

“What do people want? They want everything”: Data Delivery Systems, DUALabs, and the U.S. Census Bureau, 1962-1982

Social Science History Association
Digitizing Analog History, Session 143, Chicago, Illinois
November 22, 2025

Diana L. Magnuson, University of Minnesota
David Van Riper, University of Minnesota
Steven Ruggles, University of Minnesota

Abstract

This paper explores the evolution of data delivery systems in the U.S. Census Bureau between 1962 and 1982. We trace the history of data delivery from print volumes to early digital data products through to the Bureau’s embrace of digital data as its main product. We highlight the roles of individuals and groups both inside and outside the Census Bureau, including the key role of John “Jack” Beresford and the Data Use and Access Laboratories (DUALabs) in developing and promoting digital data use across the country. Drawing on historical evidence from the National Archives, including Census Bureau internal memoranda, conference papers, and correspondence, as well as a variety of secondary and primary source materials gathered from public and private collections, our research aims to uncover the history of the people and social science behind the development, release, and research impact of digital census data.

Data dissemination, 1790-1950

For the first 160 years of the United States Decennial Census, the federal government disseminated data solely through print volumes (Fryer 2012). Census field staff (enumerators) collected responses by going door to door, asking each household a series of questions about its residents and the physical housing unit. Field staff then returned those responses to the decennial census headquarters in Washington, D.C., where they were processed by census staff clerks into tables of statistics about different geographic units, including the nation, states/territories, counties, cities, and political wards (Salvo 2012; Ruggles and Magnuson 2020).

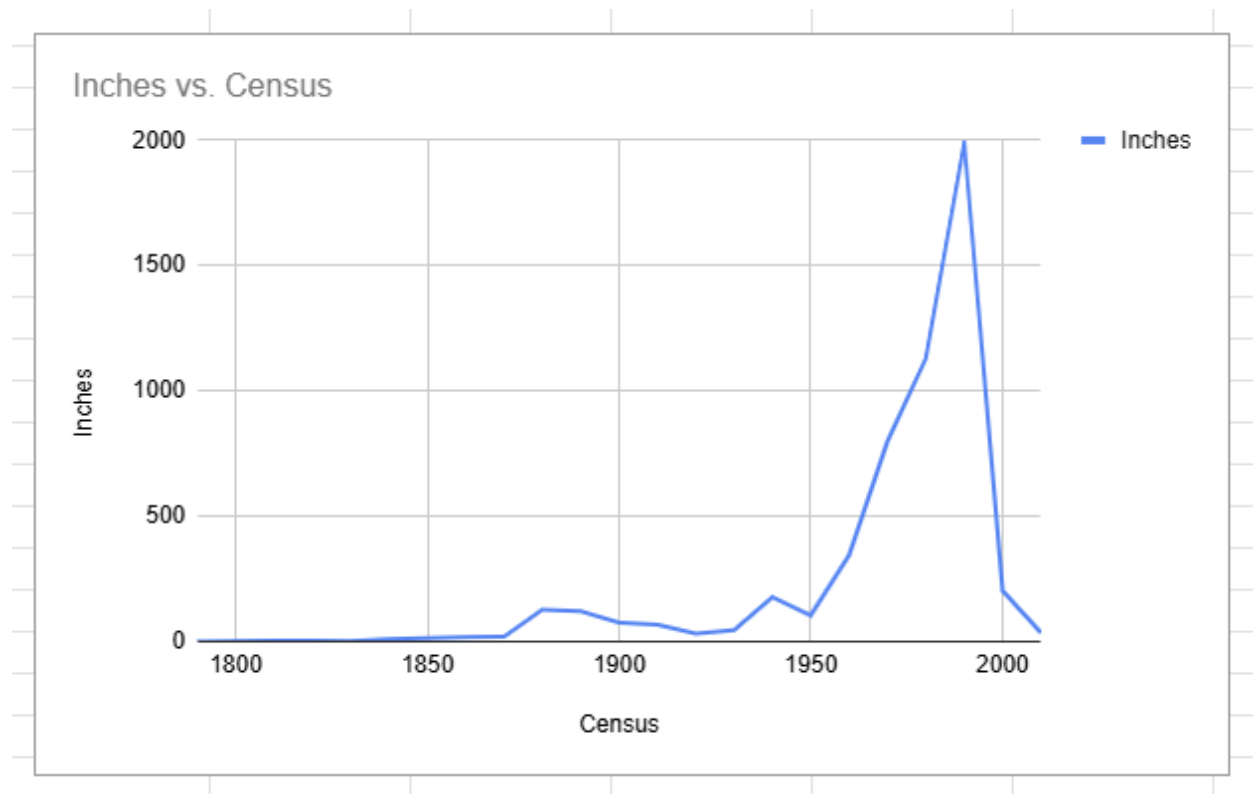
The number of census tables published varied according to the level of geography. The Census Bureau (and its precursors) typically provided the largest number of tables for the nation and states, fewer tables for counties and the cities with populations greater than 2,500, and the fewest tables for all cities and county subdivisions. During this period, the Census Office (and

beginning in 1902, the permanent Census Bureau) only published total population counts for all cities and county subdivisions.

As demand for more data about the U.S. population grew, the Bureau constructed more tables, yielding an increase in the number of published volumes. From 1790 to 1950, the number of linear feet of print volumes increased from a quarter inch to almost nine feet (Figure 1).¹ Increased demand from users for more data put pressure on the Bureau to publish more volumes, but even then, the published data were necessarily limited (Fryer 2012). Publishing summary tabulations was time consuming and expensive; therefore, the Bureau could not publish in print form all the tabulations that users wanted. When the standard set of tables in published volumes were insufficient for specific research questions, eligible users contracted with the Bureau to create special tabulations (Jenkins 1983, pp.5-6; U.S. Bureau of the Census 1955, p. 39; U.S. Bureau of the Census 1966, pp. 106-110; U.S. Bureau of the Census 1970b, p. 33; U.S. Department of Commerce 1941, pp. 42-43). While the Bureau continued publishing print volumes until 2010, the 1960 Decennial Census represented an unprecedented opportunity for the Bureau to rethink its approach to data dissemination.

¹ The Census Bureau did not stop publishing print volumes when they started publishing data in digital format. They continued print volumes until the 2020 Decennial Census, when zero volumes were published. The 1990 census was the high watermark, when the Bureau published more than 165 linear feet of print volumes.

Figure 1. U.S. Decennial Census published volumes, 1790-2010.



1960 - the first computerized Census

Starting in 1945, the Census Bureau contracted with the Eckert-Mauchley Company to design and build the world's first commercial electronic computer, the UNIVAC. The computer was completed in March 1951, too late to be of significant use in tabulating the 1950 census. The 1950 decennial census staff therefore mainly processed census returns by punch card tabulating machines, a technology that had been in use since 1890. The Bureau continued to work with the UNIVAC during the 1950s, using it to tabulate results from its 1954 Census of Manufacturers and Businesses (McPherson and Drury 1958; Duncan and Shelton 1978, pp.120-129; Ruggles and Magnuson 2020).

The Bureau recognized that computers (and the systems built up around them) could create efficiencies around data capture, tabulation, and dissemination. The Bureau also realized that a computerized census “makes possible far greater utilization of data for derivative statistics and alternative classifications” (McPherson and Drury 1958). By shortening the time to publication, the decennial census statistics would be more useful and less “stale” for users. Concurrently and

importantly, access to computers was becoming more common for researchers in business and university settings (Citro 1968; Ceruzzi 2003).

The computerization of the 1960 Census resulted in a proliferation of census-generated statistical products. External users began requesting data in a variety of new formats, including computer summary tapes (digital data), photocopies of tables printed from the summary tapes, and special tabulations produced by re-running the basic record tapes (BRTs) (Citro 1968; Gaquin 2012). In response to this demand, the Census Bureau invented two revolutionary new data formats: (1) a public use microdata sample of one-in-1000 households distributed on punch cards or magnetic tape, and (2) aggregated tabular summary files distributed on magnetic tape or as photocopies. We have outlined the history of microdata elsewhere (Magnuson and Ruggles 2025). Here we focus on the development of census summary files.

The first Census Bureau release of digital tabular data came at the request of Edgar Horwood, professor of civil engineering at the University of Washington's College of Engineering.² In 1961, Horwood called Jack Beresford, a Census Bureau staff member, to request block level data for Seattle. Beresford told Horwood that it would be available in printed form in a couple of years and that the only place where it currently existed was on computer tapes used by the Bureau for its internal processing work. According to Horwood, he asked Beresford, "Well, then why don't you send us a copy of the tape and a write-up of what's on it?" After a "deep pause," Beresford replied, "Well, there's nothing I know of that tells me I can't. Providing there is appropriate suppression to avoid disclosure on small entries. I'll send it on out to you at cost" (Horwood 1977). Horwood received "UNIVAC encoded summary data for census blocks with data suppression codes for blocks with less than some number of housing units." Working with census data in this form was incredibly difficult. Horwood's student, William Clark, labored for "about a year to convert the data to IBM 709" (Dueker 2012, p. 42).

Shortly after Horwood made his request, the Bureau established a process to fulfill such requests from external users and formally announced the availability of tabular data in electronic form (Census Bulletin 1962). These digital data products were important because they contained unpublished tables for geographic units as small as enumeration districts, and they were available for purchase for the cost of duplicating the tape (Census Bulletin 1962; Citro 1968, U.S. Bureau of the Census 1970a). The Bureau expected that local planners, governments, and businesses would be the primary purchasers of these data products.

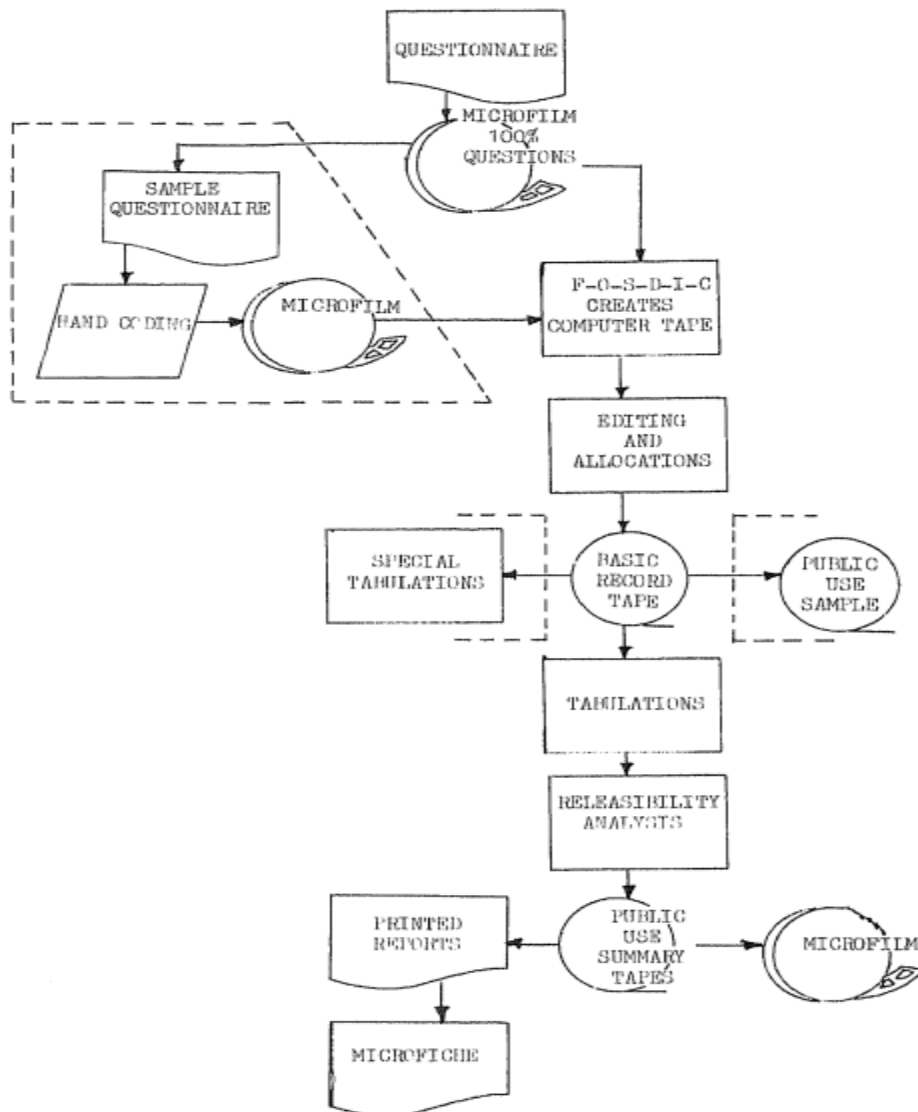
Between 1960 and 1967, governmental agencies, businesses, and non-profit organizations made 5,710 requests to the new data services unit. Demand was highest for photocopies of tables from the summary tapes (3,590 requests), maps (1,100 requests), out of print reports (840 requests),

² Horwood was a founding member and first president of Urban and Regional Information systems Association (URISA), now the Geospatial Professional Network (GPN).

and special tabulations from the BRTs (180 requests) (Beresford 1968, pp.8-10). High demand for these services outran the Bureau's ability to satisfy these requests. It became clear that users wanted access to diverse types of products than those currently produced by the Census Bureau. Thus, the Bureau began considering how to meet those user needs in the future (Anderson and Neidert 2012; Beresford 1968, p.11).

The services provided by the new data services unit staff were not integrated in the data collection and production workflow for the 1960 decennial census (Figure 2). The 1970 census data production workflow was oriented towards the printed publications the Bureau has been producing since 1790. It was only after publication staff finalized the printed publications that user support staff could provide additional data services. During the 1960s, however, "...demand for data to meet the Nation's growing information needs increased tremendously. More users wanted small-area summaries which were only available on tape. More users wanted to receive all data tabulations in machine-readable form" (U.S. Bureau of the Census 1970a). In terms of the Bureau's workflow, satisfying these user needs would require rethinking the sequencing of decennial census statistical data production so that a wider variety of data access methods, including digital and print, could be sustainably supported by Bureau staff (Figure 3).

Figure 2. The Processing of the 1970 Census Data Products (U.S. Bureau of the Census 1970b, p. 27)



This is necessarily a simplified presentation. Dashed lines indicate separate processing operations.

Figure 3. 1960 U.S. Census sequence of events that made data access services possible (paraphrased from Beresford 1968)

Sequence	Event
1.	Geographic mapping
2.	Census field work
3.	Preparing completed questionnaires for computer processing
4.	Microfilming and storage of microfilm
5.	Preparing and passing “raw” computer tape records through FOSDIC
6.	Reviewing and correcting records to improve completeness and consistency (by computer)
7.	Creating “finished” tape records (Basic Record Tapes, BRT)
8.	Creating BRT documentation
9.	Preparing standard tabulation programs
10.	Creating large-scale summary matrices on tape (summary tapes)
11.	Creating summary tape documentation
12.	Preparing computer programs to organize summary tapes into readable tables with labels
13.	Extracting data from summary tables using prepared computer programs
14.	Printing general reports, specialized data booklets, and descriptive uses of items
15.	Data access services

Fortunately, there was an energetic and forward-looking Census Bureau staff member who was working in the data services unit and paying attention to the strengths and weaknesses of the Bureau’s data access workflow. These experiences led John Beresford to spend the rest of his career--both in- and outside the Census Bureau--developing, implementing, and championing the importance of digital data products, comprehensive documentation describing those products, and software to help users effectively use this rich data source about neighborhoods, municipalities, counties, and more.

John “Jack” Beresford

The Census Bureau hired John “Jack” Beresford in 1958 as a statistician in the fertility, household, and family statistics group. Beresford then became Chief Instructor for the 1960 Census, followed by a three-year stint as a technical liaison to the population division and decennial census. In this role, Beresford served as the “translator” between the computer programmers and the subject matter experts. He then served three years (1963-1966) as staff assistant for machine readable data user services (Beresford 1984; Beresford n.d.). These roles put Beresford in contact with Bureau computer programmers who created the digital data and with users who wanted to access and use digital data. The rest of Beresford’s career built upon the lessons he learned between 1961 and 1966.

From 1967-1968, Beresford was a staff assistant to the associate director for Demographic Fields. The following year Beresford served in two roles: staff assistant to Associate Director for Research and Development and Chief, Data Access and Use Laboratory (Beresford 1984, p. 1) In these roles he used his experience supporting users who wanted digital data from the 1960 census to begin drafting the plan for the production and use of machine-readable data from the 1970 census. Beresford described these plans in a 1967 *Demography* article entitled “Projected Innovations in the Data Delivery System for the 1970 Census” (Beresford 1967). His interactions with users helped him realize that “[w]hat do people want? People want everything” (Beresford 1967, p754). While producing “everything” was impossible, a robust machine-readable data delivery system could provide a path for the Bureau to increase the volume of data published for every decennial census.

Horwood’s request for summary data tapes came in 1961, and the Census Bureau announced the availability of digital tabular data in 1962. It took until mid-1967, however, for the Census Bureau to establish the Data Access and Use Laboratory (DAUL) and to appoint Beresford its director (Beresford n.d.). The DAUL team, assembled by Beresford, and under his direction, developed “tools, training and procedures that would facilitate use of the 1970 Census output in machine readable form” (Beresford n.d.). While these developments may seem unremarkable in 2025, they were revolutionary at the time. From providing access to digital data shortly after the 1960 census (formally and informally), to establishing a unit dedicated to digital data seven years later, the Bureau recognized the importance, utility, and possibility of such products to other federal agencies, business entities, and academic researchers. It was Beresford’s focused and energetic work outside the Bureau, however, that drove adoption of digital data throughout the country.

Growing out of the data services unit established in the early 1960s, the Census Bureau’s Data Access and Use Laboratory (DAUL) was established with the mission to “improve access to census data and services to Bureau customers” with a particular focus on data delivery and access for the forthcoming 1970 Decennial Census (Beresford 1968, p. 12; Citro 1968, p. 3; Census Bulletin 1968, p. 1). With an operational budget of \$150,000, a staff of eleven (mostly hired from outside the Bureau), and an enterprising leader in Jack Beresford, DAUL set out to develop “a new class of user services” along three operational dimensions (Beresford 1968, p. 18) (Figure 4).

Figure 4. Data Access and Use Laboratory operational dimensions (Beresford 1968)

Organization
Recruit and train staff
Obtain external software development support
Brainstorm with CB stakeholders
Introduce “prototype summary tape user workshop” to potential users in Madison, WI
Innovation
Develop 1970 Census User Dictionary
Draft 1970 Census User Guide
Initiate <i>Data Access Newsletter</i>
Develop and promote Summary Tape Processing Center concept
Coordination
Develop inventory of requests filled by data access services unit
Establish Census User Dictionary coordinators
Create “Documentation Central” to support effective and efficient use of Bureau digital data products

While Beresford and DAUL were remarkably productive during the first year of DAUL’s existence, the Bureau, in Beresford’s view, failed to provide financial and staff resources to sustain DAUL’s success. In mid-1969, Beresford left the Bureau and established the Data Use and Access Laboratories (DUALabs) (Data Access News 1969, p. 1; Beresford 1969; Beresford, n.d.). The goal of DUALabs was to develop and provide support for users of digital census data through training workshops, software development, technical documentation, and outreach through newsletters and a journal publication.

Data Use and Access Laboratory (1969-1982)

Beresford established DUALabs outside the Census Bureau to train and support machine-readable data users in a manner that the Bureau could not provide at the time. While the company itself no longer exists, its legacy lives on in the power and reach of machine-readable data, expectation for user access, robust data documentation, and lively user engagement.

Founded by Jack Beresford as a for-profit company, DUALabs first product was the 1970 Census Summary Tape Assistance, Research and Training (START) Program. Businesses, universities, state and local governments, and non-profits could subscribe to START for an annual cost of \$5,000. A START subscription provided users with copies of the summary tapes, customized software that facilitated access to data on the tapes, training on how to use the software, comprehensive documentation about the data on the tapes, a newsletter, and regular updates about problems or errors in the data on the tapes. The goal of the computer tapes, software, documentation, and training was to “facilitate non-Federal research use of large Federal statistical files” (Activities of Data Use and Access Laboratories (DUALabs 1969-1982 n.d., p. 1). Beresford hoped that as more users subscribed to START products, user capabilities

would grow, effectively embedding knowledgeable census data users within their organizations (Beresford 1972, p. 203).

START was well received by its subscribers. Patricia Becker, a demographer with the city of Detroit in the late 1960s, participated in the program, and in remarks published after Beresford's death, wrote: "I still have a good set of 1970 DUALabs documentation in my 'history' bookshelf. I'll never discard it. To this day, it stands as a shining example of what users need to know about a data set in order to use it well. The Census Bureau never produced adequate documentation for the 1970 files; DUALabs is it" (APDU Newsletter 1995, p. 13).

Unfortunately, demand for START was not as robust as DUALabs and Beresford had expected. DUALabs fell short of acquiring enough clients to cover its costs, and DUALabs staff were concerned about the company's viability. To generate more revenue, DUALabs obtained support from the Ford Foundation to subsidize partial START subscriptions for universities throughout the country. This subsidy stabilized the DUALabs' finances for a time, but it was not enough to save the for-profit status of the company (APDU Newsletter 1995, p. 14).

In 1970, DUALabs and the Center for Research Libraries (CRL) received a grant from the National Science Foundation (NSF) to establish and run the Clearinghouse and Laboratory for Census Data (CLCD) (Beresford 1972, p. 203). To receive NSF funding, DUALabs converted into a non-profit organization, returning all capital it had raised to its investors (Beresford 1971). The NSF grant saved DUALabs from bankruptcy and allowed it to continue making machine-readable census data and documentation accessible to users.

While the START product enhanced the technical capabilities for accessing and using machine-readable census data, the goal of the CLCD was to support researchers at START and non-START institutions that wanted to learn more about these data and whether they could be used in the researchers' projects. Essentially, the CLCD was established to provide consulting services to "orient a user, to guide him, to offer special training as needed, to bring him in contact with those who can provide data, and to help insure that resources exist to accomplish his research objective" (Beresford 1972, p. 203).

User Contact sites were established by the CLCD at fourteen locations, including universities, private corporations (e.g., Kroger), and local governments (e.g., Davidson County, TN), across the country. CLCD staff selected these locations because they "ha[d] established themselves as competent sources of assistance in the use of the 1970 Census, with proven experience in meeting users' application requests in a timely and efficient manner" (Beresford 1972, p. 203).

Impact of DUALabs

Through the combination of START and the CLCD, DUALabs had a major impact on the usability and accessibility of machine-readable data. By the end of 1974, DUALabs had disseminated over 8,500 reels of tape and 2,700 copies of data access software programs to users. The company created programming manuals for twelve pieces of software and machine-readable documentation for sixty-seven data files (Activities of Data Use and Access Laboratories (DUALabs) 1969 to 1982 n.d., pp. 2-3). DUALabs customer base was diverse. More than nine hundred federal, state, and local government agencies, almost one-thousand businesses, and private organizations, and just over five hundred universities and colleges purchased tapes and software from DUALabs (Small-Area Data Activities 1974, p. 5). Most importantly, DUALabs trained more than 4,700 people to access census data using its software and data (Activities of Data Use and Access Laboratories (DUALabs) 1969 to 1982 n.d.).

DUALabs expanded its reach by developing software, training, and outreach for machine-readable census data to other federal agencies and even international organizations. During the mid- to late- 1970s, DUALabs secured contracts or grants with the National Institute of Child Health and Human Development, U.S. Department of Health, Education, and Welfare, the Department of Justice, U.S. Department of Housing and Urban Development, and the U.S. Commerce Economic Development Administration to prepare software and training materials to support machine-readable data usage. On the international side, DUALabs received contracts from the U.S. Agency for International Development to support the 1980 round of censuses throughout the developing world and from the Government of Nigeria to assist with survey data processing (Activities of Data Use and Access Laboratories (DUALabs) 1969 to 1982 (n.d.), pp.3-4).

After Beresford left the Census Bureau in mid-1969, the Census Bureau continued to pay attention to the work he and DUALabs were doing. The Bureau recognized the success DUALabs had in meeting user needs and accordingly used the DUALabs' technical and data user service approaches for the 1980 Decennial Census (Activities of Data Use and Access Laboratories (DUALabs) 1969 to 1982 n.d.). While Beresford was not at the Census Bureau when it happened, the Bureau finally made machine-readable data a first-class product. By 2020, the Census Bureau ceased publishing print data altogether (Figure 1).

Although the Census Bureau formally began disseminating machine-readable data in 1962, it was not until the 1970s innovations of DUALabs that electronic summary files emerged in their modern form. The standards developed by DUALabs for timely data dissemination, robust data documentation, accessible user services, and lively user engagement are now core elements of digital data infrastructure around the world.

References

- Activities of Data Use and Access Laboratories (DUALabs) 1969 to 1982 (n.d.) (IPUMS-Citro-007.pdf). Constance F. Citro Collection, IPUMS Archive, University of Minnesota.
- Anderson, A.F. and Neidert, L. (2012). Dissemination of Data: Electronic Products, entry in Encyclopedia of the U.S. Census, edited by M.J. Anderson, C.F. Citro, and J.J. Salvo, pp. 182-188). Sage Publications: CQ Press.
- APDU Newsletter (1995). John C. “Jack” Beresford (IPUMS-Citro-004.pdf). Constance F. Citro Collection, IPUMS Archive, University of Minnesota.
- Beresford, J.C. (1984). John C. Beresford Resume (IPUMS-Citro-000.pdf). Constance F. Citro Collection, IPUMS Archive, University of Minnesota.
- Beresford, J.C. (1972). The Clearinghouse and Laboratory for Census Data and Statistics on Federal Statistics Users. Proceedings of the Survey Research Methods Section of the American Statistical Association, pp.203-205.
- Beresford, J.C. (1971). Correspondence from Beresford to Constance F. Citro, January 31, 1971 (IPUMS-Citro-008.pdf). Constance F. Citro Collection, IPUMS Archive, University of Minnesota.
- Beresford, J.C. (1969). Memo: A New Approach to Meeting Data Users’ Needs (IPUMS-Citro-011.pdf). Constance F. Citro Collection, IPUMS Archive, University of Minnesota.
- Beresford, J.C. (1968). The Role of the Census in Providing Data Access Service (IPUMS-Citro-003.pdf). Constance F. Citro Collection, IPUMS Archive, University of Minnesota.
- Beresford, J.C. (1967). Projected Innovations in the Data Delivery System for the 1970 Census. *Demography* 4(2), 753-758.
- Beresford, J.C. (n.d.). 21c U.S. Bureau of the Census (IPUMS-Citro-001.pdf). Constance F. Citro Collection, IPUMS Archive, University of Minnesota.
- Census Bulletin. (1968). Early Tape Summaries Planned for 1970 Census, 18(17).
<https://www.census.gov/library/publications/1968/comm/cb-volume-18-17.html>
- Census Bulletin. (1962). Computer Tapes Now Available to Public, 12(3).
<https://www.census.gov/library/publications/1962/comm/cb-volume-12-3.html>

- Ceruzzi, P.E. (2003). *A History of Modern Computing*. Cambridge, MA: MIT Press.
- Citro, C.F. (1968). *The 1970 Census and Its Products—A General Orientation* (IPUMS-Citro-006.pdf). Constance F. Citro Collection, IPUMS Archive, University of Minnesota.
- Data Access News. (1969). *DUALabs Formed—START Program Announced*, 1(1) (IPUMS-Citro-044.pdf). Constance F. Citro Collection, IPUMS Archive, University of Minnesota.
- Dueker, K.J. 2012. “Origin and Evolution of URISA,” in *Foundations of Urban and Regional Information Systems and Geographic Information Systems and Science*, Special Publication in Celebration of URISA’s 50th Anniversary Conference 1963-2012. Urban and Regional Information Systems Association, pp. 39-51.
- Duncan, J.W. and Shelton, W.C. (1978). *Revolution in United States Government Statistics, 1926-1976*. Washington, D.C.: Government Printing Office.
- Fryer, J.S. (2012). *Dissemination of Data: Printed Publications*, entry in *Encyclopedia of the U.S. Census*, edited by M.J. Anderson, C.F. Citro, and J.J. Salvo, pp. 188-191. Sage Publications: CQ Press.
- Gaquin, D.A. (2012). *Data Dissemination and Use*, entry in *Encyclopedia of the U.S. Census*, edited by M.J. Anderson, C.F. Citro, and J.J. Salvo, pp. 120-122. Sage Publications: CQ Press.
- Horwood, E. 1977. “Perspectives on URISA's Origin and on the Emergence of a Theory of Urban and Regional Information Systems,” (reprinted from *Proceedings: URISA'77*) in *Volume V Invited Papers Prepared for the "Perspectives Track" of URISA '92* edited by Barry Wellar and Daniel Parr, 1992, pp. 15-33.
- Jenkins, R. (1983). *Procedural History of the 1940 Census of Population and Housing*. Madison: University of Wisconsin Press.
- Magnuson, D.L and Ruggles, S. (2025), “Equally Available to Anyone”: The Invention of Public Use Microdata at the US Census Bureau. IPUMS Working Paper No. 2024-07. DOI: <https://doi.org/10.18128/IPUMS2024-07.v2>
- McPherson, J.L. and Drury, R.F. (1958). *New Applications of Electronic Data Processing to Census Work*. Record Group 29, Eighteenth Decennial Census Methodological Files Containing Speeches, Articles, and Conferences Papers, NARA. <https://catalog.archives.gov/id/274957056>

- Small-Area Data Activities. (1974). Reviewing the Demand for 1970 Census Summary Tapes, 9(3), p.5.
- Ruggles, S. and Magnuson, D.L. (2020). Census Technology, Politics, and Institutional Change, 1790–2020. *Journal of American History* 107(1), 19–51.
<https://doi.org/10.1093/jahist/jaaa007>
- Salvo, J.J. (2012). Data Capture, entry in *Encyclopedia of the U.S. Census*, edited by M.J. Anderson, C.F. Citro, and J.J. Salvo, pp. 117-120. Sage Publications: CQ Press.
- U.S. Bureau of the Census. (1970a). Census Summary Tape Depository Library Memorandum No. 2, March 26, 1969, in 1970 Census Summary Tape User Memorandum. Washington, D.C.: Government Printing Office.
- U.S. Bureau of the Census. (1970b). 1970 Census Users' Guide; Washington, D.C.: Government Printing Office.
- U.S. Bureau of the Census. (1966). 1960 Censuses of Population and Housing: Procedural History. Washington, D.C.: Government Printing Office.
- U. S. Bureau of the Census. (1955). The 1950 Censuses - How They Were Taken. Washington, D.C.: Government Printing Office.
- U.S. Department of Commerce. (1941). Twenty-Ninth Annual Report of the Secretary of Commerce, 1941. Washington, D.C.: Government Printing Office.