Summary of Panel Proposal

Title: Adoption as Innovation – User Roles in the Creation of Technological Industries

Organizer: Thomas Haigh, University of Wisconsin-Milwaukee.

Chair: TBA.

Commentator: Daniel U. Holbrook, Mashall University

Session Abstract: Please see over.

Papers:

> "An Industry of Enthusiasts: Users Make the Computer Personal, 1975-1981," Thomas Haigh, University of Wisconsin-Milwaukee.
>
> "From Whence Hi-Fi?: User-Led Industrial Formation in High-Fidelity Audio Equipment", Jeffrey Tang, University of Pennsylvania.
>
> "Broadening the Definition of Users: The Air Force's Role in the Creation of the Knowledge Industry," Glen R. Asner, Carnegie Mellon University

Session Abstract

This panel explores the roles played by users and customers in the formation of new, technologically oriented industries. Following a recent emphasis in the history of technology on the role of users in shaping technologies, we suggest that the role of consumers of technological products and services in the creation of new industries goes far beyond choosing between rival offerings.

Although nobody denies the importance of customers in the creation of any industry, most analysts portray users as highly abstracted "adopters" or "consumers" of technological products whose characteristics and meanings are created exclusively within the firm supplying them. Consumers may winnow out unsuccessful technologies, but they play little role in creating new technological industries. Furthermore, historians of business and economics have paid scant attention to the formation of new industries. Business historians work primarily at the firm level, while neo-classical economic theory is not well suited to explaining technological innovation or the formation of new industries. Exceptions, such as Joseph Schumpeter, Paul Krugman, and Paul David, nevertheless maintain the focus on the interaction of producers with market mechanisms. Authors advocating evolutionary frameworks for understanding industrial formation – likening new industries to emerging social systems and suggesting that they emerge from technological trajectories – continue to accord little role to users, even as they break away from the rigidity of economic orthodoxy.

Haigh's paper surveys the extraordinarily varied and widespread role of users in creating a viable personal computer industry during the 1970s. As is well known, electronics hobbyists were both the first users and the first suppliers of personal computers. But enthusiasts also founded the first personal computer dealerships, user groups, software companies, trade shows, newsletters and magazines. Individual users spread awareness of personal computers through schools, offices and communities. The personal computer's unfamiliarity and lack of obvious utility, combined with its technical and cultural flexibility, gave them an extraordinarily powerful role in shaping its development.

Tang's paper examines the role of home audio enthusiasts in creating an industry supplying "high fidelity" audio equipment to domestic consumers during the 1950s. The motivation and ingenuity of audio hobbyists provided the early impetus for the industry. The paper charts the development of the hi-fi audio industry from its beginning as the exclusive province of zealous tinkerers to a thriving niche market, supporting specialist firms largely led by members of this new "audiophile" community.

Asner's paper considers the federal government as a user of technology, bridging a gulf separating the growing literature on the users of technologies (which has focused primarily on individuals) from an extensive but rather insular literature on the history of governmental research and development policy. While the RAND corporation has a certain historical notoriety, few realize the deliberateness with which the U.S. Air Force of the 1950s attempted to create a new "basic research industry" or the ambition of its original plans. In this case, the movement of people, resources, and ideas between the military and the institutions they sponsored thoroughly blurs the lines between the creators and users of technological products and services.

An Industry of Enthusiasts:
Users Make the Computer Personal, 1975-1981

Thomas Haigh, University of Wisconsin – Milwaukee

Topic: This paper examines the various and profound roles of "ordinary" computer enthusiasts in the development of the personal computer industry, from its conception in 1975 to its early adolescence with the introduction of the IBM PC. As is well known, electronics hobbyists were both the first users and the first suppliers of personal computers. But enthusiasts also founded the first personal computer dealerships, user groups, software companies, trade shows, newsletters and magazines. Individual users spread awareness of personal computers through schools, offices and communities.

Argument: Crucial aspects of technological innovation and industrial creation take place through the apparently passive act of technological adoption. This is particularly apparent here, since early personal computers were almost entirely useless. Because their suppliers lacked elaborate market research abilities, or good ideas on what ordinary people might do with a computer, users did most of the cultural and technical labor required to transform the personal computer into a reasonably useful and practical tool. The incredible flexibility of computer systems, achieved by adding additional hardware and by reprogramming, makes this an exceptionally good case in which to study user involvement.

Evidence: Early computer magazines and newsletters are a rich source of information on enthusiast computer use, because they features many articles and program listings submitted by readers. While the records of microcomputer suppliers have escaped traditional archives, emulator programs and online software repositories allow reconstruction of many aspects of the early user experience. I will also draw on a series of oral history interviews recently conducted under the auspices of the Software History Center. In interests of a lively talk, the conference version of the paper will favor visual evidence, taken from print advertisements, sales brochures, user newsletters, instructional books and television commercials.

Contribution to Existing Literature: This paper begins the task of reinterpreting a vital story within the conceptual frameworks used by historians of business and technology. Its focus on the role of users and its attention to groups operating beyond the confines of California make it particularly significant. While an extensive mythology surrounds the role of enthusiastic amateurs such as Steve Jobs and Steve Wozniak in creating the personal computers industry, this work is journalistic and focuses on a tiny number of hardware company founders. Recent work by JoAnne Yates and James Cortada has begun to explore the use of mainframe computers and punched card machines, but only by large businesses in an earlier period. There has been very little serious scholarly attention given by historians to the origins of the early PC hardware industry, or to the use of personal computers.[1]

[1] One exception: there are chapters on the personal computer in standard, synthetic accounts such as those by Aspray & Campbell-Kelly and Cerruzi. However these are fairly cursory compared to the same authors' richer treatment of pre-1975 events, and are sourced from popular and journalistic secondary sources. Campbell-Kelly includes a richer treatment of microcomputer developments in his recent business history of the software industry, but this focused entirely on the dynamics of the software business, rather than on users or hardware.

From Whence Hi-Fi?:
User-Led Industrial Formation in High-Fidelity Audio Equipment

Jeffrey Tang, University of Pennsylvania

During the decade following the end of World War Two, a group of technological enthusiasts effectively fomented a new industry in home high-fidelity equipment. Comprised mostly of young men, many of whom had been introduced to new audio technologies during the war, these passionate consumers – who came to be known as audiophiles – began buying professional audio components from wholesalers and assembling them to create customized, high-quality audio reproduction systems. Presented with a committed, generally affluent, and growing group of consumers intent on achieving more realistic "high-fidelity" reproduction, some wholesalers and equipment manufacturers realized that a home consumer market had practically fallen into their laps and began producing equipment better suited to the audiophile market. By the mid-1950s, the hi-fi craze had swept across America, and high-fidelity audio had become a thriving, profitable industry.

This case of industrial genesis is notable for the extraordinarily strong role played by users. Although high fidelity equipment grew out of wartime developments in audio reproduction technology, enthusiast consumers actively "pulled" the home hi-fi equipment industry into existence their the sheer force of their spirited demand. The role of entrepreneurship in the birth of high fidelity was rather limited: highly motivated consumers sought out parts from professional dealers and assembled their own systems. Furthermore, a great many high-fidelity entrepreneurs came directly from the ranks of hi-fi enthusiasts. The small, craft-based nature of the firms comprising the hi-fi audio industry maintained the strong ties between producers and consumers and ensured the continued importance of audiophile enthusiasts in shaping the development of the industry. Even hi-fi's initial surge in popularity during the 1950s resulted more from proselytizing audiophile users spreading the hi-fi gospel than from industry marketing campaigns.

The story of high-fidelity pioneers differs from most traditional views of industrial formation – most of which follow the Schumpeterian interest of emphasizing the power of dynamic entrepreneurs – that treat consumers as passive decision-makers making yes-no purchasing decisions about specific, fully realized products. My treatment of the users as important players shaping particular technologies contributes to a wave of new research in the history and sociology of technology emphasizing the active role users – especially home-consumer users – often play in technological evolution.[2]

The crucial role of home audio enthusiasts in the development of the hi-fi equipment industry is clear from contemporary periodical coverage, especially magazines featuring extensive home audio coverage like *High Fidelity* and *Saturday Review*. During the 1950s, a variety of audio critics, many of whom were audiophiles themselves, remarked on the unusual foundation of the industry and the effects of its user-led creation. Other contemporary observers reported on the power of audiophiles in bringing about and shaping the development of the hi-fi industry.

[2] This emphasis on users arguably began in the late 1980s with Ruth Schwartz Cowan's notion of the "consumption junction" and has been most fully explored in *How Users Matter*, edited by Nelly Oudshoorn and Trevor Pinch.

Broadening the Definition of Users:
The Air Force's Role in the Creation of the Knowledge Industry

Glen R. Asner, Carnegie Mellon University

Topic: This paper examines the role of the United States Air Force in the creation of institutions devoted to the production of knowledge. Although historians view the Air Force of the 1950s as an emblem of American technological leadership, research officials within the service at the time worried that a vast store of knowledge with the potential to revolutionize war fighting lay beyond the reach of traditional contracting arrangements. Among the most radical proposals to emerge from officials seeking to improve Air Force access to non-military research was to create a "basic research industry," defined as an industry composed of companies involved in basic research with no production and limited development capabilities. Although it never embarked on a grand initiative to create a basic research industry, the Air Force lead the military services in stimulating the growth of institutions dedicated to producing knowledge. Think tanks, Federally Funded Research and Development Centers (FFRDCs), and the central research laboratories of defense contractors served as proxies for the basic research industry Air Force planners had envisioned.

Argument: This paper argues for expanding the definition of users to include a broader range of social actors, in this case Air Force R&D leaders. Officials who raised the possibility of creating a basic research industry viewed the Air Force as a user of scientific knowledge. The notion that ideas conceived in isolated settings would open new opportunities for technological development, a central element of Vannevar Bush's linear model, made possible the conceptualization of a separate industry to produce basic research. The knowledge industry that emerged in this context blurred the lines between producers and users. The defining characteristic of the relationship between the Air Force and the knowledge industry was the active engagement of both groups in shaping the needs, objectives, and strategies of the other.

Evidence: Correspondence, reports, and studies from military archives provide the foundation for discussing Air Force deliberations on how to increase the flow of knowledge from industry to the service. This paper also relies on secondary sources to develop a framework for conceptualizing thinks tanks, FFRDCs, and corporate research laboratories as components of the knowledge industry.

Contribution to Existing Literature: This paper extends the corporate and military R&D literatures into new territory and challenges historians of user/producer interactions to define more clearly the boundaries of the term user and the elements of the user framework. If only hobbyists and amateurs are users, and only in technological contexts, as some historians argue, than the term is misleading and must be discarded. This paper suggests that the central characteristic of the user framework is not technology or the social standing of the user, but the fact that the "user" contributes to the design or definition of the thing created, whether the "thing" is a product, service, or industry.

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SELECTED ACADEMIC:

University of Wisconsin Milwaukee, Assistant Professor**,** School of Information Studies, 2004-

The Haigh Group, Consultant, historical projects, Fall 2003-present

Indiana University, Bloomington, Visiting Assistant Professor, Informatics School, Fall 2003

Colby College, Visiting Instructor/Visiting Researcher, STS/Ad. Sci., 2001-3

University of Pennsylvania, History and Sociology of Science **M.A**. August 1997. **Ph.D**. May 2003

Dissertation: "From Office Manager to Chief Information Officer:
Managing Information Processing in American Corporations, 1917-1990"

Manchester University (UK), Department of Computer Science, B.Sc. & M.Eng, 1991-1995

SELECTED PEER REVIEWED PUBLICATIONS:

Thomas Haigh, "A Veritable Bucket of Facts: Origins of the Database Management System" in *Proceedings of the Second Conference on the History and Heritage of Scientific and Technical Information System* (New Jersey: Information Today, 2004).

"ADAPSO and the Service Bureau Industry, 1961-1968," *IEEE Annals of the History of Computing* 26:1 (January-March 2004): 78-85.

Thomas Haigh, "Software in the 1960s as Concept, Service, and Product", *IEEE Annals of the History of Computing 24* (January-March 2002): 5-13.

Thomas Haigh, "The Chromium Plated Tabulator: Institutionalizing an Electronic Revolution, 1954-1958", *IEEE Annals of the History of Computing 23* (October-December 2001): 75-104 .

Thomas Haigh, "Inventing Information Systems: The Systems Men and the Computer, 1950-1968" *Business History Review 75* (Spring 2001): 15-61.

OTHER:

Thirteen shorter publications, including book reviews, obituaries, biographies, comments, and two review essays.

Twelve competitively reviewed presentations, including three SHOT papers, two Business History Conference papers, the North American Labor History Conference and Hagley conference on the Technological Fix. Eight invited presentations and departmental seminars.

Awards, Grants and Fellowships include:
Software History Center Research Fellowship (2003),
IEEE Life Member Fellowship in Electrical History (2000-01),
Tomash Fellowship in the History of Information Processing (Babbage Institute, 1999-00),
William Penn Fellowship (1995-99) - four year non-service stipend and fees,
Fulbright Award for post-graduate study in the US (1995-96)

Biographies editor and board member of IEEE Annals of the History of Computing

Jeffrey Tang

Education:

Ph.D. Candidate, History and Sociology of Science, University of Pennsylvania, Sept. 1999-Dec. 2004 (expected).

Dissertation: Sound Decisions: Systems, Standards, and the Role of Consumers in American Audio Technology, 1945-1975

M. A., History and Sociology of Science, University of Pennsylvania, Sept. 1997 to Aug. 1999

Thesis: A Standard Edison Story: Compatibility Standards in Thomas Edison's Development of the Phonograph

M. Phil., Economic and Social History, University of Oxford, Sept. 1994 to June 1996

Thesis: Timely Success: The Role of Locational Lock-in and Path-Dependence in the Rise of the South-west Lancashire Watchmaking Industry

B.A., Economics, Northwestern University, Sept. 1990 to June 1994

Publications:

Review of David Morton's *Off the Record: The Technology and Culture of Sound Recording in America*; published in *Business History Review*, v.74, n.3, Autumn 2000, pp. 529-31.

Conference Presentations:

"'Everything but the Popcorn': Domesticating the Cinema by Remaking the Living Room," presented at the annual meeting of the Society for the History of Technology, October 2004, Amsterdam, Netherlands.

"The Endless Quest for Fidelity: A portrait of the early audiophile community," presented at annual meeting of the Society for the Social Study of Science and Technology, August 2004, Paris, France.

"The Consumer as System Engineer: Compatibility Standards and the American Audio Industry, 1948-1958" presented at Workshop on Standards, Democracy, and the Public Interest, August 2004, Paris, France.

"The Short, Happy Life of Quadraphonic Sound," presented at the annual meeting of the Society for the History of Technology, October 2002, Toronto, Canada.

"The Quadraphonic Quandary," presented at the Mid-Atlantic Conference for the History of Science, Technology, and Medicine, July 2000, Carnegie Mellon University

"The Four-Channel Flop," presented at Failure: An Interdisciplinary Graduate Student Conference, April, 2000, Harvard University

"Timely Success: The Genesis of the South-west Lancashire Watchmaking Industry," presented at On Time: History, Science, Commemoration, September, 1999, Liverpool, U. K.

Honors and Prizes:

University of Pennsylvania, Chimicles Fellowship for the Teaching of Writing, 2003-2004
University of Pennsylvania, University Fellowship, 2002
University of Pennsylvania, Jack Pressman Award, 1999
University of Pennsylvania, SAS Fellowship, 1997-2001

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EDUCATION

Ph.D., History and Policy, Carnegie Mellon University, expected December 2004.
M.S., History and Policy, Carnegie Mellon University, May 1997.
B.A., History, University of Wisconsin, Madison, May 1994.

RECENT EMPLOYMENT

Contract Historian, Defense Acquisition History Project, January 2004 – present.
Research Analyst, Science and Engineering Associates, Inc., April 2002 – April 2004.
Research Consultant, Hagley Museum and Library, October 2001 – April 2002.

PUBLICATIONS & WORKS-IN-PROGRESS

"The Linear Model, the U.S. Department of Defense, and the Golden Age of Industrial Research," *The Science-Industry Nexus: History, Policy, Implications* (forthcoming, 2004).

"Researching the History of Technology at the Hagley Museum and Library," *Technology & Culture* (October 2003).

Entries on Thermoelectric Refrigeration, Absorption Refrigeration, Mechanical Refrigeration, and the Organization of Science and Technology in the 20th Century in the *Encyclopedia of 20th Century Technology* (Fitzroy Dearborn Publishers, forthcoming).

"Managing Cold War Science: Government Policy, Corporate Strategy, and Industrial Research, 1945-1972," Ph.D. Dissertation, Carnegie Mellon University, expected 2004.

Book reviews in *Journal of Economic History*, *Business History*, and *Economic History Review*.

PUBLICS PRESENTATIONS

Invited Speaker: 123rd Nobel Symposium, Stockholm, November 2002; National Air and Space Museum, May 2001; Hagley Museum and Library, June 2000; University of Delaware, November 2001; and Carnegie Mellon University, November 1999.

Conference Presentations: Society for the History of Technology, Toronto, October 2002; Policy History Conference, St. Louis, June 2002; Business History Conference, Miami, April 2001; History at the Grassroots Conference, Charleston, Illinois, October 2000; and Johns Hopkins University, Baltimore, August 1998.

Additional Conference Experience: European Business History Association Summer Workshop, Terni, Italy, September 2003; Session Chair, American Studies Association, D.C., November 2001; Commentator, Society for the History of Technology, San Jose, October 2001; and Conference Organizer, The Mid-Atlantic Conference in the History of Science, Pittsburgh, July 2000.

FELLOWSHIPS AND AWARDS

Guggenheim Fellowship, National Air and Space Museum, 2000-2001; Henry Belin du Pont Dissertation Fellowship, Hagley Museum, 2000; J. E. Rovensky Fellowship, Economic History Association, 1999-2000; Dissertation Improvement Grant, National Science Foundation, 1999-2000; Graduate Fellowship, National Science Foundation Sponsored Graduate Training Program in Cold War Science and Technology Studies, 1996-1999; Senior Thesis Prize, History Department, University of Wisconsin, 1994; University of Wisconsin Award for Academic Excellence, 1994.

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Education

Ph.D. History and Policy. Carnegie Mellon University, 1999.

M.S. Applied History. Carnegie Mellon University, 1994.

B.A. American Studies, Brandeis University, 1986.

Professional Experience

Assistant Professor, Dept. of History, Marshall University Huntington, WV 2003- present

Coordinator, Regents Bachelor of Arts Degree Program, Marshall University, Huntington, WV 1997-2003.

Assistant Curator, Charles River Museum of Industry, Waltham, Mass. 1986-1989.

Curator, Museum of Transportation, Brookline, Mass., for the exhibit "Putting America on Wheels: New England Paves the Way." 1988.

Selected Publications

"The Electronics Industry" In Joel Mokyr, ed., *Oxford Encyclopedia of Economic History* (Oxford University Press, 2003).

"The Nature, Sources, and Consequences of Firm Differences in the Early History of The Semiconductor Industry." with Wesley Cohen, David Hounshell, and Steven Klepper. In Constance Helfat, ed., *The SMS Blackwell Handbook of Organizational Capabilities: Emergence, Development and Change* (Blackwell, 2003).

Complementarity, Cooperation, and Collective Innovation: Materials Research in the Semiconductor Industry." 75-132 in Andrew Goldstein and William Aspray, eds., *Facets: New Perspectives On the History of Semiconductors* (New Brunswick, NJ: IEEE Center for the History of Electrical Engineering, 1997).

"Government Support of Semiconductor Technology: Diverse Approaches and Information Flows." *Business and Economic History* Vol. 24, no. 2 (Winter 1995).

Grants and Awards

1994 National Science Foundation Dissertation Improvement Grant.

1994 Alfred D. Chandler Traveling Fellowship in Business History and Institutional Economic History from Harvard Graduate School of Business Administration.

1994 John E. Rovensky Fellowship in Business and Economic History from the University of Illinois Foundation.