Technologies: **https://www.ieee.org/about/history-center/fellowship.html**

Pugh Young Scholar in Residence: **https://www.ieee.org/about/history-center/internship.html**

Middleton History Prize (awarded to a book in the history of technology): **https://www.ieee.org/about/history-center/middleton-award.html**

WAYS YOU CAN HELP HISTORY

As you read this newsletter, you will see the many success stories of the IEEE History Center and the ways it nurtures the heritage of the profession. As successful as the Center is, it relies on the support and contributions—financial, intellectual, and time and effort—of many people. We ask you to help further our work by:

Proposing an IEEE Milestone—Milestones recognize significant achievements in technology **ieeemilestones.org**

Contributing a First-Hand History—Written and oral histories help us chronicle important innovators and innovations **http://ethw.org/create**

Authoring an article for the ETHW—The Engineering and Technology History Wiki (ETHW) is an authoritative collection of historical information about technology's contributions to society **ethw.org/create**

Supporting the History Center's mission with a donation.

However you can help, it is always deeply appreciated.

NEWSLETTER SUBMISSION BOX

The IEEE History Center Newsletter welcomes submissions of letters to the editor, as well as articles for its **Reminiscences** and **Relic Hunting** departments. "Reminiscences" are accounts of history of a technology from the point of view of someone who worked in the technical area or was closely connected to someone who did. They may be narrated either in the first person or third person. "Relic Hunting" are accounts of finding or tracking down tangible pieces of electrical history in interesting or unsuspected places (in situ and still operating is of particular interest). Length: 500–1200 words. Submit to **ieee-history@ieee.org**. Articles and letters to the editor may be edited for style or length.

a traveling exhibit program that has been dubbed the IEEE Global Museum. Look for a report in the November issue of this newsletter.

However, we have hardly been idle even while working remotely. The Life Fellow Oral History project is moving ahead at full speed, enabled by various web platforms (see page 6). The IEEE REACH program is being particularly active over the summer, including a pre-

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sentation at the UNESCO-sponsored Open Education Global Conference in France. Again, look for a full report in November. The Engineering & Technology History Wiki (see page 5) continues to grow dramatically in content and use.

As always, I want to thank you, our loyal supporters, for making all of these programs possible with your generous donations. Continue to stay safe and be well.

HISTORY COMMITTEE ACTIVITIES

DAVID E. DUNNING IS 2022-2023 IEEE LIFE MEMBERS' FELLOW IN THE HISTORY OF ELECTRICAL AND COMPUTING TECHNOLOGY


David E. Dunning is a historian of science, mathematics, and computing in modern Europe and North America. His research explores the material and social dimensions of abstract knowledge. He is currently launching a project that explores the early history of programming languages in tandem with conceptions of language more broadly, investigating how different visions of human language shaped and were shaped by the evolution of programming practices. Dunning holds a Ph.D. in History of Science from Princeton University. He is currently a Postdoctoral Research Associate at the University of Oxford and in 2022–23 will be affiliated with the University of Pennsylvania as a Lecturer in the Integrated Studies Program.

CENTER ACTIVITIES

KONSTANTINOS KONSTANTIS IS 2022 PUGH VISITING SCHOLAR
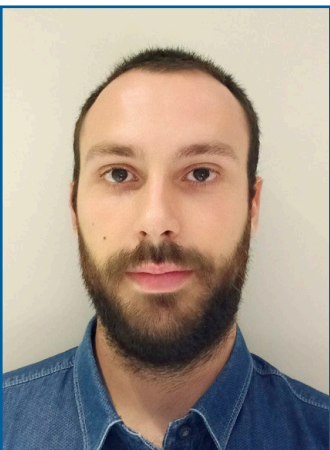
Konstantinos Konstantis is a doctoral candidate in the History of Technology at the Department of History and Philosophy of Science, National and Kapodistrian University of Athens (NKUA). The title of his Ph.D. thesis is "Contextualizing the Emergence of Engineering Ethics." Konstantis graduated from the School of Electrical and Computer Engineering of the National Technical University of Athens. Konstantis' work is driven by the belief that artificial intelligence ethics cannot be adequately studied without the inclusion of STS approaches. His doctoral dissertation investigates the emergence, development, and crystallization of the field of engineering ethics. Specifically, it aims at the reconceptualization of the ethical concerns that this emergence has produced, and, mainly, at the formulation of a framework within which these concerns can be addressed.

The Elizabeth & Emerson Pugh Young Scholar in Residence at the IEEE History Center provides research experience for students in the history of technology and engineering, while enlisting the help of promising scholars for the Center's projects.

RETURN TO OUR ROOTS: IEEE HISTORY CENTER BACK AT IEEE OPERATIONS CENTER

7 March 2022 saw the return of IEEE staff to the office as COVID numbers dropped. Within that reopening was the return of the IEEE History Center and its staff to the IEEE Operations Center in Piscataway, NJ. The History Center began its existence in the New York office of IEEE at IEEE's headquarters on 345 East 47th Street, and later moved out to the IEEE's Operations Center in Piscataway as part of the larger move of IEEE staff from the New York Office. In 1990, the History Center moved to the campus of Rutgers University, in New Brunswick, NJ, U.S.A., and in July 2014, the Center moved again, this time to offices in the library of the Stevens Institute of Technology in Hoboken, NJ, U.S.A.

Those academic affiliations came to an end in 2020, when Stevens chose not to renew the contract for the office space beyond the end of the year. The History Center staff, who had been working from home since March of that year because of the pandemic, came in to the Stevens office one day at a time, isolated, to pack up their cubicles, the Center's library collection, and the teaching collection of artifacts. A moving company was dispatched to bring the materials to the Center's new

> *"We are back in the office, the boxes are unpacked, the books are on their shelves. Thanks to John Hunt and the IEEE Facilities team, the Center has a six-foot, three-shelf display case fronting our area, which we will use to show artifacts of interest to our coworkers, and to celebrate the heritage of IEEE's fields of interest."*

quarters in the Operations Center, awaiting the reopening of the office.

Now, we are back in the office, the boxes are unpacked, the books are on their shelves. Thanks to John Hunt and the IEEE Facilities team, the Center has a six-foot, three-shelf display case fronting our area, which we will use to show artifacts of interest to our coworkers, and to celebrate the heritage of IEEE's fields of interest (see cover photo). The display case was part of the Historical Showcase Project made possible by a generous gift from Prof. John Impagliazzo, Ph.D.

Being in the same physical location as their IEEE coworkers allows the History Center staff opportunities for synergies. Already, collaborations such as the Tech History Mystery (see page 6) and Standards History have arisen, and we look forward to many more. We have hung out our banner, and we're getting back to our roots.

For a more complete account of the History Center's peripatetic experiences, see the entry on the Engineering & Technology History Wiki at: **https://ethw.org/IEEE_History_Center**

NO JOKE: THE IEEE HISTORY CENTER'S NEW MINITEL TERMINAL

On 1 April, upon its relocation to IEEE's Operations Center, the IEEE History Center received an unexpected and welcome gift from *IEEE Spectrum* senior editor Stephen Cass. The 1990 Télic Alcatel Minitel 10 terminal, practically new in box (missing only its plastic bag), will turn on, he says, with a proper adapter. Befitting the timing on April Fool's Day, there won't be much to see onscreen, alas, without a network to access. Officially launched in 1982, Minitel represented the successful fusion of a government-provided digital network and equipment with private entrepreneurs offering an open marketplace of online services limited only by their legality and the system's technical capabilities. Through a V.23 modem, downlinked at 1200 bits/s and uplinked at 75 bits/s, nearly every household in France could look up phone numbers and draw on more than 26,000 other videotex-based services by the late 1990s. This terminal was manufactured by Télic-Alcatel at its factory in Woerth, Alsace, and was stored in a warehouse for more than twenty-five years instead of joining the 6.5 million terminals in service in

France, or the less well counted terminals and networks in numerous other countries, including the U.S., in the 1980s and early 1990s. Stephen was trying to rejigger it for contemporary use, but it turned out not to have the enabling chip installed on only half of these models, so over to us.

ETHW UPDATE: DONATION OF MATERIALS ON SOCIAL IMPLICATIONS OF TECHNOLOGY FROM STEPHEN UNGER

The Engineering and Technology History Wiki (ETHW) is a website powered by MediaWiki with thousands of articles, first-hand accounts, oral histories, milestones, archival documents, and lesson plans pertaining to the history of technology. The ETHW is one of the world's premier sites for the documentation, analysis, and explanation of the history of technology; the scientists, engineers, and businesspeople who made these technologies happen; and about the history of the organizations to which these men and women belonged.

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The ETHW is developed by a partnership between the United Engineering Foundation and the AIAA, AIChE, AIME, ASCE, ASME, IEEE, SPE, and SWE. It fosters the creation of narratives that not only document the history of engineering practices but also explain when, how, and why these technologies developed as they did. It uses a wiki-based web platform to foster a collaborative online environment that taps into the collective memories, experiences, and knowledge of engineering's worldwide membership – the men and women who provide the imagination, creativity, and know-how to sustain engineering progress and technological innovation. In time, this site will serve as a central historical repository of all the achievements, ideas, and first-hand knowledge of engineering association members, societies, councils, and technical communities. The ETHW will also provide a central location for all materials related to engineering's organizational history.

To view content, or to submit your own article or first-hand history, you can visit the website at: **http://ethw.org**

Some of the content recently added to the site:

IEEE Society on Social Implications of Technology foundational documents. Stephen Unger, 1985-1986 Past President of the Society on Social Implications of Technology, donated to the IEEE History Center a major collection of documents and ephemera related to the IEEE Committee on Social Implications of Technology, which became the IEEE Society on Social Implications of Technology. In addition to housing background material on the ethics issues that informed the engineering world of the 1960s, 1970s and 1980s, the collection also houses a great deal of foundational documents pertaining to the initial call to form a body dealing with ethics and social responsibility within IEEE, its function as a Committee, and eventual promotion to a Society.

From this collection, several issues of the *IEEE CSIT Newsletter*, which became *Technology and Society* in 1976 have been posted on the ETHW, as well as the 1971 issue of the *Spark* newsletter, published by the Committee on Social Responsibility in Engineering. As well as the issues of the newsletters, more than 650 pages of archival documents have been scanned and added to the IEEE Society on Social Implications of Technology page on the ETHW.

To view these documents, as well as the newsletter issues, please visit: **https://ethw.org/IEEE_Society _on_Social_Implications_of_ Technology_History**

New AIME oral histories:

The ETHW is not only an IEEE site, but is governed by eight major engineering societies. One of these partner societies, The American Institute of Mining, Metallurgical, and Petroleum Engineers, Incorporated (AIME) has a major oral history program, and has recently posted sixteen oral histories to the ETHW.

These include: Ihor A. Kunasz (AIME Hal Williams Hardinge and Robert M. Dreyer Awards for outstanding achievements in the exploration and development of lithium brine), Roberto Aguilera (Distinguished Author of the Journal of Canadian Petroleum Technology), Sara Hornby (2020 AIME Benjamin F. Fairless Award recipient), Harriet G. Dutka (Distinguished Member and Fellow of the AIST), Harry Bhadeshia (Emeritus Tata Steel Professor of Metallurgy at the University of Cambridge), Merton C. Flemings (founder of MIT's Materials Processing Center), Stanley M. Howard (2016 and 2019 president of The Minerals, Metals & Materials Society), George A. Jedenoff (US Steel vice-president of operations), Alexander McLean (over four hundred and fifty publications and six books in contributions to the physical chemistry of steelmaking), Madhu G. Ranade (General Manager of Raw Materials Supply & Strategy for Steel Dynamics), Michael Karmis (Stonie Barker Professor of the Department of Mining and Minerals Engineering and the Director of the Virginia Center for Coal and Energy Research at Virginia Tech), Raymond L. Lowrie (Regional Director of the Office of Surface Mining Reclamation and Enforcement), Enrique J. Lavernia (Provost and Executive Vice Chancellor for the University of California), Lee Semiatin (Senior Scientist in Materials Processing and Processing Science, and research leader of the Metals Processing Group, Materials and Manufacturing Directorate, Air Force Research Laboratory, Wright-Patterson Air Force Base, Ohio), Ta M. Li (Editor in Chief of SME's "Mining Engineering"), and Douglas B. Silver (co-founder of International Royalty Corporation).

To view these and other oral histories, please visit: **https://ethw.org/Oral-History:List_of_all_Oral_Histories**

TECH HISTORY MYSTERY

Tech History trivia questions are now available as part of the IEEE Life Members' community **https://ieee-collabratec.ieee.org/app/community/1348/IEEE-Life-Members-and-Friends/activities** on Collabratec. The IEEE History Center has partnered with the Life Members staff to supply questions in this new category called "Tech History Mystery." This is similar to the Puzzlers, which has been a very active community on Collabratec, and it is expected that this partnership will greatly enhance the visibility of the IEEE History Center and tech history across the IEEE membership. To join the community, and to test your knowledge of tech history, click on the link above to join the community.

IEEE LIFE FELLOWS ORAL HISTORY PROJECT UPDATE

The IEEE History Center continues collecting oral histories from IEEE Life Fellows. This New Initiatives Committee (NIC)-funded project, "IEEE Life Fellows: Capturing and Oral History," captures the life stories and career experiences of some of IEEE most distinguished members and has developed a pilot program to build the infrastructure for peer-to-peer interviewing.

In March 2022, Mary Ann Hellrigel, Ph.D., Archivist, Institutional Historian, and Oral History Program manager, conducted another webinar (more training webinars will be offered), and has trained nearly seventy IEEE members to conduct oral histories. Gene Freeman, chair of the IEEE Computer Society's Pikes Peak Chapter helped organize the March session, and he will record oral histories of IEEE Life Fellows in the IEEE Pikes Peak Section and Region 5.

Many IEEE Life Fellows already have an oral history and the new oral histories will be posted as completed. See the collection: **https://ethw.org/Oral-History:IEEE_Life_Fellows**. Recently, Harish Mysore recorded L.M. Patnaik's oral history; K.V.S. Hari recorded Vasudev K. Aatre's oral history; Tom Coughlin recorded Alice Cline Parker's oral history and Joseph (Joe) Decuir's oral history; Michael Geselowitz recorded Gerard (Gus) Gaynor's oral history; and Mary Ann Hellrigel recorded Andrea Goldsmiths' oral history and Bishnu Atal's oral history.

While the History Center continues working closely with Jim Jeffries, 2018 IEEE President, the volunteer lead on this Life Fellows Oral History Project and Maxine Cohen, an advisor from the IEEE Life Members Committee representative, we need help from IEEE members to volunteer to participate and to serve as ambassadors for the IEEE Life Fellow Oral History Project.

If you require additional information, seek to volunteer, or recommend an IEEE Life Fellow, please contact Mary Ann Hellrigel, **m.c.hellrigel@ieee.org**

RELIC HUNTING

BOSTON'S 1889 CENTRAL POWER STATION REVIVED AND REPURPOSED AS EVENT VENUE

by Gilmore Cooke, IEEE Boston Section Historian

The Central Power Station was constructed beginning in 1889 by the West End Street Railway Company, which was the predecessor of the 'T'. This power station provided direct current electricity for the growing streetcar system of Boston. With CPS as its flagship, the West End launched the world's largest commercial electrical traction system. Within a few years, 9000 tired horses that had transported passengers around the region became obsolete and were replaced by 1000 shiny new electric streetcars. The IEEE celebrated this Milestone achievement in 2004 with these words:

Boston was the first city to build electric traction for a large-scale rapid transit system. The system was designed and developed by Henry Whitney and his associates, lead by Chief Engineer Fred Pearson. The engineering challenge to design and construct safe, economically viable, and reliable electric power for Boston's rapid transit was met by the West End Street Railway Company, beginning in 1889. The company's pioneering efforts provided an important impetus to the adoption of mass transit systems nationwide.

By 1912, advances in technology had made the power station itself obsolete. The chimney and many of the buildings were demolished, leaving only the engine room and a small-

er adjoining room. In 1999, GTI properties bought the parcel of land at 540 Harrison Avenue together with the remaining structures on it, from the Metropolitan Boston Transit Authority, and began preserving and renovating the structure. In 2021, it reopened as a grand space for events.

The Central Power Station was renovated and repurposed by GTI Properties and is now known as the SoWa power station. It is now a dramatic setting for community events, music, weddings, and many other public and private uses.

The writer would like to thank Mario Nicosia and tour guides for showing him this fantastic space. Information for private and public events is available by contacting **www.sowapowerstation.com**.
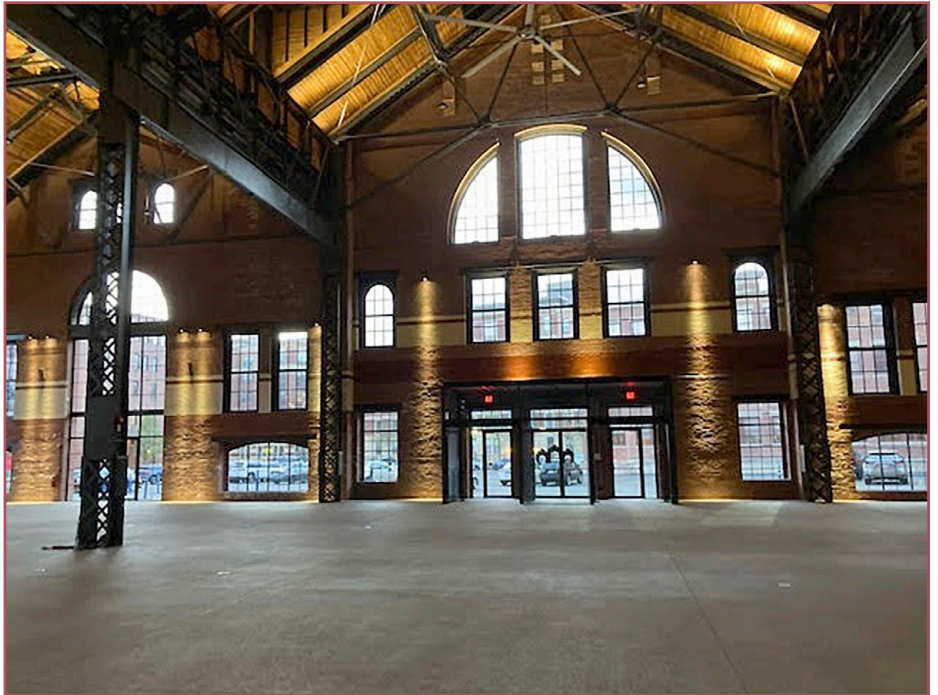
SoWa has been completely transformed into an 'iconic architectural event space'. Photo by G. Cooke.
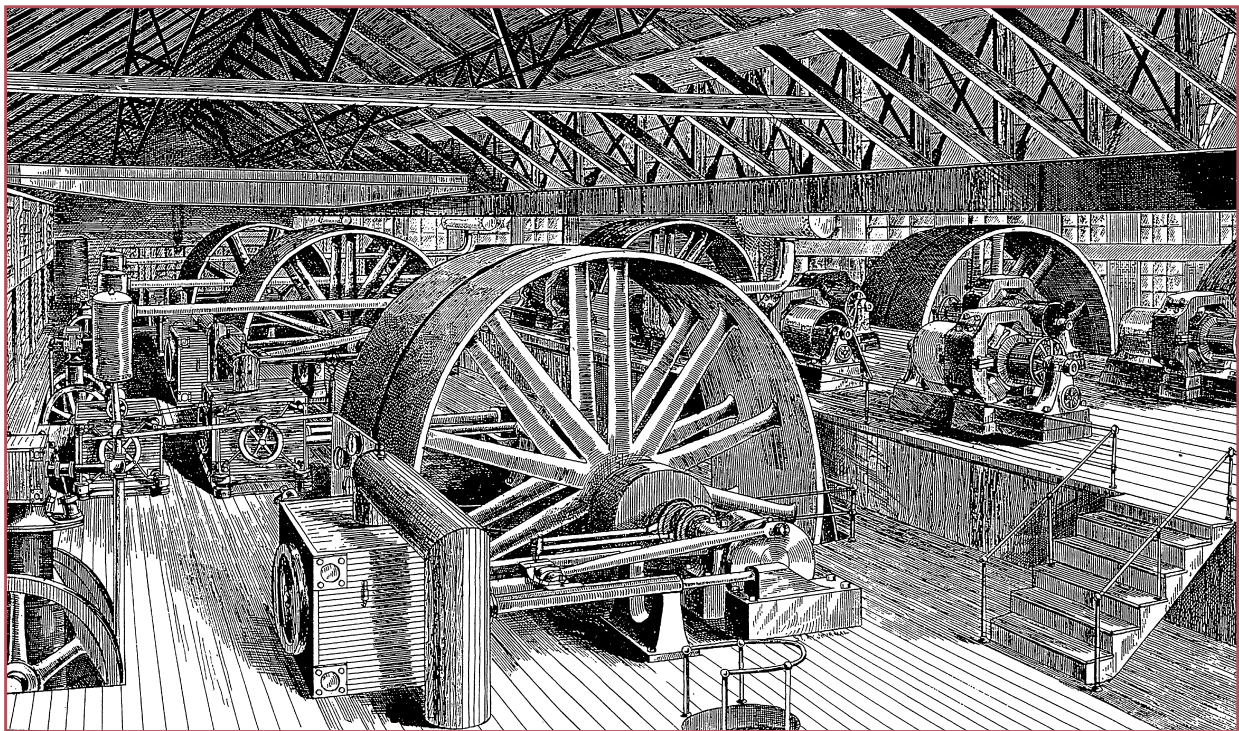
The original equipment included four rows of the largest belt driven traction generators and six large Allis-Corliss triple expansion steam engines (note that only three are visible on the left). Line shafts and belt-lighteners were located in the basement. Image provided by G. Cooke

SURFING THE WEB FOR JULY 2022

Nearly thirty years ago, when the Center's outreach historian Alex Magoun began introducing himself to former RCA staff in search of corporate information on the 45-rpm record playing system for his dissertation, Phil Vourtsis was launching a newsletter for his fellow collectors and restorers of the "Fabulous 45." Now many of these brief publications containing restoration tips and analyses, marketing materials, and contemporary advertising imagery and news are available through the New Jersey Antique Radio Club at **www.njarc.org/articles/45rpm_gazette.html**.

An anonymous blogger writes thoughtfully about the physics, engineering, biology, and technology of sound production and reproduction, including on Édouard-Léon Scott de Martinville's phonautograph, at **www.tremblingsandwarblings.com/2017/01/the-voice-in-the-soot/**. More recently Sarah Durn reported on the New York Public Library's acquisition of one of Nicholas Bergh's remarkable cylinder record players: **www.atlasobscura.com/articles/library-wax-cylinder-digitize-machine**. NYPL staff are digitizing the legendary Mapleson opera cylinders and many others in their collection.

They haven't posted their digital transfers, but for an incredible, curated collection of Edison cylinders and much, much more, sign up for a free account with collector/scholar David Giovanoni's collection of 40,000 recordings: **https://i78s.org/**. Watch his efficient and thoughtful Video Tour of how he and his associates organized the recordings to make them searchable by format, company, performer, text string, etc. The recordings run from Edison and Berliner up through the 1930s, all catalogued with additional information as well as options to hear with or without digital processing that provides a better sound than listeners could have gotten a century (plus/minus) ago.

For something not completely different, Princeton professor Emily Thompson applied some of her MacArthur Fellowship award to creating a website about the sounds of New York City in the late 1920s: **http://nycitynoise.com/**. The site is in transition since Adobe stopped supporting Flash in 2020. People in cities, notably Charles Babbage, have complained about street music and noise for over 200 years: **https://busk.co/blog/wp-content/uploads/2017/06/564px-Enraged_musician.jpg**, long before jack hammers and elevated railways. Thompson's currently limited site provides both listings of com-

> *"Google Books has made available Maurice Wilkes's 1951* The Preparation of Programs for an Electronic Digital Computer, *which many historians consider the first monograph on programming the new computing machines."*

plaints and recordings of NYC from newly audible newsreels if you dig in.

Minitel Memories: Largely in French with an English section and machine translation available, **www.minitel.org/** is now soliciting people's accounts of their experiences with France's internet.

Computer programming vs. computer science: Mark Priestley has written a thoughtful article on "Logic, Code, and the History of Programming," for *IEEE Annals for the History of Computing*: **www.computer.org/csdl/magazine/an/2021/04/09715033/1B2CWzXEKMo**, in which he makes the case for treating computer programming and computer science as alternate forms "of working with formal symbolic notations." Readers can go back to some of the sources via Google Books, which has made available, at least in the United States, Maurice Wilkes's *1951 The Preparation of Programs for an Electronic Digital Computer* (**https://books.google.com/books?id=HwkuAAAAIAAJ**), which many historians consider the first monograph on programming the new computing machines; and the proceedings of the *Symposium on Automatic Programming for Digital Computers* held at the U.S. Naval Academy in 1954 (**https://books.google.com/books?id=6AkgAAAAIAAJ**). Capping this era and auguring the transition toward a computer science, Heer de Beer has made his thesis on the creation of Algol 60 available in HTML and as a PDF: **https://heerdebeer.org/ALGOL/**.

MONTAÑO, DIANA J.
Electrifying Mexico: Technology and the Transformation of a Modern City
University of Texas Press, 2021
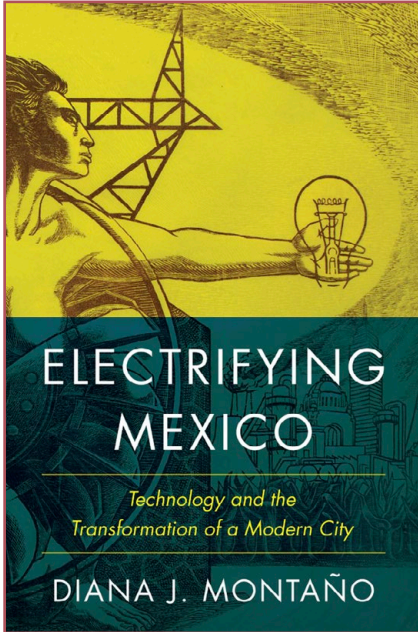
By Alexander B. Magoun, Ph.D., Outreach Historian

In the last decade, the scholarly study of the electrification of the world has spread well beyond Thomas Hughes's landmark analysis of the socio-technical construction of power networks in Berlin, Chicago, and London. Here, Professor Montaño describes the evolution of electrification in Mexico's capital from the installation of 40 arc lights in 1881 to the nationalization of the country's light and power industries in 1960. Having pored through national, federal district, corporate, university, and other archives in conjunction with a host of contemporary newspapers and publications, she interweaves political, social, and economic actions and responses to electrification. The pattern is largely inspired by David Nye's tapestry of social reactions in the United States to the diffusion of electrical systems and devices over a similar span.

If the title, pattern, and timing are similar—overlapping periods of exhibition and responses to novelty, adaptation to and uses of the new system, and integration with national, social, cultural, racial, gender, and class identities—the details and the politics are not. Montaño engages with more of the negative consequences, the shifts in national politics, the racialized bodies depicted in advertisements for appliances, and the actions of organized labor that set Mexico City's experiences apart from the electropolises of the north.

Yet the resonances with experiences elsewhere are worth exploration. Mexican critics of the novelty of arc lighting echoed complaints in Great Britain and the United States: its overwhelming brightness and the sharp contrast with areas in shadow offset the value of its efficiency in ways that were only gradually modified and accepted. Journalistic accounts of the uncountable slaughter of hapless pedestrians, their rendition into *albóndigas* (meatballs) or *guacamole* by the *eléctricos* and their *motoristas*, are far more lurid, when not revolting, than reports of New Yorkers or Los Angelenos who were run over similarly by motoneers and electric trams. Montaño's review of 63 court cases of great and small *capitalinos* charged with theft of electricity raises fascinating legal and moral issues that E. P. Thompson would have recognized from his studies of poaching and property rights in rural, early modern England.

More research is needed. Were the first electric lights demonstrated in Mexico City in November 1850 imported from William Petrie and William Staite's arc light venture, which they were promoting in London, or the uncertainly named Le Mott of France, who deprecated commercial prospects of his demonstrations? One longs to know if William Axford's electric chicken egg incubator, its feedback controls demonstrated so successfully in the Zocalo in 1881, was adopted commercially: and if not, why not. And, as the author ponders, which women in the households acquiring electric appliances in the mid-20th century actually used them? Were these tools symbolic of servile responsibility or of status and power by the housewives depicted in the advertising directed at them? Montaño has saved other historians much time in synthesizing her "electricscape" of a great city while creating more work for others to follow, and follow up on, her lead.
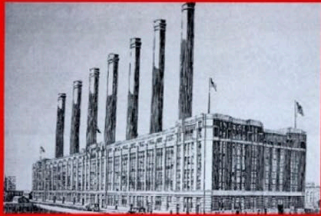
Available from University of Texas Press, Austin, TX, USA, 1-800-252-3206, **https://utpress.utexas.edu/books/montano-electrifying-mexico**, US$50, hardcover ISBN 9781477323458, xiv + 373 pp.

BOOKS FROM THE
IEEE HISTORY CENTER PRESS

NEW YORK POWER by Joseph J. Cunningham tells the story of the electrification of one of the densest electrical load areas in the world. Electrification began during the 1880s, but many innovations were required to supply urban service at a cost that would make possible large-scale consumption.
https://www.amazon.com/New-York-Power-Joseph-Cunningham/dp/1484826515/ref=tmm_pap_swatch_0?_encoding=UTF8&qid=&sr=

BELL LABS MEMOIRS: VOICES OF INNOVATION: The innovative spirit and creative energy of Bell Labs during the directorship of William Baker are described by twelve people who worked there. Through their eyes and words, the culture of Bell Labs comes alive.
https://www.amazon.com/dp/B006L7JRLY/ref=dp_kinw_strp_1
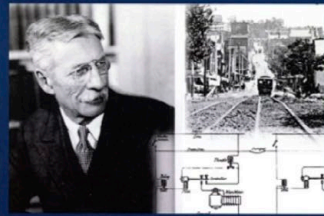
THE BIRTH OF ELECTRIC TRACTION: THE EXTRAORDINARY LIFE OF INVENTOR FRANK J. SPRAGUE: Sprague made enormous contributions in the areas of electric traction, control and safety, especially automatic signaling and brake control for railroads. He was active in the planning and construction of New York City's subway system, and in the electrification of Grand Central Terminal.
https://www.amazon.com/Birth-Electric-Traction-extraordinary-inventor/dp/1490955348/ref=sr_1_1?crid=2OXP2PN006USY&keywords=birth+of+electric+traction+sprague&qid=1641497922&s=books&sprefix=birth+of+electric+traction+sprague%2Cstripbooks%2C119&sr=1-1

SPRAGUE ELECTRIC: Sprague Electric Company's rise from a high-tech kitchen-table startup is representative of much of the U.S. electronics industry. Begun in 1926, it became a thriving manufacturer of components. More than 50,000 Sprague components rode aboard every *Apollo* mission, and more than 25,000 aboard every Space Shuttle. *Sprague Electric* provides a valuable business and technological history, a story of corporate success…and a cautionary tale of what to avoid.
https://www.amazon.com/Sprague-ElectricElectronics-Giants-afterdp/150338781Xref=sr_1_1?crid=HRWR6CMKM0D&keywords=sprague+electric&qid=1641498091&s=books&sprefix=sprague+electric%2Cstripbooks%2C147&sr=1-1

IEEE Foundation

Where technology and philanthropy intersect

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Funds and Programs:

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- IEEE History Center and REACH
- EPICS in IEEE
- IEEE Smart Village
- And many more!

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and choosing **"IEEE History Center Fund"**
at the **"Designation"** box.