Mainframing America:
Computers, Federal Systems, and the Governmental Origins of the U.S. Information Society, 1940-1985

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Introduction: Dataocracy -- Defining the Computing State

In the spring of 2009, President Barack Obama received plaudits from Congress, the media, and many in the U.S. business community for the early tech-savvy actions of his administration.[1] During his earliest months in office, he appointed the nation's first "Chief Technology Officer" and elevated an official at the Office of Management and Budget to be the nation's "Chief Information Officer," in emulation of corporate information technology management. Obama's decisions to offer his weekly public addresses online, via digital streaming, spurred the press to liken him to a Web-era inheritor of Franklin D. Roosevelt's radio address mastery.[2] Government promotion of technology even played a central role in the Administration's proposed, Great Recession-countering economic stimulus proposal: tens of billions of government dollars specifically allocated to digitize health care records, supplement electrical grids with digital "smart technologies," and expand broadband internet access to underserved communities.[3] In press conferences and public remarks, the president who had been elected thanks to the assistance of sophisticated data analysis and social media strategies spoke passionately about how "revolutions in communications and information technology have given birth to a virtual world."[4] Noting that "this world, cyberspace, is a world that we depend on every

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[1] Steve Lohr, "Taking Innovation Beyond the 'Aha,'" *New York Times*, 1 March 2009, p. BU3; Saul Hansell, "Ideas, Yes, But Not So Presidential," *New York Times*, 23 June 2009, p. B1; Amy Schatz, "Tech Industry Cheers as Obama Taps Aneesh Chopra for CTO," "Digits" Blog, *Wall Street Journal*, 18 April 2009. Available online: http://blogs.wsj.com/digits/2009/04/18/tech-industry-cheers-as-obama-taps-aneesh-chopra-for-cto/.

[2] Virginia Heffernan, "The YouTube Presidency," *New York Times*, 12. April 2009, p. SM 15; Sheryl Gay Stolberg, "Obama makes History in Live Internet Video Chat," *New York Times*, 27 March 2009, p. A17.

[3] Steve Lohr, "Technology Gets a Piece of Stimulus," *New York Times*, 26 January 2009, p. B1.

[4] For more on the role of technology in Obama's campaigning and election, see David Talbot, "How Obama Really Did It," in *The Best Technology Writing 2009*, Steven Johnson, ed. (New Haven: Yale University Press, 2009), p.

single day," the newly-inaugurated president affirmed the centrality of information technology to American society by acknowledging "our hardware and our software, our desktops and laptops and cell phones and BlackBerries that have become woven into every aspect of our lives."[5] A nation defined by its relationship to computers and digital information technologies deserved a government equally focused. Washington's embrace of "technological innovation," Obama proclaimed, would "revamp government operations from top to bottom" and enable the federal state to "help achieve our most urgent priorities."[6] Hope and change would be delivered, in part, via a networked connection.

Finally, the nation's pundits and technology evangelists concluded, a president who "got" the potential of information technology and could propel a moribund federal government into the digital age. The technology-promoting private sector beamed. Google's director of government relations endorsed a policy strategy of being "relentless in applying technology to make government work better for citizens."[7] The head of the Silicon Valley trade group, the Business Software Alliance was similarly effusive, praising the "visionary role" an expert in the computer could play "in putting IT [information technology] to work for the American people." Immersing the federal government in the techniques and tools of cutting edge information technology would

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44-55; James T. Kloppenberg, *Reading Obama: Dreams, Hope, and the American Political Tradition* (Princeton: Princeton University Press, 2011); Horace G. Campbell, *Barack Obama and Twenty-First Century Politics: A Revolutionary Moment in the USA* (New York: Pluto Press, 2010).

[5] Barack Obama, "Remarks on Securing the Nation's Information and Communications Infrastructure," 29 May 2009. Accessed online: Gerhard Peters and John T. Woolley, *The American Presidency Project*. http://www.presidency.ucsb.edu/ws/?pid=86215

[6] Barack Obama, Weekly Address, 18 April 2009. Available online: https://www.whitehouse.gov/the-press-office/weekly-address-president-obama-discusses-efforts-reform-spending-government-waste-n .

[7] Alan Davidson, "Aneesh Chopra as Chief Technology Officer," Google Public Policy Blog, 18 April 2009. Accessed online: < https://publicpolicy.googleblog.com/2009/04/aneesh-chopra-as-chief-technology.html >

ultimately yield "open government, economic growth, and social progress," concluded the group.[8] In an open letter to Obama, Silicon Valley executives noted that the introduction of computing mindsets and techniques to federal governance could "fundamentally change the relationship between citizens and their government, while improving the level and quality of government services to its citizens."[9]

In the minds of the press, the business community, and a general public weary of a federal government lurching from one ineffective crisis response to another, a presidential campaign fluent in the language and techniques of the digital age might yield a presidential administration capable of the same innovation and solution-seeking that marked the information technology sector and its mid-2000s bevy of compelling electronic products and services. By inserting the computer into the narrative, a young, vibrant chief executive could reshape the entire ethos of federal policymaking and government administration, just as the American home and office were being remade by "tech." Washington, at last, would catch up to the vision of computing's potential that Silicon Valley had reached decades before. The promise and allure of high technology would fundamentally transform the functioning of federal government, altering for the better the relationship between citizen and state and making more efficient, more informed, and more rational the policies emanating from Pennsylvania Avenue. In essence, the

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[8] Robert Holleyman, quoted in Lars Anderson, "CTO's Visionary Role Will Apply Technology Solutions to America's Challenges" press statement, Business Software Alliance, 18 April 2009. Accessed online: < https://web.archive.org/web/20100522150724/http://www.bsa.org/Home/country/News%20and%20Events/News%20Archives/en/2009/en-04182009-chopra.aspx >

[9] Amos Snead, "BSA Sends Recommendations to Obama on New Federal CTO" press release, Business Software Alliance, 10 December 2008. Accessed online: < https://web.archive.org/web/20100625222918/http://www.bsa.org/country/News%20and%20Events/News%20Archives/en/2008/en-12102008-obama_cto.aspx?sc_lang=en >

dream of an "information state," bestowing on the government the presumed versatility, accuracy, competency, and programmability of a computer.

This dream of the Aughts was not new. Technological embrace and American government have been interwoven since the exhortation of Article I, Section 8 of the Constitution to "promote the progress of science and useful arts."[10] Yet the tone of the first two decades of the twenty-first century, in which popular and policymaker admiration for the principles (disruptive innovation) and products (i-gadgets) of Silicon Valley dominate discussion of how government and businesses alike should operate, mirrors in compelling ways a specific period in American history: the decades immediately following World War II, when the earliest computers and digital information technologies were introduced in a government context. Beginning in the late 1940s, a period of dramatic growth and transformation for the American federal state, discourse within and outside Washington about the practice of governing – the dual business of policy formulation and administration -- increasingly intersected with discussion about the growing potential of the electronic computer as a tool for management of information.

"Mainframing America" argues that the electronic digital computer, and the administrative techniques associated with its use, contributed in fundamental ways to changing the structures and behaviors of the post-World War II federal state, and that concurrently the

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[10] For more on this imperative, see Edward Walterscheid, "Science, Technology, and the Constitution," *Knowledge, Technology, and Policy*, June 1999, vol. 12, issue 2, p. 6-19. For more on technology in the context of American historical identity, see Stephen H. Cutcliffe and Terry S. Reynolds, eds., *Technology & American History: A Historical Anthology from Technology and Culture* (Chicago: University of Chicago Press, 1997); Ruth Schwartz Cowan, *A Social History of American Technology* (New York: Oxford University Press, 1997); John William Oliver, *History of American Technology* (New York: Ronald Press Co., 1956); Marc Rothenberg, *The History of Science and Technology in the United States: A Critical and Selective Biography* (New York: Garland Pub., 1983); Carroll W. Pursell, *The Machine in America: A Social History of Technology* (Baltimore: Johns Hopkins University Press, 1995) and *Technology in Postwar America: A History* (New York: Columbia University Press, 2007).

U.S. government's use of information technologies for administrative and policy-making tasks shaped the development of computing technologies and the emergence of a postwar American information society. The modern American government and the modern U.S. information society came of age in tandem, and no political examination of the functioning of the postwar federal state can be complete without an investigation into the ways in which technological transformation reshaped the policymaking environment. The presence and use of computers in federal agencies in the 1950s, 1960s, and 1970s had real effects on the organizational structures, daily operations, and rhetorical mindsets of policymakers and government officials, thus shaping in subtle ways the creation and implementation of policies at federal levels. Likewise, the policy imperatives and bureaucratic contexts of federal agencies shaped the early development and dissemination of the electronic computer, laying the groundwork for a U.S. information society with deep roots in the nation's public sector. The story of the formative years of the electronic digital computer – its technological shaping, its conceptualization as a tool of information management, its proliferation as a symbol of impartial expertise and the promise of a technologically-improved future society – is the story of the computer's adoption and promotion by domestic agencies of the federal government in the decades following the Second World War. In no less a definitive fashion, the story of the postwar American state is the story of the proliferation of centralized, information-management technologies paired with the efforts of ambitious political actor to expand the scope and scale of the federal government. Growth of the modern federal state associated with the New Deal Order and its reworking of American liberalism, the Cold War impetus to growth of a permanent national security infrastructure, and the rise of rights-driven social movement agitation for expanded governmental services and protections were necessary but not sufficient elements for explaining why the postwar federal state expanded into actionable technocratic experimentation to an unprecedented degree. New conceptions of information usage and management, bolstered by the electronic computer, provided both the organizational cover and administrative capacity for the emergence of an expansive, modern state. That such a state can formulate and implement ambitious policy proposals is due in large part to its capacity to marshal complex streams of data and convert quantitative information into administrative protocols. In the postwar United States, computers were the tools, figurative and literal, that permitted complex policy agendas to be broken down into streams of manageable administrative tasks, enabling the federal state to grow in scope, scale, and ambition. The modern computer and the modern organizational state came of age in tandem and due in large part to mutual influence on the other.

By exploring the attitudes towards computers held by representative political actors and the uses to which those devices were put during the period from 1945 to 1985 – the era when centralized, mainframe computing came to dominate the information processing protocols of federal agencies – "Mainframing America" illuminates the ways in which organizational process and technological convergence intersect with political context to subtly reshape how the federal state functioned in the postwar period. Whether defined as a Warfare, Welfare, or Developmental State; whether shaped by its proximity to combative political ideologies, the agitations of social protest movements, or changing popular consciousness about categorized rights or market-state relations, the postwar United States government operated in a context marked by the increasingly visible presence of new information technology tools and processes in its day-to-day functioning. The presence and use of digital information technologies in the postwar state matter on a substantive level: over a four-decade period the devices and processes associated with computing increasingly structured the environment in which the business of government occurred, with consequences for the channels through which policy was developed and implemented and the nature of the relationship between government employees and those outside government with vested interests in the functioning of the American state.

Mainframe computers, information processing machines associated with specialized software programs, changed how government operated in the post-World War II period by routinizing in the form of information technology-centric language and behavior new administrative practices that prioritized flows of data as components of the policy process. Chiefly, computers in the employ of federal agencies in the 1950s, 1960s, and 1970s organized information – statistics, accumulated data from reports, analysis drawn from and models based on said reports. Political development in this era found itself dramatically transformed from within as the minutiae of bureaucratic information exchange, increasingly dictated by administrative protocols designed around the functioning of elaborate computer systems, shaped the processes through which agencies developed and implemented policy. Computers – increasingly embedded within the daily functioning of federal agency operations due to convenience, sunken cost, and the enthusiasm of individuals with the power to promote computerized systems as tools of management – changed how government operated to the degree that they framed analysis of the informational inputs that went into designing policies and the administrative outputs that entailed implementation and oversight of said policies.

If American political development as a historical discipline traces the interplay of enduring institutional structures with contextualized political change over time, few topics provide as compelling, and understudied, a lens into the workings of the American state as the electronic computer and rise of the modern digital information state. Under this framework, the struggle to design and enact policy in the post-World War II era is shaped not just by dynamics of party change, durability of economic regimes, or linkages of organized interests, but mechanisms of institutional change embedded within the very information-gathering and –analysis protocols of the administrative state. The computer fundamentally altered the operating environment in which information intended for purposes of governing was collected, disseminated, interpreted, and utilized as part of the policy design process. As the funnel through which an increasingly assertive information state approached the definition of policy, the computer system structured the conditions around which the post-WWII domestic state operated. In tandem with the assorted government restructurings, partisan flips, and ambitious named policy programs that mark traditional narratives of the development of the postwar state, the electronic digital computer quietly but aggressively grew in stature as a fixture in the operations of government agencies. The computer and the era of digital information transfer it engendered are not the sole keys to understanding American government in the years following World War II, but they are all-too-often overlooked elements that inform in compelling ways the transformation of the postwar American state at an operational level.

Defining Dataocracy

This four-decade period may be termed an era of "dataocracy" – a portmanteau describing both the government-adjacent communities of computer users who ascended to prominence in the postwar decades of mainframe computing dominance and the pro-systems organizational mindset that came to characterize the institutions they inhabited. An interlinked network of government officials, external consultants, representatives of private firms, and researchers based at universities and government-affiliated think tanks who came to shape the scope and use of government information systems in their professional capacities, dataocracy was defined by the aggregate actions and ambitions of its participants. The gradually ascendant, technocratic worldview regarding the potential of computerized management held by many within the dataocratic space was challenged by the messy reality of computers as they actually functioned in the postwar American state. Neither partisan nor ideological, dataocracy served as an umbrella for a set of attitudes regarding the place of technology in a rapidly-transforming American state. A catch-all for a concept neither fully understood nor adequately articulated at the time by those who inhabited it, mid-century dataocracy encompassed computing hardware and the software and peripherals designed to interact with it, the administrative and physical infrastructure established to support computing endeavors in government, the personnel (engineers, salesmen, systems analysts, professional computer operators, and clerical inputters of information) who interacted with information technologies on a daily basis, and the organizational procedures and behaviors that sprang up around computers as they embedded themselves into the distinctive hierarchies of federal agencies. Computers were not restricted to government offices, of course. What differentiates dataocracy from contemporaneous run-of-the-mill computer operations for business or research functions in the private sector is the explicitly state-centered element of its mission, the notion that government computing contributed to a larger, enduring, shared purpose (while simultaneously operating under the constraints implied by a public administration setting). Most crucially, dataocracy as a framework includes the associated attitudes about the computer projected by government workers, contractors, and general citizens who encountered the devices in the course of interacting with the state. A mindset as well as a processes, dataocracy incorporates the intellectual context in which attitudes around the relationship of the computer to the state percolated.

Technocratic Planning and Narratives of Continuity

This was not the first time in American history that those in power in the federal government had been seized with a fascination in harnessing information technologies to make the operations of the state more efficient, more transparent, more responsive, or more functional. Nor was it the first instance when an awareness percolated among the broader American public that the agencies of the national government might make use of new technologies to govern in fundamentally different fashion. The so-called "Progressive Era" at the opening decades of the twentieth century saw ambitious reformers schooled in scientific principles of management and armed with credential of professional expertise descend on citadels of governance determined to reform the American state within.[11] Gathering statistics related to industrial workplace conditions, public health, and the criminal courts, experts and engineers sought to quantify the

[11] For more on the general era, see John Whiteclay Chambers, *The Tyranny of Change: America in the Progressive Era, 1890-1920 (*New Brunswick, NJ: Rutgers University Press, 2000); Samuel P Hays, "The politics of reform in municipal government in the progressive era." *The Pacific Northwest Quarterly* 55, no. 4 (1964): 157-169; Robert H. Wiebe, *The Search for Order* (New York, hill and Wang, 1967). Regarding the era's impulse for technological management, see JoAnne Yates, *Control through Communication: The Rise of System in American Management* (Baltimore: Johns Hopkins University Press, 1989); Daniel Nelson, *A Mental Revolution: Scientific Management since Taylor* (Columbus: Ohio State University Press, 1992); David Demeritt, "Scientific forest conservation and the statistical picturing of nature's limits in the Progressive-era United States." *Environment and Planning D: Society and Space* 19, no. 4 (2001): 431-459; Jennifer Karns Alexander, *The Mantra of Efficiency: From Water Wheel to Social Control* (Baltimore: Johns Hopkins University Press, 2008); Judith A. Merkle, *Management and Ideology: The Legacy of the International Scientific Management Movement* (Berkeley: University of California Press, 1980); Kathryn W. Kemp, "The Dictograph Hears All: An Example of Surveillance Technology in the Progressive Era," *The Journal of the Gilded Age and Progressive Era*, vol. 6, issue 4 (2006), p. 409-430; Hindy Lauer Schachter, "The Two Faces of Progressive-Era Professions," *Administrative Theory and Praxis*, Dec. 2014, vol. 36, issue 4, p. 489-509; Robert H. Wiebe, *Businessmen and Reform: A Study of the Progressive Movement* (Cambridge, MA: Harvard University Press, 1962). On the general theme of scientific expertise and Progressive Era state building, see David M. Hart, *Forged Consensus: Science, Technology, and Economic Policy in the United States, 1921-1953* (Princeton: Princeton University Press, 2010).

parameters of urban life and state governance – much as efficiency expert Frederick W. Taylor might feed stopwatch observations of assembly line workers into his principles of scientific management. [12]

In Thorstein Veblen's collection of essays "The Engineers and the Price System," written between 1919 and 1921, the eminent sociologist, and contemporary of engineer Taylor, sought to alleviate the dilemma of profit-motivated business owners directing the course of industrial society solely for their benefit by proposing professional engineers.[13] Veblen's technocratic epiphany held that engineers – professional, expert, and attuned to the complex innerworkings of industrial production – would be better suited to direct the economic and social policies of a nation as they could properly harness the application of technology to benefit the general welfare of society.[14] His attitudes might not be out-of-place in 2012 where would-be technologist disruptors routinely asserted their sharing economy apps should bypass oversight by the regulatory state. In the 1950s, 1960s, and 1970s, a descendant generation of attitudes would

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[12] For more on these statistical and technological interventions, see Martha Banta, *Taylored Lives: Narrative Productions in the Age of Taylor, Veblen, and For*d (Chicago: University of Chicago Press, 1993); Samuel Haber, *Efficiency and Uplift: Scientific Management in the Progressive Era, 1890-1920*, 1964 (Chicago: University of Chicago Press, 1973); Layton, Edwin T. Jr., "Measuring the Unmeasureable: Scientific Management and Reform," chap. 6 in *The Revolt of the Engineers,* 1971 (Baltimore: Johns Hopkins 1986). For a dissenting view that argues Taylorist principles of scientific management were not as commonly used as business and technologies historiographies traditionally suggest, see Richard K. Fleishman, "Completing the triangle: Taylorism and the paradigms." Accounting, Auditing & Accountability Journal 13, no. 5 (2000): 597-624.

[13] Thorstein Veblen, *The Engineers and the Price System* (New York: B. W. Huebsch, 1921). For historical context see William Akin, *Technocracy and the American Dream* (Berkeley: University of California Press, 1977).

[14] For more on the nineteenth-century origins of institution-based drives for engineering efficiency, see Samuel Harber, *Efficiency and Uplift: Scientific Management in the Progressive Era, 1890-1920* (Chicago: University of Chicago Press, 1964).

elevate systems analysts and those who could frame computing solutions to complex social problems to positions of real influence in the generation and implementation of policy.

The situation was not unprecedented. By the 1920s, emboldened by wartime technocratic mobilization, clusters of like-minded social scientists and engineers were joined by practitioners of the young profession of business administration in an ambitious, scientific agenda of centralizing, rationalizing, and restructuring government relations with the economic sphere.[15] The first peacetime efforts at macroeconomic planning in the United States, commissioned by Commerce Secretary Herbert Hoover, drew materially from copious gathering of statistics and personnel-wise from the research professionals of new think tanks and business schools. The ideal technocratic solutions embraced by this movement exhibited "a tendency to depoliticize authority, to remove political issues from political processes, and to encourage the determination of public policy within the administrative precincts of technocratic and managerial elites."[16] In appeals that neutral authority and administrative expertise, divorced from personal political interest, should guide policy formulation, Progressive Era central planners articulated a core of the philosophy that would motivate agents of technocracy four decades later – that advanced technological practices, exercised under the guidance of highly trained specialists, could arrive at optimal policy solutions externalized through an unimpeachable neutral party.

Herbert Hoover's colleagues had a metaphorical black box of scientific rationalism. The technocrats of the mainframe era had literal metal boxes into which they fed numbers, instructions, punch cards, aspirations, and agendas, with the hope that the results could shape policy in preferred fashion. In this regard, the interconnections between government function and

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[15] Guy Alchon, *The Invisible Hand of Planning: Capitalism, Social Science, and the State in the 1920s* (Princeton: Princeton University Press, 1985).

[16] Ibid, 171.

technological implement that marked the era of mainframe computing may be seen as a continuity with earlier periods of institutional reform centered on making the operations of the state more “modern” and “efficient.” And yet, something is distinctive about the language, action, and attitude of government computer users in the post-World War II era, an element that distinguishes the way the computer interacted with the broader setting of government, rendering the age of dataocracy more than mere continuity of earlier, Progressive Era impulses to engineer forms of central planning.

A second structural and intellectual progenitor of dataocratic governance would manifest during the administration of Herbert Hoover’s presidential successor, Franklin D. Roosevelt. [17] The expansion of the federal state under the New Deal, even if enacted at times in an improvisational or haphazard fashion, proved a transformative condition for the capacity and scope of national government in the United States. Streams of technocratically-inclined planners, economists, and civil servants pressed the boundaries of what the regulatory state could legitimately claim to oversee and coordinate during the national crisis of the Depression, establishing in the process for a robust, expansive, and openly active bureaucratic apparatus that would endure through the crisis of the Second World War and the subsequent stand off the Cold War. No more the submerged entity operating out of sight that had marked much of its

[17] For more on the emergence of the New Deal state, see Theda Skocpol and Kenneth Finegold, “State Capacity and Economic Intervention in the Early New Deal,” *Political Science Quarterly*, vol. 97, no. 2 (Summer 1982): 255-278; Alan Brinkley, “The New Deal and the Idea of the State,” from Steve Fraser and Gary Gerstle, eds., *The Rise and Fall of the New Deal Order, 1930-1980* (Princeton: Princeton University Press, 1989), 85-12; and William Leuchtenberg, *Franklin D. Roosevelt and the New Deal, 1932-1940* (New York: Harper & Row, 1963). For more on the legacy of the New Deal state as administrative apparatus, see Eva Bertram, *The Workfare State: Public Assistance Politics from the New Deal to the New Democrats* (Philadelphia: University of Pennsylvania Press, 2015). For more on technology as an expression of New Deal state exercise of power, see Sarah T. Phillips, *This Land, This Nation: Conservation, Rural America, and the New Deal* (Cambridge: Cambridge University Press, 2007). For a cultural analysis of the idea of New Deal era “big state” growth, see Michael Szalay, *New Deal Modernism: American Literature and the Invention of the Welfare State* (Durham, NC: Duke University Press, 2000).

nineteenth century existence, the New Deal state expressed its ambitions to tackle complex social issues, regulate the economic sector, and confront national crises with direct governmental action. Institutionalizing via an ever-growing array of government bureaus and agencies the intellectual exercises in planning practiced by Progressive Era technocrats, New Deal state-building permitted a sufficient growth in the administrative capacity of the federal government to provide a fertile base from which dataocracy might bloom. The political and ideological imperatives of the Depression era for the Roosevelt government to respond to popular calls for economic security (such as the problem of crushing poverty among elderly Americans) manifested in enduring institutional entities with the personnel, budgetary wherewithal, and political base to sustain their existence beyond the point of crisis (such as the Social Security Administration). The expansion of administrative federal capacity during Depression and War provided both an organizational platform conducive to the sorts of elaborate planning exercises associated with early computing and a sense of mission among earnest government employees that their agency mandates called for expansion of government into previously unaddressed realms of collective social concern. Planning a response to immediate crisis became, with the infrastructure of an expanded New Deal state, planning for the potential of government to transform broader American society.

Given these prior influences, what, then, sets dataocracy apart from a longer tradition of technocratic planning in the United States? What differentiates the era of centralized mainframe computing from prior decades' flings with applying technologically astute managerial capitalism to questions of economic and social policy? Should the post-World War II period of electronic computers in government be viewed as anything more than a slightly more expensive means of engaging in the same planning activities that marked the 1910s, 1920s, and 1930s?

Though the era of dataocracy drew its staying power in part from a legacy of continuity as inheritor of a longer tradition of technocratic planning, the few decades following World War II can also be seen as an inflection point in which discernable change does occur. While building in particular off of Progressive Era ambitions of harnessing engineering mindset and tools to the complex agendas of governing, the mainframe decades saw three noteworthy differences in the ways in which technology, administrative management, and government policy regime intersected. First, unlike previous instances of technocratic planning where efforts to harness scientifically-adjacent methods of administration were limited in their scope, computing under dataocracy was widely dispersed and used for purposes other than formal planning. Even as postwar computers ran simulations and models, aggregated administrative data, and structured processes of policy implementation along the lines of flow charts, computers throughout government agencies were increasingly used for scientific research, payroll calculations, inventory management, and routine administrative practices associated with the day-to-day running of agency operations. Thanks to widespread dissemination of the computer as a tool for tasks beyond policy planning, computing practices embedded themselves in the daily routine of agency life even as they reinforced the normalcy of employing computers and digital information systems for all manner of task.

Secondly, and related to the wide dispersal of dataocracy, postwar computers in government were widely accessed, used and observed regularly by individuals other than planners, engineers, and technologists. The elements of government computing that comprise midcentury dataocracy are distinctive from previous iterations of the “planning state” in part because of how pronounced, public, and widespread the discussion of government computerization was, inside and outside the corridors of power, in the decades following War II. Publicity materials released by federal agencies, the statements of elected officials, press coverage of computerization efforts, and highly visible restructurings of agency organizations and operations to accommodate increased computer usage implied government endorsement of the computer as a tool for management.[18] Computers in the service of federal agencies became both symbol and shorthand for tasks and attitudes far beyond the calculating tasks assigned to them; the ascendance of computers embodied a more general rise of expertise and scientifically-based decision making as government practice and ideal.

Finally, computers as tools of governance were a topic discussed openly, explicitly, and enthusiastically within a multitude of personal, professional, and popular culture contexts outside of government in the postwar years. Unlike previous modes of technocratic planning relegated to institutional files cabinets or historians’ notes, mainframe computer-assisted governance openly

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[18] One could extrapolate glowing statements about the adoption of the computer emanating from agency officials as a form of “government speech,” a category of constitutional/administrative law analysis in which the state itself may advance non-neutral expressions of preference. Though the framework has only been sparingly applied by legal scholars to government adoption of particular emergent technologies – as opposed to the state supporting competing technologies, or refraining from use of a particular technology as a matter of choice – a considerable body of literature explores the theory in a policy context, particularly in regards to abortion, labeling of agricultural goods intended for consumers, and – on the state level – the issuing of controversial sponsored license plates. On government speech and use of digital communications technologies by government, see Helen Norton and Danielle Keats Citron, "Government Speech 2.0," *Denver University Law Review* 87.4 (2010), 899-944. For more general treatments of the principle, see Steven H. Shiffrin, “Government Speech,” *UCLA Law Review* 27, no. 3 (1980), 565–655; Mark Yudof, *When Government Speaks: Politics, Law, and Government Expression in America* (Berkeley: University of California Press, 1983); Abner S. Greene, "Government Speech on Unsettled Issues," *Fordham Law Review* 69.5 (2001), 1667-1688; and Joseph Blocher, “Viewpoint Neutrality and Government Speech,” *Boston College Law Review* 52, no. 3 (2011), 695–767.

and visibly spanned decades, permeating not just government employees' understandings of their work, but popular culture perceptions in which use of advanced computing technology and fundamental government purpose intertwined. Enthusiasm for computers as avatars of societal progress spread widely across American culture in the decades following the Second World War in a way that mere promotion of new methods of planning in earlier decades never could. The 1950s and 1960s were the Atomic Age, the Jet Age, and the Space Age.[19] The same decades were also unquestionably the Mainframe Era. From novels by Kurt Vonnegut and Isaac Asimov to television episodes of the T*wilight Zone* to successful motion picture releases such as the 1957 Spencer Tracy-Katherine Hepburn comedy *The Desk Set*, American popular culture embraced the idea of the centralized, mainframe computer as a natural, if not inevitable, extension of large scale institutions. Governments, like corporations, should make use of digital computers for reasons of efficiency and modernity, even if such pieces of creative media never described to the general public precisely what computers did. Beyond their ubiquity, beyond their hidden influence on organizational protocols and behaviors, computers mattered to the narrative of American government in the 1950s, 1960s, and 1970s in part because those who evaluated, analyzed, and experienced the consequences of policymaking outcomes in the postwar era thought they mattered.

More crucially, many advocates of expanded government computing acknowledged the existence of a larger, government information management revolution – a sort of software of

[19] Walter J. Boyne, Donald S. Lopez, Anselm Franz, and National Air and Space Museum. *The Jet Age: Forty Years of Jet Aviation* (Washington: National Air and Space Museum, Smithsonian Institution Press, 1979); Margot A. Henriksen, *Dr. Strangelove's America: Society and Culture in the Atomic Age* (Berkeley: University of California Press, 1997). On general social attitudes to technology in the period context, see Jon Wiener, *How We Forgot the Cold War: A Historical Journey Across America* (Berkeley: University of California Press, 2012).

dataocracy – that went beyond the hardware devices labelled computers. For many officials immersed in setting, it was difficult to escape the conclusion that use of computers for government meant more than a machine; computing as process entailed innovation in defining and acquiring the right system for the task at hand, negotiated back-and-forths with private contractors who supplied equipment and trained users, new management techniques for integrating computer systems into agency workflow, and the introduction of a new cadre of specially-trained systems experts who both supervised the information technology management process but who also sought to rationalize and quantify the policymaking process.

It is precisely this status – one of basic continuity, but distinctive enough in application to provoke the impression of something original among contemporaries that makes the era of dataocracy so potent as a framework for situating the growth of the post-World War II American state. By exploring the ways in which adoption and use of emerging information technologies shaped development and implementation of policies by federal agencies in the decades following World War II, "Mainframing America" illuminates a largely untold operational narrative of postwar political development, one in which new perceptions of information management, organizational structure, and the nature of policy-relevant data challenge and complicate historical narratives of why the postwar federal state grew in the directions it did. State actors explicitly deployed newly emergent information technologies both to ease administrative burdens of executive agencies and to structure and analyze the data that informed policy formulation. Computers changed the very way in which policy makers thought about information and its role in devising policy; likewise, those tasked with executing policy assessed the instrumental power of information management differently in the era of the computer. Evolving ideological stances by elected officials, mobilization in the streets by political activists, and changing social attitudes in American homes and businesses may have contoured the landscape in which the postwar federal state operated, but those actual operations were increasingly processed via digital computer.

"Mainframing America" refutes a false assumption embedded in the Obama Administration's circa-2009 efforts to remake the federal bureaucracy through infusion of information technology: that the U.S. government for decades lagged the private sector in adopting and responding to innovations in computing and information management, stubbornly remaining in an analog cocoon of nineteenth-century clerks and paperwork while corporate best practices, communications media, and ordinary consumer habits embraced an increasingly digital world. Instead, computers in the federal government were a constant, subtly important presence for decades, not only remaking federal administrative process but shaping the growth of the information society itself. More compelling is a state-centered history of the computer obscured in traditional narratives of both technological innovation and government action: government agencies did not just create the computer through their patronage, but actively shaped the emergence of an information technology-infused society by actively using the computer as a tool of assessment and implementation across a range of domestic policies from the 1950s onward. Silicon Valley may be twenty-first century America's paragon for how institutions ought to interact with advanced technologies, but for the first four decades of the computer revolution in the United States, Washington, DC, arguably shaped the contours of information technology more so than any technology firm.

Technological and Political Frameworks

In July of 1945, in the pages of *The Atlantic*, Vannevar Bush, director of the Office of Scientific Research and Development, penned an essay the magazine's editor likened to Ralph Waldo Emerson's influential 1837 address on "The American Scholar." Over the pages of "As We May Think," Bush, who had overseen the early development of the atomic bomb and would go on to shape the founding of the National Science Foundation, outlined a vision of postwar American society that encapsulated the ethos that would drive attitudes of dataocracy over the next three decades. Bush's essay presages postwar governmental dataocracy both in content and aspiration. A sort of microcosm of the emergent information society, Bush's essay concludes that advances in materials science, mathematical formulation, and administrative practice might revolutionize the sort of cluttered, complex record-keeping undertaken by libraries, scientific institutions, and government bureaus – through the use of machines.

Vast stores of knowledge were inaccessible to scientists – and planners – because it was impractical to collect and collate them into readily accessible format. Yet innovations in manufacturing and engineering yielded streams of labor-saving machines. If the latter solution could be applied to the former problem, Bush concluded, previously impractical information streams could duplicated, indexed, and interconnected.[20] More importantly, once assembled and made inter-relatable, individual elements of such a collection of knowledge could be searched and sorted under principles of mechanization designed to emulate human logic. Relay circuits might be engineered to respond to principles of formal logic, with the "turn of a crank" generating "conclusion after conclusion, all in accordance with logical law, and with no more slips than would be expected of a keyboard adding machine." Bush took as a given that such

[20] Bush termed this encyclopedia-like associative index of knowledge a "memex."

devices would leap from scientific curiosities to valid tools of public life: “There will always be plenty of things to compute in the detailed affairs of millions of people doing complicated things.”[21]

The emergence of dataocracy as a central component of the post-World War II administrative state loosely traces the path evidenced by Bush’s essay: affiliates of the federal government seek technological solutions for complex social problems by envisioning new regimes for managing complex pools of information, informed by the assumption that more complex and discrete data will lead to better governing decisions, and that refined and modern techniques of administrative management will make feasible the use of this influx of information. Embracing digital tools of information management they come to know through professional and social networks, government officials join with private sector technologists and research scientists in defining the parameters for what digital computers should be expected to do. Those computers are installed within federal agencies and rapidly become integral components of the routine organizational identity of said offices. Guided by an ambition to incorporate modern technologies and managerial practices into the pursuit of more robust policy development and administration practice, government officials in the era of dataocracy open their organizations to unexpectedly transformative organizational elements, partly remaking their agencies in the image of the computer.

Three broad bodies of academic literature converge in the reframed narrative presented by “Mainframing America.” The first is the history of technology, particularly the subset of

[21] Vannevar Bush, “As We May Think,” *The Atlantic Monthly* (July 1945), 105.

computing technologies.[22] More than an account of pushing buttons or pulling levers, the craft of history of technology places into broad social, environmental, and intellectual context the ways in which mankind devises and utilizes tools and mechanical processes to shape the surrounding world.[23] In regards to broader historiographic questions on the agency of technology – how deterministic are particular technologies on the conditions resulting from their usage, how socially-determined is the reception of a particular technology, how embedded is a technological transformation in either the context of its introduction or timeless principles scientific innovation – this project stakes a middle ground. The rapid spread of the computer within the federal government in the postwar period – and the parallel ascendance of dataocracy – can be seen as innovation adapting to social context, the motivations of multiple actors intermingling to drive technological adoption.[24] Once accepted and integrated into the organizational infrastructure of particular governmental agencies, though mainframe computers exercise no specific agency of their own, they do emanate a degree of cultural weight that makes certain outcomes – namely increased use of computers – path dependent. The history of technology as a field encompasses a rich tradition of exploring co-evolution of new technological practices and the modern nation-state. [25]

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[22] On the general history of technology, see George Basalla, *The Evolution of Technology* (Cambridge: Cambridge University Press, 1988); for more on the general history of technology in U.S. history, see Alan I. Marcus and Howard P. Segal, *Technology in America: A Brief History* (New York: Harcourt Brace Jovanovich, 1989).

[23] Thomas P. Hughes, *Human-Built World: How to Think about Technology and Culture* (Chicago: University of Chicago Press, 2004).

[24] For a model of this, see W. Bernard Carlson, *Innovation as a Social Process: Elihu Thomson and the Rise of General Electric* (Cambridge: Cambridge University Press, 2003).

[25] For a more traditional economic narrative, see Fred Block and Matthew R. Keller, eds., *State of Innovation: The US Government's Role in Technology Development* (Boulder, CO: Paradigm, 2011) and Sylvia K. Kraemer, *Science and Technology Policy in the United States: Open Systems in Action* (New Brunswick, NJ: Rutgers University Press, 2006).

On the technological front, the mainframe computer and practices associated with its adoption muscled their way into American corporations and universities, driving a narrative of "cities of knowledge," the rise of a post-industrial, information economy in which attention was paid to the firms, metropolitan areas, and non-state entity actors who harnessed federal dollars to advance technological research and fuel the rise of the "tech sector."[26] The argument of "Mainframing America" embraces this narrative, but refocuses emphasis on the federal state aspect of the equation, framing Washington itself as a "city of knowledge" central to the development of the computer. Washington, DC, as a physical location plays an outsized role in the narrative of the ideas underlying the spread of federal computing -- as seat of government policy design, as font of government contracting dollars, and as locus of the networks of federal employees needed to transmit amongst themselves a growing enthusiasm for the potential of the computer as a tool for governance. Though dataocracy was not confined to the District, its earliest incarnations sprouted along the banks of the Potomac, circulating among the military, scientific research, and eventually civilian policy communities that intersect as a result of the

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[26] On the intersection of municipalities, local business elements, and research universities in the promotion of information-technology clusters of knowledge, see Margaret O'Mara, *Cities of Knowledge: Cold War Science and the Search for the Next Silicon Valley* (Princeton: Princeton University Press, 2005); Elizabeth Tandy Shermer, *Sunbelt Capitalism: Phoenix and the Transformation of American Politics* (Philadelphia: University of Pennsylvania Press, 2013); Lily Geismer, *Don't Blame Us: Suburban Liberals and the Transformation of the Democratic Party* (Princeton: Princeton University Press, 2014). On research universities and private firms as recipients of federal research dollars in computing-adjacent areas, see Atsushi Akera, *Calculating a Natural World: Scientists, Engineers, and Computers during the Rise of US Cold War Research* (Cambridge, MA: MIT Press, 2008); William Aspray and Bernard O. Williams, "Arming American Scientists: NSF and the Provision of Scientific Computing Facilities for Universities, 1950-1973." *Annals of the History of Computing* 16(4) (1994), 60-74; Stuart W. Leslie, *The Cold War and American Science: The Military-Industrial-Academic Complex at MIT and Stanford* (New York: Columbia University Press, 1993).

spread of the Cold War state.[27] In the modern United States, even the federal government's official examinations of U.S. historical development acknowledge this interplay of state and technology – particularly the federal government's promotion through official and unofficial channels of emergent technological practices – in the nation's economic and social development.[28]

The present history of computing literature does not entirely ignore the presence of the federal state in its narrative of incremental technological transition, from vacuum tubes to microprocessors, mainframes to mobile smartphones, hardware to software.[29] The state is a recurrent player, commissioning firms to design and deliver multi-million-dollar computer installations; the reasons for these contracts are only fleetingly explored, however, and most of

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[27] For more on the intellectual context of postwar Washington and its social networks, see Daniel Bell, *The End of Ideology* (New York : Free Press, 1965); Lane, Julie B., "From Cab Rides to the Cold War," *Journalism History* 36, no. 1 (Spring 2010): 2-12; John Fousek, *To Lead the Free World: American Nationalism and the Cultural Roots of the Cold War* (Chapel Hill : University of North Carolina Press, 2000); Robert Booth Fowler, *Believing Skeptics: American Political Intellectuals, 1945-1964* (Westport, CT: Greenwood Press, 1978);); Richard H. Pells, *The Liberal Mind in a Conservative Age: American Intellectuals in the 1940s & 1950s* (New York: Harper and Row, 1985); David Michael Weinstein, "Live from the Nation's Capital: A History of Television in Washington, D.C., 1946-1958," University of Maryland, College Park dissertation, 1997.

[28] The practice is as old as the Founding Fathers. Both Thomas Jefferson in his *Notes on the States of Virginia* (1785) and Alexander Hamilton in his *Report on the Subject of Manufactures* (1791) include sections on technological advancement in the context of civic development. For twentieth-century examples of government-sponsored reports on the topic, see United States National Commission on Technology, Automation, and Economic Progress, *Technology and the American Economy* (Washington: U.S. Government Printing Office, 1966); Office of Technology Assessment, *Technology and the American Economic Transition: Choices for the Future* (Washington, DC: U.S. Government Printing Office, 1988).

[29] On general history of computing, see Martin Campbell-Kelly and William Aspray, *Computer: A History of the Information Machine,* 3rd Edition (New York: Westview, 2013); Martin Campbell-Kelly and Daniel D. Garcia-Swartz. *From Mainframes to Smartphones: A History of the International Computer Industry (*Cambridge, MA: Harvard University Press, 2015); Michael S. Mahoney, *Histories of Computing,* Tom Haigh, ed. (Cambridge, MA: Harvard University Press, 2011).

the body of computer history research explores the design, manufacture, and instrumental innerworkings of computers from the perspective of the firms and technologists who sold them.[30] These narratives almost circumnavigate the contribution of government as institution though, focusing on the contributions of private sector figures in the act of "structuring the information age," as one prominent scholar frames it.[31]

Even computing histories that frame the emergence of the digital age in an explicitly political context do so through a largely non-state perspective, tracing back the rise of personal computing to West Coast counterculture and social movement-inspired opposition to institutional government.[32] This framework prioritizes innovation in computing as the product of rebellious acts against centralized authority without interrogating the nature of the existing "computing power" against which would-be hackers are revolting.[33]

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[30] Some works that do address the state in more expansive fashion (in an American context) include Kenneth Flamm, *Creating the Computer: Government, Industry and High Technology* (Washington: Brookings Institution, 1988); Mina Rees, "The Computing Program of the Office of Naval Research, 1946-1953," *Annals of the History of Computing* 4 #2 (1982), 102-120; reprinted in *Communications of the ACM*30 #10, (October 1987), 832 – 848; Arthur L. Norberg and Judy E. O'Neill, *Transforming Computer Technology: Information Processing for the Pentagon, 1962-1986* (Baltimore: Johns Hopkins University Press, 1996).

[31] JoAnne Yates, *Structuring the Information Age: Life Insurance and Technology in the Twentieth Century* (Baltimore: Johns Hopkins University Press, 2005); Arthur L. Norberg, *computers and Commerce: A Study of Technology and Management at Eckert-Mauchley Computer Company, Engineering Research Associates, and Remington Rand, 1946-1957* (Cambridge, MA: MIT Press, 2005);

[32] Fred Turner, *From Counterculture to Cyberculture: Stewart Brand, the Whole Earth Network, and the Rise of Digital Utopianism* (Chicago: University of Chicago Press, 2006); John Markoff, *What the Dormouse Said: How the Sixties Counterculture Shaped the Personal Computer Industry* (New York Penguin, 2005). These histories serve as an influence for present-day calls to further democratize the digital realm, such as Astra Taylor's *The People's Platform: Taking Back Power and Culture in the Digital Age* (New York: Picador, 2015).

[33] Steven Levy, *Hackers: Heroes of the Computer Revolution* (New York: Anchor Press/Doubleday, 1984).

"Mainframing America" re-centers the history of postwar computing development on the federal government as a buyer and user of elaborate computer installations. [34] Private firms and non-state actors continue to play extensive roles, but now the story of computers in the federal government in the postwar era centers on a history of networks, crisscrossing intersections state adjacent actors and organizations interacting within a particular intellectual framework focused on questions of how computing might be applied within a government context.[35] "Mainframing America" argues that U.S. federal agencies served as nodes both structuring and defining the initial growth of the earliest American computing networks, defining the purposes to which computing in its earliest stages was applied, financing the development and spread of computing installations, and normalizing reception of electronic computers as essential elements of large-scale, postwar organizations. It was out of structures engendered by the United States government – sometimes formally, frequently as a result of iterative stages of ad hoc decisions

[34] Though no American historians have taken this approach to date, a British scholar, Jon Agar, touches on this theme in his account of information processing by the British Civil Service, *The Government Machine: A Revolutionary History of the Computer* (Cambridge, MA: MIT Press, 2003).

[35] This framework develops upon, and is extensively indebted to, a robust historiography of technological, organizational, and idea-exchange networks. For more on elaborate technological networks, see Thomas P. Hughes, *Rescuing Prometheus: Four Monumental Projects that Changed the Modern World* (New York: Pantheon, 1998); a more recent work on the theme is Andrew L. Russell, *Open Standards and the Digital Age: History, Ideology, Networks* (New York: Cambridge University Press, 2014). Scholar of communications Richard John explores the interplay of institutional structures and technological network construction in two seminal volumes, *Spreading the News: The American Postal System from Franklin to Morse* (Cambridge, MA: Harvard University Press, 1995) and *Network Nation: Inventing American Telecommunications* (Cambridge, MA: Belknap Press of Harvard University Press, 2010). More recent popular press authors of technology and American society have traced the intellectual networks that shape emergence of socio-technological networks, such as Walter Isaacson, *Steve Jobs* (New York: Simon & Schuster, 2011) and *The Innovators: How a Group of Inventors, Hackers, Geniuses, and Geeks Created the Digital Revolution* (New York: Simon & Schuster, 2014). These works contribute to a broader discourse in which I center my contribution: the ways in which institutional and organizational frameworks provided the latticework upon which dataocracy became successfully embedded within the postwar federal government.

resulting from daily use of the computer in federal agencies – that emerged the pools of expert technological talent, the funding for research into better hardware and software, and the impetus to apply computing power to ambitious tasks. The great digital cloud that embodies the early twenty-first century era of mobile computing ironically hearkens back to the centralized mainframe and terminal model developed in the 1950s and 1960s, as well as new modes of information access (time-sharing, distributed computing) researched under government aegis in search of solutions to the needs of government data processors frustrated by the limitations of performing single tasks at a time in batches.[36]

Examining the computer, a technological artifact, in the context of postwar American politics means addressing a body of literature that explores whether technological objects themselves have politics.[37] As inanimate objects – inert hunks of copper and chrome hulking in specially designed chilled rooms – mainframe computers of the 1950s, '60s, and '70s exerted no direct agency, engaged in no self-derived promotions determining the fates of human actors. Yet, as components of larger technological systems (comprising machines, persons, and organizational structures), computers could have very tangible influence on the daily operations of a given federal office – and thus indirectly shape in a multitude of ways the policies that

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[36] Tung-Hui Hu, *A Prehistory of the Cloud* (Cambridge, MA: MIT Press, 2015).

[37] Langdon Winner, "Do Artifacts Have Politics?" *Daedalus* (1980): 121-136; David J. Hess, *Science and Technology in a Multicultural World: The Cultural Politics of Facts and Artifacts* (New York: Columbia University Press, 1995); Steven Lubar, "Machine Politics: The Political Construction of Technological Artifacts," *History from Things: Essays on Material Culture,* Steven Lubar and W. David Kingery, eds. (Washington: Smithsonian Press, 1993): 197-214; This topic is addressed directly in computing history in Bayta Friedman and Helen Nissenbaum, "Bias in Computer Systems," *ACM Transactions on Information Systems*, vol. 14, no. 3, July 1996, p. 330-347.

emerged from that system.[38] Computers mattered to the outcomes of postwar federal policymaking because human actors – technologists, policymakers, adminstrators – successfully embedded them in the routine processes by which policy was defined and the data used to analyze those policies were collected and manipulated.[39] Under the dataocratic model, computers exerted influence – at times significant – on the operations and modern identities of certain federal bureaus and agencies not because computing technology itself was deterministic, but because organizational practices adopted by government officials seeking more efficient or responsive administrative techniques proved remarkably conducive to propagating the vision of the computer as an essential tool of technocratic institutional management.[40] The presence and use of computer systems adopted by federal agencies in the years following World War II ended up influencing government organization, and thus the policy outcomes of those organizations, in unexpectedly expansive fashion after they had been deliberately introduced to have a more limited and defined purpose. In the narrative of "Mainframing America," the case of the Bureau of the Budget provides an example of this tendency. Originally a smallish executive agency focused on drafting annual budget proposals for the White House, by the early 1950s the bureau had adopted loftier ambitions, inspired in part by exposure to the early culture of Washington

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[38] This reflects a school of thought from the discipline of social studies of science known as "social construction," best outlined by the contributors to the Wiebe E. Bijker, Thomas P. Hughes, and Trevor Pinch edited volume, *The Social Construction of Technological Systems* (Cambridge, MA: MIT Press, 1987).

[39] Theoretical musings on how historians of technology might account for lived human experience in narratives of machine development include John M. Staudenmaier, *Technology's Storyteller's: Reweaving the Human Fabric* (Cambridge, MA: MIT Press, 1985) and Thomas J. Misa, "How Machines Make History, and How Historians (and Others) Help Them to Do So," *Science, Technology & Human Values* 13 (1988), 308-31.

[40] For more on the perils of technological determinism in the hands of historians, see Merritt Roe Smith and Leo Marx, *Does Technology Drive History? The Dilemma of Technological Determinism* (Cambridge, MA: MIT Press, 1994).

computing promotion. Budget officials in pursuit of more accurate statistics realized that control over sources and interpretation of budgetary data provided a route into more direct oversight of the task of organization; dictates on how information should be managed extrapolated into oversight into how organizations should be managed. Within two decades, the Bureau of the Budget had been transformed into the Office of Management and Budget, the two concepts linked by the understanding that control of statistical information conveyed bureaucratic authority.

Just as use of a technology encompasses more than a machine itself, understanding the place of computing historically and administratively in the context of American government entails dissecting a larger history of information.[41] The relatively young intellectual framework of "critical information studies" – an interdisciplinary hybrid of media studies, cultural studies, and political economy approaches to defining flows of information – provides a template for assessing the politics of information, particularly the "structures, functions, habits, norms, and practices" by which differing levels of control and power are exerted as pieces of information are transmitted.[42] In the context of postwar Washington dataocracy, an information studies approach

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[41] See Toni Weller, "An Information History Decade: A Review of the Literature and Concepts, 2000-2009," *Library and Information History*, vol. 26, iss. 1 (2010): 83-97; William Aspray, "The Many Histories of Information," *Information & Culture* 50, no. 1 (2015): 1-23. For a theoretical framing of information management in modern institutional context, see Stewart Whittemore, *Rhetorical Memory: A Study of Technical Communication and Information Management* (Chicago: University of Chicago Press, 2015). An excellent analysis of the ways government support of technological information flows shaped the early Republic can be found in Richard John, *Spreading the News: The American Postal System from Franklin to Morse* (Cambridge, MA: Harvard University Press, 1995).

[42] Media studies and legal scholar Siva Vaidhyanathan suggests that critical assessment of information's place in American society must, by the very nature of an "inchoate" subject, draw from disciplines as diverse as American studies, political science, library science, computer science, and anthropology (among others). See "Critical Information Studies: A Bibliographic Manifesto." *Cultural Studies* 20 (2/3; March/May 2006): 292–315.

accentuates the role of the computer within a larger system of data transfer and analysis, moving beyond computers as machines to examination of the quantity, quality, origins, destination, and content of the information processed through a computerized system. How information is regulated as it flows through systems administrative and technological has consequences for the content of the information that emerges; a critical information perspective acknowledges the institutional, commercial, legal, and human fingers that touch and transform information as it is processed and exchanged, raising questions of power, cost, access while suggesting that norms and cultural elements influence how informational content is altered and received within a system of information exchange.

Information likewise provides an invaluable framework for defining activities of the state. Anthropologist James C. Scott has traced in his widely cited volume *Seeing Like a State* how, since the emergence of modern nation states in the west in the sixteenth century, successful, self-institutionalizing national governments have sought to control information. Whether in form of mapping their frontiers, authorizing official grammars, or conducting censuses of their taxpayers and minorities, modern states have sought to manage the risk of the unknowable and retain their solvency by accumulating as much information as possible about their environment.[43] Early modern states became consummate aggregators of information in a dizzying array of forms.[44] Advanced communications (the telegraph and telephone) and transportation (the train, the airplane) technologies in the nineteenth and early twentieth centuries further extended the reach of the state into the task of gathering information at an accelerated rate. In the post-World

[43] James C. Scott, *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed* (New Haven: Yale University Press, 1999).

[44] Jacob Soll, *The Information Master: Jean-Baptiste Colbert's Secret State Intelligence System* (Ann Arbor: University of Michigan Press, 2009).

War II world, with the introduction of operations research and the staggering wealth of information unleashed by advances in data processing technology, successful states were compelled even further to pursue elaborate strategies of compiling information and incorporating some aspects of their findings into the policymaking process. The elaborate, automated recordkeeping strategies of earlier decades found a solution in the promise of the electronic computer. For much of the postwar period, seeing like a state meant seeing like a computer.

From governmental statutes fostering distribution of newspapers via federal post through backing the stringing of telegraph wires to legislating conditions favorable to the growth of telephone, radio, and television communications, the American state had from its earliest days been embedded in the structures promoting flows in technologically-abetted information.[45]

Beyond its technological context, “Mainframing America” engages with a second set of academic literature focusing on the politics and development of the American state. As a political history, it draws on a body of scholarship detailing the innerworkings and structures of governmental institutions that undergird political transformation over time.[46] Of particular concern is the question of organizational capacity – how did the American state come to do functionally what it did at various crucial moments? The increasing use of computer technologies by postwar government agencies proves to be an ideal example of technological

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[45] See Alfred D. Chandler and James W. Cortada, eds., *A Nation Transformed by Information: How Information Has Shaped the United States From Colonial Times to the Present* (Oxford: Oxford University Press, 2000); William Aspray and Barbara M. Hayes, *Everyday Information: The Evolution of Information Seeking in America* (Cambridge, MA: MIT Press, 2011).

[46] This school of thought, a hybrid of history and political science, often goes by the moniker of American Political Development. For more, see Karen Orren and Stephen Skowronek, *The Search for American Political Development*. New York: Cambridge University Press, 2004 and Mag Jacobs, William J. Novak, and Julian Zelizer, eds., *The Democratic Experiment* (Princeton: Princeton University Press, 2003).

innovations adopted in part because of the personal and professional motivations of bureaucratic officials interested in strengthening their organizational positions. I am influenced here by Stephen Skowronek's definition of "state building" as the process by which "government officials seeking to maintain power and legitimacy try to mold institutional capacities in response to an ever-changing environment."[47] As expensive, visually striking installations requiring on-going capital investment, operating budget allocations, and assignment of new and more expert employees, mainframe computers, irrespective of their actual purpose, automatically conferred techno-administrative heft on government offices that acquired them.

Egos and line items were not sole contributing factors, of course. As a tool of management, the electronic computer in the hands of ambitious postwar bureaucrats became a potent vehicle for expanding the capacity of the federal government. Since at least the late-nineteenth century, mid-level officials in American federal bureaus recognized they could further their administrative missions, resist political controls, and respond to external interest groups aligned with their departments' agendas by demonstrating policy innovation.[48] Bureaucratic autonomy – the ability to effectively provide the services or perform the functions an agency is mandated to do – arises from strong coalition networks backing the agency's actions and an unwillingness on the part of elected officials to challenge the efficacy of agency actions. From the late 1940s onward, electronic computers – seemingly neutral, expert machines associated with extensive and powerful coalitions promoting the use of information technologies for

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[47] Stephen Skowronek, *Building a New American State: The Expansion of National Administrative Capacities, 1877-1920* (Cambridge: Cambridge University Press, 1982), 10.

[48] Daniel Carpenter, *The Forging of Bureaucratic Autonomy: Networks, Reputations and Policy Innovation in Executive Agencies, 1862-1928* (Princeton: Princeton University Press, 2001).

governmental purposes – could provide cover of both autonomy and capacity for forward-thinking bureaucrats.

This framework runs parallel to, but is distinct from, more conventional postwar political narratives centered on competing ideological or partisan regimes, the interplay of social movements and elected officials over contentious issues of rights and regulation, or the malleable relationship between market and state.[49] Though the narrative of the computer involves political figures who hope to employ information technologies to pursue partisan or ideological policy agendas – as in Eisenhower's drive for budget efficiency through data processing or Johnson's agenda to electronically calculate potential expansions of social welfare programs – the growth of dataocracy does not fit neatly into a paradigm of electoral shifts or changing social orders. Dataocracy has been obscured in prior historical narratives of postwar federal state and

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[49] For narratives of the rising and falling fortunes of political ideologies as organizing principles, particularly the strange career of American liberalism, see Fraser, Steve and Gary Gerstle, eds., *The Rise and Fall of the New Deal Order, 1930-1980* (Princeton, NJ: Princeton University Press, 1989.); Alan Brinkley, *The End of Reform: New Deal Liberalism in Recession and War* (New York: Vintage, 1995); Gareth Davies, *From Opportunity to Entitlement: The Transformation and Decline of Great Society Liberalism* (Lawrence: University Press of Kansas, 1996); Theodore Lowi, *The End of Liberalism: Ideology, Policy, and the Crisis of Public Authority* (New York: Norton, 1969). Counterparts examining the alternating decline and ascendance of American conservatism include Kim Phillips-Fein, "Conservatism: A State of the Field" *Journal of American History* (December 2011) Vol. 98, No. 3, and *Invisible Hands: The Making of the Conservative Movement from the New Deal to Reagan* (New York: W.W. Norton, 2009); Paul P. Pierson and Theda Skocpol, eds, *The Transformation of American Politics: Activist Government and the Rise of Conservatism* (Princeton: Princeton University Press, 2007); Bruce J. Schulman and Julian E. Zelizer, eds., *Rightward Bound: Making America Conservative in the 1970s* (Cambridge: Harvard University Press, 2008); Alan Brinkley, "Conservatism as a Growing Field of Scholarship," *Journal of American History* (2011) 98 (3): 748-751; Donald T. Critchlow, *The Conservative Ascendancy: How the GOP Right Made Political History*. Cambridge: Harvard University Press, 2007; and Julian E. Zelizer, "Reflections: Rethinking the History of American Conservatism," *Reviews in American History*, June 2010, Vol. 38, No. 2. For more structural accounts of rights and political expansion, see Ira Katznelson, *When Affirmative Action was White: An Untold History of Racial Inequality in Twentieth-Century America* (New York: Norton, 2005) and *Fear Itself: The New Deal and the Origins of Our Time* (New York: Liveright, 2013).

technology precisely because it operated both out of sight and in parallel to more visible political and social trends.[50]

In the narrative of “Mainframing America,” this can be seen in the example of environmental policy-making in the 1970s and early 1980s, where relationships to regimes of environmental data, rather than traditional ideological alignments, dictated how interested parts would align on a case-by-case basis. Federal regulators, representatives of individual states, corporate interests, and environmental activists found themselves relating to one another based on their self-interested interpretations of technologically-gathered and mediated environmental data. Computer-analysis driven environmental policy meant that politically-motivated parties might find their particular interests in specific regulatory actions shaped by interpretations of collected or modeled data; whether an activist group or accused polluter accepted data findings for a particular case had as much to do with the politics of expertise, scientific authority, and data-driven government as it did with that organization’s partisan inclinations.

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[50] My research nestles nicely into a recent, growing body of literature from the fields of political science and institutional history that examines “submerged” or “hidden” mechanisms by which federal policies, institutions, and actions shape broader currents of American economy and society. Brian Balogh’s *A Government Out of Sight: The Mystery of National Authority in Nineteenth Century America* (New York: Cambridge University Press, 2010) offers a deep history of this tendency in the nineteenth century. Other relevant works include Jacob Hacker, *The Divided Welfare State: The Battle over Public and Private Social Benefits in the United States* (New York: Cambridge University Press, 2002); Suzanne Mettler, *The Submerged State: How Invisible Government Policies Undermine American Democracy* (Chicago: University of Chicago Press, 2011); Christopher Howard, *The Hidden Welfare State: Tax Expenditures and Social Policy in the United States* (Princeton: Princeton University Press, 1999); and Marie Gottschalk, *The Shadow Welfare State: Labor, Business, and the Politics of Health-care in the United States* (Ithaca: Cornell University Press, 2000). This emerging intellectual school derives in part from studies in the past two decades of hidden elements of the U.S. “carceral state,” such as Marie Gottschalk’s *The Prison and the Gallows: The Politics of Mass Incarceration in America* (Cambridge: Cambridge University Press, 2006).

The Organizational Management Framework

A final body of scholarship key to understanding the role of the computer in postwar American state and society centers on organization, administration, and management. Drawing from theories of public administration and business practice, such organizational histories explore enduring changes over time in the functioning and structure of large scale institutions.[51] While historians and sociologists have demonstrated that large-scale bureaucratic or institutional entities have historically incorporated elaborate information gathering apparatuses for centuries, the case of dataocracy provides an instance on unparalleled scale where private firms (computer manufacturers such as IBM, Honywell, or Sperry-Rand) and quasi-public entities (scientific labs at research universities who develop much of the actual technology advancing the state of computing) converge to reshape the organizational behaviors governmental offices around a particular technological phenomenon. Organizations matter as shapers of behavior of those who work within them and as institutional extensions of broader social and cultural currents.[52]

An innovative body of literature explores how computers remolded the corporate American workplace in the 1950s, 1960s, and 1970s, transforming office layouts, job titles and responsibilities, and the rhythms and training associated with ascending rungs on the corporate ladder.[53] The effect was no less dramatic in the public sector. Just as the narrative of dataocracy

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[51] An excellent starting point for this line of scholarly inquiry is Lou Galambos's organizational synthesis framework. See Galombos,"The Emerging Organizational Synthesis in Modern American History," *Business History Review*, 44 (Autumn 1970): 279-90; Galambos, "Technology, Political Economy, and Professionalization: Central Themes of the Organizational Synthesis," *Business History Review*, vol. 57, no. 4 (Winter 1983): 471-493; See also Brian Balogh, "Reorganizing the Organizational Synthesis: Federal-Professional Relations in Modem America," Studies in American Political Development, 5 (Spring 1991): 119-72.

[52] See Alan McKinlay, and Ken Starkey, eds. *Foucault, Management and Organization Theory: From Panopticon to Technologies of Self* (New York: Sage, 1998).

[53] See Nathan Ensmenger, *The Computer Boys Take Over: Computers, Programmers, and the Politics*

encompasses description of technological networks (transmitting calculated date in the service of varied policy agendas) and social networks (linkages informal and formal of individuals who transmit the ideas and customs associated with computing), it crucially also typifies networks of market transaction. Management practices adopted from private firms or arrived at through systems-focused training merged with the particular political environment in which agencies operated in almost syncretistic fashion, yielding something new: an administrative structure informed by scientific management, resembling corporate organizational order, but reflective of pre-existing political priorities and planning structures.[54] Given shifting, if not mutually reinforcing, power differentials between seller and client at various points in the computer design-purchase-installation-training-repair cycle, examination of dataocracy provides insight into a distinctive space in which the postwar state and market converge in shared purpose.[55]

Besides being embedded within organizational structures, the dataocratic elements of the postwar American state reflect a narrative of state-business firm relations that marked the postwar period.[56] Government computers were process-rooted tools acquired at great financial

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of Technical Expertise (Cambridge, Massachusetts: MIT Press, 2010); John Harwood, *The Interface: IBM and the Transformation of Corporate Design, 1945-1976* (Minneapolis: University of Minnesota Press, 2011).

[54] Joseph Litterer, "Systemic Management: The Search for Order and Integration." *Business History Review* 35 (1961): 461-476.

[55] Philip Scranton and Patrick Friedenson, *Reimagining Business History*. Baltimore: Johns Hopkins University Press, 2013.

[56] Kim Phillips-Fein and Julian E. Zelizer, eds., *What's Good for Business: Business and American Politics since World War II* (Oxford: Oxford University Press, 2012); Thomas K. McCraw, *American Business Since 1920: How It Worked*, 2nd Edition (New York: Wiley-Blackwell, 2008); Angus Burgin, *The Great Persuasion: Reinventing Free Markets Since the Depression* (Cambridge, MA: Harvard University Press, 2012); Stephen B. Adams, *Mr. Kaiser Goes to Washington: The Rise of a Government Entrepreneur (*Chapel Hill: University of North Carolina Press, 1997).

costs from private technology manufacturing firms via federal contracting protocols.[57] As the planet's largest purchaser of computer systems, the government drove the market, yet private firms (particularly giants like IBM) had considerable reciprocal influence – especially through training – once they had locked government clients into expensive contracts. Midcentury corporate culture – the supplier of information systems – and government culture – the client defining the system's ultimate purpose – reinforced one another, and the business transactions that linked them were themselves embedded in a larger postwar social context.[58]

The technological, political, and administrative histories of the postwar period converge on a topic central to the promulgation and functioning of dataocracy: expertise.[59] Computers in government service during this period were more than machines, or operable, discrete devices. Computing devices were both key instruments of, and embedded within, larger structures of information conceptualization and transmission – expert systems. "Mainframing America" explores the multiple meanings of expertise in governmental computing systems, tracing issues of authority, inter-organizational relations, and operational efficacy through debates over which

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[57] And though an example of British state-market technology connections, John Hendry's *Innovating for Failure: Government Policy and the Early British Computer Industry* (Cambridge, MA: MIT Press, 1990) provides insight into this tendency.

[58] Kenneth Lipartito, "Connecting the Cultural and Material in Business History," *Enterprise & Society*, December 2013, Vol. 14, No. 4: 686-704; Kim McQuaid, *Uneasy Partners: Big Business in American Politics, 1945-1990* (Baltimore: Johns Hopkins University Press, 1994); Kimberly Phillips-Fein and Julian E. Zelizer, eds. *What's Good For Business: Business and American Politics since World War II* (New York: Oxford University Press, 2012).

[59] For more on expertise, see Brian Balogh, *Chain Reaction: Expert Debate and Public Participation in American Commercial Nuclear Power, 1945-1975* (Cambridge: Cambridge University Press, 1991); Frank Fischer, *Democracy and Expertise: Reorienting Policy Inquiry* (Oxford: Oxford University Press, 2009); Clifford I. Nass, "Bureaucracy, Technical Expertise, and Professionals: A Weberian Approach." *Sociological Theory*, *4*(1) (1986): 61-70.

clusters of officials with specialized knowledge ought to oversee access to computers and interpretation of the results generated by information technologies. By the mid-1960s, a class of systems analysts – often not educated as technologists, but exposed to principles of computing management through government training or exposure to government computing installations – straddled the line between technological practitioner and manager, deriving their authority from arcane computer flow charts and their proximity to the computerized processes that enabled government workflows in a dataocracy.[60] America's computer experts, like its planners and policy formulators in other fields, proved a healthy export in the postwar decades. The embrace of the digital computer as a tool of management and policy simulation within the United States, particularly in the 1960s and 1970s, paralleled a broader push towards modernization and development globally.[61]

For the period of dataocracy, a key latticework defining and limiting the spread of government computing centered on the Cold War.[62] The earliest government commissioned

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[60] Atsushi Akera, "Engineers or Managers? The Systems Analysis of Electronic Data Processing in the Federal Bureaucracy." In *Systems, Experts and Computers*, Thomas Hughes and Agatha Hughes, eds. (Cambridge, MA: MIT Press, 2001); Thomas Haigh, "Inventing Information Systems: The Systems Men and the Computer, 1950-1968." *Business History Review* 75 (2001): 15-61.

[61] For a description of how American understandings of modernization were exported to the rest of the world in this period, see David Ekbladh, *The Great American Mission: Modernization and the Construction of an American World Order* (Princeton: Princeton University Press, 2011); Nicole Sackley, "Passage to Modernity: American Social Scientists, India, and the Pursuit of Development, 1945-1961," Princeton University dissertation, 2004.

[62] The seminal work on computing thought in its Cold War context remains Paul N. Edwards, *The Closed World: Computers and the Politics of Discourse in Cold War America* (Cambridge, MA: MIT Press, 1997). See also Paul Erickson, Judy L. Klein, Lorraine Daston, Rebecca Lemov, Thomas Sturm, and Michael D. Gordin, *How Reason Almost Lost its Mind: The Strange Career of Cold War Rationality* (Chicago: University of Chicago Press, 2013). For a general framing of the Cold War, see the three volumes edited by Melvyn P. Leffler and Odd Arne Westad, *The Cambridge History of the Cold War* (Cambridge: Cambridge University Press, 2012). For a single volume on the geopolitical context of the Cold Waar, see Melvin P. Leffler, *For the Soul of Mankind: The United States, The*

digital computers were products of the national security state, and Defense Department employees and contractors were integral members of the informal social networks that promoted enthusiasm for computing within the federal government and facilitated the transferal of systems knowledge from the Pentagon to civilian agencies. Prominent think tanks that articulated the language of cybernetic expertise and justified in contexts of national security and economic efficiency increased embrace of government computing techniques were frequently, as in the case of the RAND and MITRE Corporations, step-children of the military industrial complex.[63]

"Mainframing America" addresses a glaring gap in the literature by building on this narrative to trace the evolution of computing thought beyond its military complex origins into an array of domestic policy areas. Here, in halls of power that operated in a manner decidedly differently than the Pentagon, embrace of systems thought and computerized oversight practices for purposes of policy formulation and implementation took on a decidedly different cast. Though still hierarchical and couched in flow-chart language familiar to systems planners in the Pentagon, the computer promoting bureaucrats of policy categories as diverse as housing, social insurance, and budget reconciliation framed their understandings of information flows, sources of data, and accessibility of processed information by citizens in very different ways than their counterparts in uniform. Civilian governmental computing the 1950s, 1960s, and 1970s remains an under-examined point of entry into the larger postwar administrative policy apparatus;

Soviet Union, and the Cold War (New York: Hill and Wang, 2008) or Robert J. McMahon, *The Cold War: A Very Short Introduction* (Oxford: Oxford University Press, 2003).

[63] For more on RAND, see Willis H. Ware, *RAND and the Information Evolution: A History in Essays and Vignettes* (Santa Monica: RAND Corp., 2008); Martin J. Collins, *Cold War Laboratory: RAND, The Air Force, and the American State, 1945-1950* (Washington: Smithsonian Institution Press, 2002); RAND Corporation, *The Rand Corporation: The First Fifteen Years* (Santa Monica, RAND Corporation, 1963); Alex Arbella, *Soldiers of Reason:The RAND Corporation and the Rise of the American Empire* (Orlando: Harcourt, 2008).

unshackled from national security constraints (albeit granted greater budgetary constraints), civilian computing specialists and their allies in domestic policy agencies went about the task of converting the computer from a reactive machine to an implement of policy projection. The grand ambitions of political actors in postwar decades – remaking the scope of the American state, transforming the relationship of state and market, directly confronting the nation's most complex social woes – matched any of the elaborate defense networks envisioned by the military fathers of the computer while stepping beyond. Unlike closed systems for national security, domestic computer networks embraced a vision of government that fostered linkages among governmental agencies and between state and citizen. Just as "information" might mean something very different in a national security context, the notion of an "information system" in the domestic policy realm came to embody an outward-facing approach to governance. Computer systems in the Pentagon were designed as responses or deterrents to particular threats; in the domestic policy agencies, they became expansive projections of a transformed understanding of the relationship of information to the policy process.

Organization of the Project

"Mainframing America" is organized into chapters that proceed chronologically and thematically from the late 1940s through the early 1980s. Individual chapters focus on the experiences with information technologies of specific, representative federal agencies during this period as well as the relation of broader categories of public policy debate to an administrative shaped by changing understandings of technology and information management. Though chapters vary in the scale of time covered, each intermingles narratives of the introduction or application of particular computing technologies within a federal agency and broader discussion of the organizational and policy contexts in which that agency operated. The rhetoric of computing as understood within the policy sphere of that specific agency is examined, and examples trace through the experiences of representative political actors – usually, but not exclusively federal employees –- the nature of interactions with computer systems and information managements practices within government agencies .

The first chapter explores both the setting for the broader professional, intellectual, and policy networks of postwar Washington, DC, and the earliest domestic policy sphere shaped by an emerging dataocracy – the federal budget – where new conceptualizations of "information" began to transform how executive agency bureaus related to one another, their organizational mission, and the functional operations of policy production and analysis. A narrative of emergent social networks fostered in part by shared proximity to technological networks, "The Machine in the Grey Flannel Suit: The Bureau of the Budget, the Congressional Budget Office, and the Rise of Information as Policy," traces the dissemination of computing principles in the late 1940s and 1950s from the Pentagon's military and scientific communities to broader civilian policymaking audiences. Key actors in this narrative include officials from the Bureau of the Budget, such as Eisenhower-era director Maurice Stans, who identified in the 1950s new methods by which computer technologies might be employed in "making management manageable."[64] By the mid-1960s, this ideal had percolated throughout civilian federal agencies through the influence of Secretary of Defense Robert S. MacNamara, an avid promoter of systems analysis and computerized management; the chapter details how his "Planning, Programming, and Budgeting Systems" protocols, endorsed by President Lyndon Johnson and replicated throughout federal

[64] Maurice Stans speech to the Washington Equipment Managers Association, 12 March 1959; Records of the Office of Management and Budget, Record Group 51, Series 52.2, Box 33, Folder B6-7 "Speeches 31/42"; National Archives II, College Park, MD.

agencies, normalized the computer as a tool both for routine management and ambitious envisioning of governmental transformation.[65] The chapter concludes with a fracturing of computerized authority in the 1970s as the seeming authority and expertise of the computer as a tool for management and policy projection leads to the establishment of rival camps of systems-using policy officials in the legislative (Congressional Budget Office) and executive (Office of Management and Budget) branches. Officials like Roy Ash, a technology conglomerate executive tapped by President Nixon to restructure the domestic policy apparatus to make the levers of the executive branch more nimble and responsive to presidential ambition, or Alice Rivlin, an economist appointed first head of the Congressional Budget under the mandate to supply Capitol Hill with objective data to counter Ash's computer-generated budget analysis.

The second chapter, "Output = Utopia: The Social Security Administration, Technological Social Welfare, and the Promise of Systems Computing," moves thirty miles north to Baltimore, where earnest officials tasked with overseeing the nation's first social insurance program paired their faith in the technological capacity of elaborate computing hardware systems with their ambitions to expand the scope of federal social welfare programs during the era of the Great Society. The chapter explores themes of computer introduction to established, already technologically-capable executive agencies and traces the ways in which private firms – such as Social Security's vendor of choice, IBM – interacted with government agencies as they negotiated rental, sale, maintenance, and training packages of elaborate computing systems. Representative characters from the chapter's narrative reflect the

[65] See David R. Jardini, "Out of the Blue Yonder: The Transfer of Systems Thinking from the Pentagon to the Great Society, 1961-1965," in *Systems, Experts, and Computers: The Systems Approach in Management and Engineering, World War II and After*, eds. Agatha C. Hughes and Thomas P. Hughes (Cambridge, MA: MIT Press, 2000).

transformation over a decade of an agency that saw its core values complimented and threatened by the potential of the electronic computer to aggregate and manipulate vast quantities of data. Social Security Commissioner Robert Ball in the mid-1960s collaborated with Health, Education, and Welfare Department official Wilbur Cohen to envision an expanded social welfare state in which computing efficiencies – manifested in a proposed "total system" linking all Agency computers to vast databases of information on the economic status of individual citizens – would enable the government to target need and eradicate poverty. The Agency's well-deserved reputation for technological innovation in part fueled its selection as administrator of Medicare and Medicaid in the mid-1960s, and SSA's experiences with the complicated data processing tasks of social insurance would shape the context in which administrative decisions were interpreted during its move into social welfare.

Bureaucratic squabbles over how prominent new information technologies should be in the daily operations – and identity – of the agency marked Social Security in the 1960s. Representative figures like Jack Futterman, an agency executive tasked with overseeing administrative procedure and policy formulation, and Hugh McKenna, official overseeing caseworker interactions at field offices across the nation, clashed over the degree to which automation should be the face of a modern Social Security Administration. Down the hall, statistician and Assistant Commissioner Ida B. Merriam marshalled complex calculations through computers to generate proposals for technical adjustments to benefit payouts. All three recognized that flows of information guided policymaking within the agency; the chapter examines how the computer structured the channels by which that information transmogrified into policy outcome. At times, Social Security's dual enthusiasm for program expansion and complex computer installations would backfire, as in the case of the botched introduction of

Supplemental Security Income (SSI) in 1974. Thirty-something administrative planning assistant Renato DiPentima, indoctrinated with the notion that Social Security had mastered use of advanced technologies for governmental purposes, had a front-row seat to systems failures that marked SSI's rollout, observing the gap that sometimes existing between the policy planning assumptions of dataocratic systems analysts and the reality of overtaxed computing systems tasked with implementing ambitious, data-hungry policy initiatives.

A third case-study chapter, "Punchcard Pluralism: Urban Development, Modeled Cities, and the Crisis of Technocratic Liberalism in an Era of Rights Revolution," takes as its base a specific realm of policy inquiry: urban policy in the 1960s and 1970s. Examining how conceptualizations of computing's potential defined the rhetoric of urban renewal, the chapter traces the influence of computer systems, data aggregation, and urban modeling on both top-down approaches to revitalizing cities and activists working outside of the state. Ideas and communities take center stage, as new computer modelling techniques and elaborate databases are embraced by three urban policy constituencies: federal officials with the newly created Department of Housing and Urban Development, the broader national urban planning community, and citizen and business activists hoping to revitalize inner cities by directly deploying information technology for purposes of job creation and growth. Throughout this period, the drive by city planners, metropolitan officials, and federal urban affairs specialists to seek out data-heavy, modeling-based, or computer-adjacent approaches to both framing urban policy questions and structuring resulting governmental programs had considerable effects on the relationship between urban-focused policy entities and the communities targeted by programs designed through computerized processes. Computers were a silent partner in efforts to drive "maximum feasible participation" at the local level, and the rhetoric of systems analysis framed many of the assumptions and inputs underlying urban policy models.

Individuals interfacing with institutions, seeking to deploy computers to solve complex, multi-faceted social problems take center stage in this chapter. Researchers like Jay Forester transmitted their knowledge from the realm of Cold War national security to more nebulous questions of urban development and inequality, promoting the rhetoric and tools of complex systems as windows into multifaceted cities. Robert Weaver, the first HUD secretary, grappled with determining the organizational and capacity limits of his new department, among the first cabinet agencies established in a decade when it was expected large scale institutions would make extensive use of computers. Programs emerging from HUD, including the ambitious "Model Cities" antipoverty program, would come to rely on elaborately-curated data inputs and normalized computer models, further intertwining the economic dates of struggling urban areas with centralized computing activities at the federal level. Partly in response, leaders of non-governmental organizations such as the Urban League's Whitney Young pioneered civil society responses to inner city deindustrialization, partnering with computing firms such as IBM and Control Data Corporation to offer high-tech job training to urban populations traditionally shut off from the ongoing information revolution.

A final case study expands scope even further, exploring the broad regime of environmental policymaking in the 1970s and 1980s through the lens of contested electronic data. "The Machine that Defined the Garden: Big Data, the EPA, and Formulation of a Digitized Landscape" begins with the early 1970s administrative culture of the Environmental Protection Agency and ripples outwards to examine how computer-aided cultures of data collection, transmission, and modelling shaped the interrelations of environmental scientists, regulatory authorities, private firms fighting or seeking accommodation with environmental regulations, and non-state activist groups seeking to use data to promote their causes. The collection of discrete observations about environmental factors such as water or air quality by scientists and the aggregation of said scientific readings into databases frame a narrative in which complex physical conditions of the natural world are transformed into manipulable, quantifiable numbers. Despite the seeming certainty of numbers, efforts to calculate the natural world often end in discord, as the very information technologies that permit aggregation of vast databases of environmental knowledge also facilitate the rise of competing methods of simulation and modeling that can provide vastly different policy prescriptions. Like many contested issues, they frequently ended up in court.

The weaving of environmental regulatory cases through federal courts and administrative adjucation bodies provides a lens for the chapter to examine how questions of regulation, interest group politics, and market-state relations collided in a policy context saturated with digital information. By the late 1970s and early 1980s, even as the earliest personal computers are appearing to challenge the dominance of centralized, mainframe computing, political actors in the environmental realm accept the presence and use of information management technologies as routine practice, but quibble over the results of processed information as it should be applied to questions of policy. A self-designated information-using agency, the EPA struggled with the two halves of its missions – collection and analysis of scientific data about the environment versus regulation of private sector interactions with the natural world – precisely because both directives, while dependent on data, made use of information in vastly different ways. Data itself became politicized even as centralized authority and expertise became less trusted.

Just as the mid- and late-1970s embodied a larger fracturing of American society, the arena of environmental debates saw competing interest groups – governmental, corporate, non-profit – deploy the language of computerized data to further their environmental policy agendas. Interestingly, individual voices recede to a degree in this chapter, replaced by actors speaking for broader interest coalitions: scientists, administrator, environmental activists, and business people. Representative political actors in the chapter typify the human motivations of individuals confronted both with deep-rooted environmental quandaries and the slipperiness of data. Activist Kenneth Hampton of the National Wildlife Federation feared an over-reliance on analysis of computerized data in setting environmental regulatory policy might both disadvantage ecological activists confronted with reams of conflicting corporate data and cause the general public to lose sight of holistic, non-quantitative measures of environmental degradation. [66] Deputy EPA Commissioner Alvin Alm, recruited from the Bureau of the Budget, grappled with the complexity of translating a robust scientific assessment information system into a workable management system that met the approval of Congressional overseers and powerful interest groups. Lynn Brooks and Douglas Costle, the state of Connecticut's top environmental regulators, saw their innovative technological approaches to natural resource monitoring

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[66] For more on the roots of movement-driven policymaking, see David Vogel, "The public-interest movement and the American reform tradition." *Political Science Quarterly* 95, no. 4 (1980): 607-627. On the intersection technology and environment, see George Aichholzer and Gerd Schienstock, eds., *Technology Policy: Towards an Integration of Social and Ecological Concerns* (Berlin: Walter de Gruyter, 1994). For more on the intersection of technology and the regulatory state in the 1960s and 1970s, see Lee Jared Vinsel, "Designing to the Test," *Technology and Culture*, Oct. 2015, vol. 56, issue 4, p. 868-894; Richard B. Kielbowicz, "Regulating Timelines: Technologies, Laws, and the News, 1840-1970," *Journalism & Communication Monographs*, vol. 17, issue 1 (March 2015): 5-83.

emulated at a national level even as the chaffed under shifting expectations of Nixon-era federalism.

Summary: Dataocracy on the March

Throughout all these case studies runs a simple through-thread: the introduction and rapid proliferation of the electronic digital computer within the context of the post-1945 American state mattered. Though in some fashion a continuation of established traditions of technocratic planning, administrative state-building, and technological co-creation present in preceding decades, the emergence of postwar dataocracy differed in scale, breadth, function, and rhetoric from earlier efforts to fuse technological innovation and the apparatus of federal policymaking. Contemporaries at the time observed and noted that something new under the sun had embedded itself into the innerworkings of the federal government; from the vantage of historical distance we can conclude their instincts of change were spot on. The mainframe era from the 1940s through the 1970s served as an inflection point in which the use of electronic computers and associated managerial practices by federal agencies shaped not just the operations and organization of the national state but created a context in which policy was often formulated, structured, and implemented in new ways that took into account how considerably the computer had reshaped government. The story of dataocracy is one of networks – connections of individuals and ideas, linked through federal government institutional structures that provided the impetus, infrastructure, and funding. Out of these networks emerged a shared enthusiasm for the promise of the computer as a tool for solving complex problems and restructuring complicated organizations.

The postwar state typified both conditions, and the individuals who embraced principles of dataocracy worked from within government – elected offices, civilian and defense agencies – and from external nodes – research universities, think tanks, private computing firms – to proselytize the spread of digital computers throughout the federal state. Once installed, normalized, and routinized into the organizational charts and operating principles of federal agencies, computers exerted subtle but consistent pressure on the processes by which information was gathered and processed, policy protocols were planned, and policy directives were implemented on an administrative level. Computers shaped behaviors and preferences among those who used them, with very real consequences for the policy that emerged from a computerized state.

Ultimately, "Mainframing America" argues that federal policymakers and the organizational environment in which they operated in the four decades following World War II were shaped by exposure to and use of newly emergent informational technologies to the degree that the policymaking process itself was altered in distinctive ways. These attitudes and practices were reflective of a broader emerging understanding of computer-centered information technology as a transformational force capable of remaking organizational practice and institutional identity. For budget analysts in the Truman and Eisenhower years, emerging conceptions of information as a tool of organizational management opened routes for restructuring the executive branch around principles of computer-abetted administration. A decade later, for acolytes of Great Society liberalism in the Social Security Administration, subtly transformed the operations and organizational culture of their established federal agency in pursuit of an ambitious plan to tackle poverty through data collection and processing, ultimately losing sight of their historic strengths in pursuit of a technological brass ring.

Similarly, efforts in the tumultuous late 1960s and early 1970s to deploy computerized strategies of assessment and interpretation to wrangle the complexities of urban policy floundered when the limits of dataocratic optimism met the at times-unquantifiable human elements of people who lived in cities and the civil society interactions in which they were embedded. By the middle of the 1970s, efforts to create impartial, expert-driven computerized assessments of environmental matters had given rise to politicized battles over the nature of data and information assessment itself, as activists, regulators, scientists, and special interests all struggled to define the conditions that should go into computerized models of the natural world. In all of these cases, the interplay of information, technology, and political actors with complex motives fostered a new form of government administration heavily beholden to computer thought and highly influential in shaping the policies that emerged from the federal state.

While in part a continuation of prior historical trends favoring national promotion of technology and the impulse to experiment with technocratic planning practices in times of state expansion, the period of dataocracy merits examination in its own right as a unique inflection point in the intersection of institutional policymaking and technological assimilation. This era in which proliferation of centralized, mainframe computing at the federal level paired with ambitious political efforts to expand the scope and mission of the federal government stands as distinct from earlier periods of technocratic experimentation due to the degree which its principles and practices fully permeated the operational behavior and organizational structure of executive branch entities. Close examination of the practices and context of federal government computing from the 1950s through the 1970s permits reconsideration of the ways in which administrative practice and technological optimism reshaped the setting in which and processes by which the American state functioned, particularly in the expansive domestic policy categories of budget-making, social welfare, urban policy, and environmental regulation. Understanding the growth and operations of the post-World War II American state means reckoning with the place of the computer, and providing an accurate account of the rise of the modern American information society necessitates examination of the state's role in fostering the tools and techniques of information management.

Examination of the era of centralized mainframe computing in the United States from a state-centered lens would be incomplete without acknowledging subsequent transformations in American information society. Though physical and software remnants of the 1940s-1980s "golden age" of mainframe computing linger in basements of government agencies and the information technology infrastructures of most large institutions (whether governmental or commercial), the era of centralized dataocracy began to fragment precisely as the personal computer emerged as avatar of a new generation of computing. Decentralized, individualized computing, the smashing of hierarchies symbolized in Apple Computer's much-lauded "1984" television commercial paralleled growing dissatisfaction with big government itself, in the form of that decade's "Reagan Revolution." Even as mainframe-linked terminals gradually gave way to microcomputers and individual desktop computers, vestiges of dataocracy in the federal government remained, embedded in institutions, training, and organizational practices as much as in hardware or software. The federal government, since the 1940s the midwife of the computer revolution, would come to be viewed by the American public in the 1980s and 1990s as a lumbering dinosaur, hopelessly behind corporate sector innovators of information technology. The very networks of elaborate, centralized computers designed to project state power into new realms of policy implementation paled in popular imagination when placed against portable, customizable personal computers both simpler to use and more versatile in their capability. The federal state had engendered the infrastructure of the postwar American information society – the hardware and software standards that made personal computers functional, the interconnected communications backbone that would become the internet, the generation of increasingly ambitious task requests that propelled computer processing from trajectory calculations into general purpose manipulation of any and all ideas. By the conclusion of the Cold War, Silicon Valley had unquestionably lapped it both as the chief generator of excitement about the potential of computing and the arbiter of how new computing innovations should be designed and purposed.

The late 1990s and early 2000s saw official dataocracy play catch-up, with a push for e-government and computer-abetted ease of access to public services, even as dataocracy's unofficial inheritors, vast digitized aggregations of data, reshaped broader American society through private sector levers. The federal government's extensive legacy of computing – antiquated, derided, and misunderstood – had been eclipsed for a vision of an information society articulated by venders of search engines, social media networks, and e-commerce sites. By the middle of the first decade of the twenty-first century, a federal state that once made use of vast computer networks to press outward into ambitious policy sectors (social welfare, cities, the environment) found its attentions were drawn into playing catch-up to address policy issues themselves emerging from an unwieldly information society: online privacy and security, neutrality of electronic communications networks, the scale of national security surveillance of digital transmissions. In an era of ubiquitous pocket smartphones and documents stored in digital clouds – both inadvertent inheritors of mainframe era remote access terminals, where average citizens interact with complex streams of digital information multiple times per day – the federal state will be compelled again to adjust the practice and focus of government to address to complexities of an American society transformed by information technology.

Chapter Two

The Machine in the Grey Flannel Suit: The Bureau of the Budget, the Congressional Budget Office, and the Rise of Information as Policy

Comprehending the spread of Dataocratic attitudes in early postwar Washington (and from there eventually throughout the federal government) entails more than noting the migration of early data processing machines outward from the Truman-era Pentagon or tracing the networks of "systems men" from federal agencies, universities, defense contractors, and think tanks who comprised the core of the Beltway computing establishment. As important as these networks were to the spread of what would become dataocracy, the serendipitous rise of the computer as a tool for governance during this period is largely due to the more nebulous idea that emerged from the informal exchanges of knowledge these computing complexes enabled: the notion of information as a resource that could be managed via technological means for the purpose implementing, refining, or altering either the practice of government or the policies it yielded. Beginning in the late 1940s, the increasingly widespread notion that an electronic machine – not to mention the entire process of systematized, automated data processing and organizational management practices that accompanied said device – would fundamentally alter the ways federal organizations approached the various streams of information they encountered and influence how decisions were made, actions undertaken, identities assessed, and institutions restructured in a postwar world awash in information.

Control of flows of information was by no means a new feature of the American federal state. As historian Michael Birkner noted of executive branch staffers of a pre-digital era, ". . . you had to be very quick-witted and you had to know how to get information fast in a precomputer era."[67] Government clerks, mid-tier political appointees, and office holders alike made copious use of information in the decades preceding electronic data processing, but their successors would engage with an entirely different federal workplace following the introduction and widespread dissemination of the computer. These changes were not wrought by the machines themselves, however. Though capable of miraculous speed and accuracy in calculation, computers were of course simply boxes of wires and solder responding to the commands presented to them by humans. The dramatic transformation wrought on the functional operating of the American state in the era of the electronic computer is one wrought entirely by human actors, political actors, inside and outside the apparatus of the postwar state who for a myriad of purposes restructured their approaches to work around a willingness to conceptualize the notion of information itself in new ways.

Dataocracy in practice meant the emergence of a new sort of information state, one in which increasing predilection for technological methods of ordering the specialized knowledge and accumulated data necessary to describe the actions of government became married to new organizational practices and administrative structures. These transformative institutional elements reflected a self-conscious awareness among governmental employees (both overt adopters of computers and the less enthusiastic with whom they interacted) of the ways in which information exchange (the flows of those now ordered bits of knowledge and data) played a central role of the business of governing – and an increasing willingness to undertake specific maneuvers related to that information exchange process for the broader purpose of furthering

[67] Quote by Michael Birkner, transcript of oral interview "Richard W. Murphy: Legislative Assistant to Senate Hugh Scott (1964-1969)," Oral History Interviews, November 5, 2010 and November 16, 2011, Senate Historical Office, Washington, D.C., p. 21. Available online: https://www.senate.gov/artandhistory/history/oral_history/MurphyRichardW.htm.

specific political, personal, or professional agendas. If the act of governance is employing information to exercise power for a larger purpose, the Federal government in post-World War II America embodied a robust new understanding of how individuals and organizations might directly manipulate the mechanisms underlying that information, adding an additional, adventitious route for shaping the development of policy and the exercise of power. How information came to be defined and managed would have significant ramifications for the daily functioning of federal government.

The seeds of dataocracy planted by informal exchanges of knowledge between the military and civilian sectors in the immediate aftermath of the war would ultimately be nurtured by four forces that came to structure the postwar environment of information management, providing the cardinal coordinates within which the rise of a computerized state might be situated: technology, policies, institutions, and process. The final was most crucial. The real driver of the computer's speedy adoption in American government in the 1950s and 1960s was in process – though social scientists based at universities and think tanks articulated the intellectual framework in which systems management was development, and political actors pressed its aggressive adoption in order to further specific agendas, it was in the trenches of administration that new conceptions of information and technological management embedded themselves into the essential political framework of postwar America.

Assessment of two critical periods offers key insight into this conceptualization of the relationship between information management as practice and political influence as reality. The first, from the late-1940s through the late-1950s, saw established federal institutions attempt to define an emergent consensus on the importance of proper administration of information in an era of computer breakthroughs, leading to contestation over who should define, lead, and ultimately reap the benefits of controlled processing and transfer of data. In this era, aggregated information lubricated the levers of power, and organizations such as the Bureau of the Budget, the General Services Administration, and the National Bureau of Standards took increasing interest in the "how's" of technologically-assisted data management, with growing realization that such practices might yield outsized influence on the "what's" of policy. Subsequent chapters will detail the apotheosis of this tendency during the 1960s.

A second representative era, responsive to Washington's growing awareness of the influence of electronic data management on governmental activities, can be found in the early- to mid-1970s. At this moment, with computers well-established as mechanisms for research, business management, and (increasingly) policy assessment and predictions, factions across Washington sought to embrace their autonomy as information-utilizing entities, enhancing their own capacity to gather, analyze, and disseminate the datapoints that had become currency for effective discussion of policy. No longer novel, computers were now silent partners in a new understanding of managerial practice, in which control of flows of information were couched in systematized language descendant from but partly divorced from the hardware of mainframe computing. Embedded in this transformation were elements as varied as new approaches to statistical science, a postwar push for thrift in governmental operations, debates over how fully to centralize government operations, and residual, Watergate-era distrust between Capitol Hill and the White House.

Enter the Budget

Americans often think of their government as embodied by the figure of the President, or perhaps more figuratively (and generically) by the assembled body of Congress. Yet the business of governance – the daily routine of defining and implementing and assessing the policies that have trekked their way through the bombast and showmanship of political debate – rests largely on the often overlooked, frequently resented shoulders of the bureaucracy. For much of the twentieth century, no entity has been more central (or more misunderstood) in its relationship to the running of the business of federal government than a mid-sized operation housed in the Old Executive Office Building next to the White House and now known as the Office of Management and Budget (OMB).

Titled from its founding in 1923 until 1970 as the Bureau of the Budget, or BOB (the term by which it will generally be addressed in this chapter), the OMB today is a cabinet level office charged with preparing the annual federal budget presented by the Chief Executive to the Congress, and assigned the task smoothing this process along by assessing the managerial operations of executive branch agencies that administer the provisions of completed budgeting. Born of lingering Progressive-era impulses to better organize the process by which complex federal budgets were assembled and cleared with individual departments, the BOB/OMB would over time morph into a far more complex, and conflicted, entity charged with both promoting the policy directions of the currently in-office presidential administration and overseeing, in non-partisan and non-conflicted fashion, the efficient daily functioning of the federal bureaucracy.[68]

For most in Washington of the late 1940s and 1950s, however, the organization's identity was intrinsically linked to its primary task, assembling the inexorable tide of numbers required to populate the president's budget proposal to submit to the Congress. BOB procedures for

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[68] For more on the history of the BOB/OMB, see Percival Flack Brundage, *The Bureau of the Budget* (New York: Praeger Publishers, 1970); Frederick Mosher, *A Tale of Two Agencies: A Comparative Analysis of the General Accounting Office and the Office of Management and Budget* (Baton Rouge: LSU Press, 1984); Joon Chien Doh, *The Planning-Programming-Budgeting System in Three Federal Agencies* (New York: Praeger Publishers, 1971); Shelley Lynne Tomkin, *Inside OMB: Politics and Process in the President's Budget Office* (Armonk, NY: M. E. Sharpe, 1998); Larry Berman, *The Office of Management and Budget and the Presidency, 1921-1979* (Princeton: Princeton University Press, 1979).

collecting and analyzing information of a statistical nature had been honed during World War II, when under the Federal Reports Act of 1942 the office was charged both with "improvement and development of the Federal statistical program."[69] The beefing up of its statistical collection and analysis operations, intended to assist wartime agencies charged with overseeing price controls and rationing quotas, filtered through the character of the organization. The Bureau's facility could be intimidating – and suspicion provoking – among certain other constituencies in government. As late as the Johnson Administration, BOB Director Dwight Schultze had to diminish legislators' "fear of the statisticians and analysts taking overs" by jokingly insisting that "fear of being eaten alive by piranhas" ranked higher on his personal list of worries.[70]

Exposed to the computational power of electronic data processing devices via colleagues in the Census Bureau and National Bureau of Standards (as well as the informal mainframe-interested social networks that dotted the Greater Washington area), the number crunchers in the BOB would have had multiple opportunities by 1950 to observe electronic computers in operation. For these statisticians and accountants on the Bureau's staff, the electronic computer appealed primarily as a device numeric. Beyond its remarkable ability to quickly and accurately determine large sums, the quantitative marvel of a programmed electronic data processing device could extrapolate projections of budget variations on a scale beyond even the most dedicated of human "computers" armed with a library of statistical tables. As one observer noted with wonder, just like with development of industrial prototypes, "Computer will report back that,

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[69] Harold D. Smith memo to Phillip Murray, 19 March 1945; Records of the Office of Management and Budget, Record Group 51; Series 51.8.1 Records of the Director's Office. "Organization" folder; National Archives II, College Park, MD.

[70] "Computer Errs; Still Liked," *Chicago Tribune*, 14 Sept. 1967, p. D1.

given the type of performance you want, a particular design would or would not work. Thus they can save you the enormously costly job . . ." [71]

Eisenhower-era Budget directors, constantly pressured to identify greater governmental efficiencies, frequently expressed frustration at a "cumbersome, slow, and expensive" budget process in which the considerable time delay between congressional appropriation and agency expenditure wrought havoc with efforts to trace the exact "budgetary effects of bills under consideration."[72] For the accountants who still formed the core of the Bureau staff pool, the management quirks of Congressional budgeting, particularly in the wake of rapid wartime government expansion, made cumbersome any attempts to rationalize the appropriations side of the equation.

The Eisenhower administration was no stranger, of course, to bureaucratic infighting that delayed or substantively altered implementation of policies favored by the president.[73] Eisenhower invited the BOB director to informally sit in on National Security Council meetings. The Bureau was willing to challenge favored blue-ribbon panels in order to preserve the fidelity of numbers it saw as essential to constructing accurate budget projections, as in the case of the Gaither Committee, where BOB officials asserted the civil defense committee had both underestimated domestic program expenditures and falsely overstated total budget projections.[74]

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[71] Alexander Wiley, 104 Cong., Rec. 9418, (26 May 1958), 9453.

[72] Percival Brundage, untitled speech, 25 March 1955. Records of the Office of Management and Budget, Record Group 51, Series 51.8.1 Records of the Director's Office, Subject Files of the Director, 1939-68, "Stans Speech" folder; National Archives II, College Park, MD.

[73] Though the most obvious example being the inter-service branch rivalries that plagued the middle and later years of Eisenhower's time in office, less acrimonious (if still actionable) conflicts could also be found in civilian agencies. See David Lindsey Snead, *The Gaither Committee, Eisenhower, and the Cold War* (Columbus: Ohio State University Press, 1999), 9.

[74] Ibid, 136.

Yet even this task could not be divorced from a larger process of inquiry into precisely how executive branch agencies would transmutate into policy those funds that had been allocated to them through the budget reconciliation process. Each year the bureau would release for public examination a hefty, thousand-page-plus volume: the Appendix to the Budget. Journalist Walter Pincus in the early 1970s labelled the compendium "the finest source book available on operations of the United States government . . . taking as a single whole the vastness and vagaries of this massive government as they emerge from the pages of the dullest prose and endless columns of figures."[75] Early postwar BOB officials routinely dodged the question of whether their methods of statistics-gathering and information compilation for policy-budgeting were truly divorced from the politicized minutiae of policy-making. As George Herman of CBS News noted in a television interview with Eisenhower's final BoB director Maurice Stans, "The Budget Bureau, then, is really one of the major organizations or arms of the Administration in various fields of policy, is it not . . .?" Stans cautiously replied with a description of his agency as an information-gathering, not utilizing, entity: "We construe our responsibility as one of asking questions, checking progress, of checking on promises made for programs, of seeing that the programs proposed by . . . any other agency, are consistent with the policies of the Administration. . ." [76]

Early-adapter computer agencies took seriously their commitment to information in the public service. Census Bureau officials, for instance, added questions to the 1960 population survey related to working individuals' means of transportation for city planning purposes and

[75] Walter Pincus, "U.S. Budget Appendix: Book of Revelations," *New York Times* (26 March 1971), p. B1.

[76] Transcript of broadcast of "Face the Nation," CBS Television Network, 12 April 1959. Records of the Office of Management and Budget, Record Group 51, Series 51.8.1 Records of the Director's Office, Subject Files of the Director, 1939-68, "Television" folder; National Archives II, College Park, MD.

queries about presence of basements for civil defense information while rejecting questions lobbied for by the clothing, cosmetic, and pet food industries.[77] Regarding the census, for instance, collected data would be fed into "a battery of electronic computers," with ultimate results spewing "facts and figures [that] will be gobbled up eagerly by businessmen. Government planners, politicians, economists, labor unions, educators, farmers, and sociologists, professional and amateur."

Better Living through Management

The use of revised office machine-management revision to solve intra-organizational dilemmas was not one new to the BOB. The agency was partner to many elaborate office equipment contracts – for tabulators, punch key machines, and adding devices – from firms such as IBM and Remington Rand. By early 1955, Bureau officials were investigating procedures for more quickly routing incoming correspondence to multiple relevant officials than the standard, time-consuming process of passing letters down the chain from Director to Deputy Director to Assistant Director to Division or Office head. An enterprising solution emerged from staff meetings devoted to the matter "of getting incoming mail to the action point . . . more quickly": employing a cutting edge "office machine" to photocopy time-sensitive correspondence, enabling the original to be forwarded directly to the relevant office for action while ensuring all superiors were concurrently kept in the loop with "duplicate information cop[ies]."[78] Technological solutions to managerial conundrums were by no means new to the agency.

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[77] Monroe W. Karmin, "The Big Count," *Wall Street Journal*, 2 Feb. 1960, p. 1.

[78] S. T. Adams memo to Rowland R. Hughes, 17 January 1955. Records of the Office of Management and Budget, Record Group 51, Series 51.8.1, Records Relating to Administrative Management and Organization, 1921-68, Folder B6-3. National Archives II, College Park, MD.

Budget Director Percival F. Brundage attempted to explain the Bureau's mission in a public address in November of 1954: "The Bureau is still very close to the financial branch of the Government but acts as a part of the Executive Office of the President. It does not initiate policy but endeavors to carry out the policy decisions of the President and the Cabinet in reviewing and integrating all of the programs of the various departments."[79] In a television interview, Brundage asserted a fundamental link between the Bureau's most obvious task, budget preparation, and its more esoteric management supervision duties: "I think we have to go into the inner workings of all the departments and agencies in order to understand their budget requirements. Our management and Organization office has been cut down too much, I think . . ."[80] He expressed frustration at not having enough staff to follow up on "management survey" requests from various departments, implying that the essential task of constructing a budget required detailed knowledge of the operational inner workings of the various government agencies.

Throughout the 1940s and 1950s the Bureau petitioned Congress for increased allocations to hire more staff to "study and develop solutions to management and organization problems."[81] Agency officials portrayed their task as unquestionably larger and more complex in

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[79] Percival Brundage untitled speech, 1 November 1954. Records of the Office of Management and Budget, Record Group 51, Series 51.8.1 Records of the Director's Office, Subject Files of the Director, 1939-68, Box 31; National Archives II, College Park, MD.

[80] Transcript of broadcast of "Face the Nation," 24.

[81] Bureau of the Budget, "Justification of Estimates for 1961 Bureau of the Budget General Statement" memo, Records of the Office of Management and Budget, Record Group 51, Series 51.8.3 Records of the Fiscal Analysis Division and Fiscal Analysis Branch, "General Statement" folder; National Archives II, College Park, MD.

an era of greatly expanded government. [82] These new staffers were expected to focus on highly technical "workload measurement techniques, the application of work simplification processes, and the development of workable standards." The lion's share of newly requested professional staff positions were to be allocated not to the historically dominant Office of Budget Review, but rather the Office of Management and Organization "to carry out implementation of automatic data processing responsibilities as another step in improving the operating efficiency of agency programs."[83] In the words of one political scientist, the BOB would evolve into an "ad hoc interagency" troubleshooter increasingly denoted by its "managerial function."[84]

A second pillar of the agency's identity, that of management, would grow in increasing prominence as BOB staffers sought solutions for bringing order not only to the ever larger aggregations of numbers with which they dealt, but to the task of streamlining and making more efficacious problem-solving efforts of other government agencies confronted with transmuting those budget numbers into actionable policy. "Use and control of electronic equipment and other mechanical processes, particularly in mass paperwork," noted one Bureau higher-up, would ". . . bring about more economical and effective operations . . . in this way we can provide technical support to the Bureau's budget examiners which will, we believe, greatly assist in improving administration throughout the executive branch and lead to a more thorough and analytical evaluation of budgetary requirements." [85] Administration of government tasks became a central

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[82] Letter to Gale W. McGee, 26 July 1960. Records of the Office of Management and Budget, Record Group 51, Series 51.8.1 Records of the Director's Office, Subject Files of the Director, 1939-68, Folder "Organization Correspondence"; National Archives II, College Park, MD.

[83] "Justification of Estimates for 1961 Bureau of the Budget General Statement," p. 5.

[84] Gary Bombardier, "The Managerial Function of OMB: Intergovernmental Relations as a Test," *Public Policy* 23 issue 3 (Summer 1975): 317.

[85] "Justification of Estimates for 1961 Bureau of the Budget General Statement," 12.

component of the BOB's mission and identity in parallel with a dawning realization among Bureau staffers and executives: in an era of management increasingly defined by technologically-manipulated data, the mundane task of administering how and by whom information could be accessed conferred power on the agency charged with overseeing operations themselves rooted in information. From the 1950s to the 1970s the Bureau of the Budget strengthened its focus on administrative activities as outgrowths of political influence concurrently with the recognition across the federal government of the existence of "information" as valuable commodity central to the policymaking and implementation process. Organizational knowledge, constituted in the ability to collect and control disbursement of analyzable data, could be used as a procedure to influence the policy formulation process.[86]

Economy and increased efficiency supplied both bywords and justifications for investigating this route. Year after year internal memoranda emphasized to staff the necessity of having "for the Bureau's . . . budget hearings specific and carefully developed examples of savings and improvements effected by Bureau staff in governmental operations. . . "[87] Among the most highly touted examples were those that illustrated "an important improvement installed in the operations of a particular agency" – often a computer. The very terminology – installed – suggests how much simpler demonstrating physical presence of a management improvement was when embodied in the physical device of a computer system. A material object – even one as expensive as a Univac – could effectively serve as a demonstrable stand in for a largely invisible

[86] Martha S. Feldman, *Order Without Design: Information Production and Policy Making* (Stanford, California: Stanford University Press), 121-125.

[87] E. Charles Woods memo to Bureau Chiefs, 3 November 1960. Records of the Office of Management and Budget, Record Group 51, Subject File 51.8.4, Records of the Office of Budget Review, Folder B6-2-1.

system of administrative changes, persons, procedures, and techniques embodied in the machine but which extended far beyond it.

The BOB's eventual predominance as an information gathering agency stems in part from various quirks associated with its bureaucratic mandates; it became de facto questionnaire distributor for the entire government due to regulations that prevented any government office from disseminating a questionnaire to more than ten people without BOB authorization.[88] Throughout the Truman and Eisenhower administrations the agency would routinely conduct surveys of assorted government agencies on management questions, frequently for third parties (and increasingly at the behest of management consultants as the 1950s progressed). The office was charged with coordinating all Government Agency responses to the various reports and examinations associated with the Hoover Commission.[89] These elaborate assessments at times resembled what would later become consultant-driven management surveys, and checked with the BOB's reputation for thoroughness and efficiency. They led to an encyclopedic understanding of other government programs, necessary for the budget-construction process: "The Bureau men come to know more of the programs and problems of different agencies than the agency head himself."[90] This exacting extraction of information only awaited adoption of the data-management machinery to make it relevant beyond the halls of the Bureau.

Typical was a 1957 survey of use of electrical business machines throughout government by the General Services Administration (GSA) and General Accounting Office (GAO) at instigation of the House Appropriations committee; GSA approached BOB director William Dodge for assistance, assuming his staff included requisite electronic computer experts. In

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[88]Percival Flack Brundage, *The Bureau of the Budget* (New York: Praeger Publishers, 1970), 5.

[89] Ibid, 5.

[90] Joseph Kraft, "The Remarkable Mr. Gordon and his Quiet Power Center," *Harper's Magazine* (May 1965), 44.

responding to Bureau queries “full of the usual stuff about the virtues of parsimony,” representatives of virtually every government office from the Naval Research laboratory to the Atomic Energy Commission, from the Census Bureau to the Weather Bureau sent a staggeringly complete overview of the state of federal computing at the moment of its first explosive growth spurt.[91] Some agencies expressed incredulity at being asked about potential electronic data machine usage; the Securities and Exchange Commission huffed, “We foresee no need for acquiring a computer.” Others proudly detailed their elaborate, and unsupervised, computer-buying regimens, while a few agencies took the BOB’s inquiry as evidence of White House pressure to begin acquiring computers. Aggregation of the survey responses suggested that those government agencies employing computers found them effective tools for managing the vast sums of information with which they were bombarded in the postwar world. Much of this awareness emerged from operations research and its offshoot theories of noise versus signals management.[92]

When completed, the survey satisfied the original Congressional-GAO query, but left a nagging itch among some at the BOB. Computers increasingly seemed to be creeping from purely scientific or military purposes into business administration tasks, suggesting the Bureau would require regular updates on computer purchases to better understand how domestic agencies with data processing capabilities faired in terms of efficiency compared to their computer-less colleagues. The impulse to bring order to a chaotic, expanding state – a task for which the Bureau had been praised during the latter New Deal years and particularly for during the War – reared its head again, with the inclination to further investigate the potential of “data

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[91] Ibid., 40.

[92] Stafford Beer, *Decision and Control: The Meaning of Operational Research and Management Cybernetics* (London: John Wiley and Sons, 1966), 488.

processing" and "associated management improvements."[93] In pursuing these investigations, Bureau resources and interest would increasingly focus on the tasks of administration as mediated by computers and systems techniques. As one shrewd journalist observed of this period a few years after the fact, "The thrust of the agency's transformation, in short, was to make it a managerial agency."[94]

While preparing for fiscal year 1961, and likely in response to some of its survey findings, the BOB's Office of Management and Organization prepared work plans containing "an inventory of the principal management accomplishments and future opportunities for improvement among some 25 principal departments and agencies." Though listed among the report's concerns were discussions of "management review and control practices, including improvements in organization structure, planning," and analyses of "work measurement, management training programs, etc.," the first and most prominent category called for in the assembled report was a study of "methods improvement, including work simplification, [and] the use of ADP systems."[95] The likelihood of successful implementing new information control processes, the agency outlined, would "require the use of specialists in such fields as automatic data processing, work measurement and work simplification, systems and procedures, organization, office equipment and methods, and production controls."[96]

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[93] Untitled evaluation forms, 1959. Records of the Office of Management and Budget, Record Group 51, Series 51.8.5, Records of the Office of Management and Organization and its predecessors, Records of the Management Improvement and Research Branch, 1952-68; National Archives II, College Park, MD.

[94] Kraft, 40.

[95] Memorandum, 1 September 1960. Records of the Office of Management and Budget, Record Group 51, Series 51.8.1, Records Relating to Administrative Management and Organization, 1921-68, Folder B6-2-1; National Archives II, College Park, MD.

[96] "Justification of Estimates for 1961 Bureau of the Budget General Statement," 8.

Bureau offices would soon hum with new hires trained in the language of electronic data processing, who found their work assignments pleasantly complimentary to the agency assessment tasks already undertaken by traditional budget analysts. Computers provided just one more source of data to compliment the wave of information – primarily budget-related, but increasingly wider and scope and derived from management surveys – buoying BOB efforts to better understand the intricacies of executive agency administration.

The decision by BOB executives and staffers to embrace computers as tools of government administration – and their roles as guiding overseers to that process – was the product both of conscious choice and contingent circumstances of a changing office environment. At the heart of the Bureau's daily business was a constant flow of analysis, as each government Department, Agency, or Office was assigned a "staff of examiners, whose business is to continually analyze reports and operations of every phase of the agency's activities."[97] Increasingly in a culture of dataocracy, the methods for gathering, transmitting, and dissecting that flow were framed in data-centric, systems-influenced language. As Graham T. Allison notes, bureaucratic actors "[make] government decisions not by rational choice but by the pulling and hauling that is politics."[98] In the tussle of postwar Washington, currents pulled the agency in the direction of the computer, a process eventually abetted by willing bureaucrats who recognized that their office's prestige (and their personal job stability) could be immeasurably enhanced by being perceived as the authority on administrative matters in an administrative systems-obsessed universe. The deluge of information fueling government operations offered considerable authority for the organization that defined how that information should be controlled. A fall of

[97] Brundage, 5.

[98] Graham T. Allison and Morton H. Halperin, "Bureaucratic Politics: A Paradigm and Some Policy Implications," *World Politics* 24 (1972): 40-79.

1960 report on the influence of technological advancement on government laid out the influx of information starkly: “The problems introduced by rapid advances in science and technology have greatly increased the number of interrelated factors relevant to policy planning. They have simultaneously increased the sheer day-to-day operational burden of government officials. There are more documents to read, more people to talk to, more agencies to co-ordinate with. The need for clear and careful thinking about long-range policy questions is greater than ever.”[99]

Other government agencies seemed amenable to the Bureau’s increasing shift to an administrative focus. As indicated in executive memoranda, certain Department heads expressed dissatisfaction with the amount of time historically allocated in BOB relations to pursuing budget authorization “as compared with the time required for planning and carrying out the programs.”[100] The Bureau justified its expanded ambitions by noting that “the agencies have taken little initiative to achieve coordination in planning.”[101] In November of 1962 the BOB established a government-wide “Advisory Council on Automatic Data Processing. As with the United Nations Security Council, power rested in the five permanent members: the BOB (whose delegate chaired), the General Services Administration, the National Bureau of Standards, the

[99] George Kistiakowsy, et. al, “Report on Technological Advancement,” 1960. Emanuel Ruben Piore Papers, “President’s Science Advisory Council” folder; American Philosophical Society, Philadelphia, PA.

[100] P. Brundage speech, 19 May 1955. Records of the Office of Management and Budget, Record Group 51, Series 51.8.1 Records of the Director’s Office, Subject Files of the Director, 1939-68, “Brundage Speech” folder; National Archives II, College Park, MD

[101] Memorandrum for G. B. Kistiakowsky, Nov. 1956. Records of the Office of Management and Budget, Record Group 51, Series 51.8.1, Records Relating to Administrative Management and Organization, 1921-68, Folder B6-3. National Archives II, College Park, MD.

Civil Service Commission, and the National Science Foundation. Nine other slots were held by a rotating cast of other agencies, some more active than others.[102]

BOB versus GSA

The degree to which the BOB embraced its self-recognized status as arbiter of information management in the executive branch can be seen a series of late 1950s - early 1960s squabbles with the General Services Administration (GSA) over which office would supply operational directions for the series of mainframe computers mushrooming across federal agencies. Itself a creation of the mid-century government re-organizations that accompanied the Hoover Commission, the GSA had been established in 1949 to promote "standardization, coordination, and centralized control in the Government's property and administrative services," a so-called "house-keeping" authority intended to keep track of and provide maintenance for the assorted physical things owned by the federal government.[103] Normally its mission dovetailed nicely with the BOB's administrative oversight tasks, one agency processing budget requests for next year's office supplies and the other actually distributing, caring for, and keeping track of the physical objects.

[102] Just how active the BoB and other presiding members wished the rotating counterparts to be remains in dispute. The correspondence of Robert Teagle, representative from the Federal Housing Authority in the early 1960s, and a minor computer acquisition pioneer in a conservative agency, contains frequent complaint of not being notified of Council meetings. A representative of the Office of Administration recorded a hand-scrawled note on a memorandum in the HUD files indicating an attempt to placate Teagle by insisting the Advisory Council was "not operating on a rigid calendar basis." Teagle memo to Williams, 4 February 1965. Records of the Office of Housing and Urban Development, Record Group 207, Series 207.7.1 General Records, folder 7932. National Archives II, College Park, MD.

[103] Statement by P. Brundage, 13 July 1955. Records of the Office of Management and Budget, Record Group 51, Series 52.2, Box 31, Folder B6-7; National Archives II, College Park, MD.

As more non-Defense agencies acquired early mainframe computers, however, questions arose as to proper procedures for integrating the machines into the office environment. From matters of suggested "best practices" to queries over appropriate use, overtime, and precedence of use by different bureaus within an agency, memos flew across the administrative branch, with some civilian offices following procedures developed by their Pentagon counterparts and others directing questions to central authorities. The GSA saw a remarkable opportunity to secure for itself considerable influence among other executive agencies by asserting its authority over these remarkable new electronic tools of governance. Reflecting on the findings of the past few years' computer surveys, and the seemingly limitless potential for growth throughout the federal government, Bureau of the Budget officials felt it imperative for the enhancement of their office to secure oversight of these devices. Their stratagem was to employ the sometimes overlooked administrative management card.

The GSA considered computers to be machines, tools, physical property like sedans in the federal motor pool, secretaries' desks, or typewriters ordered in bulk and disbursed through property requests. The BOB, sensing a way of enhancing its authority through literal adherence to the president's directive, asserted that under President Kennedy's automation charges, computers were not devices but extensions of the workforce, elements of a larger experiment in economic productivity and labor allocation. Playing the economist trump card, they noted that overseeing the progress of federal office automation was a policy, not a property, issue. For federal purposes, computers had been redefined not as devices or objects, but as components in a larger information assessment process. They were irreducibly part of the "system" of office management, a category clearly under the purview of BOB regulations. By recognizing information as a category and elevating it to the status of administration, the BOB had staked for itself a powerful position as the arbiter of how information would operationally flow through the federal government.

Soon after the agency issued Circular A-71, the first of many iterations of an essential document outlining official federal policy regarding "information resources." The contours of this directive would fuel massive growth in the administration analysis and operational systems sub-divisions of the Bureau and come to supply a common language through which different executive branch agencies could discuss the implications of "systems approaches" to government operations. By the mid-1960s, the BOB's daily one-page memos on administrative practice had garnered the name "bed sheets" for President Johnson's habit of taking copies to the Executive Residence for late-night reading.[104] Ambitious, or watchful, federal administrators wanted to read what the president did; successful ones recognized increasingly that the key to successful framing of a Department of Bureau's business was through adoption of the systems language through which the BOB defined its own operational analysis. The Bureau helpfully offered "in any way to help clarify or otherwise improve the present text" of agencies' internal systems procedures, ensuring both some degree of uniformity across government -- and providing the Bureau unprecedented access into the technological-operational workings of assorted government entities.[105]

As the decade progressed, Bureau officials – themselves tightly linked to a civilian government network of economists, systems analysts, and promoters of computer-assisted management who circulated among the Pentagon, research universities, firms like IBM, and influential think tanks such as the RAND Corporation – came to view computers as more than

[104] Kraft, 44.

[105] Maurice H. Stans, statement before Senate Special Committee on Space and Astronautics, 13 May 1958, 104 Cong. Rec. 8500, 8583.

devices for processing calculations. These machines were culturally powerful, politically manipulable tools for projecting numeric, scientific authority onto policy proposals run through their blinking lights and tape reels. Even as computers increasingly proliferated throughout the executive branch to manage routine administrative tasks, adherents of IBM and Pentagon-style systems management techniques proclaimed a near future in which the computational power, unassailable logic, and apolitical machine-ness of mainframe computers would be applied directly to setting policy, enabling policymakers to formulate the best outcomes for implementing national policies based on analysis of reams of previously un-examinable (and uncollectible) data. This would culminate, of course, with the Bureau's name change (and organizational restructuring) in 1970. Management – and the careful control of information flows associated with it – would forever be enshrined in the agency's formal identity.

Pentagon and PPBS

This restructuring of attitudes regarding the proper relationship of information technologies and management strategies was the culmination of a half-decade's worth of Washington obsession that had reached its culmination in the Pentagon in the mid-1960s. The relationship between planning and a broader conceptualization of what it meant to program – to program a computer model, to structure a policy program, to define a programmatic set of administrative actions – informed one of the most significant managerial trends to shape Washington: Planning, Programming, and Budgeting Systems.[106] Known by the acronyms PPBS or PPB, or more prosaically as "output budgeting," this management technique rose to

[106] For more on the semantic relationship between "programing" and "planning" in an information technology context, see David Alan Grier, "Programming and Planning," *IEEE Annals of the History of Computing* (Jan-Mar 2011): 87-88.

prominence during the tenure of Robert S. McNamara as Secretary of Defense. A management technique rooted in cost-conscious, information-driven efforts to forecast the parameters of complexity that might influence administration of an organization, PPBS could be described as an effort to apply the flow-chart logic process of computers to the daily operations of an office. Crafted by Department of Defense (DOD) Comptroller Charles J. Hitch, former economist at the RAND Corporation and future president of the University of California, and promulgated by Deputy Assistant Secretary of Defense Alain Enthoven, charged with overseeing the Pentagon's Systems Analysis operations, PPBS became the analytical tool of choice for McNamara's "Whiz Kids" as they sought to compress federal budgets to engage in President Johnson's simultaneous wars on poverty and the North Vietnamese. Core PPBS principles aligned closely with enthusiasm for the sorts of complex recordkeeping and numeric analysis at which computers excelled, and the budgetary and management principles it endorsed soon filtered through the civilian agencies of the executive branch, driven first by curiosity and then executive fiat as President Johnson ordered all government agencies to adopt the technique.[107] As one observer noted, "Some people now imagine that "cost-benefiters," using computers, are taking over decision-making in the Federal government."[108]

PPBS in many ways represented the worst tendencies of dataocracy. As political scientist Allen Schick noted, "In trying to impose an informational structure suitable for planning and analysis, PPB. . . assumed that there is a unique configuration of governmental objectives – the

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[107] Jardini, David R.. "Out of the Blue Yonder: The Transfer of Systems Thinking from the Pentagon to the Great Society, 1961-1965," in *Systems, Experts, and Computers: The Systems Approach in Management and Engineering, World War II and After*, Agatha C. Hughes and Thomas P. Hughes, eds. (Cambridge, MA: MIT Press, 2000).

[108] William Goreham, "PPBS: Its Scope and Limits – Notes of a Practitioner," *Public Interest*, issue 8 (Summer 1967): 4-8.

‘program structure’ – serving all analytic purposes. In fact, however, there are as many ways to classify information as there are analytic perspectives.”[109] For all of efforts of Johnson-era official Robert MacNamara to fuse principles of governmental system analysis with practices of corporate-style management, it was an equally influential figure in a successor administration who succeeded in redefining the concept of “information management” at the federal level.

New Understandings of Information

By the 1970s and the Nixon administration, many in Washington realized that access to or control of information via data processing and systems management granted incredible backdoor influence over policy implementation to those agencies and offices, like the BOB, that could frame their recommendations as the product of expert, presumably impartial, computer algorithms. By elevating the concept of management and securing its own position atop the Executive Office hierarchy, the BOB/OMB opened itself to criticisms of political expediency and bias that far outstripped its original non-ideological mandate.[110] As the decade progressed, other federal powerbases, including Cabinet-level agencies and Congress itself, would seek to augment access to in-house producers and analyzers of data that could further the agendas of those organization’s principals.

To understand this transformation, one need only examine the 1973-1975 tenure of Roy Ash as Budget Director. Disparagingly referred to as “the human computer” by journalists, this one-time management consultant turned presidential operative embodied both the pinnacle of the

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[109]Allen Schick, "A Death in the Bureaucracy: The Demise of Federal PPB," *Public Administration Review* 33, no. 2 (March-April 1973), 152.

[110] Frederick Mosher, *A Tale of Two Agencies: A Comparative Analysis of the General Accounting Office and the Office of Management and Budget* (Baton Rouge: LSU Press, 1984), 189.

BOB's reliance on information as a tool to power and the gradual transformation of the office into a highly politicized extension of the White House's domestic policy apparatus. The same Ash who had chaired Nixon's Advisory Council on Executive Organization in 1969, where he applied his previous position's findings on the efficacy of internal government operations to push particular domestic policy, would now shape management policy for the entire Federal Government. For Ash, technology and management joined capital as "new tools of productivity," successors to transportation and industrial revolutions of earlier centuries. "Technology is exploding all around like fireworks at national celebrations," he remarked in 1970. [111]

His business reputation had been made in the postwar, aerospace-connected conglomerate, Litton Industries, a firm known both for buying and incorporating new and fashionable technologies into its portfolio of subsidiaries and for its data-driven, systems-accentuated corporate culture. Litton promoted itself as a firm that incorporated the lessons of its technology acquisitions into the managerial practice that fueled its high-dividend growth during the 1960s. Recalling his corporate success years later, Ash noted, "It was obvious that we were entering an era characterized by technological change across many, many industries. . . . we set out to create a company that would capitalize on, or convert, the new technological developments of the times into a flow of innovative products and services." [112] The ascension of Ash, a defense contractor who supplied elaborate technologies to Pentagon, to the Executive

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[111] Roy L. Ash. "The New Anatomy of World Business." *Columbia Journal of World Business* 5, no. 2 (March 1970): 90.

[112] Roy L. Ash,, et al. "Problems and Opportunities on Managing Dynamic Growth." McKinsey Quarterly 3, no. 3 (Winter67 1967): 24-35.

Branch's top management post can be viewed as reiteration of the significant influence Defense Department computing had on civilian agencies.[113]

For Ash, the seemingly benign task of "improving government management" became a vessel through which to implement his interpretation of the President's policy priorities, using tools of administration to squeeze through policy in such areas as economic stabilization. Ash himself wrote of this imperative in a 1977 guide for businessmen interested in influencing the policymaking process: "Policy formulation at the national level is largely determined by a labyrinthine process of interaction between the legislative and executive branches of government. To affect the process, it is necessary to know how the gears and levers of government work, how to grasp them, and which way and how hard to pull them." Carefully orchestrated control and analysis of data provided those levers. Under Ash, the administration grew increasingly cognizant of the need to explicitly design mechanisms for accommodating ever-changing information technologies in the operating language of legislation and administrative code. The markups to the Export Administration Amendments of 1974, for instance, contained a typical such clause: "Reporting, recordkeeping, and export documentation requirements shall be periodically reviewed and revised in the light of developments in the field of information technology." [114] Well-marshalled, systematized information control practices streamlined an organization's operations under the Ash model, elevating accounting to the art form of management. Hence the change of agency name to OMB: before Ash's directorship,

[113] Defense Department watchdog Gordon W. Rule apparently observed that "old General Eisenhower must be twitching in his grave" over the appointment of Ash, a perfect exemplar of the "military-industrial-executive department complex." Jim Horbers, "The Other Presidency," *New York Times* (3 March 1974), p. 226.

[114] "Export Administration Amendments of 1974, Committee on Banking, Housing, and Urban Affairs, United States Senate, 22 July 1974, p. 22.

only thirty employees in the agency were directly assigned to tasks labelled "management;" by 1974 some 130 employees, over a sixth of the total OMB workforce were explicitly charged with a management portfolio.[115]

By the waning months of Nixon's administration, with Bob Haldeman and John Ehrlichman removed from their domestic policy perches due to the Watergate investigation, according to one scholar, "Ash undertook to use his agency to run the government."[116] In the spring of 1973 Ash clashed with the Senate Committee on Government Operations over flows of information – the Congress demanded executive agencies supply them with the same raw data and budget models delivered to the President, at the same time such data files were delivered to the OMB for its processing of the President's proposed budget. Developing the White House's proposed budget was, to Ash, itself a systematized act, derived from careful balancing of inputs and outputs: "The whole system aims to force development of plans within constraints. That is the essence of good management."[117] Supplying budget information to Congress before the OMB had refined the numbers into a Presidentially-sanctioned budget proposal was akin to warping the cycle of input in a closed; premature transmission of budget estimates would have adverse effect on the efforts to develop those budget estimates.

Questions of information control frequently defined Ash's contentious relationship with other high-ranking officials of the Nixon era. According to Beltway scuttlebutt, the OMB director clashed in late 1973 with William Simon, the Nixon Administration's "Energy Czar," over how to define the economic conditions around which to devise energy-focused policy. Ash favored a view that held the Energy Crisis would require only short term solutions, thus

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[115] John Horbers, "The Other Presidency," *New York Times* (3 March 1974), p. 226.

[116] Mosher, 133.

[117] Mosher, 22.

necessitating only short-outlook policy prescriptions in response. Simon disagreed with Ash's predictions and with the budget director's interpretation of economic data. Energy was his office's purview, and so to should be definition of the analytical frameworks for interpretation of budget data related to the topic. Simon confronted Ash with the folksy admonition to "Keep your cotton-picking hands off my shop," to which Ash responded, "Yes, but we oversee the plantation."[118]

In a heated exchange with Senator Edmund Muskie, Ash bemoaned the legislative branch's gripes of "being so flooded by information from the agencies" that it couldn't decide whether other not to entrust information processing to the experts of the OMB. When Muskie exclaimed he wanted "that kind of information we [Congress] once had," Ash quickly snapped back, "It's not the same information, for one thing."[119] For Ash, managerial insight and administrative process (when conducted by capable hands) could perform a sort of systematized alchemy on raw numbers, transforming data actionable policy. Congress's fumbling efforts to secure enhanced access to governmental data not only jeopardized the political outcome of Nixon's proposed domestic policies, they ignored the proper procedures by which information flowed within a management system. As he noted, "We believe this system creates responsible and responsive management within the overall framework established by the executive budget. . . . We are really talking about the timing of information, not the information." Employing the metaphor of an automobile, he argued for a particular approach to information management Congress was completely disregarding:

> One can design a very efficient automobile but somebody else can come along and drive it too fast. We are talking about the system, the design of the system, we are not talking about the speed at which the system is driven. One can spend entirely too much money

[118] Ibid, 34.

[119] Roy Ash Senate testimony, 19 September 1972, 118 Cong. Rec. 30973, 31104.

> even if the system is perfect. The article to which you refer relates not to the design of the system; it relates to the speed at which that system is driven.[120]

Ash's model for shaping policy implementation through flows of information can be seen in the recommendations of the President's advisory Council on Executive Organization, which he chaired in 1970s. Arguing for fundamental restructuring of the federal government, Ash claimed that in an era of computerized analysis, existing departmental and agency structure was unresponsive to the broad policy categories identified as priorities by President Nixon. Nixon's de-evolutionist New Federalism program would be particularly difficult to implement in a Washington environment where patchwork installation of computing power abetted power imbalances between agency central offices and more ineffectual field organizations. Centralization meant that proper agency headquarters tasks of policy formulation and evaluation were frequently distracted by "efficiency in small concerns" related to operational implementation. For Ash, "advances in technology and improved communications and data handling" could promote an ideal form of decentralization, stripping from agency headquarters an impulse to meddle in field office affairs; in the view of BOB officials discussing the Ash Council report at a 1971 conference, under his paradigm "the location of processing units, such as ADP [Automated Data Processing] centers, at central locations was not necessarily inconsistent with decentralized management."[121] Data processing, if systematized in a particular fashion, could facilitate a very radical reconfiguration of government than that envisioned by Great Society acolytes a half decade before.

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[120] Ibid, 31124.

[121] BOB management conference program, 1971. Records of the Office of Management and Budget, Record Group 51, Series 51.8.1 Records of the Director's Office, Subject Files of the Director, "Management Conference" Folder. National Archives II, College Park, MD.

Representative of these changing attitudes were comments made in the spring of 1970 before the Agency Management Analyst Officers' Group (AMAOG, the voluntary Washington network of systems-inclined federal executives introduced in the last chapter) by Col. Andrew Aines of the Office of Science and Technology. A researcher in logistics, with advanced degrees in both psychology and international affairs, who had served as Chairman of the National Systems Task Group, Aines quoted Marshall McLuhan and Peter Drucker in while extolling the role of management as overseer of administrative technology: "I really believe that the managers in the United States – and I mean in government, business, and elsewhere – are one of the reasons for the technological success and power of our country. . . Having been trained in management and engaged in its practice, I must admit that I readily identify with you and you craft." [122] Presenting on the theme of "Superior Data-Handling – Must for Managers," Aines decried the folly of making executive decisions "with an inadequate data base." Managers "prone to keep their old information processes alive" could stall a management environment in which effective government officials embraced new ways employing electronic data processing rather than slotting computers into pre-existing management regimes. Minutes from the meeting reveal the subsequent discussion centered on how "management analysts . . . are more and more dependent on technological advances for information and communicating decisions."

By the mid-1970s, agencies corresponding with the OMB had learned to heavily play the data-processing card in budget requests and administrative negotiations with the executive budget-makers. The chairman of the Consumer Product Safety Commission, bemoaning in a 1974 letter a proposed diminishment in the agency's budget request, framed the reduction as an

[122] Andrew A. Aines, "Superior Data-Handling – A Must for Managers," *Office of Science and Technology*, 25 March 1970 (Washington, DC: Office of Science and Technology, 1970).

assault on "the funds required to achieve a level of organizational integrity." Denying the Commission resources necessary to expand its data processing and general administrative capacities might ironically lead to "regulatory over-kill," the argument continued, as "failure to appropriate . . . needed technical skills for understanding of the safety problems, and economic analyses capability to determine the most appropriate regulatory action" could only result in the "abandon[ment] of a major portion of its mandated mission" and "the concomitant possibility of imposing regulatory solutions based on incomplete data." [123]

Congressional Budget Office

Yet another example of the evolution of dataocracy in practice can be observed in the establishment of the Congressional Budget Office (CBO) in July of 1974. Simultaneously a product of specific Nixon-era political context and long-percolating, dataocratic trends, the formation and early years of the CBO would embody the growing political infighting between executive and legislative branches over how information should be assembled and interpreted for purposes of policy analysis and budget-setting.

The *Washington Post* noted in late 1973 and the summer of 1974 a rising chorus of critics who claimed Capitol Hill's authority over budget-making and policy oversight had been "surrendered to the White House through Congressional sloth and disorganization."[124] Freshman Utah Democrat Wayne Owens linked Congress's failure to pursue modern information management techniques to "the steady erosion of public confidence and trust in government" in

[123] Richard O. Simpson letter to Gerald Ford, 11 December 1974, p. 2-3. Domestic Affairs and Politics Files, "Consumer Product Safety Commission" series, "Organization" folder. Gerald Ford Library, Ann Arbor, Michigan.
[124] Spencer Rich, "Conferees Agree on Budget Nill," *Washington Post*, 4 June 1974.

Watergate-era America.[125] As one political scientist called in to provide expert testimony noted, "It is frequently argued that Congress has adequate staff and, if anything, is deluged with too much information. With regard to Congressional handling of the budget, that is clearly not the case."[126]

A House Select Committee on the topic framed the issue as a form of computational arms race: "The computer capability of the executive branch represents an ability to muster, manipulate, and analyze data that dwarfs Congress." Legislators were at a disadvantage in responding to the policy complexities of a modern world when they could not independently verify or assess the budget requests and complex policy formulations brought them by the Pentagon and executive agencies. As testimony revealed, the Department of Defense alone deployed over three thousand computers, while the entire House and Senate had access to only three antiquated machines employed for payroll purposes. Legislators concluded the Congress should "build its own informational capability for program and cost analyses and the evaluation of alternatives to present programs. Congress desperately needs computer services."[127]

Critics of current Congressional procedure asserted that "[if] the Congress were presented fuller information on the impact of its spending and revenue decisions, that it would be possible to get more order in the appropriations process."[128] As one Congressional bill charged, "the budget transmitted by the President to the Congress has become a massive jumble of abstract

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[125] Wayne Owens, 120 Cong. Rec. 16583, Extensions of Remarks - Tuesday, May 28, 1974

[126] Budget Control Act of 1973: Hearings before the Committee on Rules, House of Representatives, Ninety-Third Congress, First Session on H.R. 7130.

[127] "Committee Organization in the House: Hearings before the Select Committee on Committees," House of Representatives, Ninety-Third Congress, First Session 3 pt. 1 (1973), 290.

[128] Budget Control Act of 1973: Hearings before the Committee on Rules, House of Representatives, Ninety-Third Congress, First Session on H.R. 7130, 275.

figures, preventing the accurate analysis needed to determine the impact of proposals made in the budget and thus to make informed judgments whether those proposals are appropriate national policy."[129]

In particular, a Democratic-controlled Congress frequently at odds with the Nixon White House resented the stature, authority, and expertise emanating from the Executive Office-based OMB. As the *Washington Post* editorialized in December 1977 in reference to the pre-CBO status quo, "information is one of the elements of power, and the White House formerly had something of a monopoly on it. There was no congressional counterpart to the President's office of Management and Budget. . . . [The CBO] was the product of deep congressional suspicion of President Nixon, and the Democrat's well-justified assertion that his administration had repeatedly mislead them on the economic outlook." Sound data – and the capacity to autonomously aggregate and analyze it – was the basis of "economic counsel that is both sophisticated and sound," the paper's editorial board concluded. "In matters of economic policy, two computers are better than one." [130]

The Legislative Reorganization Act of 1970 included three sections authorizing creation of a "standardized information and data processing system."[131] The Budget Information Allocation Act of 1973, product of a cluster of House members concerned by the regionalist implications of President Nixon's proposed cuts to social welfare programs, demanded the White House accompany its budgetary requests with a form of metadata: "Analysis of the impact of budget proposals in human terms." More elaborate data would provide a personal perspective on

[129] Ibid, 307.

[130] "Two Computers are Better than One," *Washington Post* (12 Dec. 1977), p. A22.

[131] Budget Control Act of 1973: Hearings before the Committee on Rules, House of Representatives, Ninety-Third Congress, First Session on H.R. 7130, 308.

the perceived cost of slashing social programs. The legislation explicitly called for “that information” to be assembled “using the computer resources now available to the Executive.”[132]

The proposed solution that fluttered around federal cubicles and Georgetown cocktail parties in 1973 and 1974 built on that underdeveloped clause. A congressionally-based budget office, “something like a miniature OMB,” featuring a nonpartisan director appointed by legislative leaders. [133] Though numbers were at the heart of both the budgetary process and systems techniques of data analysis, nearly all parties involved in the push for a CBO evoked less-tangible aspects of policy formulation that could be abetted by computer processing. The final paragraph of H.R. 7130, a summation of the legislation’s intent, explicitly conveyed its dataocratic impulses. Joint Legislative Budget Staff were ordered to develop methods of using computers and other techniques for the analysis of information to improve not only the quantitative but the qualitative evaluation of budgetary requirement.”[134]

Central to public debate was the assertion that over the past decade-plus the executive branch had developed an advantage over Capitol Hill lawmakers when it came to the marshalling of information. John Gardner, former Secretary of the Department of Health, Education, and Welfare (HEW) and founder of the liberal advocacy group Common Cause, testified that to function in the policy environment of the 1970s “Congress [should] have a highly effective staff concerned with the kind of information function” seen in the private sector. To be effective, he argued, Congressional staff should have “full access to what the executive branch has . . . It should have computer capability of some kind. It should have free opportunity to contract out

[132] Ibid, 307

[133] Spencer Rich, “Conferees Agree on Budget Nill,” *Washington Post*, 4 June 1974.

[134] Budget Control Act of 1973: Hearings before the Committee on Rules, House of Representatives, Ninety-Third Congress, First Session on H.R. 7130, p. 264.

some of the required evaluations."[135] Another witness emphasized the streamlining convenience computerization might bring Capitol Hill: "With the computer geared up to spew out information on the content and exact status of the more than thirty thousand bills and resolutions introduced during the average Congress and to assist with routine housekeeping chores, committee staffs are freed for more important business."[136]

In November of 1972 the GAO surveyed 258 Hill denizens (including staffers from 44 committees and 69 members of Congress) to determine their "information needs." Illinois Congressman (and future presidential candidate) John Anderson laid out to his colleagues on the Committee on Rules what he saw as an administrative imperative for Congress to adopt methodologies of information management with policy analysis. Providing enhanced staff capability for legislators to process information would restore some Congressional suzerainty over the budget implementation process. A "strong program evaluation effort" conducted by experienced congressional staffers could "strengthen the ability of Congress to choose between competing and often overlapping programs and to reassert our role asserting national priorities."[137]

Political orientation seemed to have little to do with individual interest in promoting a more technologically-savvy budget advisory office centered in the legislative branch. California representative John H. Rousselot, a John Birch Society-affiliated management far to the right of moderate Anderson, enthusiastically touted the need for such an office. "I think it would put

[135] Committee Organization in the House: Hearings before the Select Committee on Committees, House of Representatives, Ninety-Third Congress, First Session 3 pt. 1 (1973), 266.

[136] Arthur John Keeffe, "Facelifting Time at the House of Representatives," 60 A.B.A. J. (1974): 1466.

[137] John Anderson, Budget Control Act of 1973: Hearings before the Committee on Rules, House of Representatives, Ninety-Third Congress, First Session on H.R. 7130, 169.

Congress back in the ball game of really participating in budget control instead of just complaining about it. I believe it would give us the technical equipment."[138] Even for an arch-conservative, "the necessity for having the computer capability" appeared paramount for Congress to have an authoritative say in budgetary allocation. Pursuing an ideologically-driven agenda of budget reduction, federal program shrinkage, and tax reduction, Rousselot concluded, ". . . would require of us the kind of data collection that we have needed for some time to compete with the Budget Bureau and others." At the opposite spectrum, activist Ralph Nader testified on the imperative for Congress to embrace data processing as an institutional check to the power of the executive branch and the military-industrial complex:

> There has been a lot of talk about how many computers there are in the Department of Defense or the executive branch compared to Congress. Obviously, it isn't a numbers game, but a function game. That is, if computers really are useful for storing and retrieving information accurately, then why shouldn't the Congress have its computers[?]

If Congress could not establish its own computing analysis office, he pleaded that at least legislators could "[link] into some of the computer systems in the executive branch so they can tap the information sources." Regardless of preferred political orientation, in the minds of major political actors in the early 1970s, enacting a shift in policy necessitated Congress have the computing capacity to generate its own numbers.

A parade of Congressional witnesses hammered this theme again and again in the two years preceding CBO authorization. Current Congressional procedures and tools for processing information – the raw matter of policy – were woefully inadequate; only the computer could modernize and make more efficient legislative operations. John Saloma, a leading political scientist at Harvard's Kennedy School, testified on the same basic themes he introduced to future

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[138] John Rousselot, Budget Control Act of 1973: Hearings before the Committee on Rules, House of Representatives, Ninety-Third Congress, First Session on H.R. 7130, 122.

government leaders in his public policy classes. Modernization required embedding computer experts inside the policy apparatus: "the Congress will have to recruit a sizable professional staff to implement this provision. Information requirements for computer analysis will become both more precise and more extensive." [139] Urging a comprehensive approach to "information support for decision-making," Saloma and other witnesses suggested an aggressive move beyond "computer-assisted techniques of analysis" to full-fledged, "computer-driven," "long-range models for budget projections" then being experimented with by rival think tanks the Brookings Institution and the American Enterprise Institute.

In a 1973 statement to the House Committee, Elmer Staats, former Deputy Director of the BOB under four presidents and then Comptroller General of the United States, invoked statutory authority for "information gathering and analytical responses" and questioned whether the "proposed Congressional Office of the Budget . . . would want to get involved in the complex and technical tasks of defining and specifying information requirements and classifications for systems designers and computer specialists." [140] Such an office would not require its own programmers, systems analysts, or mainframe time-sharing, Staats asserted: "The important point is that congressional budget analysts get the information."[141] The White House and the OMB, he implied, should continue as the source of that information. Proponents of the CBO disagreed – the siting of machines and the analysts who interpreted the reams of data they generated was a crucial element of autonomy. Information was not merely the final output, but

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[139] Budget Control Act of 1973: Hearings before the Committee on Rules, House of Representatives, Ninety-Third Congress, First Session on H.R. 7130, 1154.

[140] Elmer B. Staats, Budget Control Act of 1973: Hearings before the Committee on Rules, House of Representatives, Ninety-Third Congress, First Session on H.R. 7130, p. 224.

[141] Ibid, 224.

the entire process. Members of the Washington legal and lobbying establishments tipped their hats to the new order, as in one column labelling the OMB "the legislative answer to the president's Office of Management and Budget, staffed with specialists and armed with computer capability."[142] The National Committee for an Effective Congress called for "A Congressional Budget Office, or its equivalent, staffed by experts and provided with modern computer equipment."[143]

Reflecting a recurring theme of Dataocracy-era Washington, increased authority by computer-savvy, or at least computer-interested, staffers facilitated Capitol Hill's push to adopt increasingly computerized methods. More specialized committee work meant an increased number of staffers, many of whom brought backgrounds working with information technologies. Assessing changes to bookkeeping practices in the upper chamber in the late 1960s, historian Donald Ritchie noted, "the phenomenal growth of the Senate staff forced the institution into the computer age."[144] The impulse to increasingly deploy computerized solutions in the federal government in the 1960s and 1970s was product of the juncture of expanded mission scope and available personal; just as seen in the Pentagon, domestic agencies encountered more complex tasks brought about by governmental expansion, the fulfillment of which fell to recent hires or promotions predisposed to favor the computer as a tool of management.

Establishing the CBO

[142] Keeffe, "Facelifting Time at the House of Representatives,"1466.

[143] National Committee for an Effective Congress, 1972 statement. Included in Congressional Quarterly, *Historic Documents of 1973, cumulative Index 1972-1973* (Washington, DC: Congressional Quarterly, 1974), 181.

[144] Donald Ritchie, introduction to oral history interview with William Ridgely, Senate Historical Office (1982), 1.

The final enabling legislation contained in the Congressional Budget and Impoundment Control Act of 1974 explicitly authorized the CBO director "to equip the Office with up-to-date computer capability . . . obtain the services of experts and consultants in computer technology, and develop special techniques for budgetary evaluation and information."[145] Acknowledging "scarce resources of space, power, money and skilled personnel" inherent in any Washington computing installation, the Rules Committee appended an "upon approval" clause ensuring the CBO must seek approval from House and Senate administrative committees and coordinate with other governmental data processing facilities to promote cooperation and avoid duplication of equipment purchases. Implicit in the directive was the assumption that legislators would maintain strict oversight of "their" newly created experts. Further distancing itself from the assertions of informational privilege asserted by the Nixon White House, Congress instructed (with the exclusion of a few national security categories) that all information obtained and processed by the CBO be made available to the public.[146]

The period's focus on more detailed and accurate analysis of information enabled a complementary rise in accountability on the origins of that data. Under the same clauses of the Legislative Reorganization Act of 1970 that laid the groundwork for the Office of Technology Assessment and the Congressional Budget Office (along with the revitalization of the Congressional Research Service), the General Accounting Office would increase its professional staff by a quarter in the first half of the 1970s. Congressmen and committees could now draw on

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[145] Legislative History of the Congressional Budget and Impoundment Control Act of 1974 P.L. 93-344 88 Stat. 297 (1974), 37.

[146] 120 Cong. Rec., Senate - Friday, June 21, 1974, 20465. For more on general attitudes towards transparency and availability of information during the period, see Michael Schudson, *The Rise of the Right to Know: Politics and the Culture of Transparency, 1945-1975* (Cambridge, MA: Belknap Press, 2015).

an expanded pool of auditors and investigators to verify the data contained in specialized reports and policy briefs generated by executive agencies.[147]

The new organization's first director would not be a technologist, but an economist and policy analyst who embodied how systems-refined, computer-assisted analysis might be applied to budget preparation and establishment of policy priorities. A fellow with the Brookings Institution and Assistant Secretary for Planning and Evaluation in Lyndon Johnson's Department of Health, Education, and Welfare, Alice M. Rivlin in 1973 published the widely read *Systemic Thinking for Social Action*. Nicknamed "Congress's Budget Queen" by the *Economist* magazine, she quickly linked the success of her new posting to Congress's willingness to invest in a modern information management infrastructure: "the Congressional Budget Office really can't do its job without computers."[148]

This was in part due to the veneer of legitimacy and neutrality granted by the aura of data processing. As one observer noted of the nascent CBO, "if its political mechanism proves unworkable, budget reform may be discredited without leaving any substantial improvements in budgetary information available to the Congress." The solution was to

> develop methods of using computers and other techniques for the analysis of information to improve not only the quantitative but the qualitative evaluation of budgetary requirements.. . the Congress will have to recruit a sizable professional staff to implement this provision. Information requirements for computer analysis will become both more precise and more extensive.

The nascent agency contracted the American Management Systems Corporation to conduct a study into "preliminary specifications for an automated budget information system." Rivlin

[147] Keeffe, 1466.

[148] Hearing before the Committee on House Administration, Ad Hoc Computer Subcommittee, 121 Cong. Rec. 31825, 3189 (6 Oct. 1975), 4.

explicitly emphasized the Congressional ownership of any data processing machines her bureau would rent or purchase, noting that while the organization's establishing legislation "authorizes the CBO to obtain its own computer equipment," the office would first seek to make use of existing Congressional computers (for payroll, etc.) should such devices suffice.[149] Virtually all communications from Rivlin and her staff to congressional committees emphasized, word-for-word, that "CBO [had] diverse and complex responsibilities in the establishment of an automated system for meeting the budget information needs of the Congress."[150] Modeling potential impacts of alternative policy proposals with the speed and specificity the office's mission mandated essentially required advanced data processing technologies. The very task of "scorekeeping" – comparing the calculated probable results of proposed policy alterations to stated Congressional budget targets – was an exercise of constant flow of information, constant strings of slightly revised policy iterations predicated on the slightest tweaks to budgetary inputs.

By 1975, with the CBO firmly established and its staffers generating analysis for review by congressional committee staffers, Rivlin and her colleagues sought to harness the Hill's enthusiasm to establish a "visible and useful, user-generated budget information system." Among the suggestions: a "Visibility Room," or computerized "Situation Room" in the Capitol building where "Members of the Congress might be able to find the kind of computer graphics and charts . . . to help them determine the status of the federal budget or the appropriations process or the past history of a federal program."[151] Reminding the legislators that "all" of her agency's statutory responsibilities "involve[d] computers in some way," she outlined to a

[149] Alice Rivlin, "Statement before the Subcommittee on Legislative Branch Appropriations, House Committee on Appropriations," 121 Cong. Rec. 33240, 33303 (21 October 1975).
[150] Ibid, 333275.
[151] Hearing before the Committee on House Administration, Ad Hoc Computer Subcommittee, 6 Oct. 1975, 2.

congressional committee a “rather grand design for a major computer information system” inspired by a recent “visibility room” installation in Washington State. This chamber of computer terminals, electronic display boards, and quickly generated answers to Congressional questions (“in tabular or in graphic form”) would break present and historical budget data into formats useable for projection modeling or easily printed handouts suitable for committee sessions or constituent meetings.

The actual home of the newly established office was far less glamorous, reflective of the tedious, intricate, often unheralded work undertaken by CBO staff. G. William Hoagland, later staff director for the Senate Budget Committee, recalled his early Hill employment in Rivlin’s CBO as “hard analytical work with punch-cards carried to large mainframe computers,” a “stark,” warehouse-like space in the then-unnamed House Annex #1 (later the Ford Building). Rivlin referred to hires like Hoagland, who had both policy and statistical experience, as “bastardized children,” tasked with floating between the policy and budget analysis groups as they designed models of cost estimates for the Farm Bill. [152] As the Senate Budget Committee would not receive a direct data transmission to the CBO until the 1980s, “people [would] make computer runs all the way from the CBO all the way up here, back and forth,” shuttling data to be inputted, computerized results, and requests for revisions between agency offices and staffers continually remarking bills. [153] Rivlin described the position of computer programmer as “critical” to the task of producing the revenue estimates the office was legally-obligated to present to legislators.[154]

[152] “Oral Interview #1” with G. William Hoagland, Senate Historical Office (28 November, 2006), 14-15.
[153] Ibid,. 22.
[154] Alice Rivlin, Statement before the Subcommittee on Legislative Branch Appropriations, House Committee on Appropriations” (12 November 1975).

The centrality of computer-assisted planning in the CBO reflected the triumph of dataocratic understanding of information management that had percolated two decades earlier with the then-Bureau of the Budget before dispersing throughout the postwar executive branch. CBO staffers "developed a number of sophisticated analytic computer models of federal programs" that undergirded the agency's entire cost estimate procedure. Looking back on the CBO's first decade, one agency official noted in 1986, "Computers continue to be essential to our operation."[155] By the end of that decade, a "master computer" operated jointly by the CBO and the Appropriations and Budget Committees of each chamber generated daily or weekly scorekeeping reports to members of the Appropriations and Budget committees. [156]

The test of partisan transition of power illustrated that Dataocracy as an approach to governance transcended party label. In 1977 President Jimmy Carter urged his Democratic allies in Congress to endorse his ambitious, if sketchily-outlined public works and energy conservation proposals. Rather than defer to the preferences of a President of the same party as the congressional leaders who oversaw her office, Alice Rivlin and the number-crunchers of the CBO presented computer-generated models of economic impact as combative to the White House's wishes as any generated during the Nixon or Ford years. As the *Washington Post* observed, "Even the most loyal of the President's friends in Washington were reluctant, apparently, to return to anything like the old custom of taking the President's numbers on faith."[157]

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[155] Rudolph G. Penner, Statement before the Subcommittee on Legislative Branch, Committee on Appropriations, United States Senate (26 June 1986), p. 30.

[156] "Interview #4: The Appropriations Process," oral history interview with Warren Featherstone Reid, Senate Historical Office (23 July 1981). 152.

[157] "Two Computers are Better Than One," *Washington Post* (12 Dec. 1977), p. A22.

Control and analysis of information were the keys to effective policy-making. As Rivlin noted, "Before one rationally decides where one wants to go, one has to know where one is. . . While not planning as such, these efforts do lay some of the necessary informational and analytic groundwork for a more rational decision-making process." As technologically-abetted processors of information, CBO staffers were akin to translators, communicating "technical results" to office holders, giving "the decision maker an opportunity to make a more rational decision by increasing the level of information and by focusing the decision point in the out years, and thus providing greater freedom of choice."[158] The sort of aggregation and analysis facilitated by electronic computers offered not just speed and accuracy, but a fundamentally more open form of government, in which lawmakers were presented with more policy options.

The ultimate product of entrenched dataocracy was choice. By the close of the 1970s, though, information-facilitated choice frequently led to discord and ideological contestation over how competing flows of information should shape policy outcomes at local and federal levels. Nowhere was this more apparent than in the realm of environmental policy.

[158] Alice Rivlin, Statement before the Joint Session of the Subcommittee on Fisheries and Wildlife Conservation and the Environment of the House Committee on Merchant Marine and Fisheries and the Subcommittee on Environment and Atmosphere of the House Committee on Science and Technology (30 June 1976).

Chapter Three

Output = Utopia:
The Social Security Administration, Technological Social Welfare, and the Promise of Systems Computing

Most Americans are surprised when they find out the Social Security Administration (SSA) is not headquartered in Washington, DC.[159] The agency that administers the iconic social welfare program that may arguably be the New Deal's most enduring legacy resides some forty-five miles away, in Baltimore, rather than among the federal agency-lined streets of the nation's capital. This matters for two reasons: it illustrates the organizational distinctiveness (some employees would say "exceptionalism") that has historically marked the agency and its bureaucratic self-attitudes, and more importantly, it reinforces the largely forgotten narrative of how central the physical machinery of information technology has been to the growth and administration of social insurance in the United States. The rationale for the isolation of Social Security's headquarters from the epicenter of government life rests with the simple explanation that its record-keeping operations have historically required space – space for storing the information detailing the lifetime records of its millions of beneficiaries, space for the machines required to process that information, space not available in crowded Washington when the social insurance program was first established in 1935.[160]

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[159] That's assuming that Americans pause to consider the organization that administers the United States' largest federal program. As social science researchers have indicated, most Americans misunderstand how social security functions and only view its operations within the context of heated political rhetoric. See Jennifer Jerit and Jason Barabas, "Bankrupt Rhetoric: How Misleading Information Affects Knowledge about Social Security," *The Public Opinion Quarterly*, Vol. 70, No. 3 (Autumn, 2006): 278-303.

[160] As noted by early Social Security official Arthur J. Altemeyer (*The Formative Years of Social Security* [Madison: University of Wisconsin Press, 1966]) and historian Brian Balogh ("Securing Support: The Emergence of the Social Security Board as a Political Actor, 1935-1939," in Ellis W. Hawley and Donald T. Critchlow, eds., *Federal Social*

The situating of Social Security was in essence dictated by the physical reality of information technology. The Social Security Board, charged with registering 26 million American industrial workers for social insurance benefits by January of 1937, recognized that it would need to acquire suitable, temporary space capable of housing both storage files for tens of millions of pieces of paper and a large installation of noisy, heavy, constantly vibrating office machines; the tabulators, card punch machines, and sorters required to organize data and process payments, not to mention the rows of file cabinets containing cards associated with each Social Security Number, would occupy 24,000 square feet of office space. For a period of several years, until a budgeted-for Social Security Building could be completed on the corner of Independence Avenue and Fourth Street in the District, Social Security officials would have to rent office and warehouse space of suitable size. None was available in overflowing, New Deal Washington; the closest suitable structure was a dilapidated warehouse-type office building on Baltimore's Inner Harbor. The Candler Building would remain Social Security's home until the late 1950s, when, driven by the imperative for more file-storage and processing-machine space, the SSA would construct an elaborate headquarters complex at Woodlwan, in suburban Baltimore. SSA's computing needs had outgrown its ability to move back to the nation's capital. The shape data requirements would take – the needs of information technology abruptly stepping in to shape the preferences and actions of Social Security's employees – would be a constant presence in the agency in the era of "dataocracy."

Policy: The Historical Dimension (University Park: Pennsylvania State University Press, 1988): 55-78, the considerable task of processing benefit information for a multimillion-person, mobile population was one of the chief considerations of FDR's administration in situating social security as a federally-supervised program in 1935. Having forty-eight varied state governments track records, process benefits, and exchange information in non-coordinated fashion would have been an impossible informational undertaking.

From the mid-1950s until the late 1970s, the Social Security Administration embodied much of what was best and worst about the concept of dataocracy in American government. A pioneer in office technology use in the 1930s and 1940s, the proactive agency pressed IBM in the 1960s to develop innovative new technologies like optical character recognition for processing vast sums of data. The agency became bogged down in promoting its identity as a technology pioneer, however, and by the early 1960s found itself possessor of numerous expensive and incompatible computer systems ill-suited to the changing nature of its institutional mission. The impulse to acquire ever more mainframes in the name of improving capacity was, after all, not without legislative mandate. Senator Alexander Wiley of Wisconsin had enthused to his colleagues in 1958 that "where the battle for life may be literally a matter of hours or days or weeks, installation of more electronic brains, carefully adopted, can make all the difference in the world." [161] Social Security took this to heart.

The social insurance agency's embrace of computerized information processing from the early 1960s through the early 1970s reflected broader period tendencies that intertwined the push to automate data with the impulse to expand Social Security's reach into the fabric of the welfare state. The heyday of Social Security's mainframe fixation was also the zenith of Lyndon Johnson's Great Society and its ambitions for managed social transformation in America.[162] The first embodiment of the datocratic synthesis in the agency during this period can be observed in the brief, if influential, push to develop a "Total Data Systems Plan" that would unify all of

[161] Wiley, 104 Cong., Rec. 9418 (26 May 1958), 9453.

[162] For more on the Great society in its ideological and policy context, see Davies, Gareth, *From Opportunity to Entitlement: The Transformation and Decline of Great Society Liberalism* (Lawrence, Kansas: University Press of Kansas, 1996); Milkis, Sidney M. and Jerome M. Mileur, eds., *The Great Society and the High Tide of Liberalism* (Amherst, MA: U. of Mass. Press, 2005);

SSA's information processing activities in a single, unbroken protocol that might – in the visions of some agency officials – permit the agency to lead a massive expansion and transformation of the social welfare state. Principles and methodologies developed during that phase directly shaped a subsequent dataocratic moment, the highly successful implementation of Medicare from 1965 to 1967, when SSA's Bureau of Health Insurance capably corralled a massive information processing endeavor and employed computerized management techniques to structure the daily policy decision-making relationships between Social Security and private sector insurance providers.[163] All competence and good will engendered by this ringing success dissolved into overreach and embarrassment by the turn of the 1970s, when data processing failures and an inability to translate new types of social programs into practicable, "Social Security"-style management regimes marred the rollout of the Supplemental Security Insurance program and permanently scarred the SSA's reputation for information management aptitude.

Computing as part of its mission became key to SSA's identity. "Three cards on the average are punched for each bill; never less than two cards per bill are punched," noted one pamphlet touting how every piece of information about social security card holders was processed by multiple machines.[164] Internal self-evaluation documents from the late 1970s include extensive documentation of SSA's earlier attempts to rewrite its history of computer use, puffing up its collaborations with IBM and other vendors and discounting the degree to which its systems frequently became overloaded.[165] What had been a relatively commendable status as

[163] Contemporary observers might find parallels in the difficulties encountered by, and the reception to, the rollout of the Affordable Care Act.

[164] Social Security Pamphlet 26/50, 1965. Pamphlet Revolving file. Social Security Administration Archive, Baltimore, MD.

[165] Renato DinPentima, College Park, MD. University of Maryland dissertation, 1984, 76

early adopter was exaggerated beyond any sense of proportion. Even as computers ascended in prominence within SSA offices, providing the administrative and number-crunching capability that drove the agency into new programmatic directions far removed from its strict social insurance origins, officials at all levels of embraced data processing and advanced information management techniques as an organic extension of the Agency's earliest values. In 1985, Michael Cronin, technical Advisor to SSA's Office of Legislative and Regulatory Policy, observed, "While it is true that the computer age has changed a great deal about the operation, today's process is a direct, recognizable descendent of the original one. Furthermore, the tabulating and posting machines used in the agency's infancy were every bit as revolutionary in their own day as computers were when SSA first began to use them nearly 30 years ago."[166] From the late 1940s through the early 1980s, the institutional memory of the Social Security Administration placed its executives and line workers in the unusual position of seeking to validate embrace of elaborate electronic computing installations as seamless inheritors of an older, Depression-era, non-digital mechanized accounting heritage.

Situating Social Security – Mission and Records

Compared with most other executive agencies of the federal government, Social Security has historically maintained a special sense of identity among its employees and officials, a difficult-to-define yet still tangible *esprit de corps* derived from sense of purpose. [167] Originally

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[166] Michael A. Cronin, "Fifty Years of Operations in the Social Security Administration," *Social Security Bulletin*, Volume 48 - June 1985 - Number 6.

[167] Incidentally, this sense of mission was accompanied by a keen sense of the Agency's own place in history. In 1963, less than thirty years after its establishment, the SSA would appoint its first staff historian.

this sense of purpose – suffused through agency culture through shared communication, employee training and socialization, and even explicit efforts to describe an "SSA way" (including internal magazines, staff hobby groups, and social security songs) – focused on Social Security's Depression-era origins and the contributory nature of its social insurance. Emblematic of this attitude was J. Douglas Brown's assessment twenty-five years into the program:

> . . . we wanted our government to provide a mechanism whereby the individual could prevent dependency through his own efforts. We wanted to keep the individual in the picture as a person and not merely a statistic. Our idea of social security was a social mechanism for the preservation of individual dignity, not for the insurance of a political status quo.

Extolling the basis of a program derived from "protection as a matter of right and not as a benevolence of government," Brown drew attention to those elements that enabled social Security's early backers to push through Congress a program on such a massive scale: a focus on the individual taxpayer, strict avoidance of any class rhetoric, the relatively conservative linkage of differential benefits to contributed earnings. Fittingly, he observed, "We had two good reasons for building our systems on this foundation, to preserve motivation and to relate earnings and benefits in diverse economic situations." Yet his subsequent sentence reveals an embedded element of dataocracy fundamental to the way the Social Security Administration would come to operate, a reliance on information processing hardwired into the very structure of the agency: "If another reason were needed, it was our predisposition for accounting machinery which made percentage computations of wages both easy and convenient in the payroll offices of the country."[168]

[168] J. Douglas Brown, "The Idea of Social Security, speech before the Meeting of Old Age and Survivors Insurace, November 7, 1957. Reprinted by the Government Printing Office (Washington, DC, 1958). J. Douglas Brown file, Social Security Administration Archive, Baltimore, MD.

A brainchild of Franklin Roosevelt's New Deal, the Social Security Act of 1935 established a retirement program eventually administered after 1937 by the Bureau of Old Age Insurance (BOAI). A pure social insurance program, Social Security of the 1930s and 1940s relied on payroll deductions from all salaried and wage workers in industry and commerce (with significant sectors of the economy excluded) to generate revenue that would pay benefits to the retired. Originally overseen by an independent Social Security Board, the organization was subsumed into the Federal Security Agency in 1939, renamed the Social Security Administration in 1946, and placed under the Cabinet-level Health, Education, and Welfare Agency (HEW) during President Eisenhower's reorganization of government in 1953.[169] Under separate titles of the Social Security Act, the same Board oversaw a national unemployment compensation program and – via grants to states – financial assistance to maternal and child welfare programs, blind individuals, and certain public health programs.

Over the next three decades, nine amendments would drastically expand the reach and scope of the agency's mandate – creating an environment in which functional responsibilities changed greatly but the legacy of social insurance origins colored the organization's self-identity.[170] Traditional narratives of the Social Security Administration follow a programmatic course, laying out this expansion of benefit programs the agency oversaw (and the corresponding increase in citizenry served). Understanding Social Security becomes the story of new waves of beneficiaries becoming eligible for blue-and-white Social Security cards: farmers, domestic

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[169] Following the events of the timeline of this chapter, SSA would move to the Health and Human Services Agency (HHS) under President Carter's reorganization of 1980 before finally being released to its original status as an independent agency by President Clinton in 1995. Regardless of whatever fealty the agency owed, throughout its history the programs it oversaw, while generally popular in theory, became political footballs in practice.

[170] For more on Social Security's history, see Abbott, Grace, *From Relief to Social Security: The Development of the New Public Welfare Services and Their Administration* Chicago: University of Chicago Press, 1941).

servants, housewives, railroad workers, the self-employed, members of Congress. Though illuminating, these narratives are insufficient, especially for fully explaining the origins and impact of major Social Security expansions of the 1960s and 1970s that brought newly created programs for medical insurance (Medicare and Medicaid) and relief for the elderly poor or disabled (Supplemental Security Income) under the aegis of SSA. To fully understand the transformation of Social Security from the 1950s through the 1970s requires consideration of the rapid rise of electronic computer use within the agency and the ways in which embrace of computerized data processing by SSA leaders during that timeframe propelled a willingness to expand the agency's mission.

Dataocracy in this case presents a fresh lens on the gradual expansion of Social Security's scope, one rooted in ambitious recognition of managerial and technological capacity as much as demographic and social movement-driven expansion of the pool of social welfare recipients.[171] Social Security officials, while responding to the broader context Great Society liberalism, were on a daily basis presented with a technocratic justification for pursuing expansion of the mandate of national social insurance: the possessed the information processing capacity to do so.

Two decades of agency growth preceding the 1960s reveal the groundwork for these attitudes. In 1939 the BOAI became the BOASI (Bureau of Old Age and Survivors Insurance) with the additional of Congressional amendments providing benefits for surviving spouses and dependents of workers insured under Social Security. Within a decade, a Division of

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[171] For more on the politics and demographics of social security benefit classes, see Jerry R. Cates, *Insuring Inequality: Administrative Leadership in Social Security, 1935-1954* (Ann Arbor: University of Michigan Press, 1983) and Linda R. Wolf Jones, *Eveline M. Burns and the American Social Security System, 1935-1960* (New York: Garland, 1991). For a contrarian view, see Larry DeWitt, "The Decision to Exclude Agricultural and Domestic Workers from the 1935 Social Security Act," *Social Security Bulletin*, Vol. 70 No. 4 (November 2010).

Management Planning and Services had been established to address the information overload associated with growth in the BOASI – growth both in the number of cases processed and the ballooning staff required to process said cases. During the agency's first decades, the appointed officials who provided the earliest public face of Social Security took great pains to intellectually erect a cultural firewall between the contributory social insurance program that formed SSA's largest mandate and the sundry public assistance programs authorized by the Social Security Act. An insurance program into which workers paid could avoid the stigma of "welfare" and skirt accusations of government overreach into the realm of charity; in Social Security's public persona, the federal government merely leveraged its organizational capabilities to securely look after funds a worker had paid from his own labors. Behind the veil, in terms of administrative functionality, the silo-ing of welfare operations from social insurance operations gradually eroded as all components of the broader agency came to rely on increasingly inter-connected information management practices and technologies.

The Agency developed a hybrid organizational structure – a powerful central office headquartered in Baltimore, supplemented by twelve regional offices with their extensive administrative powers, and eventually hundreds of local field offices that provided direct services to citizen-clients.[172] Much like the federal court system, the entire Social Security infrastructure possessed an identifiable "shared sense of self" but expressed some regional differences; though the central benefit rolls were housed in Baltimore, significant information management staffs to process, certify, and recertify claims filled the payrolls at these regional centers.

[172] By the mid-1960s there would be 618 offices around the nation.

Uniting these seemingly disparate identities – a social insurance legacy in an increasingly welfare-oriented bureaucracy – was faith in the administrative expertise of the agency and its employees. As former Secretary of Labor Frances Perkins, then eighty years old, noted at twenty-fifth anniversary of the signing of the original Social Security Act:

> I think too that as we stand here, and as we sit here and think about this precious child we want to see it grow. It has grown enormously in these years, it has improved, its administration has grown bigger and bigger as the imagination of those in charge have pointed out what could be done. [173]

Of particular pride to Perkins and other speakers at those 1960 festivities was the centrality of efficient information management to that administrative identity.

> . . . and, as for how we were going to keep the records, you know, of the social security program once it was launched, was one of the great problems. The IBM hadn't been invented, the machines you all operate so easily. And I want you to realize that it took some courage, Mr. Secretary, to launch the program without the IBM machines. I would like to add that under any circumstances I was always a bit nervous about it, and I remember the day that Arthur Altmeyer, who was then First Assistant Secretary of Labor, walked into my office and said, "You know I think we found it." Because he had been talking about, you know, handwritten pieces of records and how they were to be organized and stacked up, "I think we've found it. These new IBM machines, I believe they can do it." And so out of that really inventive group, that worked in the IBM research group we found a way by which this could be done. [174]

Selling the Public

This tendency can be viewed in the context of Social Security's public relations efforts. At the same time Administration officials disseminated computer and systems ideals within the SSA, documents directed towards the public also displayed such attitudes. Though it was only by the mid-to-late Sixties that the Social Security Administration's public face became increasingly dominated by its link to computers and automated systems management, elements of an

[173] "Remarks by Frances Perkins," August 15, 1960. Clipping from Frances Perkins folder, Social Security Administration Archives, Baltimore, MD.

[174] Ibid.

information-focused persona routinely appeared in pamphlets, circulars, and brochures directed at the general public in the late 1940s and 1950s.

A representative brochure from 1949, “Insurance for Workers and their Families,” contains mentions of SSA field offices, “traveling officers” serving communities, and the relationship between the individual in capacity as benefit recipient and Social Security as a mechanism for delivering benefits. Like most agency publications throughout the 30s, 40s, and 50s, focus is on the existence of benefits and the necessity for claimants to contact their local SSA office to correct mistakes and claim back payments.[175] Social Security’s mission and the individuals it is mandated to serve provide the parameters for discussion of the Agency. During the 1950s internal bureaucratic discussions on how to portray SSA and its mission focused on “terms more meaningful to the public,” deliberately eschewing descriptions of “internal operations.”[176]

A 1955 public brochure produced by the SSA’s Bureau of Old Age and Survivors’ Insurance, “Your Social Security Record,” further typifies this earlier era of Social Security public relations. Couched as a series of questions that follow a typical citizen through the claims process, the booklet emphasizes the human factor of interaction between SSA representative and client. Where automated machines appear, they are humanized, benign extensions of the service process. On the cover of another mid-fifties pamphlet, smiling, anthromorphic, cartoon card-punch machines appear as servants waiting on the Social Security card of John Q. Public.[177]

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[175] United States Government, Federal Security Agency, Social Security Administration. “Federal Old-Age & Survivors Insurance: Insurance for Workers and Their Families.” December 1949. Author’s collection.

[176] T. Parrott and H. McKenna to Robert M. Ball, May 31, 1960, Publications File; Social Security Administration History Room, Baltimore, Maryland.

[177] “Your Social Security Record,” 1955, Brochure File; Social Security Administration History Room, Baltimore, Maryland.

After 1965 the computer and all it symbolized became the public face of Social Security. That year's booklet "Social Security USA: The Program and its Administration" focuses heavily on the technology and processes used to deliver beneficiaries' payments. Hailing an "office revolution," the booklet details Social Security's operations "from account number to benefit" and praises "new electronic equipment" that processed over a million records a day. [178] The need to "handle this mass of records quickly, efficiently, and economically" and the "need for greater speed and accuracy and for the delegation of more of the routine jobs . . . to machines" required SSA to constantly expand and update its computing resources, according to the brochure's text.[179]

After recounting a history of the agency's use of "the first large scale computer to maintain records of earnings," the booklet proclaims the imminent arrival of a

> fully integrated data processing system of the future that will enable Social Security Administration to handle a greatly increased volume of work, to gather more quickly the information needed for claims decisions, and to solve the problems of distance inherent in a decentralized organization with nationwide responsibilities.[180]

While still including traditional Agency prose extolling the contributory and compulsory facets of social insurance, the pamphlet is interspersed with images of computers at work. Though the images of benefit recipients contain a multitude of smiling faces, the photographs showing bureaucrats at the machines consist almost exclusively of men, faces away from the camera, engrossed in their machines. In the most glaring example, two men, their backs to the

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[178] "Social Security USA: The Program and its Administration," 1965, Brochure File (Social Security Administration History Room, Baltimore, Maryland).

[179] Ibid.

[180] Ibid.

camera, intently monitor an IBM 360 mainframe labeled “Data Processing System.”[181] Likely intended to convey a sense of accuracy, efficiency, and professionalism to the general public, the photograph also hints at emergent machine fetishism among those who shaped Social Security’s public image. Other images depict vast office spaces with scores of clerks intently processing punch cards or stacks of spooled magnetic tape awaiting insertion into ADP machines.
Yet, even among such visibly effusive praise for computers, Great Society underpinnings are not forgotten, as the pamphlet opens with an excerpt from a June 1964 speech by President Johnson.[182]

The public apparently understood, recognizing the significance of electronic data processing to the eventual delivery of benefit checks. The Agency’s internal newsletter reveled in printing letters to the SSA, some from children, addressed “Dear Computer.” One frustrated applicant of the late 1960s, perhaps familiar with the delays and backlogs that characterized Social Security, simply pleaded, “Please, Mr. Machine, give this to some human to read.”[183] Seeking to link SSA’s image to computers for a future generation of social security recipients, Futterman and Deputy Assistant Commissioner Louis Zawatzky arranged for Maryland Boy Scouts to complete their Computers Merit Badge through a program run out of the Woodlawn operations center, encouraging SSA systems analysts, programmers, and computer operators to instruct scouts in the “understanding of the computer’s role in society.”[184]

Even the very act of requesting a statement of one’s Social Security earnings account had by the late sixties become a vehicle for demonstrating how thoroughly computerized systems had

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[181] Ibid

[182] Ibid.

[183] “Dear Mr. Machine,” *OASIS*, 13 (Nov. 1967): 20.

[184] “Now the Scouts Look at Computers,” *OASIS*, 15 (Dec. 1969): 18.

overtaken the Agency. An individual requesting such a free statement received from SSA a computer printout signed neither by Commissioner Ball nor a regional assistant commissioner. The stamped signature appended to the millions of such earning reports – and thus the public embodiment of SSA bureaucratic purpose – was that of William Hanna, Director of the Bureau of Data Processing.[185]

As Social Security's mandate expanded in the sixties, the agency made certain to clearly emphasize that SSA alone administered the new programs under its portfolio and that modern, computerized data processing would speed along benefits to the eligible. Some fifteen million eligible elderly Americans in 1965 received partially filled-out punch card application forms to enroll in Medicare's Plan B; the pre-stamped return address was simply "Social Security Office."[186] Though largely concerned with enrolling as many potential applicants as possible in Plan B for purposes of distributing actuarial risk, SSA made certain to link the policy of health insurance expansion to both social security as a concept and computer processing as a method.[187]

Visual representations of SSA services directed at the public increasingly adopted the tone and imagery of systems planning. A simple graphic from the early 1960s conveying the processes involved in filing an initial claim for benefits would frequently consist of a few steps, neatly laid out for both public and internal consumption.[188] Later images – like internal

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[185] B. Hanna benefit request response, circa 1969, Photo File; Social Security Administration History Room, Baltimore, Maryland.

[186] Edward Berkowitz, "Medicare: Great Society's enduring National Health Insurance Program," in *The Great Society and the High Tide of Liberalism*, ed. Sidney M. Milkis and Jerome M. Mileur (Amherst, 2005), 337.

[187] For more on relationship of the federal government to general concepts of "risk," see David A. Moss, *When All Else Fails: Government as the Ultimate Risk Manager* (Cambridge: Harvard University Press, 2002).

[188] SSA District Office initial case chart, circa Feb. 1964, Public Affairs Box, RG 47, Social Security Administration Papers (National Archives II, College Park, Maryland).

organizational charts of the agency and schematics detailing operations procedures – began to resemble less standard illustrations and more computer system maps. Stages of public interaction were rendered as forms of input, with visualization of the flow of information – and the intermittent stages of processing – dominating both the imagery the message it conveyed. A mature Social Security Administration highlighted internally and externally its focus on process – the carefully calibrated administrative steps by which benefits and claims were received, calculated, and dispersed. As depicted in these materials focused on the systems of social insurance and social welfare programs, managing flow and transforming inputs to outputs was the business of late Sixties Social Security.

The Business of Government Computing -- IBM and SSA

The *Wall Street Journal* labelled the Federal Government "The [Data Processing] Industry's Best Customer."[189] One government disbursement supervisor described the sales tactics used by representatives of a typical information services firm in the mid-1960s.

> So they sent around two young fellows from the company. They started talking to me, they had a presentation of course, and they gave me a copy, and I sat and talked to them for hours. My prime response to them, if we did consider to automate or computerize the payroll, was that the system we brought in would have to be as good or better than what we were doing manually. . . . They kept saying, "Well the computer can do anything. If the logic is put in correctly it can do anything."[190]

Chief among the external consultants who introduced systems planning to SSA, and most influential in its daily influence on the Agency, was America's leading technology concern, International Business Machines (IBM). At the close of the Second World War "simply a mid-

[189] Richard F. Janssen, "Federal Computers," *The Wall Street Journal*, Dec 30, 1964, p. 1.

[190] William A. Ridgley, oral interview with Senate History Office (9 February 1982), 106.

size firm specializing in manufacturing, leasing, and serving office machinery," IBM had by the 1960s leveraged its packaged sales of mainframe computers, systems components, and much-touted managerial expertise to dominate the automation and data processing industries. [191] Since 1936 IBM had been "principal supplier" and at times "sole source" of Social Security's automated data processing equipment, CPU's, and "total systems." [192] Contracts for automated tabulating machines and other office equipment had sustained IBM in the era of the pre-electronic computer, and the steady flow of SSA contract funds into IBM's coffers permitted some degree of security to the company even as it scrambled to catch up with competitors who outpaced it into the business of electronic computers after 1946. Threats posed by the emerging vacuum tube electronics industry and the research innovations trickling out from the laboratories of early electronic computer pioneers Eckert and Mauchly Computer Company and Engineering Research Associates convinced IBM chairman Thomas Watson to assign key executives to monitor electronics developments in government labs and federally-funded university research programs.[193]

The firm's close working relationship with Social Security – the bedrock of its reputation as an innovator in information processing on a massive scale – smoothed entrée into the emerging federal computing complex, where IBM soon carved out a niche in experimental scientific computers and complex military systems problems (the Air Force's SAGE bomber network). By the mid-1950s, IBM would begin its ascendance over firms such as Univac as the

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[191] Atushi Akera, *Calculating a Natural World: Scientists, Engineers, and Computers during the Rise of U.S. Cold War Research* (Cambridge, Mass., 2006), 12.

[192] E. Lannon to T. Schutzman, Nov. 2 1978, SSI Systems Folder, Subfolder Lannon; Social Security Administration History Room, Baltimore, Maryland.

[193] James W. Birkenstock, "Pioneering on the Frontier of Electronic Data Processing, a Personal Memoir," *IEEE Annals of Computing* (January-March 2000): 18

dominant supplier of business-task computers for private enterprise and government payroll offices alike. IBM's Federal Systems Division, with its own manufacturing capabilities in Gaithersburg, Maryland, would emerge from the cluster of researchers working to develop navigational computer systems for the Air Force's B-52 bomber program and develop close working relationships with a number of executive agencies.[194] Strength of federal contracts, especially the evergreen Social Security account, soon permitted the company to obscure the fact that it had been a relative latecomer to the development of commercial electronic computers. IBM had a facility for inserting its corporate presence into discussions of the history and future of the emerging electronic computer industry. In the spring of 1953, Watson arranged a celebratory luncheon in the company's Manhattan boardroom in honor of J. Presper Eckert, John Mauchly, John von Neuman, and other "founding fathers" of the electronic computer. Before a slew of invited guests from government and industry, Watson paid tribute to the assembled honorees and presented each with a gold Tiffany watch inscribed "In Appreciation of Your Contribution to the Computer Industry in the Early Years – IBM."[195] IBM – the firm of "starchy dress code and conservative public image" managed to insert itself into the public's mind as the proper embodiment of how a computer services contractor should appear[196].

The close relationship between vendor and agency was a source of pride to SSA employees; even those with little technical knowledge of the operations of data processing equipment saw the agency as a driving force in development of new information management technology through its relationship with IBM. That the agency made the leap from elaborate automated office machines to electronic computers as early as it did came to be a fixture of SSA

[194] Ibid, 25.

[195] Ibid, 25.

[196] Robert V. Head, "*Datamation*'s Glory Days," *IEEE Annals of the History of Computing* (April-June 2004): 17.

identity – that the agency not only embraced electronic computing, it helped drive the popularization of such machines through its patronage. Official agency publications asserted that "as early as 1945 . . . the [Social Security] Board began studying the possibility of using electronic data processing (EDP) for processing earnings information."[197] As this internal agency narrative asserted, early electronic computers such as the Howard Aiken-designed MARK I at Harvard were intended "to handle king-sized mathematical and scientific problems with a relatively small volume of input and output," a design framework unsuitable for the gargantuan reams of data the SSA sought to process. The agency's reluctance to commit in 1950 to purchasing an actual mainframe following a report commissioned by the National Bureau of Standards came to be viewed by a later generation of SSA official as a prudent decision "to track developments in computer technology because it appeared inevitable that the technology the agency needed would soon be developed."

As one employee eagerly noted in an oral history, "IBM actually had a facility at Social Security Headquarters where they were working on their processes."[198] The internal origin story that circulated within the agency painted as an act of political and bureaucratic courage the decision to undertake such an endeavor as a national social insurance plan in the era before the electronic computer; in this view, SSA's partnership with IBM drove forward the development of the computer for civilian purposes. As former Secretary of Labor Frances Perkins noted at the celebration of the 25th anniversary of the Social Security Act in 1960, " . . . and so out of that

[197] Michael A. Cronin, "Fifty Years of Operations in the Social Security Administration," *Social Security Bulletin*, Volume 48 - June 1985 - Number 6.

[198] Bob Bynum oral history, Oral History collection, Social Security Administration Archives, Baltimore, Maryland.

really inventive group, that worked in the IBM research group we found a way by which this could be done."[199]

SSA employees likewise emphasized the "ingenuity of our own staff" in "pioneering" machine-processing techniques that IBM would adopt. In return, according to institutional memory, by the 1950s, with a telephone call from SSA data-processing chief Joseph Fay to "the head of IBM or people prominently at the top level," the corporation "would divert equipment that was meant for somebody else to us, or they would speed up certain developments; or would undertake to solve SSA's problems."[200] Agency officials proudly wore their mantle of "model site" to which IBM directed visitors from its business school-affiliated management programs.

The agency presented itself not just as patron, but also the progenitor of the model for the ideal client for information processing services industry that IBM would come to dominate. In this view, IBM's future success derived directly from its business and technical partnership with the government agency from the 1930s onward. As one official noted,

> IBM was working with us very closely, it was really learning the guts of how to make its machines useful to the business world. . . with our help in processing all this work, we were inventing the systems that employers could use and they could sell. It was from that date, in 1936, that IBM's importance as a business systems operator, and being the largest one, took off. . . . Thus Social Security played a big part in developing one of the industries that became so important, and is so important today, in the United States. And I can't over-stress the fact that Social Security was, if not the only certainly the best, organization for IBM to work with to do this kind of innovative development.[201]

[199] "Remarks by Frances Perkins," SSA Archives.

[200] Jack Futterman oral history, Part II, Oral History Collection, Social Security Administration Archives, Baltimore, Maryland.

[201] Ibid.

Throughout the late ‘60s and early ‘70s, IBM management magazines and pamphlets were widely distributed among SSA headquarters staff. Internal histories of the agency proudly recalled employees “working very closely” with the industrial titan to develop specialized collating machines that made the first Social Security checks possible.[202] Rather than purchase other manufacturers’ optical reader and scanning devices already on the market, SSA would contract with IBM to have that firm custom build such machines. IBM held the notable status as the only computer company to maintain a permanent sales office (as opposed to a customer service or engineering representative) in a Government building – SSA’s Baltimore headquarters.[203]

The language the company employed to define its corporate culture shared notable similarities with that of Wilbur Cohen promoting SSA as an agent of Great Society idealism. As IBM Chairman Frank Cary noted in September 1973, “Our growth, if you will, is a symptom of the importance of what we’re doing, of the impact our products are having on the lives of people and in the way things are done and produced and measured.”[204] A third of the company’s “Advanced Management School” seminars for business executives were advertised as being led by “authorities who are knowledgeable about problems of social concern,” including government officials.[205]

This nearly incestuous relationship between vendor and client drew frequent rebuke from SSA’s external auditors. In May of 1973 the General Services Administration chastised the SSA

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[202] Robert M. Ball and Jack S. Futterman, “Forward,” Fall 1964, Ball Folder; Social Security Administration History Room, Baltimore, Maryland.

[203] E. Lannon to T. Schutzman, Nov. 2 1978, SSI Systems Folder Lannon; Social Security Administration History Room, Baltimore, Maryland.

[204] IBM *Think*, Sept. 1973, IBM Folder; Social Security Administration History Room, Baltimore, Maryland).

[205] Ibid, 5.

for seeking to lease an IBM "ADP system for use at Baltimore, Maryland" without first going through the government bid process: "In the past we have repeatedly reminded your Administration of the necessity for full competition in the selection of ADPE. Despite assurance that you are working to this end, we see no evidence of progress."[206]

The IBM Corporation's willingness to embrace complexity in managerial solutions unwittingly found its dark side in the patchwork, haphazard attempts of Social Security officials to overlay a total systems plan on a fragmented, rebellious agency. One IBM training manual seemingly supported Deputy Commissioner Jack Futterman's efforts to construct a total system despite the need to correct existing computer applications: "Management has to understand that the simplest way of organizing work may not be the right way." [207] Such a refrain would prove the bane of thousands of Agency employees forced to work around failing computer systems. Efforts to define direct solutions to Agency operational woes ran afoul of a Catch-22: SSA's scope of mission was sufficiently complex to necessitate use of computers for both benefit projection and claim processing activities, yet increased usage of more complex computer systems made more difficult the organization's managerial task. This aversion to the simple even embedded itself in external Agency assessments: a congressional white paper in 1977 observed that "the complexity of the Social Security system makes it difficult to construct truly typical examples."[208]

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[206] A. Trimmer to L. Zawatzky, May 22, 1973, Systems Folder; Social Security Administration Archives, Baltimore, Maryland.

[207] IBM *Think*, 2.

[208] James W. Kelley and Joseph R. Humphreys, "Congressional Intent Concerning the 'Notch' Issue: Legislative Background of the 1977 Social Security Amendments." Reports and Studies folder, Social Security Administration Archive, Baltimore, Mayland.

SSA Under Robert Ball

In April of 1962 Robert M. Ball was sworn in as the fifth man to serve as Commissioner of Social Security. A lifetime employee of the Social Security Administration, Ball would over his decade-long tenure dramatically transform the SSA's internal operations and help redefine the Agency's mission. His 1965 major reorganizing of the SSA would permit the agency to integrate the latest technologies and management styles into its operations, a decision that would fundamentally and unexpectedly change Social Security's relations with its employees, clients, and legislative overseers. By the mid-1960s, SSA's operational functions included establishing and maintaining identification, earnings, and beneficiary records; certifying records and computations of benefits; identifying and enrolling individuals in Medicare; and "maintaining health insurance benefit-use records."[209] To support these increasingly complex operations, the Division of Accounting, steward of punch card machines during the 1940s and 1950s, was re-titled the Bureau of Data Processing and Accounting (BDPA) and elevated to a status equal to the program bureaus. Under Ball's restructuring, how tasks were done would become as significant as what the tasks were. The bureaus overseeing retirement, Medicare, and disability payments came to discover as the decade progressed that the nature of their oversight was strongly directed by the increasingly influential computer programmers located in BDPA and organizational planning experts in the Office of Administration (OA). Focus on computer processes proved an intentional component of Ball's restructuring, as the Agency's increasing turn to computer experts would provide a surprising method for SSA officials to enhance their organizational influence and autonomy during the rise of Lyndon Johnson's "War on Poverty."

[209] U.S. General Accounting Office, *Increased Efficiency Predicted if Information Processing Systems of Social Security Administration are Redesigned: Report to the Congress* (Washington, DC: General Accounting Office, 1974), 6.

Internal SSA communications on the potential of data processing and managed information to provide service to a needy public adopted tones not dissimilar to public statements of the War on Poverty-focused Office of Equal Opportunity. In 1965 that agency published a profile of its activities that asserted "Poverty is people. But it is also statistics." To that end OEO touted its use of "a computerized information and data system to serve the needs of its own management and fulfill the requests of Congress, Federal, state, and local officials, as well as interested citizens." Marshalling of "current, integrated data . . . available on computers" (such as computerization of the Head Start program) provided vital program refinements that permitted precise targeting of poverty relief funds to sectors of society that might have been overlooked without a computer lifting the veil on previously unassessed need. The OEO's linkage of purpose and process could have been lifted from a contemporaneous SSA publication: "But information and data are not an end in themselves. They must be applied against a specific target of people and their environment." [210]

Ball's Correspondence with the Executive Office had placed frequent emphasis on his pride in his "technical staff."[211] By the mid-1960s, though, amplified focus on efficiency as a component of agency mission saw Ball and other top officials increasingly reference the New Deal agency's early technical successes, a seeming effort to link Social Security's past successes and heritage with Johnson's call for an expanded social welfare system – using the medium of data processing operations. The Commissioner actively framed electronic automation as a natural extension of FDR's vision for Social Security: "So progress in systems and technology to do our

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[210] "Examination of the War on Poverty Program," Office of Economic Opportunity (1965), p. 78. "War on Poverty" folder, Social Security Administration Archive, Baltimore, Maryland.

[211] Robert M. Ball to Victor Christgau, Oct. 1965. Records of the Social Security Administration, Record Group 47, Folder PE-14-2; National Archives II, College Park, Maryland.

tremendous task better is not just of recent origin but rather has been historically characteristic . . . . The electronic data processing which so much preoccupies us today is but a projection of our earliest activities."[212] Virtually identical language praising SSA's "reputation for creative, imaginative, and vigorous pursuit of new and better systems, machines, and methods" and linking systems development to the agency's New Deal origins prominently appeared in copies of the Total Data Systems Plan distributed to staff.[213] Even Undersecretary Wilbur Cohen, crafter of much of the language of Great Society idealism underpinning Social Security's expansion, was not above resorting to referencing his charge as an automated wonder, as when he described Medicare as a program of the "Cybernetic Age."[214]

Though at times admitting frustration with the system as implemented, directives and memoranda from SSA top officials to their employees indicated a largely unflagging faith in the potential of computer systems to enact the idealistic promise of Social Security's expanded mandate. Glitches and delays were anomalies that would be eliminated once the total system was fully operational. Ball framed his employees' palpable frustration as evidence of a dedicated, even idealistic, work ethic: "I want you to know that I recognize that all of the organization people are working overtime, and they are doing so because everybody recognizes that this is the only way to get the job done."[215] The Commissioner and his administrators attempted to conceal

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[212] Robert M. Ball and Jack S. Futterman, "Forward," Fall 1964, Ball Folder; Social Security Administration Archive, Baltimore, Maryland.

[213] Total Data Systems Plan, 1965, Systems Folder, Social Security Administration Archive, Baltimore, Maryland, 14, 99.

[214] Wilbur J. Cohen, untitled speech, Dec. 1965, Records of the Social Security Administration, Record Group 47, Social Security Administration Papers, "Cohen Speeches" folder; National Archives II, College Park, Maryland.

[215] Robert M. Ball speech on Overtime, circa 1968. Records of the Social Security Administration, Record Group 47, Implementation Box; National Archives II, College Park, Maryland.

from other government agencies the disarray computer stresses were heaping on daily Social Security operations. On a proposed 1972 plan to employ Social Security numbers as "reference and control" mechanisms for state welfare agencies, Ball pleaded Executive Branch higher-ups for more implementation time, yet refused to suggest his agency was unprepared, instead professing to desire more "flexibility."[216] To admit the inability to process new program expansions would potentially tarnish the Agency's reputation, hinder its expansion as a key element of government, and constrain efforts to effectively use Social Security as a tool for massive social improvement.

Johnson Visits SSA

Lyndon Johnson signaled the key place the SSA held in his agenda by becoming the first president to visit the Agency's Baltimore headquarters and specifically address SSA employees. Under "brilliant fall skies" some thirty thousand invited guests and curious members of the public, including hundreds of Baltimore school children, gathered on October 11, 1966, to see LBJ pay his respects to the Social Security Administration at the center of his new Medicare program.[217] Though Johnson for purposes of timing apparently declined Ball's repeated offers to tour the agency's visually impressive computer facility, the president did overtly extol Social Security's reputation by charging SSA employees to use their reputation for creative efficiency to devise new services and methods by which the Federal Government might achieve the goals of the Great Society:

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[216] Robert M. Ball to John B. Twinn, June 21, 1971; Welfare Categories Folder; Social Security Administration Archive, Baltimore, Maryland.

[217] Kermit Gordan to Robert M. Ball, Oct. 13, 1966, Records of the Social Security Administration, Record Group 47, Folder: pe 13-12 Award ceremony 1966; National Archives II, College Park, Maryland.

> So today I ask each employee of the Social Security Administration of the United States to give us suggestions for new programs, new needs, new plans, and new forces that we should unleash and put into effect to make this a better America, a stronger America, a healthier America. . . . You are building. You built with social security, you built with Medicare, you are building with the improvements we are suggesting today. Now give us the benefit of your ideas, of your dreams, of your recommendations and let's leave this a better world for our children than we found it ourselves.[218]

The president's visit had a mobilizing effect on SSA leadership, codifying the role they saw for themselves at the center of Great Society efforts to eliminate poverty. Ball, writing to Wilbur Cohen, noted that "the President's visit was a tremendous morale booster for the entire Social Security organization."[219] Johnson's words were reprinted in internal publications directed at all levels of Agency staffers.[220] The Commissioner further indicated to an aide "that the President's message . . . and the Congressional reaction to it, made it clear that SSA has been selected to carry out the entire domestic policy in the basic area of social insurance and assistance."[221] LBJ had reassured Social Security staffers that they were central to the stated mission of his administration. Hidden in the president's celebratory speech, though, lay the directive that would unintentionally undermine the idealism inherent in his remarks: a charge to efficiency.

Vice President Hubert Humphrey articulated the Johnson Administration's hopes for systems when he noted the potential of computers and "the systems analysis that we have used in

[218] Lyndon B. Johnson, speech to Social Security Administration, Oct. 11, 1966, 7-8; Records of the Social Security Administration, RG 47, "Presidential Visit materials" Folder; National Archives II, College Park, Maryland.

[219] Robert M. Ball to Wilbur J. Cohen, Oct. 14, 1966, Records of the Social Security Administration, RG 47, "Presidential Visit materials" folder; National Archives II, College Park, Maryland.

[220] "The Bureau of Disability Insurance Places Emphasis on Promptness," OASIS, 12 (Dec. 1966), 8.

[221] Robert M. Ball, "Remarks by the Commissioner," BRSI folder; Social Security Administration Archive, Baltimore, Maryland.

our space and aeronautics program" to create "a livable social institution" in the inner-city.[222] If systems could solve the urban crisis, certainly they could enable SSA to better combat poverty, internal logic flowed. To achieve complete automated, computerized efficiency, SSA officials quickly bought into the logic of systems. Ball's assistant Jack Futterman saw Social Security's destiny for the 1970s as using "the computer more and more to help us to manage the workload efficiently," a process that would require extensive, centralized "control of every type of action we process." [223]

Outsiders confirmed this attitude. One Congressman thundered on the potential for computers to transform social welfare, "I am no scientist and I am no expert on these computers, but I say that electronic computers represent a revolution, in fact, which can open up magnificent possibilities for the well-being of man."[224] For those in the agency who felt the War on Poverty would be "fought in the bureaucratic trenches," computers offered a reassuring way to apply metrics of efficiency and normalcy to otherwise highly emotional human cases.[225] Such attitudes reflected broader period understandings of advanced technologies – electronic computers as much as jet engines and rocket launches – bringing speedy transformation to American society. When the New York World's Fair opened in April of 1964, the SSA was only national government entity granted a separate space for its display in the Fair's Federal Pavilion.[226] Not

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[222] Agatha C. Hughes and Thomas P. Hughes, eds., *Systems, Experts, and Computers* (Cambridge, Mass., 2000), 16.

[223] Jack S. Futterman, "SSA Administrative Style for Today and for the 70s," Futterman Folder; Social Security Administration Archive, Baltimore, Maryland).

[224] 105 Cong. Rec 5020, 24 March 1959, p. 5032

[225] Mark I. Gelfand, et al. *The War on Poverty, 1964-1968* (Frederick, MD: University Publications of America), 127.

[226] Roy L. Swift, "Public Information and Public Relations in the Field of Social Security" (Sept. 1964); Public Information folder, Social Security Archives, Baltimore, MD.

far removed from a neighboring "information center" display of a Univac 490 Real-Time computer sponsored by the American Library Association, the SSA display conveyed an assured vision of digital information managed competently for the public good, of remarkable technology applied for the betterment of American society, similar in tone to exhibits in the Fair's nearby Ford, RCA, and DuPont pavilions.

SSA's Transformation

Increased dependence on electronic computing to achieve the efficiency that had become SSA's hallmark would gradually alter the entire organization's culture. Though difficult to trace today, the chain connecting idealistic expansion of welfare and direct application of computers was an admitted fact to contemporaries. Addressing critics in 1968, Undersecretary Cohen refuted those who doubted Social Security's "cost and efficiency" by asserting that SSA's modern benefit calculation and distribution could "through needed benefit increases, contribute to the abolition of poverty."[227] By the time of the implementation of Supplemental Security Income (SSI) in 1974, reports from other governmental agencies routinely conflated SSA's mission with the electronic methods it employed. That year the General Accounting Office reported to Congress that "SSA's automated information processing systems directly affect the lives of a large segment of our population through the issuance of benefit payments and thus affect the general welfare."[228]

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[227] Wilbur J. Cohen, *Towards a Freedom from Want* (Madison: University of Wisconsin Press, 1968), 74.

[228] U.S. General Accounting Office, *Increased Efficiency Predicted if Information Processing Systems of Social Security Administration are Redesigned: Report to the Congress* (Washington, DC: General Accounting Office, 1974), 3.

Language of system functioning became conflated with the mission of SSA's Bureaus: "No one can argue with the point that the rapid move to real time, interactive systems is essential if we are to carry out the concept of 'the right check to the right person in the right amount at the right time.'"[229] So-called "good management concepts" consisted of "having machines/system do what they can best do" and establishing "a total system that works for us in the quickest, most responsive way and does the maximum number of things that machines can do most quickly and economically . . . [employing] an appropriate number of people to interface with that machinery/system to optimize the capacity and efforts of machinery and people."[230] The computer experts who committed SSA down a particular path of computer usage largely did so out of the expectations of their training and the culture of their nascent discipline.[231]

Nowhere was this more evident than in training of new employees and recently-elevated supervisors. Regional staff seminars for SSA employees increasingly featured computer and systems-related programs as a dominant portion of the program. Traditional lectures on "The Philosophy and Background of the Social Security Act" were book ended by psychologist led discussions on "Over-all Communications in The System."[232] For senior level staff flown into the Baltimore headquarters, roundtable discussions on program philosophy were augmented by

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[229] J. Forbus to L. Zawatzky, Aug. 4, 1972, Systems Folder (Social Security Administration History Room, Baltimore, Maryland).

[230] Jack S. Futterman to Hugh McKenna, Feb. 7 1969, McKenna File (Social Security Administration History Room, Baltimore, Maryland).

[231] As historian of management David Noble notes, engineers and the forerunners of systems analysts "tended to seize upon only those technological potentials which promised to further corporate objectives, deemed them necessary (and thus historically inevitable), and denied all others." David Noble, *America by Design: Science, Technology, and the Rise of Corporate Capitalism* (New York, 1982), 258

[232] Regional Staff Conference Program, July 8, 1968, Conference File (Social Security Administration History Room, Baltimore, Maryland).

sessions on "management style," "the social psychology of innovation," "production-morale" "analysis input," "computer training," and "critical psychological reading [of] technical materials."[233]

Training for those who would operate newly acquired computers at payment centers was described as "steer[ing] the payment center through our great leap forward in technology with as few stripped gears as possible."[234] By the close of the decade, the simple flow charts used internally to convey administrative hierarchy and operational duties – as well as charts produced for public consumption – bore more resemblance to the IBM-produced charts showing computer programming functions than anything the agency employed in the previous three decades. One such chart graced the SSA's 1965 report to the President; given this document's foundational nature in establishing computer-aided efficiency as an Agency credo, it is not surprising that the chart's traits crept into seemingly non-related internal diagrams.[235]

By 1968 systems management language had so thoroughly woven itself into daily training and operations at SSA that employees felt free to joke about it. One humor submission in employee magazine OASIS guaranteed to transform anyone into "an instant computer expert" by letting him or her "pick words at random from columns A, B, and C" to produce gobbledygook not entirely indistinguishable from official "total systems orientation."[236]

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[233] Staff Seminar Agenda, circa 1967, Training Folder (Social Security Administration History Room, Baltimore, Maryland).

[234] "BRSI Looks Ahead," *OASIS*, 14 (May 1968), 27.

[235] U.S. General Accounting Office, *Increased Efficiency Predicted if Information Processing Systems of Social Security Administration are Redesigned: Report to the Congress* (Washington: GAO, 1974)**,** Illustration III.

[236] Phil Nathanson, "Be an Instant Computer Expert," *OASIS*, 14 (Nov. 1968), 10. The sample phrase suggested by this article's author is alarmingly similar to the prose of the Total Data Systems Plan: "To achieve an integrated output capability, coordinated operations criteria must be developed, with particular emphasis on data input

Hearkening back to New Deal-era jokes about "alphabet soup" agencies, such expressions reveal the complex ways dataocracy shaped the legacy of New Deal governance. Computer-influenced management practices, deployed in the name of expanding Social Security's New Deal legacy in a Great Society era, represented an active strategy for promotion of liberal social policy. The proliferation of computer-aligned values was an unintended consequence of sincere efforts to effect expansion of benefits by political actors operating under New Deal-influenced attitudes towards the purpose of government, not a replacement cohort of technocrats cool to the agency's existing mission.

Marginalia on meeting minutes from this period now collected in the SSA agency archives reveal the tension and discomfiture during this period as the agency raced to computerize every office task possible, even as top officials remained uncertain on how this data-centric approach would be organizationally administered. One official scribbled in a note to a seatmate, "We're vulnerable – in terms of managing our own systems."[237] In an agency increasingly defined by its progressive use of computer-heavy systems methodologies for accomplishing programmatic ends, to lose control of directing one's own systems meant ceding power to another entity entirely – most likely the Bureau of Data Processing or Jack Futterman's Office of Administration. Another meeting participant, perhaps expressing displeasure at the degree to which computer talk dominated discussion of almost all policy and procedural matters, annotated his agenda with the remark, "EDP systems planning vs. what should go on system."[238]

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validation and automated access requirements. In-line control specifications can be given only in terms of man-machine subsystems interface and within the framework of a total systems orientation.""

[237] Loose memoranda, 1965, Box 1985-CC, Social Security Archives, Baltimore, Maryland.

[238] Meeting comments, 1965, Box 1985-CC, Social Security Archives, Baltimore, Maryland.

During the late 1960s and early 1970s, with each additional Amendment responsibility or benefit adjustment, complaints about workload and backlogs became constant refrains within SSA. Under the 1965 Social Security Amendments, for instance

> Automatic data processing systems were designed and put into operation to process the enrollment of individuals for health insurance coverage; to handle the notices of hospital admissions; to process requests for information on eligibility, bills, and payments; and to prepare premium notices and handle premium collections. To facilitate health insurance operations at the local level, each social security district office was provided with a microfilm locator record, which in a high proportion of cases enabled it to provide health insurance claim numbers and to verify entitlement to hospital insurance and enrollment for medical insurance when a beneficiary was unable to present his health insurance card to a provider of service.
>
> In the retirement and survivors insurance area, extensive planning and preparation was made for the automatic recalculation of benefits of those persons whose total earnings record might support a benefit increase on the basis of additional work. Programs were completed so that eligible individuals could be identified and their benefits automatically recalculated by computer.[239]

Promises of computer solutions did little to appease employee worries: "Even with our augmented and trained technical staff [we will] be operating under heavily strained conditions for many months into the future."[240] Another official ruefully noted that the computer-induced backlog was a "national phenomenon."[241] The one constant lay in squarely pinning blame on broke, recalcitrant, unmanageable, or inadequate computers: "the overall SSA machinery/system has been so inadequate."[242] Internal employee correspondence consistently pegged the agency's

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[239] "Organizational Changes," *History of the SSA During the Johnson Admnistration*, SSA Archives.

[240] H. McKenna to J. White, Dec. 18, 1970, BRSI Folder (Social Security Administration History Room, Baltimore, Maryland).

[241] H. McKenna to Robert M. Ball, June 16, 1970, McKenna Folder (Social Security Administration History Room, Baltimore, Maryland).

[242]Jack S. Futterman to Hugh McKenna, Feb. 7 1969, 2; McKenna File (Social Security Administration History Room, Baltimore, Maryland)

elaborate computer systems as the primary source of increasing delays in processing benefit payments.

How could a model agency, an exemplar of the application advanced technologies for shared governmental and social welfare purposes, fail so abjectly at the very act of its perceived competence? The answer lay in the very administrative structures abetted by the rise of dataocracy. The task of managing information with electronic computers overtly required new personnel, technological devices, and systems of internal organization; it also facilitated subtle and unforeseen changes in the dynamics of the agency as a workplace and bureaucratic institution.

Turf Wars

To implement these transformative data processing goals, Ball delegated considerable responsibility to the systems-based Office of Administration (OA), led by Associate Commissioner Jack Futterman. With great difficulty Futterman attempted to reign in the semi-autonomous Agency divisions, suggesting that systems training permitted OA analysts to observe and correct problems invisible to other staff divisions: "To accomplish our mission, a great deal of inter-bureau activity is involved, and quite often decisions must be based on a broader set of considerations than those apparent in the given situation." [243] Futterman's OA, in tangent with the Bureau of Data Processing, controlled top-down systems implementation at SSA. Thus, with Ball's statement "I rely on the Office of Administration for advice on the implications of systems changes that require my decision and for decisions in those that do not,"

[243] Robert M. Ball to SSA staff, May 24, 1966, Systems Folder (Social Security Administration History Room, Baltimore, Maryland).

Futterman's division became unquestionably dominant among the bureaucratic fiefdoms that had marked SSA's previous thirty years.[244] This was in part due to Futterman's personality – one colleague described the man thusly: "Jack's wondrous egotism made him assume that his own interests and those of SSA were inseparable" – and in part to his prescient embrace of systems management techniques as an extension of Social Security's evolution: "He was identified with the program to the point where he thought he was SS." [245]

This re-structuring sparked turf wars among previously autonomous bureau and sub-division heads within the agency. The so-called "Barons of Baltimore" who headed each bureau had from the 1930s onward held incredible autonomy in arranging administrative matters. Each department was run as a separate fiefdom, with the degree of automation – and the nature of information flow – dictated by the corresponding Assistant Commissioner or Bureau Chief. Futterman's rapid ascent – and the increasing centralization of systems authority under either the Bureau of Data Processing or the Office of Administration – concerned those who felt the values of "Total Systems," no matter how congenial to Great Society ambitions, might not adhere to the traditional practices of social insurance. Career staffer Hugh McKenna, eventually head of district operations, routinely dashed off letters posing "some meaningful and somewhat alarming questions" to his superiors, both in SSA and HEW.[246] In McKenna's assessment, over-reliance on computers sapped warmth and meaning from the client-caseworker relationship at SSA district offices; continual computer backlogs and delays made his frontline employees look

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[244] Robert M. Ball to SSA staff, May 24, 1966, Systems Folder (Social Security Administration History Room, Baltimore, Maryland).

[245] Wunsch Note 108; Melvin Wunsch Papers, Folder F11-47-184, Wisconsin Historical Society, Madison, Wisconsin.

[246] Hugh McKenna to Victor Christgau, Feb. 23, 1965, Training Files, RG 47, Social Security Administration Papers (National Archives II, College Park, Maryland).

unprofessional when they couldn't access data to review client cases. Those clients – typically elderly, poor, disabled, or bereaved – understood little of technological excuses for delay of their benefits; caseworkers trained in human, client interactions chafed at their inability to work around (or at times even comprehend) the computer-derived glitches that arose with regularity.

McKenna personally seethed at the authority slowly eroded from his bureau to Futterman's administrative shop; especially galling was the praise lavished on Futterman for his foresight in embracing the potential of the electronic computer as a tool for reordering social security. As one HEW official toasted at an agency banquet, "It was in the period immediately following the 1965 amendments – bringing with them new, massive workloads – that Mr. Futterman foresaw the pressing need to step up systems development and provide greater unity and coordination for systems planning and implementation."[247] Futterman could be acclaimed as a visionary because he (much like certain officials in the late 1950s Bureau of the Budget), recognized the aura of expertise and authority congealing around computerized management as a category. For Futterman, the emerging prominence of the electronic computer naturally dictated a new type of centralization: "As computers took over more and more, geographic location became less and less important in certain functions."[248]

[247] Christgau speech, 1965, Banquets folder, Social Security Archives, Baltimore, Maryland.

[248] Futterman oral history, Part II, Oral History Collection, SSA Archives, Baltimore, Maryland.

HEW Secretary Wilbur Cohen meets with the “Barons of Baltimore” over a computer console in the SSA’s Woodlawn Headquarters, 1968 (SSA Archives)

The new employees Futterman drew to his office during this period reflected this systems-heavy, computer-friendly sensibility. Among the staff hired by the Office of Administration in 1965 and 1966 were a “Research Psychologist” from IBM, Management Analysts from the State Department and Veterans Affairs, a Management Analyst from RCA, a Statistician from Western Electric, and two Digital Computer Systems Analysts from the Office of Naval Intelligence and the Department of the Army.[249] Additional hires included Operations Research Analysts from the Navy, Army, and Atomic Energy Commission and a Mathematician

[249] Division of OA Personnel Chart, circa 1965; Computers Folder (Social Security Administration History Room, Baltimore, Maryland).

from NASA.[250] The military industrial complex, supported by IBM 360 mainframes and RAND-style systems analysis, had successfully transplanted itself to the civilian sector.

Such a focus complimented the muted but influential role the Office of Research and Statistics, the number-driven research arm of Social Security, played in policy development within the headquarters complex. As social security historian Larry DeWitt has noted, "[ORS] drove policy in the Agency to some degree" during the 1960s.[251] Much like the Bureau of the Budget for the broader executive branch, the ORS under Assistant Commissioner Ida B. Merriam provided the complex calculations that guided proposed technical adjustments to social security benefits. While Merriam noted that "research was closely related to policymaking," she asserted that its chief contribution was a degree of choice, policy options not possible without elaborate data analysis: "Research doesn't tell the policymaker what to do. It does give him a body of tested knowledge and an understanding of the probable consequences of alternative policy decisions. . . . [R]esearch that, in a changing world, could help point the way toward the unchanging goal of economic security for all first laid out in the Social Security Act of 1935."[252]

[250] Division of OA Personnel Chart, circa 1965; Computers Folder (Social Security Administration History Room, Baltimore, Maryland).

[251] L. DeWitt interview with Jack Schmulowitz, Oral History Collection, SSA Archives.

[252] Ida C. Merriam, "Celebrating a 50th Anniversary," (1985), Merriam folder, Social Security Archives.

Ida Merriam examines fresh-off-the-tape-reel data, c. 1972 (SSA Archives)

Policy decisions with real, substantive outcomes were affected by the statistics and models originating in the ORS and then filtering through the computers and systems analysis charts of other divisions of SSA. The Agency's 1968 decision to adjust upwards poverty thresholds for standard of living benefit adjustments drew directly from statistical indexes prepared by Merriam's office. [253] The office collected data and carried out analytical studies on health insurance both in the run-up to and following the implementation of Medicare. Yet Merriam and ORS staffers expressed a desire to collect and process even more data to obtain a more accurate portrait of the needs of American citizens. In 1966, unsatisfied with the paucity of statistics provided on the topic by other government agencies, the ORS implemented the first

[253] Gordon M. Fisher, "The Development and History of the Poverty Thresholds," *Social Security Bulletin*, vol. 55, no. 4 (1992); Ida C. Merriam, "The SSA Poverty and Low Income Cut Off Points for 1967 Incomes" memo, 3 May 1968; "Income calculation" folder, Social Security Archives.

comprehensive survey of disabled persons in the nation's history – seeking to enhance the quality of its data by asking "questions that the Public Health Service did not want to tackle."[254] Designed to elicit answers useful to the long-term computer models favored by SSA's systems analysts, the data yielded by the survey would go on to be hardwired into the projections the office provided regarding benefits for the disabled, thus shaping policy.

Bureau and sub-division heads poached promising young system experts from one another in efforts to demonstrate their data-use competence. Memoranda from government officials to their superiors would frequently highlight promising new hires or agency interns "making quick strides as [systems planners]" [255] Futterman expressed frustration that younger members of his Central Planning Staff (CPS) would undergo extensive systems trained, paid for with his staff development funds, and then transfer to other SSA divisions or even other agencies before repaying their "extensive training" with a commensurate time commitment to CPS. [256] In his eyes, building up of specific subunits damaged the systems cohesion of the whole: "Further incursion into this highly specialized resource would be to the disadvantage of SSA." Futterman's specialized resource entailed the "systems people" that could effectively promote computer installations and impress HEW officials with their managerial self-assurance.[257]

Whereas the majority of congressional interactions with the agency before the late 1960s were instigated by the lawmakers themselves (typically on behalf of constituents) and handled by SSA's Office of Information (excluding Senate Finance Committee hearings when the

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[254] Ida C. Merriam, "Celebrating a 50th Anniversary," (1985), Social Security Archives.

[255] Futterman to Ball, 29 March, 1965. SSA archives, L1-Carrier 9, "Medicare Early Planning (1960-1965)" folder.

[256] Ibid.

[257] Nathan Ensmenger, *The Computer Boys Take Over: Computers, Programmers, and the Politics of Technical Expertise* (Cambridge, Massachusetts: MIT Press, 2010), 45.

Commissioner would join a coterie of undersecretaries and HEW officials testifying on Capitol Hill), in 1967 Futterman suggested to Ball that the Office of Administration's Division of Administrative Appraisal and Planning (DAAP) collaborate with OI to permanently plant "an SSA person on the Hill."[258] The seemingly apolitical task of easing the telephone workload of SSA's public inquires office became yet another inroad for OA systems planners, granting the Agency's most ardent computer supporters voice in answering legislators who sought "opinions on how proposed legislation would affect SSA operations."[259] SSA's most vocal prophets of automated data processing helped determine the nature of congressmen's daily interactions with the agency.

Bureau of Data Processing officials responded by directing that computer resources be employed to clear backlogs before resuming normal tasks. One frustrated supervisor suggested that his employees, in attempting to corral a massive backlog, were doing irreparable damage to their regular work loads: "Payment center personnel that are working all this overtime become less efficient and less accurate as the amount of overtime increases." [260] An ever increasing number of employees worked "2 hours overtime every weekday and 8 hours overtime on Saturday." Noting his office's "situation has continued and intensified over the last year and there is no end in sight," another official somberly noted the "constant pressure to get the work out against an almost impossible time schedule has affected the morale" of his employees.[261] With increasing computerization, the Baltimore headquarters developed a reputation for a

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[258] Jack S. Futterman to Robert M. Ball, April 24, 1967, Correspondence Folder, file 2466, RG 47, Social Security Administration Papers; National Archives II, College Park, Maryland; .

[259] "Just the Facts, Ma'am, Just the Facts," *OASIS*, 18 (Mar. 1972), 5.

[260] George Sheya to D. Christensen, Jan 23, 1967; Social Security Administration Records, RG 47, Systems Records folder; National Archives II, College Park, Maryland.

[261] Ibid.

"Woodlawn milieu" at odds with the on the ground experiences of district offices, who had to adopt interest and proficiency in systems language foreign to the social welfare backgrounds of many district staffers.[262]

In the changed institutional culture of SSA, district office employees increasingly saw their place less as professionals focused on clients than operators of recalcitrant machines. Computers and those who designed them, not caseworkers or district claims specialists who interacted with citizens, became the public face of social security operations. By the 1970s, constituents angrily wrote their congressional representatives to complain about SSA-"computer-generated letters which were difficult to understand" explaining benefit calculations.[263] SSA employees were keenly aware of the direct link between the sudden rise to prominence of BDPA within the agency and the overtime mandated by proliferating computer systems. At the 1970 SSA employee awards reception, BDPA programmers received the lion's share of prizes – leading to black humor jokes about overtime being required to complete the ceremony's "workload." [264]

That backlogs and periodic system failures, only patched by massive expenditure of employee overtime, should continue to plague an established system contradicted views of even later critics of SSA computing, who labeled the 1960s "Years of Service and Satisfaction." As early as 1953, constant Congressional alterations to benefit scope and level stressed the Agency's capacity to manage workload. Each new computer installation provided to the SSA headquarters

[262] M. Wunsch to T. Streb, 27 April 1966; Folder F13-22-185, Melvin Wunsch Papers, Wisconsin Historical Society, Madison, Wisconsin.

[263] "Report to the National Commission on Social Security" (1980), 300. "Reports file," Social Security Archives, Baltimore, MD.

[264] "A time to Remember," *OASIS*, 16 (Dec. 1970), 20.

or one its regional offices promised alleviation to the problem of workload, but also added complexity to existing administrative procedure. As a favored agency operating under appropriations largesse from 1954 to 1968, "computers allowed SSA to cope with rising workloads," as one observer noted, by applying bandaids to a growing manpower shortage.[265] Each new computer pressed on the agency by eager IBM salesmen or revelatory systems reorganization schemes emanating from the Commissioner's office "saved" the cost of hiring new clerical employees at the cost of making the entire superstructure susceptible to disruption by one element. Cobbled together with each benefit expansion and mainframe system, SSA's computing complex was forward-thinking but mired in a heterogeneous reality, one SSA officials saw in the totality but line-level employees experienced piecemeal.

Total Systems

Social Security's internal publications by the mid-1960s routinely buzzed with indeterminate references to "systems modernization."[266] Unveiling in 1965 the Orwellian-sounding Total Data Systems Plan (TDSP), Agency planners elevated the task of establishing an integrated data processing system to the most pressing need facing Social Security: "The overall SSA task ahead is the long-range one of producing a single integrated data processing system."[267] Only the long-range planning associated with systems management – and because of its complexity, directed by computers – could apparently capture the ephemeral idealism at the

[265] Office of Technology Assessment, "The Social Security Administration and Information Technology – Special Report" (Washington: Government Printing Office, 1986), 95-97.

[266] See the multiple folders labelled with the topic still held in the SSA's internal archives in Baltimore. SSA Archives, Kardex L1, Row 13, "Systems Modernization" folders.

[267] Total Data Systems Plan, 1965, Systems Folder (Social Security Administration History Room, Baltimore, Maryland).

heart of SSA's mission: "[Total Data Systems Planning is] in a way, an indication that not only have machines and systems become more sophisticated but also that we ourselves have become more sophisticated in the way we do our planning. . . . an attempt to give concrete form to systems values, concepts, and goals that we can all agree on." [268] In time, though, "systems" values, no matter how sophisticated, would mask and gradually supplant "Social Security" values.

Presented to SSA employees as a "Framework for the Future," the Total Data Systems Plan – 775 pages and 46 charts – purported to give "a new dimension of the task we face in administering the Social Security Act."[269] Likewise, the agency's new administrative responsibilities included in the 1965 Social Security amendments were cast in the language of TDSP. The introduction of the two health insurance programs' workloads was pitched to employees in December 1965 as "Our Total Task."[270]

Constant tinkering with and expansion of the Agency's computer systems reflected fully the computer-systems management ethos of the time. Extended planning was a hallmark of systems style: "Systems applications by their very nature require a great deal of time in the planning and design stages," wrote one BDOO supervisor to employees concerned about delays in implementing computer upgrades. [271] Such work in the name of developing a coherent "total system" did little, though, to alleviate the backlogs that ensued whenever new pieces of computer

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[268] Total Data Systems Plan, 1965, Systems Folder (Social Security Administration History Room, Baltimore, Maryland).

[269] Mel Wunsch, "Framework for the Future," *OASIS*, 11 (Feb. 1965), 3.

[270] "Our Total Task," *OASIS*, 11 (Dec. 1965), 3.

[271] BDOO Memo, July 10, 1969; Social Security Administration Records, RG 47; BDOO Memo Box, National Archives II, College Park, Maryland.

equipment were added, older pieces were altered, or new programs were introduced in mid-processing cycle.

By the end of the decade even the traditionally aloof Actuary's Office had adopted the language of Total Systems when issuing routine reports: "emphasis has been placed on securing total data rather than a sample."[272] In time, basic policy decisions could be shaped by BDPA and OA determinations of what might or might not be possible under current automation and future systems plans. At times programmers or computer operators would choose to interpret legislation in the ways most favorable to their navigation of the computer system. Aware they would not be able to fully program certain complex actions within the window between legislative passage and implementation, systems analysts needing to dispense with isolated case clusters (such as non-cash, in-kind income) would guess what Congress intended to implement months before legislation was finalized; at times such programs were not altered after the fact to reflect actual mandated policy. As DiPentima noted, "Often the system remained as it was and the policy was changed or adjusted."[273]

Following adoption of the Total Data Systems Plan, the Social Security Administration spent the better part of a decade seeking to implement a systems-based, integrated data processing network linking its Baltimore headquarters with branch offices. To that end it continually acquired new IBM computers and subjected itself to a battery of management consultant studies. Despite such efforts, the on-the-ground reality was one of flawed, pieced-together systems and overtaxed computers abrogating their potential. Delays, massive overtime, and patchwork fixes – not an efficient, computer-regulated model of systems management –

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[272] Robert Myers, "Social Security Actuarial Study No. 68," Records of the Social Security Administration, RG 47, Actuarial Studies Box; National Archives II, College Park, Maryland).

[273] DiPentima, 158.

actually marked much of the Social Security administrative experience throughout the 1960s and 1970s. The reasons for such discordance between public image and actuality stem from both the magnitude of the tasks SSA agreed to undertake in its computer-driven confidence and the inability of systems planners to ever actually implement, test, and train all employees in the use of new technologies.

As long as systems planners continually promised changes to current operations in light of an eventual "total system," SSA employees had little incentive to become familiar with – or even trust – their constantly replaced ADP equipment. Computers both dictated the pace of work and set the procedural parameters for responding to work stoppages; when the machines failed chaos erupted. As one frustrated employee noted, "Management has no effective way of leveling the workloads because computer run backlogs and run priorities determine how long it will be before a particular block of output is received."[274] Under a total systems regime, computers were supposed to address failings with other computers.

Social Security officials associated with Futterman pushed from 1965 onwards to include more overt references to computers in literature aimed at the general public in an apparent effort to personalize the increasingly complex social security system. Futterman directly refuted the charge that "mechanized government, with automatic data processing as its symbol, leads down the road to impersonality,' instead noting, "ADP enables the undertaking of tasks giving each member of the public individual treatment which was not possible before." [275] For Futterman, the computer system's ability to quickly recalculate automatic benefits could result in higher benefits for millions, just as the elimination of paper filing in favor of electronic records could shift the

[274] George Sheya to D. Christensen, Jan 23, 1967; Records of the Social Security Administration, RG 47, Systems Records box; National Archives II, College Park, Maryland.
[275] "1965 DHEW Awards Ceremony," *OASIS*, 11 (May 1965): 4.

burden of understanding "complex provisions of law" from benefit applicants to the machine itself. Computers would eventually identify eligible beneficiaries who had never filed for their payments, permitting benefits to reach those unaware of their eligibility or unable, due to lack of education or access, to claim benefits themselves. In the assistant commissioner's worldview computers became the magic bullet to personalize an increasingly complex system: "ADP is a positive force in better achieving the program's purpose in relation to each individual." [276] Ball himself in 1966 praised the BDP for "giving further meaning" to the "SSA spirit" of "courteous service with sympathetic treatment of all people." [277]

Run-up to Medicare

To a surprising degree, planning for the structure and implementation of Medicare relied on assumed understandings of Social Security's computer competency and a presumption that certain systems-based approaches to aggregating and analyzing information were optimal to program efficiency. The successful implementation of national, single-payer health insurance for the elderly was in fact a sort of union of Great Society ideology and holdover total systems focus. Congress believed the Social Security Administration could handle such a massive expansion of assignment based on the persona of computer competence it had conveyed, and remarkably that ability carried through and enabled (generally) successful Medicare implementation. The success was due in large part to the fact many of the proposed elderly health insurance beneficiaries already resided on the Agency's retirement and survivors' rolls. The 1965 Amendments implementing Medicare added within the first year some five million

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[276] Ibid, 4.

[277] "The Bureau of Disability Insurance Places Emphasis on Promptness," OASIS, 12 (Dec. 1966): 10.

additional claims to the 3.5 million the agency already processed per annum; the task would require a massive information processing and control procedure comparable to that which had faced Social Security in 1935 with the establishment of old age and survivors' insurance. Within short order the "Division of Methods & Procedures" within the Bureau of Health Insurance was rechristened the "Division of Systems" to reflect the enormity of the task.[278]

Scholars of healthcare such as Christy Ford Chapin have observed in recent scholarship that the political maneuvering around the implementation of Medicare was not just an example of partisan and ideological compromise, but an accommodation to institutional realities of entrenched insurance and physician interests that limited the shape any federally-backed health insurance would take.[279] The techno-institutional characteristics of dataocracy eminently suited it for a place in discussion of a compromise, "middle-of-the-road" approach to a massive governmental health insurance program by enabling parties with conflicting interests to imagine the ways neutral, efficient computers could facilitate their preferred agendas. As much of the negotiation over passing and then implementing the legislation centered on the role of program administration, and the complex interrelationship of hospitals, private firms, and government entities, questions of capability of management arose on the part of both insurance firms and the federal government. Controlling costs meant not just competition, but capable administration – which in the 1960s was defined by successful use of computerized systems.

Establishment of the Health Insurance program was interwoven with computerization from its start. In its report on the history of Medicare, SSA highlighted the centrality of a

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[278] M. Wunsch, Notes document, 127, Folder F13-42-185, Melvin Wunsch Papers, Wisconsin Historical Society, Madison, Wisconsin.

[279] See Christy Ford Chapin, "The Politics of Medicare," Chapter 7 in *Ensuring America's Health: The Public Creation of the Corporate Health Care System* (Cambridge: Cambridge University Press, 2015).

“nucleus of people familiar with electronic data processing and with other problems of handling large masses of records.”[280] The basis for delimiting Medicare’s structure rested with the Agency’s existing computer-tape records of all Social Security beneficiaries over age sixty-five. For practical purposes such a massive medical insurance proposal would have to rely on the accumulated database of social insurance recipients already held by SSA; the patina of presumed technical competence only made the assignment even more sensible. The information stored in these magnetic tapes provided the core of list of the fifteen million retirees who were contacted with the option of enrolling in medical benefits for a three dollar monthly premium; eligible beneficiaries were mailed computer-generated cards detailing their options. Beneficiaries were instructed to mark their enrollment preference and return the card to the Social Security Administration, which could convert the postcards into punchcards and directly process the results back onto magnetic tape. Some two million other Medicare eligible Americans who were not already Social Security beneficiaries would need to be added to the computer databases, an endeavor that drew on information-gathering capabilities at both the administrative level (IRS income tax rolls) and the street level (efforts by District Social Security Offices and regional agents of the Office of Equal Opportunity who identified eligible citizens on a neighborhood level).

“Electronic processing” was touted as the solution for expediting benefits for Medicare-eligible hospital patients who had not filed for the insurance or who could not present their issued cards. Federal information-processing competence would fill the gaps in pending claims that hospitals could not. District SSA offices at the local level, individual hospitals, and

[280] “Brief Statement on Systems for Dr. Somers,” 5 May 1966; Folder F13-23-185, Melvin Wunsch Papers, Wisconsin Historical Society, Madison, Wisconsin.

intermediary carriers such as Blue Cross all transmitted claim information via high-speed, government-owned network wires to the SSA's Chicago communications center.[281] These notices were compiled daily by the SSA central offices, sorted by account number and fed onto magnetic tape; computers compared this daily tape against the master magnetic tape records to verify entitlement status. Teletype machines relayed results each day over government wires back to the hospitals that originated the claims. These hospitals repurposed this data into bills sent to insurance intermediaries, who approved payment and forwarded the bills to Social Security, who associated the costs to the master record for each account and prepared a computer-generated "notice of utilization" to be mailed to individual beneficiaries.

Key to the Medicare network was a coded roster of healthcare interrelationships – hospitals, physicians' offices, laboratories, home health agencies, nursing homes and rehabilitation facilities, and insurance intermediaries and carriers. The Social Security Agency's primary charge was distilling this web of connections into a series of linear relationships along which direct communications might be sent. Thus information – service descriptions and payment authorizations – could be transformed into funds transferred and medical services provided. This mutually beneficial transfer of information paralleled the compromises that ultimately convinced Blue Cross and the Health Insurance Association of America (HIAA) to sign onto Medicare – constantly updated government tape reels of eligible Medicare beneficiaries would enable insurers to drop cost-heavy elderly patients while efficient computerized networks would presumably simplify the cash-generating task of administering Medicare under the public-private system.[282]

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[281] Wunsch memo, 1966; Folder F13-24-185, Melvin Wunsch Papers, Wisconsin Historical Society, Madison, Wisconsin.

[282] Chapin, 431.

The Bureau of Health Insurance, charged with overseeing implementation of Medicare, "had the advantage of picking the best people from the SSA," as staffers later recalled.[283] Describing two "OR [operations research] people" who would be lost from a central planning office of SSA to the newly established Health Insurance Bureau under a proposed Medicare staff shuttling, Futterman estimated to Commissioner Ball a replacement cost of $50,000 per specialist for training, travel, and salary inducements to bring replacement hires "up to the point where [the current systems experts were]."[284] Officials detailed to the newly formed health insurance bureau admitted the need for systems specialists as they established their operational framework: "There will doubtless be areas in the HIB activity where effective utilization of Operations Research Techniques and approaches may well benefit Management decision problems. . ."[285]

Existing social insurance bureaus protested having to surrender their brightest computer analysts and systems planners to the SSA's new cousin, the bureau that would oversee the health insurance provisions of Medicare: "There is no question, of course, that we need good people to form a cadre for the HIB and the supplemental health insurance programs but there is also the matter of insuring against denuding the established areas of responsibility under the present program . . . it would be unwise to . . . permit HIB to have a monopoly on all the budding talent on the basis that its priority is number 1-A . . . ."[286] Partly motivating those complaints was a fear of loss – loss of access to the experienced data and systems men who drove so much of the

[283] Wunsch note (1975), 125; Folder 5087, Melvin Wunsch Papers, Wisconsin Historical Society, Madison, Wisconsin.

[284] Futterman to Ball, 29 March, 1965. L1-Carrier 9, "Medicare Early Planning (1960-1965)" folder; Social Security Archives, Baltimore.

[285] John H. Moss to George E. Rawson, 26 March 1965; . L1-Carrier 9, "Medicare Early Planning (1960-1965)" folder; Social Security Archives, Baltimore.

[286] Futterman to Ball, 29 March, 1965. SSA archives, L1-Carrier 9, "Medicare Early Planning (1960-1965)" folder.

policy implementation discussion in the agency. For an organization increasingly concerned with meta-level discussion of "information" as a concept, Social Security in the mid-sixties was beset with employee frustration with a "recurring problem of coordination" due to the fact "much of the information" that circulated internally on how to manage information was never written down.[287] Knowledge of how to navigate a world still tinged with the flavor of total systems required a specific sort of expertise to be prized. To reconcile the agency's silo-ed culture with the reality of a massive undertaking that would require extensive information management collaboration from multiple SSA bureaus, a new adage sprang from the pages of official meeting minutes: "the flow of information must be vertical as well as horizontal."[288]

If Jack Futterman of the Office of Administration embodied the top-down, technocratic approach to merging computerized systems within SSA's established organizational structure, Bureau official Melvin Wunsch typified the on-the-ground, lived experience that marked the experiences who those who sought to translate Medicare legislation into workable policy through the means of information processing. Wunsch was unquestionably proud of SSA's computerization efforts in regards to Medicare, seeing the endeavor as a natural continuation of the Agency's New Deal spirit.[289] In his memoirs he noted, "When I look back at the size of the

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[287] Wunsch to Rawson, "Staff meeting" memo, 18 May 1966; . L1-Carrier 9, "Medicare Early Planning (1960-1965)" folder; Social Security Archives, Baltimore.

[288] Ibid.

[289] Wunsch, deeply passionate about the New Deal origins of Social Security and the agency's social insurance mission, was a bit of a fastidious crank when it came of matters of cleanliness and order. His personal papers at the University of Wisconsin contain detailed memoranda to the administrators of the cafeteria at Social Security's Woodlawn headquarters complex complaining about unwashed lunch trays, cold croquettes, and inadequately sliced roast beef. Wunsch to Robert Peddicord, 7 Nov. 1966; Folder F13-79-185, Melvin Wunsch Papers, Wisconsin Historical Society, Madison, Wisconsin.

staff we were given to set up the systems for a new program as complex as Medicare, I feel like going out to find a government-hater shooting off his mouth about how lay and incompetent federal workers are so I can punch him in the nose. If private industry had set up Medicare, it would have taken four times as many people and wouldn't have been ready on time."[290]

The act of Medicare implementation proved a form of policy in action. As Wunsch noted, "Medicare is huge and complex, only a few minutes in operation and subjected to powerful pressures from many directions. It is obvious that many and drastic changes should be made in its forms, procedures, and instructions if it is to develop into a smoothly running program."[291] It was the act of administration, mediated by computers, that would corral the massive undertaking and reveal where flaws in policy legislation would need to be corrected through bureaucratic discretion. Careful management by computer-vetted systems would not just ensure operational scalability to reach millions of citizens – it would provide a diagnostic venue where the unanticipated shortcomings of the Medicare enabling legislation and regulations might be tested and corrected. As Wunsch asserted, "Everyone assumes that legislative as well as administrative changes will be made in the Medicare program in the near future. Unless we have a clear picture of how the present program is working and how it might be best administered, our agency will not have a sound basis for statutory changes. We need extra staff to gather such information."[292]

[290] Wunsch note 128 (1975), Folder F13-60-185; Melvin Wunsch Papers, Wisconsin Historical Society, Madison, Wisconsin.

[291] Wunsch memo 2 (1966); Folder F13-62-185; Melvin Wunsch Papers, Wisconsin Historical Society, Madison, Wisconsin.

[292] Wunsch memo 3 (1966), Folder F13-63-185; Melvin Wunsch Papers, Wisconsin Historical Society, Madison, Wisconsin.

In theory, the tasks assigned to Social Security regarding Medicare were straightforward; most of those to be enrolled were already accounted for on its retirement and social insurance rolls.[293] The more complex tasks of deducting Medicare Program costs from benefits and of delivering payments to service providers, however, required both establishing new information processing protocols and navigating the dictates of complex legislation that had emerged from a contentious political compromise. The administrative functioning of Medicare payments required technological systems be calibrated for political limitations; once established, those administrative information systems were factors that bureaucrats and lawmakers alike had to take into account when adjusting the program in the future. The enabling legislation itself, the 1965 Social Security Act Amendments, is littered with directives for both federal overseers (the SSA) and designated providers (insurance companies) that frame constantly updated flows of information as essential to administrative functioning; both sides were incentivized to seek out "effective and efficient means of administration."[294] In the debates preceding passage, Senator Wayne Morse of Oregon articulated the views of a faction of lawmakers who saw computerized administration of health insurance as a neutral broker among conflicting interests. He proclaimed, "Federal direction of the recordkeeping function is absolutely necessary if maximum benefit is to be obtained from the multiple-use possibilities of computer systems. Federal operation provides the opportunity to establish an information system which would benefit all our citizens, and all the groups concerned with health services . . . ."[295]

[293] Office of Technology Assessment, "The Social Security Administration and Information Technology – Special Report" (Washington: Government Printing Office, 1986), 104.

[294] 1965 Social Security Amendments.

[295] Wayne Morse, *Congressional Record*, Senate, (8 July 1965), 15970.

The centrality of information processing to administration of the Medicare Amendments reflected the complexity of individual benefit combinations embedded in the legislation. Even minor legislative adjustments, such as the so-called "Prouty Amendment" of 1966, could have convoluted repercussions for program administration. Though it added a mere 700,000 new claims that autumn (general revenue support for those over age 72 who had not previously paid into Social Security), the legislation mandated differentiation by quarters of coverage based on what calendar year a recipient turned 72; two individuals with the same birthday could accrue very different benefits based on a complex brew of variables. Implementation of even minor policy adjustments became juggling of numeric variables best cross-correlated by computer. Information flows were so central to implementing minor, technical points of Medicare policy development that the Bureau of Health insurance had to devise a formal procedure for "obsoleting" circulating information.[296] Some 40 analysts in the Bureau of Health Insurance alone juggled an ever expanding central file of policy questions that required flow-charted, information-processed-rooted solutions. Wunsch, as a frequent intermediary between the District Offices and the systems staff of the Bureau of Health Insurance, noted that "the forms used in a system necessarily reflect decisions on processes and politics."[297]

The promise of computerized ease of number manipulation made such minor adjustments feasible in the eyes of lawmakers and law-implementers, even as the actual act of translating complex legislative code into tape- and card-ready computer code bedeviled those on agency

[296] M. Wunsch, Memo 3 (1966), 5; Folder F13-51-185; Melvin Wunsch Papers, Wisconsin Historical Society, Madison, Wisconsin.

[297] M. Wunsch, Note to self (1966), 3; folder F13-37-185; Melvin Wunsch Papers, Wisconsin Historical Society, Madison, Wisconsin.

front lines. As an agency-produced internal history of Social Security changes under the Johnson Administration noted in 1969:

> The handling of these greatly increased workloads was made more difficult because it was necessary to integrate some of the new Medicare computer operations with the old cash claims operations. The greatly increased workloads and new programs were also superimposed on what had been a mayor increase in the volume of payment center operations over the last few years.[298]

Thus the 1969 observation in an official report: "During the first two years of the program much of the statistical effort of the Medicare program has been directed to the further development, testing, and refinement of the data collection system."[299]

SSA internal memoranda reveal a certainty among agency officials that Social Security alone could provide equivalent expertise in claims processing and electronic data systems. When designing a procedure for training representatives from intermediary insurance firms in the proper procedures required to report admissions and transfer claims files, SSA systems staff fretted that they would likely be confronted with insurance firm employees schooled only in one area of expertise: "There is also a chance that an intermediary might send an EDP [electronic data processing] man who did not know claims processing or a claims man who did not understand EDP."[300]

A series of small incidents reveal how implementation of Medicare reflected the subtle ways in which decisions regarding how to manage and define information ballooned outwards into substantial policy consequences. SSA encouraged larger Plan B intermediaries to develop

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[298] *History of the SSA During the Johnson Administration, 1963-1968* (1969); History Folder, Social Security Archives, Baltimore.

[299] "Medical Insurance Operations," *History of SSA During the Johnson Administration 1963-1968*

[300] "Report on Intermediary Training Project," 1966; Folder F13-48-185; Melvin Wunsch Papers, Wisconsin Historical Society, Madison, Wisconsin.

their own compatible EDP facilities that could deliver claim inquiries to SSA headquarters directly on magnetic tapes shipped through the mail rather than on slower teletype transfers. SSA cultivated a system by which intermediaries depended on Baltimore's computations to determine if deductibles had been met in many complex claim cases, placing it squarely in the center of the entire process of payment to beneficiaries and doctors. District offices were encouraged through training manuals and handbooks produced by the Division of Health Insurance Methods and Procedures to view the relationships among Social Security line staffers, Medicare beneficiaries, and private firm intermediaries as interconnected communications webs in which questions about determination of charges or claim handling could be appealed to higher authorities with access to greater information on "technical aspects."[301] The fluidity of this structure – with its appeal to balanced information – generated some internal tensions within Social Security, as the line staffers of the District Offices tried to wrest control of certain aspects of health insurance administration from the Division on Operations.[302]

SSA provided to carriers such as Blue Cross "detailed technical instructions for message formats and message transmission" and provided "a series of training sessions for intermediary personnel in the use of equipment" in the spring and summer of 1966.[303] These carriers and financial intermediary firms met semi-regularly with BHI to "discuss mutual problems, air

[301] Kopelman to Coakley memo, 13 May 1966; Folder F13-30-185; Melvin Wunsch Papers, Wisconsin Historical Society, Madison, Wisconsin.

[302] Wunsch Self memo, 1965; Folder F13-33-185; Melvin Wunsch Papers, Wisconsin Historical Society, Madison, Wisconsin.

[303] Wunsch memo, 1966, p. 2; Folder F13-36-185; Melvin Wunsch Papers, Wisconsin Historical Society, Madison, Wisconsin.

gripes" about the evolving practices of Medicare implementation.[304] When General American Insurance, Kansas City Blue Shield, and St. Louis Blue Shield proposed in fall 1966 a meeting with Social Security regional officials to discuss in-office processing methods, SSA officials urged inclusion of a central office representative from the Division of Systems.[305] When the regional Part B "summit" was held in Kansas City that November, the insurance intermediaries presented a litany of questions. They chiefly demanded a "list of who the responsible officials in BHI were," indicating they had no general idea of "who was in charge" of health insurance administration given the prominence of data processing and systems analysis staffers in providing communications and instructions to insurers.[306] They expressed frustration in delays in receiving processed magnetic tapes claims back from Social Security headquarters. Carriers insisted that they needed to know what information they would be required to supply to SSA before they could commence writing their EDP programs.[307] SSA's envoys expressed frustration in the insurance carriers' inability to appreciate the complexity, size, and general accuracy of the still-developing claims information network. On an inspection visit to Buffalo Blue Shield the following year, SSA representatives "dropped the bomb" over their dissatisfaction with the information processing practices they observed at the insurance intermediary.[308] Combining

[304] Wunsch note (1975), 132; folder F13-142-185; Melvin Wunsch Papers, Wisconsin Historical Society, Madison, Wisconsin.

[305] Roy Marquardt, "Intermediary Contact Report," 16 Nov. 1966, Folder F13-73-185; Melvin Wunsch Papers, Wisconsin Historical Society, Madison, Wisconsin.

[306] "Informal Report," Kansas City Meeting, 22 Nov. 1966, Folder F13-74-185; Melvin Wunsch Papers, Wisconsin Historical Society, Madison, Wisconsin.

[307] "Informal Report on the Staff Meeting," 8 Feb. 1966, Folder 5093; Melvin Wunsch Papers, Wisconsin Historical Society, Madison, Wisconsin.

[308] Wunsch memo, Feb. 1966; folder F13-129-185; Melvin Wunsch Papers, Wisconsin Historical Society, Madison, Wisconsin.

brutal efficiency with technocratic expertise, the visiting SSA systems analysts suggested simple computer fixes to greatly enhance efficiency, dramatically improving methods, leading to near immediate clearing of a processing backlog, and awing the Blue Shield executives. SSA urged that magnetic tapes containing processing requests be airmailed daily from Buffalo to Baltimore, cutting down on the some 2,000 plus claims queries a day Blue Shield was routing to SSA headquarters through its Chicago phone-data transfer hub. The maneuver would speed up the claims process, but it would further enmesh the carrier with the agency by leaving it to SSA to "us[e the] computer to check reasonable charges." The federal systems experts urged trust in the computer protocols: "Just process and let the machine sort them."[309] Should complacency creep in again, one of the analysts noted that another few months might be "time for a shakedown, another review of their operations."[310]

Promotion of computerization became one method by which SSA asserted its primacy in the Medicare hierarchy. Many experienced social insurance veterans resented the insertion of private insurance firms in Medicare's foundational legislation, blaming Congress for conceding to "big business" while ignoring SSA's "highly successful administration of a complicated social program."[311] Melvin Wunsch, himself a frequent critic of the petty inefficiencies of the Baltimore headquarter's computerized bureaucracy, asserted that "We [SSA] could have run the entire program much more smoothly and at less cost." Throughout the agency in 1965 and 1966,

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[309] "Random Notes on Buffalo Visit," 13 April 1967; F13-140-185; Melvin Wunsch Papers, Wisconsin Historical Society, Madison, Wisconsin.

[310] Wunsch memo, April 1967; Folder F13-131-185; Melvin Wunsch Papers, Wisconsin Historical Society, Madison, Wisconsin.

[311] Social insurance die-hards who bristled at medical trade group influence on the legislative evolution of Medicare labelled the bill "The Doctors, Hospitals Nursing Homes, and Laboratories Relief Act of 195." Wunsch self note (1975), 129; folder F13-70-185; Melvin Wunsch Papers, Wisconsin Historical Society, Madison, Wisconsin.

internal consensus concluded that the “machinery for processing claims” – both technical and organizational – proposed by private insurers was insufficient for an undertaking as complex as Medicare. Data processing experts in the field such as George Friedman, who toured computer facilities of major private insurance intermediaries in 1965, reported back to systems planning staff “that ‘no way’ were they [the carriers] ready to handle claims either properly or efficiently.”

A major portion of implementing Medicare, then, would focus on structuring “operations and setup” of the technical relationship between Social Security and private carriers who bridged between health care providers and federal coffers. SSA middle level bureaucrats charged with implementing the health insurance program deliberately made the nature of information processing a political issue. According to the SSA’s self-mythology, the “BHI had to push and shove and coax and cajole the Blues and the insurance companies” to develop advanced computerization and adopt the SSA’s preferred systems methodologies. Social Security staffers chafed at “carriers and intermediaries . . . [who] delighted in reminding us we had never paid a medical insurance claim while they had years of experience.”[312] Trade associations chafed at what they saw as heavy-handed imposition of federal computing methods on their member firms’ established management practices (some which had been employing their own mainframe systems since the mid-1950s). The National Association of Blue Shield Plans (NABSP)’s chief complaint was “that they have no control over their claims process and that they are dependent upon SSA for ‘minute guidance.’ SSA has not concerned itself with the carrier’s internal processes except in those cases where the presence of completely unacceptable backlogs made it necessary.”[313]

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[312] Ibid, 125.

[313] Wunsch to J. Levy, 22 May 1967; folder F13-147-185; Melvin Wunsch Papers, Wisconsin Historical Society, Madison, Wisconsin.

Control of information proved another sticking point. Other private sector entities objected to Social Security's maintenance of "complete eligibility records" they felt should only be held at the insurance carrier level, not nationally; the decision by Social Security to maintain central records on all claims – ostensibly to prevent high rate of error and stave off issues over confirming deductibles -- was itself a massive, influential policy choice that directly inserted information management into Medicare structure. The Agency further mandated that private firms would have to maintain a certain level of "operational, statistical, and recordkeeping capacity" to retain eligibility to participate in Medicare programs. A debate in the winter of 1966 over best practices for coding centered on whether public codes should be created to identify individual physicians by profile. The American Medical Association favored devolving such information to regional carriers.[314] One side argued cost savings and better service to patients; the AMA insisted the preferences of SSA added needed complexity and robbed physicians of system-wide anonymity. Marsden Blois, a physician and general proponent of health informatics, articulated the frustration many doctors felt:

> There also seems to be an important misconception involved — a physician may feel he is being replaced to some degree by a computer system rather than perceiving the system as a tool to extend and amplify his skills. This misconception has been encouraged by some computer advocates, who envision computer systems as cognitive replacements for physicians rather than as consultants or decision aids. . . medical computer programs have offered the physician very little.[315]

More substantively, many doctors felt the process of coding physician identity only exacerbated a broader issue associated with the converting of complex patient charts into standardized,

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[314] "Informal Report on the Staff Meeting," 8 Feb. 1966, 4; folder 5094; Melvin Wunsch Papers, Wisconsin Historical Society, Madison, Wisconsin.

[315] Marsden S. Blois, *Information and Medicine: The Nature of Medical Descriptions* (Berkeley: University of California Press, 1984), 117.

machine-processed numeric codes. Reducing the patient-doctor relationship or the intricacies of a full diagnosis to a series of routinized codes in fact abstracted away certain nuances and context, resulting in "an irreversible loss of information."[316] Under this line of reasoning, for all its cost and aura of precision, the intricate, centralized network of code imposed on insurers and thus doctors in order to make the Medicare enterprise work actually inadvertently shaped (and potentially restricted) the quality of medical care on a patient basis by imposing around health care delivery a structural framework in which "meanings the code was used for . . . [were] external to the code itself."

Once again, the Social Security Administration and centralized information won out. The intricate back and forth mattered over minor details because it furthered centralized the techniques and language associated with medical record-keeping systems with the preferences and systems organization of the Social Security Administration. Ostensibly about providing the SSA with a more readily available database for spot checks of patient and physician records, storing complete collections of Medicare records on SSA mainframes and compelling insurance firms to constantly communicate with central, federal record-keeping reflected a dataocratic impulse to erect a comprehensive system containing as much information as possible.[317] The policy implications of this would be staggering. Prior to implementation of Medicare, very little data existed to suggest how such a national health insurance program ought to be monitored; the flow of information – demographic, administrative, medical, and budgetary – from insurers to the SSA's centralized databases permitted linkages between enrollees and providers that could be aggregated into the basis for proposals to revise Medicare operations the next time the

[316] Blois, 229.

[317] Jonathan Spivack, "Medicare's Impact," *Wall Street Journal* (30 July 1965).

authorizing legislation came under review. Standardization of millions of billing codes and the technological capacity to do something analytical with the aggregate of them "have made the Medicare administrative data system a national resource for researchers and policy analysts." [318] Intended as tools to implement a politically-complex piece of legislation that had been thrashed out in political compromise, the SSA computers became the mechanism by which interested parties could now secure previously unavailable data to bolster their arguments for transformation or reform of the Medicare program.

Early in the development of Medicare, the SSA's Bureau of Data Processing and Analysis expressed great concern with "misuse of the system" by intermediaries.[319] Great attention was paid to "level of usage" and "load of messages" on the capability of "such a sophisticated system." SSA regional offices obsessively compiled statistics on which intermediary firms made information processing errors and which were "doing a good job."[320] Representatives dispatched to intermediary offices were encouraged to speak with "clerical and EDP people" and with executives to secure "assurance that all parties concerned had absorbed the information" needed to accurately implement the highly computerized claims process.[321] Each regional office was encouraged to employ a minimum of one person versed in "technical knowledge of these processes." The computerized shorthand and coding specifics mandated by Social Security had real world consequences. Even in a matter as simple as sending bills to

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[318] Marian E. Gornick, et al, "Thirty Years of Medicare: Impact on the Covered Population," *Health Care Financing Review*, vol. 18, no. 2, (Winter 1996): 229.

[319] Notes on Wunsch telephone conversation with Bob Mayne, 17 May 1966; folder F13-38-185; Melvin Wunsch Papers, Wisconsin Historical Society, Madison, Wisconsin.

[320] Wunch note, June 1966; folder, F13-49-185; Melvin Wunsch Papers, Wisconsin Historical Society, Madison, Wisconsin.

[321] Ibid.

intermediaries and Social Security for review, processing determined levels at which beneficiaries were instructed to submit small bills, thus inadvertently influence pricing on small procedures. SSA analysts settled on $50 as a threshold appropriate to justify batch processing small claims, meaning claimants were eventually encouraged to cluster small expenditures to that level or endure a far more prolonged reimbursement process.[322] Physicians would price services to fall within more quickly processed reimbursement windows. Efforts to control the expense of personnel overtime in the Bureau of Data processing had real, if inadvertent, influence on the "cost of decreasing other services."[323]

Justification for administrative policymaking by computer processing was found in the efficiency and costs savings on a massive scale that presumably benefitted taxpayers. SSA promoted data centralization as a means of saving money while adhering to the most rigorous definitions of administrative oversight dictated by Medicare's enabling legislation. Constantly updated procedures and ever-updated "voluminous instructions" were the price grumbling carriers would have to pay to participate in the lucrative Medicare system. And the system itself, particularly the computer-driven interface by which claims were processed, would constantly evolve as Social Security itself refined its systems methodologies. SSA painted the constant operational tweaks that streamed from Baltimore to carrier offices across the nation as essential. "If we had not . . . it is almost certain that the program would have bogged down completely in

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[322] Wunsch note, Aug. 1966; folder F13-86-185; Melvin Wunsch Papers, Wisconsin Historical Society, Madison, Wisconsin.

[323] Wunsch note, 1966; folder F13-95-185; Melvin Wunsch Papers, Wisconsin Historical Society, Madison, Wisconsin.

short order."[324] As Wunsch cheerfully noted, "In a dynamic program such as Medicare, there actually is no such thing as a 'final' manual."[325]

Even substantive differences between Medicare Part A and Part B could be differentiated (administratively, at least) in terms of the nature of information transfer. Part B information transfer was structured on a geographic basis, with individual doctors assigned specific insurance intermediaries to which to remit their claims.[326] While promoting a process of collaboration with professional groups (such as the AMA), health care providers, and insurance intermediaries, Social Security officials delineated the "basic work flow and operating concepts for the program," exerting influence on the operating policies of reimbursement by "establishing means of communication" and "developing the forms which will be used in transmitting information between beneficiaries, providers, intermediaries, and SSA." Intermediaries such as Blue Cross may have shaped the initial legislative scope of Part B through lobbying of Congress, but Social Security officials found avenues for shaping their visions of Medicare by "writing the instructions for the processes involved."[327]

In his official report on the implementation of the 1965 Medicare Amendments, Commissioner Ball waxed ecstatically on the monumental task undertaken by his agency's employees, increasing benefit payments, and integrating a medical insurance infrastructure into

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[324] Wunsch memo 3, 1966; folder F13-149-185; Melvin Wunsch Papers, Wisconsin Historical Society, Madison, Wisconsin.

[325] Wunsch self note, (1975) 2, F13-148-185; Melvin Wunsch Papers, Wisconsin Historical Society, Madison, Wisconsin.

[326] Wunsch memo (1966), 3; folder F13-25-185; Melvin Wunsch Papers, Wisconsin Historical Society, Madison, Wisconsin.

[327] Wunsch draft program instruction, 5/13/66; folder F13-35-185; Melvin Wunsch Papers, Wisconsin Historical Society, Madison, Wisconsin.

existing Social Security rolls: "I believe it is safe to say that no other job like this, in terms of volume, has ever been done before anywhere. No beneficiary roll was ever before this large."[328] By the sixth paragraph, the role of information processing and the Agency's prowess with computer technology had taken center place: "The job could not have been done without our having planned ahead for conversion of the benefit payment process from punchcard to electronic processing; it could not have been done, either, without the skillful and imaginative work of those in charge of the equipment and those charged with the planning."

Planning for Medicare meant self-consciously planning with computers. Outlining the challenges associated with implementing both a hospital insurance program and a supplemental, voluntary patient medical insurance program administered through multiple insurance carriers, Ball highlighted the crucial nature of "systems planning" and "an extensive statistical program" that would maintain centrally-located records necessary for both halves of the program to function; the work of "a punch-card operator in the Bureau of Data Processing and Accounts" was to feel as central to the success of Medicare as those who "write procedure or carry it out." The act of administration itself could yield valuable insight in how to improve the program; again, process leading to policy. An appraisal study of benefit allowances commissioned in 1967 that sought to "measure the extent of compliance with established policy and procedure," while "not designed to measure the effectiveness of the policy" could as a "byproduct of the system" reveal "that a deficiency or irregularity in the process resulted from a weakness in policy or procedure rather than from the way they were followed."[329]

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[328] Ball, *Report on Implementation*, Dec. 1965. The increase in benefits Ball referenced was estimated to be $6 billion in fiscal year 1967, an spike to $25 billion in total expenditures over the pre-Amendment estimates of $19 billion.

[329] Social Security Administration, *History of SSA During the Johnson Administration 1963-1968*.

Testing and review of the technological system established by legislation could, according to enthusiastic SSA staffers, inform re-evaluation of the underlying policy itself. Each month a selection of random sample review cases from one of the Agency's administered regions was shipped to appraisal staff based in another region, with the assumption that any observed differences in payment center decisions would indicate issues worthy of consideration in "applying national policy and procedure." A so-called Evaluation and Measurement System implemented in the fall of 1964 was designed to "assess the validity of the assumptions underlying claims policy."[330]

Recalling Medicare's early planning stages in a later oral history, Arthur Hess noted a push among Agency officials to categorize potential health insurance intermediaries and carriers by their degree of automation and suspected competence in systems management: "We tried to pick out the ones that looked like they were big enough to know what they were doing . . . . we found out rather quickly that most of them (except for Texas which had Electronic Data Systems [EDS] and Ross Perot) did not have really good EDP systems and state-of-the-art claims operations." [331] These distinctions revealed the at-times contrary objectives of SSA officials and insurance companies. Both wanted to serve customers, but the necessity of insurers to make certain administrative decisions about benefits on a profit motive meant their definition of computerized efficiency might vary from that of the federal agency. The necessity of such precautions became apparent when one views the process by which insurance carriers were

[330] SSA, "Office of Research and Statistics, Work Plan, Fiscal Years 1969-1970," (1970); Office of Research and Statistics folder, Social Security Archives.

[331] *Recollections (Discussions) by Social Security Administration Officials' Knowledge and/or Involvement in Certain Stages of Early Implementation of the Medicare Program (Calendar Year 1966)*. 25 September 1992. (Atlanta, Georgia: Social Security Administration, 1992), 4.

expected to review each bill submitted under health insurance provisions: "checking each bill against data previously compiled on the physician's customary charges and the prevailing level of charges in the locality in which the physician practices," a phase of the process the guidelines contained in the Federal Register encouraged be "computerized."[332] Five "distinct but related computer tape record systems" were detailed as being optimal for the "statistical system for collection and maintenance of data on the utilization and financing of hospital and medical services," including a "master eligibility record, provider record, hospital insurance (part A) utilization record, medical insurance (part B) payment record, and the record containing a sample of the medical insurance bills."[333] Computer-management of records within the Medicare framework became a policy issue precisely because the intricacies of health insurance record-keeping procedures as administratively mandated of carriers by Social Security virtually necessitated that elaborate electronic data processing schema be developed to fulfill on-the-ground implementation of Medicare in hospitals and doctors' offices.

Top SSA officials hoped to instill an awe about the scope of the agency's EDP operations and the potential of computers by physically demonstrating computer processing to interested elected officials. Following the 1965 reorganization, Ball drafted a letter to each Senator, inviting the legislators and their staffs to visit the SSA's Baltimore headquarters. Explaining that the distinctive nature of his agency's "central operations" meant his office would be located in Baltimore rather than Washington, the Commissioner noted the particular attraction of "the electronic system for maintaining lifetime earnings records for 150 million people."[334]

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[332] "Medical Insurance Operations," *History of SSA During the Johnson Administration 1963-1968*.

[333] Howard West, "Health Insurance for the Aged: The Statistical Program," *Social Security Bulletin*, January 1967.

[334] Robert M. Ball, undated draft typescript, c. 1965, Communications Files, Records of the Social Security Administration, RG 47, "Robert Ball-Speeches" folder; National Archives II, College Park, Maryland.

SSI Debacle

The departure of Democrat Lyndon Johnson from the White House and the arrival of Republican Richard Nixon in January 1969 did little to stem the heady, mission-driven sense of expansion that marked the SSA's preceding five years. Despite the presence of a new administration and the departure of Wilbur Cohen from the HEW Secretary's Office, most key Social Security officials – including Ball and Futterman – remained in place. Hugh Heclo notes that high appointees in Social Security viewed their roles as political but not necessarily partisan; though their direction might be nudged by political concerns, these bureaucrats saw themselves beholden to the "long-standing public commitment" of their office, not to changing elected officials.[335] They would ensure that Great Society dedication to poverty elimination would remain central to the Agency's mission, even if now phrased under different terminology, and steer Social Security's continued expansion.

It was in this environment of internal chaos and outward profession of exceptional competence that the Social Security Administration accepted yet another monumental managerial challenge in the early 1970s. Incorporated into the 1972 Social Security Amendments, so-called Supplemental Security Income (SSI) would transfer from state authority to federal administration some six million welfare recipients, many of whom were excluded from the social insurance program because they were not regularly employed: the elderly poor, the blind, and the disabled. Though their benefits would be paid from general Treasury funds, all accounting procedures, benefit calculations, beneficiary enrollment, and case management would all be overseen by SSA employees (including thousands of new hires) already overseeing social

[335] Hugh Heclo, *A Government of Strangers* (Washington: Brookings Institution, 1977), 159, 149.

insurance payments. In the eyes of many congressmen, the Social Security Administration's very reputation as an efficient, fraud-free harbinger of modern management would percolate into the new programs it was slotted to administer, removing much of the stigma associated by the general public with welfare.[336]

The initial authorizing legislation for SSI, the 1971 Amendments to the Social Security Act, contained congressional praise of HEW and its constituent SSA, noting "that the strong efforts which have been made to improve the operating effectiveness of these programs [specifically Medicare and Medicaid] will continue."[337] Such comments echoed the views of Nixon political appointees, like HEW Secretary Robert Finch (apparently partly unaware of the massive backlogs bedeviling the agency), who praised SSA for avoiding the technical difficulties that marked some other agencies: "My main purpose here is to thank all of you for making the Department of HEW look so good . . .[for] not raising problems and doing so well in providing solutions."[338]

Commissioner Ball was initially an unenthusiastic supporter of SSA's administering supplemental security.[339] As historian Jerry Cates notes, many upper tier officials in SSA harbored "institutional bias" against non-contributory payment programs, feeling they detracted from the mission of social insurance.[340] Yet bringing such welfare payments into the SSA fold

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[336] Paul L. Grimaldi, *Supplemental Security Income: The New Federal Program for the Aged, Blind, and Disabled* (Washington: government Printing Office, 1980), 74.

[337] U.S. Congress, House, Committee on Ways and Means, S*ocial Security Amendments of 1971*, 92 cong., 1 sess., (197)1, 6.

[338] "Annual Awards Ceremony," *OASIS*, 16 (Jan. 1970), 12.

[339] Edward D. Berkowitz, *Robert M. Ball and the Politics of Social Security* (Madison: University of Wisconsin Press, 2003), 112.

[340] Jerry R. Cates, *Insuring Inequality: Administrative Leadership in Social Security, 1935 – 54* (Ann Arbor: University of Michigan Press, 1983), 156.

would expand the Agency's reach (and enhance its prominence within an Administration presumably less-inclined to view social security as a tool of poverty relief). Consequently, Ball and other officials actively worked to incorporate SSI's mission into that of the broader agency – SSI, after all, was designed with Social Security as a base and was intended to further the Great Society goal of eliminating poverty among the neediest. Even the program's name implied that these welfare payments were in addition to the base support of SSA-administered social insurance.[341] Such efforts at theoretical integration could not mask the enormity of the actual task – nor the operational implausibility given the sorry state of SSA's backlogged computer systems.

Even opponents of Supplemental Security Income framed their arguments within the rubric of SSA's assumed automated efficiency. In his dissenting view to the Social Security Amendments of 1971, Oregon Democratic Rep. Al Ullman all but conceded that shifting family welfare administration to Social Security's efficient computerized management would start American society down the "road to guaranteed annual income." Placing the "disorderly welfare system" under the touted oversight of SSA opened the specter of never having to distinguish between employed and unemployed aid recipients; the dazzling efficiency of such reforms would mean Congress could neglect studying a national childcare program.[342]

Former Chief Actuary and sometime Ball foe Robert Myers recognized both the technological determinism and holdover Great Society idealism at the heart of SSA's push for Supplemental Security. Though distrustful of the "brand new philosophy" of SSI, Myers conceded the legislation contained "certain attractive and desirable features," namely the "reduction in administrative expenses" that would accompany efficient SSA administration of

[341] Berkowitz, *Robert M. Ball and the Politics of Social Security*, 208.

[342] U.S. Congress, Senate, Committee on Finance, *Hearings on Social Security Amendments of* 1971, 92 Cong., 1 sess. (Aug. 2, 1971), 385.

the program.[343] Computers would enable a well-run program, and while indirectly benefitting a liberal agenda, would reclassify millions of current welfare recipients under the same programmatic umbrella as middle class social insurance: “SSI will eliminate much of the stigma that is now attached to receiving public assistance. This may be considered good or bad, depending upon one’s personal philosophy.”[344] Even conservative opponents of welfare expansion like Myers assumed that SSA’s historic efficiency would institutionalize a well-managed national public assistance program the way social insurance had been.

The 1971 Amendments to the Social Security Act establishing Supplemental Security had explicitly directed that “the computer equipment and other capabilities of the Social Security Administration. . . be utilized in the administration” of SSI in order that the new assistance program might be “economical and efficient.”[345] Already taxed to the breaking point by backlogs and delays from previous years’ amendments and an ever-expanding beneficiary pool, SSA’s electronic data processing machines could not bear both the current load and the current runs of SSI processing they were expected to conduct. The results were particularly grim from an operational standpoint.

Of the one million claims actually filed under SSI since July 1973, less than a third had actually been processed by May 1974.[346] Of the claims that had been processed, nearly a quarter

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[343] Robert J. Myers, *Social Security* (Bryn Mawr, PA, 1975), 413.

[344] Ibid, 417.

[345] U.S. Congress, House, Committee on Ways and Means, S*ocial Security Amendments of 1971*, 92 cong., 1 sess., 1971, 198.

[346] DiPentima, 214. These numbers represent the most generous estimates given that continual computer system failures meant SSA officials often did not know at a given point how many claims that had previously processed or were currently processing.

were of incorrect amount or made to the wrong individual.[347] The SSA's saving grace was that less than half the anticipated number of claimants actually submitted claims. Simple operational errors, including a misprogrammed decimal point in the benefit amount column, cascaded into major glitches that yielded entirely incorrect payment amounts or crashed systems unable to reconcile directions countermanding their programming. Mechanisms to effectively alter the preprogrammed computer run times or to force immediate payments from the system had not been designed in the "total system" intended to integrate SSI payments with regular social insurance payments. As SSA data processing employee Renato diPentima noted, "the designers believed . . . that the system would operate so efficiently that such a mechanism would be unnecessary."[348]

Errors caused further delays in both SSI payments and SSA's other programs as staffers were shuffled to manually produce checks. By the close of the first week in January, overburdened by the sheer number of data queries to the central network, "the entire SSA's telecommunications network collapsed," severing links among local offices, payment centers, and the central Baltimore headquarters that contained the programmers and systems analysts responsible for repairing such failures.[349] Each successful restoration would soon be knocked off again by the sheer volume of data inquiries made to Baltimore; itself a faultily-designed system, SSA's internal communications network could not handle an overload of inquiries about the agency's other faulty systems. The $110 million SSA estimated the government would save by

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[347] Grimaldi, 77.

[348] DiPentima, 207-08.

[349] Ibid, 204.

shifting state administration of welfare funds to its oversight instead yielded astronomical bills for computer consulting, employee overtime, and public relations response.[350]

Near riot crowds gathered in New York, Philadelphia, and other cities when promised checks were late. In Baltimore headlines somberly noted, "Welfare Foul-up Leaves Many Hungry." The *New York Times* thundered at Social Security's administrative failings, noting that for "several thousand aged, disabled, and blind persons, turned into human shuttlecocks and made to stand for hours in the cold and snow, the advent of the new system has proved an inhuman experience."[351] The *Wall Street Journal* concluded in July 1974 that the situation was "worse than [a disaster]."[352] National newspapers relished the dramatic story even as reporters expressed some confusion at the situation's rapid deterioration. One disgruntled Californian, reported the *Los Angeles Times*, objected to his local SSA office's excuse of "computer foul-ups": "How in the hell could there possibly be a foul-up. . . They've been planning this program for a year."[353] Similar questions emanated from elected officials who had placed the ambitious new welfare program under SSA's supervision. How could the Social Security Administration, nearly universally praised as the federal government's most efficient subset, have so completely and disastrously failed its constituency? News reports repeated the agency's elaborate, yearlong preparations for implementing Supplemental Security (SSI): 14,000 new employees, 243 new branch offices, and most importantly, a new "centralized computer system to handle the records."[354] How could such deliberate planning descend in operational chaos?

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[350] Grimaldi, 75.

[351] "On the Long Line," *New York Times*, Jan. 12, 1974, p. 32.

[352] "A Long Look at the SSS," *Wall Street Journal*, July 15, 1974, p. 10.

[353] Mike Goodman, "Check Delay Creates Hardships for State's Aged, Blind, Disabled," *Los Angeles Times*, Jan. 16, 1974, p. 25.

[354] Joanne Omang and Martin Weil, "Shift in Welfare Raises Benefits," *Washington Post*, 15 Jan. 15 1974, p. C2.

Loss of Confidence

Though the computer-based failures that marked SSI's implementation in January 1974 remain the most visible example of an SSA system malfunction, the agency's dirty little secret from 1965 onwards was that it almost continually teetered on the brink of computer collapse, despite regularly purchasing new machines, hiring additional programmers, and training staffers of all levels in systems methodology. Implementation of the highly touted Total Data Systems Plan seems to have even worsened the problem; mean processing time (average time from receipt of claim to final mailing of check to the beneficiary) for a particular lump sum survivor's payment was 36.3 days in January 1961, 31 days in July 1965, 48 days in January 1966, and 60 days in January 1967.[355]

Throughout the 1960s and early 1970s the SSA had regularly issued statements proclaiming the procedural soundness of the social security system.[356] Confidence in the program and its administration were generally high – despite occasional delayed checks or mis-processed benefits, the SSA served the majority of its clients in a timely and accurate fashion (albeit at the price of extensive overtime). For ten years Social Security had been presented as unimpeachably capable and efficient, able to harness computers to accurately calculate and disperse benefits. The blunders that marked the implementation of SSI in the first months of 1974 undid public faith in the touted automated efficiency of the nation's social security system. The Office of Management and Budget routinely rejected Ball's requests for more manpower,

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355 Mean Processing Time Chart, circa July 1972, McKenna Files, Social Security Administration Archives, Baltimore, Maryland.

356 SSA Press Release "Actuarial Balance," Mar. 23, 1964 report, Records of the Social Security Administration, Record Group 47, Public Affairs Files, folder 2525, National Archives II, College Park, Maryland.

citing SSA's past ability to "absorb this increased workload in part through improved work methods and through use of data processing." [357] Its proclaimed computer-based efficiency had come back to haunt the agency – OMB thought Ball was attempting to needlessly expand Social Security's empire when in fact the large number of bodies he requested were needed to process the backlog created by failure of data processing systems. The computer system that would lead to streamlined ability of SSA to achieve poverty eradication in fact lessened quality of service to needy clients by malfunctioning, delaying checks, and souring employees on their duties. HEW officials merely concluded, "Realistically, SSA's workload is always high and new complexities continue to arise." [358] Their solution was to propose another management consultant study.

Martha Derthick, Edward Berkowitz, and other scholars of Social Security have demonstrated that constantly shifting legislative priorities provided much of the basis for the turmoil that marked the implementation of SSI.[359] Equally important though were the operating procedures and policies rooted in the passion for systems management that swept the Agency after 1965. So while Congressional tweaking to the Social Security Amendments may have led to six different formulas being employed to calculate benefits between 1965 and 1973, the ever-changing nature of benefit calculation was more practically hindered by the constant addition of new technology.[360]

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[357] F. Malek to E. Richardson, Aug. 14, 1970; Consultant Studies Folder (Social Security Administration History Room, Baltimore, Maryland).

[358] Ibid.

[359] Martha Derthick, *Agency Under Stress: The Social Security Administration in American Government* (Washington, DC: Brookings Institution, 1990), 56-8; Edward D. Berkowitz, *Robert Ball and the Politics of Social Security* (Madison, WI: University of Wisconsin Press, 2003), 283.

[360] Myers, 93.

Regarding SSA's ultimate assumption of responsibility for supplemental security, no group was more decisive than Congress. Traditional Social Security historiography rightly points to the role of Congress in complicating the Agency's mission, setting up the failures of SSI by radically altering SSA's mandate with a too-short timeframe for implementation.[361] The GAO's 1974 investigation of SSI's implementation admitted as much, noting "frequent changes in legislation affecting social security programs in recent years have greatly increased the workload of SSA's information processing systems."[362] Overlooked in this account, however, is the complicity of SSA officials, whose willful promotion of computers actually encouraged lawmakers to press more responsibilities on the Agency. SSA leaders convinced legislators that their advanced computer systems could handle increased and varied workloads; congressmen responded by assigning more complex responsibilities to the agency and its computers.
SSA and HEW officials already manifested Great Society optimism about the potential of Social Security in these hearings, regularly regaling congressional leaders with staggering numbers of Americans who could be lifted from poverty should Administration-desired benefit increases be authorized.[363] Edward Berkowitz has described SSA's relationship with Congress during this period as "largely collaborative."[364] Such collaboration, and their reputation for computer-backed expertise, often meant SSA bureaucrats received their wishes for expanded portfolio from congressmen primarily concerned with increasing benefits in election years.

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[361] Derthick, *Agency Under Stress*, 71.

[362] U.S. General Accounting Office, *Increased Efficiency Predicted if Information Processing Systems of Social Security Administration are Redesigned: Report to the Congress* (Washington: GAO, 1974), **1.**

[363] 363 U.S. Congress, Senate, Committee on Finance, *Hearings on Social Security Amendments of 1967*, 90 Cong., 1 sess., Aug. 24, 1967, 314.

[364] Edward Berkowitz, "Medicare: Great Society's enduring National Health Insurance Program," in *The Great Society and the High Tide of Liberalism*, ed. Sidney M. Milkis and Jerome M. Mileur (Amherst, 2005), 337.

As the inauguration of SSI approached, Ball's testimony further reinforced public images of the Social Security Administration's efficiency. Answering a question from the Senate Special Committee on Aging in January 1973, on "the matter of workload in Social Security offices," Ball responded by indicating that "to meet the challenges" of the 1972 amendments SSA had "anticipated and responded to new and increased workloads by changing the organization and types of positions used in our offices, expanding EDP systems. . ." The challenge of "provid[ing] service to increasing numbers and types of beneficiaries" would be met by "restructuring workload and job organization, expanding EDP systems capability, reorganizing management structures."[365] Ball's implication was clear: Congress would legislate and Social Security would adjust its systems and management to meet the challenge.

It is conceivable a quiet, non-controversial implementation of SSI could have radically forestalled criticisms of both social insurance and social welfare, or at least reframed parameters of debate more favorably to defenders of public assistance and the beleaguered SSA. Instead, the clear short fallings evidenced those chilly first few months of 1974 opened the entire poverty-eradication scheme embodied by Social Security to valid criticisms regarding the roles of welfare, Medicare, and social insurance itself. Though the intellectual underpinnings for the assault on Social Security that marked the mid and late 1970s lay outside the control of SSA, with flawed Congressionally-mandated double-indexing of benefits and inflationary tendencies beyond any bureaucrat's purview, the Agency's sheer failure to deliver SSI checks in a timely or accurate constituted an operational failing with considerable future policy implications. After January 1974, skepticism regarding all of SSA's claims to competence was inevitable.

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[365] U.S. Congress, Senate, Committee on Finance, *Hearings on Social Security Amendments of* 1971, 92 Cong., 1 sess., Aug. 2, 1971, 283.

1985 Associated Press photograph of SSA employee Lillie Steinhorn on occasion of her 50th year working for the agency, having begun with paper records and moved to magnetic tapes

By the early 1980s, each alteration to Social Security law, whether cost-of-living adjustment, expansion of benefits, or tweaking of eligibility definitions, provoked a minor operational crisis because it entailed a software revision to an already fragile computer network that had to continue operating under one standard even while being reprogrammed to function under new legislation.[366] The system's creaky operational status only fueled howls of disdain from conservative think tanks dedicated to reformulating or eliminating the program. It would be the early 1990s, well past the era of the mainframe into the world of the personal computer, on the cusp of widespread internet usage and the emergence of calls of "e-government," before

[366] James W. Cortada, *The Digital Hand, Volume III: How Computers Changed the Work of American Public Sector Industries (*New York: Oxford University Press, 2008), 176, 529.

Social Security could confidently claim to have its information technology processes under control.[367]

[367] Ibid, 177.

Chapter Four: "Punchcard Pluralism: Urban Development, Modeled Cities, and the Crisis of Technocratic Liberalism in an Era of Rights Revolution"

The story of dataocracy is one of an emergent information society transforming the American public realm in the decades following World War II. No policy category exhibited this more clearly than the nebulously-labeled, interrelated cluster of concerns known as "urban policy." Beginning in the late 1950s, but especially pronounced in the 1960s and 1970s, computers would rise to the forefront as a tool associated with policymaking on issues connected to America's cities. The so-called "urban crisis" engendered by deindustrialization, racial tensions, shrinking tax bases, and decaying infrastructure would be filtered in the minds of policymakers, the rhetoric of activists, and the aspirations city planners through the promise of information management technologies. Understanding how and why so many Americans of the tumultuous sixties and seventies chose to interpret urban issues in part through a computer-tinged lens conveys both the broad reach of dataocracy and the widespread hope that a rational, impartial fix – one mediated by technology – might bring order to a nation unravelling at its core. The computer in this case can be situated in a broader period embrace of technology as a means of social improvement: medical advances as extenders of life and body, nuclear power as the promise of unlimited energy, and rockets and space travel as exemplars of the human spirit.[368]

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[368] See Brick, Howard. "Optimism of the Mind: Imagining Postindustrial Society in the 1960s and 1970s." *American Quarterly* 44, no. 3 (1992): 348-80 and Werth, Karsten. "A Surrogate for War—The U.S. Space Program in the 1960s." *Amerikastudien / American Studies* 49, no. 4 (2004): 563-87. For a contrasting view on how differences over technological exceptionalism exacerbated social conditions in the 1960s, see Jewett, Andrew. "The Politics of Knowledge in 1960s America." *Social Science History* 36, no. 4 (2012): 551-81 and Ehrlich, Howard J. "Social Conflict in America: The 1960's." The Sociological Quarterly 12, no. 3 (1971): 295-307.

This chapter seeks to trace the intertwining of electronic management of information and urban policymaking during the crucial "Sixties/Seventies" period by focusing on three aspects of dataocracy in action. First I present a broad overview of the rhetorical and intellectual context of urban policymaking from the late 1950s through the 1970s, a period when the very language used to describe urban renewal and the predominant mindsets of urban policymakers were inundated with references to systems techniques, computer models, and the promise of the computer as a tool for distilling into manageable form complex social issues. A second segment examines the ways in which eagerness to embrace electronic data processing played a prominent and recurring role in the early years of the Department of Housing and Urban Development (HUD). A final portion conveys the spread of the dataocratic impulse by examining how non-state actors – civil society groups and private business firms interested in engaging in acts of urban-focused social responsibility embraced the computer as a tool of societal transformation. Dataocracy may have emerged from the laboratories and clerks' offices of the federal government, but in application in the case of complex policy issues, its influence encompassed non-governmental political actors interested in articulating policy viewpoints and pressing forward particular political agendas.

Efforts to address the sheer multifaceted complexity of urban policymaking in a time of near-universally accepted crisis gradually drifted into the sphere of computers and electronic systems precisely because these tools offered a means of harnessing complexity. The problem of the postwar American city was one of visible causes – deindustrialization, decay of housing stock, flawed transportation programs – and uncomfortable-to-discuss dilemmas – unsustainable municipal finances, rival constituencies with diametrically opposed interests, and the question of race. Employing dataocracy as a lens to understand the urban policymaking regime in the 1960s and 1970s permits an understanding of policymakers and those with whom they interacted – local citizens, activist groups, and commercial interest – viewed the complexity of American cities. Unlike the realm of social insurance, where ambitious proposals to employ computing technology stemmed from pre-existing –and pre-digital – recordkeeping institutions, discussions of the electronic computer entered the postwar urban question as the promise of a technocratic solution to a policy dilemma with seemingly no workable solutions.

Computers and the Rhetoric of Urban Policy

From the earliest days of centralized computing, technologists and policy formulators alike discussed the prospect of the "electric brain . . . providing some precise yardstick in the traditionally inexact social sciences" for purposes of tackling complex human affairs.[369] Beginning in the 1960s, envisioning the transformation of the American urban scene – or even conveying that vision to the general public -- became impossible to do without incorporating some element of dataocracy. Urban issues became one of the most prominent realms of American social discourse where elements of electronic data processing interwove with public discussion and policy formulation. As think tank researcher Anthony Burns noted in the *Public Administration Review* in the fall of 1967, "The glamorous capabilities of computerized "urban information systems" appear so dazzling that no major city planning proposal is considered respectable unless it contains at least one section on EDP, ADP, or an urban data bank."[370]

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[369] Gladwin Hill, "Scientists Confer on 'Electronic Brain': Mathematicians Predict Use of Computers in Problems of the Social Sciences," *New York Times*, 23 June 1949, p. 25.

[370] Anthony Downs, "A Realistic Look at the Final Payoffs from Urban Data Systems," *Public Administration Review*, Vol. 27, No. 3 (Sep., 1967), p. 204.

Urban planners themselves would not always personally operate the new electronic computer, but they were encouraged to incorporate computer resources into their daily routines. And computer specialists would be brought into the fold of urban affairs as essential personnel. As one management journal noted, "Ultimately the burden for implementing the solutions to these issues and problems generated by planners and laymen devolves upon the electronic data processing specialist."[371]

Historians of the Cold War and scholars of technology have written at length about the enthusiasm with which systems management-promoting defense contractors and think tanks embraced the urban policy sphere as an extension of their operations research and control systems national security focus. Aerospace firms in particular, as Jennifer Light details in her masterful *From Warfare to Welfare*, sought to expand their policy influence (and garner a share of the lucrative contracts associated with the expansion of the federal welfare state) by promoting opportunities to transfer techniques of defense system design and management to the contested realm of urban policy. The authority connected with the computerized systems that these firms designed for the Pentagon granted entrée into the realm of domestic policymaking. After all, was not the so-called crisis of the American city just another complex set of coexisting variables to be calibrated and systematized, much like the problem of tracking enemy bombers?

As federal dollars began pouring into urban redevelopment planning studies designed to stem the decay of urban cores rapidly losing middle-class population to emerging suburbs, so-called "defense intellectuals" found a secondary business turning their mainframes and analytical

[371] N. S. Sutherland, "Machines Like Men," *Science Journal* (Oct. 1969), p. 44-48. Quoted in P. F. Sheldrake, "Attitudes to the Computer and its Uses," *The Journal of Management Studies* (February 1971): 49.

flow charts to the salvation of cities plagued by unemployment, crime, riots, and general decay. From these think tanks and aerospace/systems firms, through research universities, to private computer firms flowed a growing fascination with the prospect of applying the power of computers to model the complexity of cities. Thus MIT Professor Jay Forrester, director of the Cold War-era Project Whirlwind for the Navy could be simultaneously lauded by policymakers and intellectuals for his work on "urban dynamics." For those eager to promote the virtue of computer-influenced policy-making, the realm of urban affairs was the obvious zone in which to experiment with their methods; as one report noted, "Since the United States is a highly urbanized society, most-policy-making in this country takes place in an urban environment."[372]

The appeal of a technologically-mediated solution to this intersecting complex of problems appealed to Americans far beyond the "defense intellectuals" detailed by Light and embodied in the career of Jay Forrester. From the late 1950s through the mid-1970s, references to data-processing and computerized systems increasingly permeated the entire constellation of urban planners, metropolitan office holders, federal officials, community activists, and members of the press who debated how best to save America's faltering urban cores. As the Sixties progressed into the Seventies, the very language of urban policymaking became saturated with references to – and assumptions about – the computer as an information processing tool.
As sociologist Herbert Gans noted in 1967, the field of urban planning had by the end of the 1950s partly degraded into a simmering standoff between a new school of social-planning-minded experts, who sought to undo some of the "demolish first" excesses of the prior decade's urban renewal focus, versus a "conservative wing" centered on "traditional physical planning . . .

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[372] Office of Research and Development, Environmental Protection Agency, *A Guide to Models in Governmental Planning and Operations* (Washington: Environmental Protection Agency, August 1974), 168.

and middle class values."[373] The former group was ascendant in the era of the Great Society and during the widespread adoption of Robert McNamarra's Planning-Programming-Budgeting-System method for allocating federal resources and Richard Nixon's block grants for urban development programs. For these whiz kids, early mainframes had been inappropriately utilized by the urban renewal advocates and transportation planners who remade immediate postwar cities with soulless expressways and obliterated neighborhoods. "The first primitive attempts to use computers in transportation planning were woefully inadequate," noted one chastised urban planner to congressional inquisitors demanding accountability for urban revitalization expenditures. "The computer no longer dictates an expressway plan; instead it is fed alternative plans, and their cost and adequacy are compared. Thus planners, elected officials, and local voters can make the final choice on the basis of the helpful findings emerging from the computer." [374]

Rebellious young architects and urban planners sought to distance themselves from "those planners" they labelled as having "degenerated into bureaucrats, salesmen, or power brokers." Despite its uses as a tool of centralized authority, for many would-be urban planners the computer became a tool for challenging entrenched planning interests and promoting more livable cities, a sort of mechanized silver bullet for achieving the type of dense, complex, and self-defined urban communities extolled in Jane Jacob's 1961 volume *The Death and Life of Great American Cities*. As one architectural critic observed, this new school espoused the belief

[373] Martin Rein and S. M. Miller, "Poverty Programs and Policy Priorities," *Poverty in America: A Book of Radings.* Louis A. Ferman and Joyce L. Kornbluh, eds. (Ann Arbor: University of Michigan Press, 1968), 309. For more on the deep ideological context of urban infrastructure, see Jason Smith, *Building New Deal Liberalism: The Political Economy of Public Works: 1933-1956* (New York: Cambridge University Press, 2006).
[374] 111 Cong. Rec 6365, 31 (March 1965), 6447.

"that man can develop machines with intelligence to help design the world of the future."[375] Computers could capture in analyzable form the complexity of the twentieth century city by divining patterns of interconnecting urban life untraceable by human observation alone. As one Arizona land-use advocate noted in 1966, "Of particular significance in the last ten years has been the growth of regional techniques of analysis [for city planning]. These have been given new impetus by the use of computers."[376] The two were mutually reinforcing. "Spurred both by increased concern about urban problems and by recent advances in modeling techniques, researchers and policy analysts have constructed literally hundreds of such models in the past two decades . . . ."[377]

The intermingling of systems-focused and urban centered research constituencies occurred early. The Twelfth National Meeting of the Operations Research Society of America in 1957 focused an entire themed session on Urban Planning.[378] Three years later the National Academy of Sciences bemoaned the slowness with which data processing techniques had been applied to the question of urban renewal. When it came to questions of city design and planning, "performance data required for systems analysis are rarely obtained. Only in certain areas of urban development and design are truly scientific approaches underway." [379] An operations researcher concurred in 1961: a shift to "modern data processing methods will soon enable

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[375] John Pastier, "Form of Structured Anarchy Seen as Cure for Urban Ills," *Los Angeles Times*, 28 June 1970.
[376] H. S. Coblentz, book review of *Location and Land Use*, *The Natural Resources Journal*, Vol. 6, No. 1 (January 1966): 171 .
[377] Office of Research and Development, Environmental Protection Agency, *A Guide to Models in Governmental Planning and Operations* (Washington: August, 1974), 168.
[378] Back Matter, *Operations Research* , Vol. 5, No. 5 (Oct., 1957), 739.
[379] "Urban Planning, Transportation, and Systems Analysis," L. M. K. Boelter and M. C. Branch *Proceedings of the National Academy of Sciences of the United States of America* , Vol. 46, No. 6 (Jun. 15, 1960): 831.

planning agencies to keep up to date a perpetual inventory of land uses, zoning, and economic activity."[380]

These computer-aided approaches would permit variations on two pressing themes that bedeviled transportation planners and urban space analysts: generality and interdependence. Because of the granularity permitted by incremental data adjustments and the relatively (given processing time) unfettered ability to run multiple variations on a model, the "specific numerical results" generated by "the employment of the computer" could be "generalized in several ways . . . The computer allows the testing of many nodal arrangements." [381] In turn, this generality would begat an almost organic ability to simulate the interconnectedness of complex systems, enabling the programming of a multitude of complex policy variables that might influence a city:

> To be sure, many more data than are now recorded and available will be needed to design systems with predictive characteristics, but the electronic computer is at hand to correlate, store, and otherwise process the information. In their treatment of all elements of an organism as interdependent, planning and systems engineering contrast with the artifice of treating each component separately. [382]

To consider the growth of this mentality, consider two special issues of the *Journal of the American Institute of Planners* separated by a mere six years. Both the 1959 and 1965 issues focused exclusively on the theme of urban models. The later volume framed the task of modeling almost exclusively as a task for electronic computers, noting that within the field of urban planning, the most significant recent "major breakthrough . . . was in data handling and

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[380] "Some Problems in the Theory of Intra-Urban Location," Britton Harris, *Operations Research* , Vol. 9, No. 5 (Sep. - Oct., 1961): 695-721.

[381] "Urban Planning, Transportation, and Systems Analysis," L. M. K. Boelter and M. C. Branch *Proceedings of the National Academy of Sciences of the United States of America* , Vol. 46, No. 6 (Jun. 15, 1960): 830.

[382] Ibid, 826.

analysis."[383] Pressure from state governments further hastened many municipal planners' move to incorporate electronic computers into their urban policymaking portfolios; as a study from the Council of State Governments noted in 1965, "state interest shifted to ADP" over the preceding half decade as a part of a larger "movement for coordination and cohesion with its concomitant, effective executive leadership and control." To "implement effective ADP operations" would smooth "increasingly strong centrifugal ties to federal agencies" on planning-related issues and foster "interagency use" cognizant of "consideration of the common informational interests of local units of government." The council concluded that on the state and local levels, "both executive and legislative leadership must be clearly aware of the utility of computers, with positive and continuing support for policies built around this broad awareness."[384]

Throughout the 1960s and 1970s, trade journals and newspaper classifieds carried job listings for data analysts with experience in "urban databases" for employment at universities, think tanks, and community development programs with an interest in "urban affairs."[385] By the mid 1980s, a typical degree in "Urban Studies" aimed at would-be city planners included core courses on "computer applications" in management and training on IBM and Apple terminals to facilitate research into "housing and the urban community" and "urban economics."[386] Planners who dealt in physical spaces and tangible concepts like housing stock and unemployment rates had been replaced by "urbans systems researchers . . . skilled in the use of computers and analytical, systems-derived research . . . able to assume responsibility for computer applications

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[383] *Journal of the American Institute of Planners*, Vol. 31, issue 2 (1965): 176.

[384] John M. Capozolla, ed., "Researcher's Digest," *National Civic Review*, September 1966 (Vol. 55, Is. 8): 476.

[385] Ad for "Programmer/Data Analyst," *Cleveland Plain Dealer*, 17 March 1977, p. 102.

[386] "Real Estate Report" *Times Picayune*, 7 June 1986, p. 87.

in a variety of projects."[387] For most urban experts and policymakers of this era, to discuss urban issues was to have a conversation about the scope and nature of data processing, computerized modeling, and systems analysis.

Though discussion of how to apply computers to resolve the multitude of America's woes may have been concentrated among those urban planners, systems specialists, and municipal office holders conceptualizing urban issues as part of their daily routine, summaries of and allusions to their ongoing conversation were regularly included in the mainstream media. The Science Editor of a prominent West Coast newspaper proclaimed that for citizens of wealthy, developed nations like the United States, three major challenges beset their societies: "nuclear war, computers, and cities."[388] "Systems Analysis Can Help Solve Crisis, Negro Leader Tells UCI Audience," proclaimed one 1969 headline in the *Los Angeles Times*.[389] Another, from three years earlier, introducing a 1966 urban planning conference at Woods Hole, Massachusetts, provocatively asserted, "City Planners Hope to Shift Some of Woes onto Computers."[390] Interconnected networks of systems-interested parties could in the pages of America's newspapers and magazines reinforce their mutual beliefs in the restorative power of the computer.

A Department of its Own

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[387] "Urban systems researcher" advertisement, *The Plain Dealer,* 11 February 1979, p. 191.

[388] Irving S. Bengelsdorf, "What Are Your Problems? – Well, Are You Rich or Poor?," *Los Angles Times,* 23 June 1966, p. A5.

[389] "Computer Assistance to Ghettos Foreseen: Systems Analysis Can Help Solve Urban Crisis, Negro Leader Tells UCI Audience," *Los Angeles Times,* 18 Apr. 1969, p. D10.

[390] McGrory, Mary. "City Planners Hope to Shift some of Woes Onto Computers." *Los Angeles Times*, Jul 19, 1966, p. A5.

By virtue of its Great Society-era roots in the mid-1960s, the Department of Housing and Urban Development (HUD) became one of the first major governmental institutions established and set-up during the era of widespread mainframe computing. Senior HUD officials saw establishing a coherence as an institutional computer user as a central imperative for solidifying the newly-formed agency's overall identity. This agenda entailed acquiring computer systems adequate for the new agency's extensive portfolio of administrative tasks while integrating the pre-existing computing resources of the Federal Housing Administration (FHA), an early adopter of data processing technology for purposes of corralling its "vast mortgage insurance records." Robert Weaver confessed to BOB Director Elmer Staats the frustrations (characterized as a "shakedown process") of transmuting an established ADP system designed by accounts officers into the modern "capability for the fast retrieval of key statistics on the Agency's far flung program activities."[391] He later declared "a necessary, common sense step . . . will be to provide a single data processing facility to serve all parts of the Agency."[392] While making preparations to move the Agency into its new headquarters building, HUD official Dwight Ink noted to Secretary Weaver this: "I believe we all agree that it is unthinkable to have more than one Automatic Data Processing system when we move into the new building."[393] To project the image it wanted to convey, HUD would need to streamline its systems. More crucially, it would need to seamlessly integrate the not always complimentary acts of gathering data on urban issues and incorporating processed information in the policy analysis and decision-making process.

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[391] D. Ink to E. Staats, 13 Feb. 1964, Records of the Office of Housing and Urban Development, Record Group 207, Series 207.7.1 General Records, folder 7933; National Archives II, College Park, MD.

[392] Weaver memo, 6 July 1964, Records of the Office of Housing and Urban Development, Record Group 207, Series 207.7.1 General Records, folder 7955. National Archives II, College Park, MD.

[393] Dwight Ink to Robert Weaver, 16 September 1966, Records of the Office of Housing and Urban Development, Record Group 207, Series 207.7.1 General Records, folder 049-108-7571. National Archives II, College Park, MD.

Upon being allocated $10 million research budget, HUD officials identified as an early priority for expenditure of the funds investigation into “a methodology for the diagnosis of urban problems, including measurement tools, data requirements, and conceptual models.”[394]

Typical was a September 1968 exchange between Charles Zwick of the Bureau of the Budget and HUD Secretary Weaver, in which the former noted the need for “more comprehensive, systematic, and timelier information than ever before” to grapple with “the growing size and complexity of our Federal Management problem.” Extolling the virtues of internal PPBS systems for cabinet departments, he noted how crucial “the various information systems that underpin our decision-making processes” were “for making studies and conducting analyses of alternative methods in meeting program goals and objectives.” He explicitly requested of Weaver “cooperation and support” in the task of “promot[ing] the use of such system as the primary basis for major program decisions at the agency level.”[395]

Crucial to cementing this attitude were hiring decisions that brought into the nascent agency new employees comfortable with – if not necessarily proficient in -- computer systems. Within its first decade, it was not uncommon to encounter high-ranking HUD officials with experiences that drew from traditional industry, military, and think tank systems communities in addition to more expected urban planning and real estate backgrounds. Ross Boyle, who served in HUD under both the Johnson and Nixon administrations, eventually rising to the policy-centered Deputy Assistant Secretary position, had been an employee of Eastman Kodak. Official

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[394] HUD Budget report, 1965, 190, Records of the Office of Housing and Urban Development, Record Group 207, Series 207.7.1 General Records , Folder Doc49-127-139. National Archives II, College Park, MD.

[395] R. Zwick to R. Weaver, 14 Sept. 1968, Records of the Office of Housing and Urban Development, Record Group 207, Series 207.7.1 General Record, folder 049-123-0206. National Archives II, College Park, MD.

R. O. Symmes noted in a memo (punctuated with a smiley face) to all fellow division chiefs in HUD the three impulses suggesting the agency aggressively pursue a technological upgrade hiring agenda:

> (1) It's economically practical, e.g. we can provide increased, faster, and more accurate service for less money than we're now spending with new equipment that's available now.
> (2) It will be quite significantly easier to attract and retain good people because of being "modern," and
> (3) The attached press release says we're doing it. ☺

The press release Symmes referenced sported the title "Computers to Speed Operations at HUD's New Headquarters Building," and promised that the Department would "be equipped with the most modern computing devices to help management maintain efficient control over its complex operations."[396]

Following its 1965 establishment, the Department was scheduled to hire 1000 additional employees in 1967 and another 2000 in 1968. Many of those hired would punch cards, program computers, analyze tape spools, or diagram policy priorities on systematized flow charts.[397] Though HUD only began the process of automating its own employee records system in 1967, since the Department's founding its executives had prepared for the eventual establishment of extensive internal data processing offices. [398] The Office of ADP Systems Management and Operations would employ 239 people in the Washington office in 1968, 309 in 1969, and 348 in 1970 – at a time when both Presidents Johnson and Nixon sought to contract the number of full-

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[396] HUD News press release, 17 Feb. 1968, Records of the Office of Housing and Urban Development, Record Group 207, Series 207.7.1 General Records, folder 7799; National Archives II, College Park, MD.

[397] Jerry Kluttz. "The Federal Diary." *The Washington Post*, Feb 16, 1967, p. A2.

[398] "Systems overview," Records of the Office of Housing and Urban Development, Record Group 207, Series 207.7.1 General Records, Box 49-112, folder 8196; National Archives II, College Park, MD.

time civilian federal employees. Even as that office's numbers climbed each year, the percentage of employees at GS-6 level or below gradually declined, lower level clerks and keypunchers driven out by highly-paid programmers and systems analysts.[399] Bureaucratic horse-trading ensured that each programmatic bureau within HUD – from the Office of Metropolitan Development to the Assistant Secretary for Mortgage Credit to the Riot Insurance and Fair Housing sections – received some man-year allotment from the staff of the Systems Development and Programming Division.[400] Though they were "systems men," and many at the lowest rungs might only tangentially contribute to strict definition or implementation of policy, data processing staffers were considered "housing and urban development" employees first, as their work with data placed them in intimate juxtaposition with the numbers and models that underlay policy. Thus Lowell Payne, Programmer with the Automatic Data Processing branch, was in February 1968 denied by HUD's General Counsel permission to engage in part-time real estate sales in Virginia; though the counsel's office concluded "Mr. Payne's HUD employment [was] not connected with any of the Department's programs involving land," his duties as programmer were as "closely allied to the work of Department" as those of a real estate entrepreneur would be, triggering conflict of interest concerns.[401] By the close of the decade, the work of HUD was the work of the computer.

Internal memos flew between the executive suites of HUD headquarters (temporarily housed in rented space above a shopping mall) regarding the credentials needed for a "project

[399] "Budget Estimates FY 1970"; Records of the Office of Housing and Urban Development, Record Group 207, Series 207.7.1 General Records, folder 7741; National Archives II, College Park, MD.

[400] HUD ADP files, Records of the Office of Housing and Urban Development, Record Group 207, Series 207.7.1 General Records, Box 049-109; folder 7743. National Archives II, College Park, MD.

[401] T. McGrath to D. Ink, 8 Feb. 1968, Records of the Office of Housing and Urban Development, Record Group 207, Series 207.7.1 General Records, folder 7894. National Archives II, College Park, MD.

manager with considerable ADP experience." Their deliberations reveal the mindset of executive agency officials confronting how to integrate computerized file management into the daily routine of an administrative office. Correspondents questioned whether data processing should report to the Office of Management or the Office of Administration. Other queries embraced a more philosophical tack. One memorandum – subtitled "The Problem" – delineated the existential quandary facing a new agency uncertain of how to frame its identity in relation to electronic information management:

> * How to separate areas of responsibility without losing essential elements required for one-department, unified ADP performance?
> * How to establish functions which are practiceable in HUD's present primitive and fluid ADP situation but which will lead into and support greatly expanded and unified Departmental systems?
> * How to cope with increasing pressures from outside the Department to take over control of ADP on a functional basis and thereby control HUD programs?[402]

As this agency official observed the field, judiciously applied expansion of computerized data processing could provide great benefits to the agency in terms of gradually evolving its policy mandate, but overreliance on external systems assistance could compromise HUD's control of the very policy programs that made such extensive use of data systems. This unnamed bureaucrat's proposed solution was to diffuse control of information within the Department, assigning "broad policy governing information flow and retention and for specific decisions concerning rate, priorities, and configuration of systems innovations" to the office of the Deputy Undersecretary, while "the Assistant Secretary for Administration would have corresponding responsibility for the development and refinement of systems; programming, testing, conversion,

[402] HUD ADP memo, 1966, Records of the Office of Housing and Urban Development, Record Group 207, Series 207.7.1 General Records, folder 7586; National Archives II, College Park, MD.

and operations; ADP production management and control of equipment utilization; and supervision of systems analysis, programming, and production staff."[403] Collaboration between the bifurcated staffs of "information systems planners, systems analysts, and programmers" would remain paramount, as "only in this way can the Department anticipate problems in new applications and optimize the solutions within available resources." Deliberately cleaving the staffs of "information planners, systems analysts, and programmers" into two camps with overlapping responsibilities was thus posited as a way of staving off administrative capture of the Department's entire computing capability by external agencies. Dispersing systems staff throughout HUD ensured policy, programmatic, and administrative offices would be indivisible as they employed electronic data systems in furtherance of Agency goals.

Would HUD be better served by simply "adding on" capacity to the existing (purchased in 1961) Federal Housing Authority mainframe computers it had inherited, or would it be more effective to construct a new, "integrated" system merging personnel, payroll, and other administrative ADP systems? The eventual compromise result – product of manpower realities and programming barriers – was to "maintain two systems with different codebases" embracing the Department's existing, inherited personnel computers and its new payroll needs, a parallel construct that would in theory "facilitate the eventual establishment of a single integrated system."[404] In preparing a budget of $5.25 million in 1968 to purchase a new mainframe computer and associated peripherals (optical character readers for scanning, etc.), HUD officials proudly noted that though their ADP activities exceeded previous years' computer usage, their

[403] Ibid.

[404] HUD ADP overview file, 1976; Records of the Office of Housing and Urban Development, Record Group 207, Series 207.7.1 General Records, box 049-109; folder 7724-26. National Archives II, College Park, MD.

proposed expenses were below those of comparable agencies.[405] As seen in similar debates in the Bureau of the Budget and Social Security Administration, HUD officials who embraced dataocracy were tugged by competing impulses – a desire to centralize and expand computing installations to test the potential of systems management and an equally strong impulse to demonstrate the cost-savings of data processing to the point of parsimony.

Such costly expenditures – and replacement of the seven-year-old FHA mainframes, acquisition of new machines, and the establishment of a combined "Computer Center extending support to all Departmental elements" – were necessitated by "the nature of the requirements for data processing support [that] were changing rapidly." David Albright of the Office of ADP Systems Management and Operations outlined to Assistant Secretary for Administration Dwight Ink in September of 1968 the "requirement" for "providing management data to program managers at local as well as headquarters level within a time frame that assures usefulness of the information." Such timeliness stemmed from "increased demand on the part of policy level officials for 'impact' information that will monitor, measure, and evaluate program effectiveness within sociopolitical frameworks and at the same time provide a basis for determining administrative efficiency." An extensive computerized system accessible to direct inquiry at "city, state, region, and Assistant Secretary levels" was the only feasible means, Albright concluded, of

> furnish[ing] planning, operating, and managing officials with information necessary to their respective functions . . . the HUD database must contain details relating to housing; other urban facilities and amenities; resources committed and resources available to improve the urban environment; descriptions of particular urban social, economic, and

[405] 23 Sept. 1968 memo, Records of the Office of Housing and Urban Development, Record Group 207, Series 207.7.1 General Records, folder "HUD ADP files," 7732. National Archives II, College Park, MD.

physical environs; the status of HUD projects and programs; and measures of HUD's effectiveness and efficiency in dealing with related problems.[406]

A National Clearing House Facility database under discussion by department administrators, Albright continued, would have to be joined by a "system for collecting, storing, and retrieving objective and subjective information for Model Cities Administrative management," and databases sufficient for the needs of the Department's Flood Insurance, Fair Housing, and Riot Insurance programs. The new department's expanded portfolio of responsibilities necessitated "new data systems requiring changed technological capabilities" to meet the needs of data-driven policy. Converting the FHA's 4.5 million analog active records to an integrated electronic database would entail expenditure of cash and man hours but would ultimately yield more malleable ground for information-driven policy experimentation with the accounts thanks to "more flexible and higher speed equipment." [407]

Just like their counterparts at the Social Security Administration, late-Sixties HUD officials had considerable faith that a shift to next-generation mainframes and a move away from "serial order processing" would "permit the development of a more comprehensive management system" with "immediate information reply" enabling "simulation, model building, and the techniques of the Planning-Programming-Budgeting-System." [408] Agency officials eagerly sought to convert local officials to the notion that computers could be applied for more than payrolls, serving as capable tools in defining and implementing policy. As observers noted in 1979, with promotion of data banks and urban development models in the late 1960s, "federal

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[406] Albright to Ink, Sept. 1968, Records of the Office of Housing and Urban Development, Record Group 207, Series 207.7.1 General Records, folder "HUD ADP files," 7732. National Archives II, College Park, MD.
[407] Ibid.
[408] Ibid.

support attempted to raise the sophistication of computer use – from automation of routine operations to support of decision making."[409]

In Los Angeles, for instance, HUD supported the creation by the county government of a "Housing Policy Evaluation Model . . . to assist local decision-makers in housing policy analysis." The agency emphasized the necessity of carefully selecting appropriate "operational models" as the first step in generating "a set of outputs, or consequences."[410] Federal systems analysts realized that due to the expense and complexity in initiating highly-touted modeling processes, the results of said simulations were likely to have lasting consequences in policy decisions as elected officials operated under deadlines. When presented with reams of data broken down into options, decision makers frequently found their solutions not just inspired by simulations but mirroring the course of particular model results. In an evaluation of the general "Community Analysis Model," HUD advisors suggested an approach taking "the form of large-scale computer-based mathematical models which attempt to explain the behavior of the various actors who make up urban neighborhoods."[411]

Organizations commissioned by HUD to conduct research into urban questions by the late 1960s overtly identified the computer techniques they employed as fundamental to the evaluative process. The Urban Institute, funded by HUD's Office of Policy Development and Research in the early 1960s on a national survey of residents of 400 housing projects on the

[409] Kenneth I. Kraemer and James L. Perry, "The Federal Push to Bring Computer Applications to Local Governments," *Public Administration Review*, vol. 39, no. 3, (May/June 1979): 260.

[410] William B. Hoffman, et. al, "The Los Angeles Housing Model Summary Report," (Los Angeles: HUD Library, 1974), 11.

[411] Donna E. Shalala, "Foreward," *A Critical Evaluation of "The Community Analysis Model."* Report by Office of Policy Development and Research, U.S. Department of Housing and Urban Development. (Washington, U.S. Government Printing Office, 1978).

question of how well the public housing was managed, used liner function programs designed for biomedical analysis to link certain high levels of resident satisfaction to lower operating costs. Favoring a causal inference between well-received management practices and the act of decreasing expenses numerically added policy fuel to proposals to downwardly adjust funding for less-well-reviewed housing managers. Two consultants employed by HUD noted "a virtual revolution in terms of the quantities of data that are being requested, collected, processed, disseminated, and applied at every level of government."[412] The key was the transition from the data-processing condition of the former to the actionable results of the latter stage.

Beyond shaping personnel decisions and setting the tone for use of electronic computers within the organization, the reliance of HUD upon computerized systems had wider ramifications in the realm of urban policy implementation. Undertaking simultaneous ambitious policy initiatives that all competed for computer time in preparation of their models and simulations meant that individual bureaus were frequently starved for processing time. Correspondence from February of 1969 between HUD's Director of ADP Systems Management and Operations and the Deputy Assistant Secretary for Administration reveal actual time estimates of delay of implementation of programmatic objectives unless additional systems analysts and programmers were hired. Completion of Agency programmatic objectives was so linked to computer processing agendas that absence of qualified computer operators shaped the courses of action open to division heads deliberating how to proceed with policy modeling questions. Starkly titled "Effect of Systems Analyst Shortage on Scheduled Systems Development," the memorandum outlined in months the anticipated delay (or "slippage") that would affect specified policy programs – one month for fair housing, three for demolition grants,

[412] Barry S. Weller and Thomas C. Graff: Geographic Aspects of Information Systems: *Introduction and Selected Bibliography* (Monticello, IL: Council of Planning Librarians, 1971).

five each for urban planning assistance and water/sewer models. To carry out those holdover housing policy initiatives that the Nixon Administration intended to preserve from Lyndon Johnson's agenda would, without additional systems staff, entail a hypothetical delay of eighty-one months.[413] Such delays could cripple ambitious proposals to interject time-dependent computer analyses into programmatic experiment. A long-simmering proposal by the Financial Management Improvement Program and the Assistant Secretary for Metropolitan Development to promote flexible bond maturity schedules for local public agencies was caught between a mission objective of "utilize[ing] ADP techniques in the preparation" of its models and the realization that slow data-processing could render futile efforts to ensure optimal bond market conditions.[414]

Bureaus and offices that wished to see their programmatic agendas acted upon had vested interests in refining their processing needs to match certain accessible processing standards. This remained true even in early policy initiatives where mutual agreements among officials ultimately concluded that the particular experiments themselves had been failures. One of HUD's earliest initiatives was a short-duration, high-budget examination of computer simulation for urban policymaking. Actually begun on paper in 1959 by its predecessor entity the Housing and Home Finance Agency, the optimistically-titled "Community Renewal Program" would pump some two million dollars into Pittsburgh- and San Francisco-based trials of elaborate computer simulations to augment more traditional electronic data banks.[415] Pittsburgh's HUD-

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[413] "HUD Processsing Memo," 1966; Records of the Office of Housing and Urban Development, Record Group 207, Series 207.7.1 General Records box 049-109; folder 7698.

[414] HUD department report, 30 June 1966, Records of the Office of Housing and Urban Development, Record Group 207, Series 207.7.1 General Records, 2; folder DSCN8375

[415] Jennifer Light, *From Warfare to Welfare: Defense Intellectuals and Urban Problems in Cold War America* (Baltimore: Johns Hopkins University Press, 2004), 58-9.

backed model received only one use before being shuttered, a casualty of city hall in-fighting over how best to use the technical expertise required to operate the model.[416] Even more disastrously, at the end of the two year experiment San Francisco's eager adoption of HUD-promoted efforts at computerized land planning assessment was described by one scholar thusly: "despite considerable... post project effort on the part of members of the Planning Department, San Francisco does not have an operating computer simulation model that can be reliably or routinely used for renewal policy-making... the model is nowhere near completion and has been set aside. . . ."[417]

Model Cities

Nowhere was this clearer than with the Model Cities initiative. Central to the Model City Program was the evaluative process by which applicant municipalities would be scrutinized and graded to determine their suitability. Internal HUD documents indicate elaborate attention paid to establishing chains of data transfer – part of the process of getting Model Cities right was making sure each city's information conformed to a systematic, analytical scheme. Accusations of bias, favoritism, or any selection criteria beyond best-fitted suitability for the program's agenda would be countered by portraying the selection process as one driven by impartial, mechanized information processing. Throughout the process of grant application, investigation, award, and review, systems-employing consulting firms were contracted by HUD to refine the comparative evaluation process and enhance information-sharing practices among communities,

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[416] Howard Pack and Janet Rothenberg Pack, "Urban Land-Use Models: The Determinants of Adoption and Use," *Policy Sciences*, Vol. 8, No. 1 (Mar., 1977): 81.

[417] Garry Brewer, *Politicians, Bureaucrats and the Consultant: A Critique of Urban Problem Solving* (New York: Basic Books), 1973, 114.

states, and federal officials.[418] Analysis was rewarded even on a financial level – though Model Cities regulations limited recipient cities to spending no more than fifteen percent of an annual grant on administrative costs, the cap excluded separately counted "funds for staff to evaluate projects."[419] The enthusiasm exhibited by HUD Assistant Secretary Ralph Taylor over the prospects of a data system for Model Cities are remarkably reminiscent of the ambitions of Robert Ball at Social Security a half decade earlier: "The real payoff of any information system is its output – the correct data provided to the right person in the proper form at the appropriate time."[420]

Policy outcomes would emerge from a sort of machine-facilitated data-sifting that would enable HUD and the administration to achieve overt political ends – and target assistance to particular kinds of cities – while placing the onus of controversial choice on input-driven selection criteria. As the Director of the Office of Urban Technology and Research noted, "it is the responsibility of Assistant Secretary Taylor's Office, with the assistance of my Office to provide . . . data and information related to the Model Cities Program . . . so as to allow comprehensive ultimate Departmental program evaluation(s) to be made."[421] Great realization existed among HUD brass that the way information previously supplied by cities was processed through the agency's information systems would dictate very real policy outcomes and drive a flood of highly lucrative federal dollars. It was in defining, weighting, and interlinking that the variables that would undergird the Model Cities selection process that a major portion of the

[418] "Business Briefs: Model Cities Contract," *The Washington Post*, July 08, 1970, p. E5.

[419] Eugene L. Meyer. "$2.4 Million Asked to Run Model Cities." *The Washington Post*, May 30, 1971, p. B1.

[420] Ralph Taylor to Robert C. Wood, 1 January 1968, Records of the Office of Housing and Urban Development, Record Group 207, Series 207.7.1 General Records, folder 49-127-31.

[421] T.F. Rogers to Robert C. Wood, 19 January 1968, Records of the Office of Housing and Urban Development, Record Group 207, Series 207.7.1 General Records, folder 49-127-27.

ultimate policy outcome would be set. Hence heightened interest throughout the implementation in "the manual and mechanical mechanisms which will convert inputs into the outputs needed by HUD personnel."[422] Technological solutions were at the forefront of the way Model Cities implantation was portrayed to legislators funding the program. Freshman Congressman Bill Alexander of Arkansas, one of eight Congressman who toured the Model Cities Brooklyn office and neighborhood rehabilitation projects in Bedford-Stuyvesant the spring of 1969, cheerfully asserted that "with improved technology . . . there appears to be a glimmer of hope." A Model City office staffer had previously shouted to Alexander and his colleague Morris Udall of Arizona the true driver of technological change in the federal bureaucracy: "Send cash!"[423]

Cognizant of the weight accorded to information supplied by applicant cities, departmental publications aimed at prospective applicants demanded more than just a ream of numbers: "Information requirements at all levels are both subjective and objective, both narrative and statistical." Outline materials prepared for information services contractors who would bid on the system reflected a desire to capture data beyond the statistical: "Although the system will be primarily quantitative . . . it must provide for narrative comment and subjective evaluation and comment on program performance."[424] Beyond a mandate that the Model Cities supervisory computer systems contain mechanisms for analyzing the "number of citizens participating in [the] decision-making process," HUD sought some means of "determination of their representativeness."[425] Through its technical advisory and education programs, it sought to

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[422] Ralph Taylor to Robert C. Wood, 1 January 1968.

[423] Richard L. Madden, "Model Cities Congressmen Get Brooklyn Advice: 'Send Cash'." *New York Times*, March 21, 1969, p. 44.

[424] "Model Cities materials," 1966; Records of the Office of Housing and Urban Development, Record Group 207, Series 207.7.1 General Records, folder 49-127-39.

[425] Ibid.

enable cities and local Community Development Agencies to devise their own computerized, systematized programs for gathering even more comprehensive information about the condition of urban neighborhoods and the demographics of those who lived there. In the eyes of officials overseeing Model Cities, an appropriately designed federal information system should have mechanisms for sifting to the top of grant piles those applications that provided better input information that more clearly indicated the participation and contribution of community groups. Well-designed local systems would empower those whom the grants were seeking to assist: "The quality of information coming to HUD should be better because it is produced as a byproduct of the CDA's own internal system. The technical assistance in information handling provided to the CDA's should result in better local management of the program and is consistent with its demonstration character." [426]

The Bureau of Standards, called in by HUD to consult on their proposal to automate Model Cities progress reports based on computer modeling, noted the inherent difficulties of developing a sufficient model "yet recommended the use of a model (despite known deficiencies) for Model Cities evaluation purposes because of 1) the assistance it could provide to the evaluation process, 2) the organization the model would bring to data collection activities, an 3) the educational role the model could play with local citizens and officials."[427] Firms like Westinghouse – manufacturer of television sets, mainframe computers, and nuclear reactors – parlayed their expertise in technological modeling into contracts to survey applicants for Model

[426] Ralph Taylor to Robert C. Wood, 1 January 1968.

[427] Office of Research and Development, Environmental Protection Agency, *A Guide to Models in Governmental Planning and Operations* (Washington: August, 1974), 178.

City status.[428] HUD aggressively spent in its quest to promote computer models for urban policy solutions. The $500,000 contract it awarded in 1968 to the firm EDP Technology, Inc. “to develop an automatic system for analyzing information on the model cities program” was then the largest that firm had received in its history.[429] The Durham-based North Carolina Fund received $160,000 to apply “computer methods” to determine the ideal “combination of materials, components, and techniques for producing low-cost housing.”[430] The aptly-named Systems Development Corporation received a $48,000 grant in 1967 to consolidate “all the significant information about major computer-based data systems for urban planning” across the United States.[431]

Even the visual iconography of mundane HUD publications reflected a general impulse within the agency to promote a vision of urban revitalization in which computers played key background roles. In 1971 the Model Cities Service Center published and widely disseminated a report on the program’s progress. The volume’s puce green cover depicted a sample of run-down, slum-grade urban housing stock (sporting broken windows, boarded-over doors, and crumbling brick) transitioning into clean, orderly, and uniform structures as the stereotypical urban block vanished into the horizon. Jutting up beyond the residential street in the image’s background are a cluster of vertical downtown skyscrapers – the windows of which are visibly patterned in the style of computer punch card slits. The scene implied data-driven, computerized oversight as a natural, expected element of the urban renewal process.

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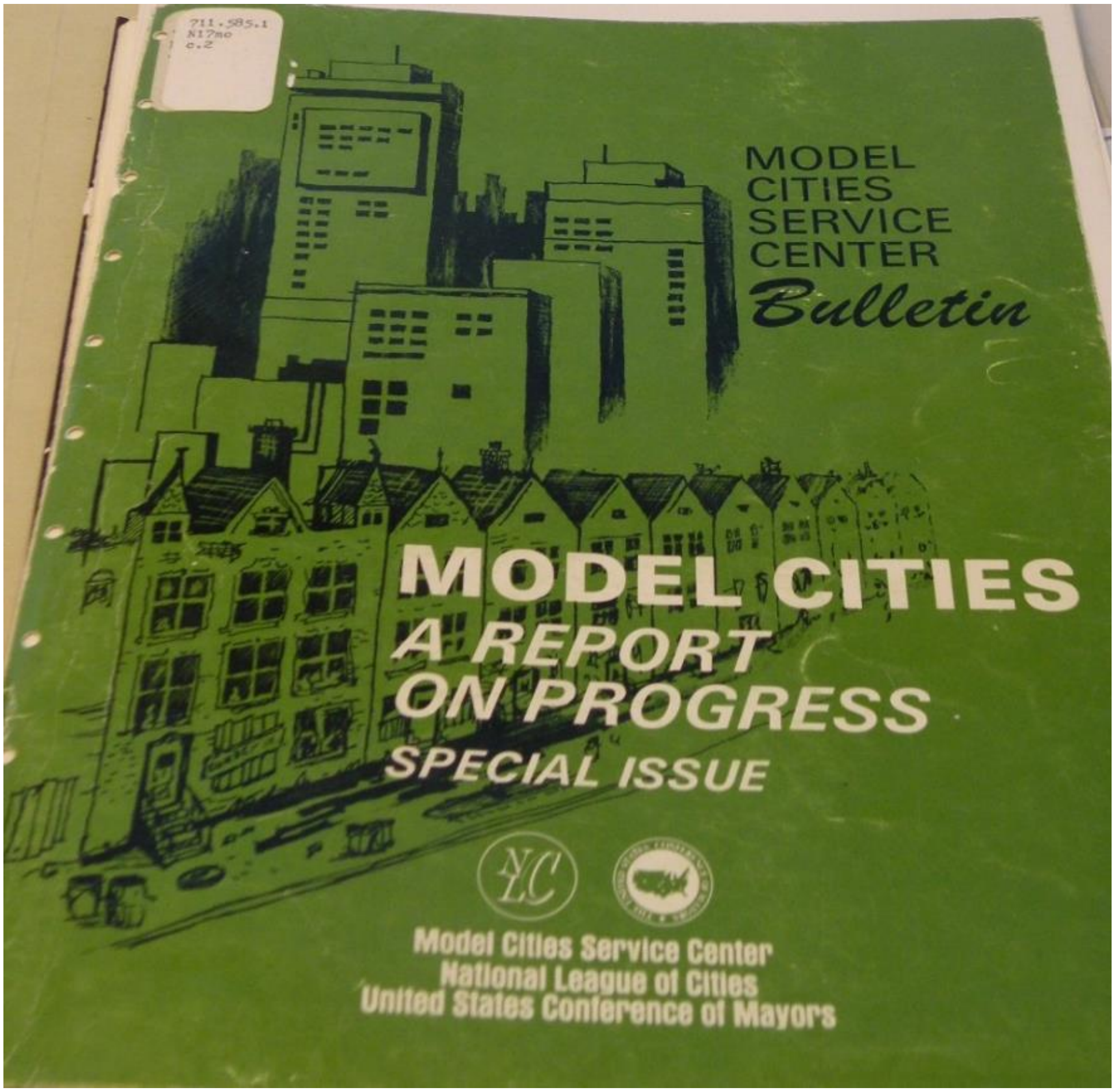
[428] Westinghouse would eventually establish a subsidiary to “manage urban renewal projects” for a fee for those lucy cities selected for Model City demonstration site status. Albert R. Karr, "Westinghouse, in Self-Improvement Drive, Seeks 15% Return: Is Deep in 'Social Work'." *Wall Street Journal*, Dec. 5, 1968, p. 36.

[429] Alexander R. Hammer, "Technology Concern Weathers Shift in Politics." *New York Times*, July 6, 1969, p. F22.

[430] "Computer to Pick Materials." *New York Times*, Dec. 26, 1965, p. W3.

[431] "HUD Data Centralized." *The Washington Post*, Apr. 08, 1967, p. G16.



The Punchcard Metropolis (National Archives II)

Local governments and regional planning authorities were amenable to entering into complex, data-processing driven approaches not solely for the bundles of federal cash associated with Model Cities and similar land use and metropolitan redevelopment programs. Implicit in the visions of systems-abetted urban renewal promoted to local communities by information management consultants and HUD officials alike was a mutual partnership, a breaking down of jurisdictional barriers made possible by sharing of data and expertise.[432] Information systems would "facilitate effective sharing of land use data between departments within a jurisdiction and between jurisdictions"; concerned with prospect of securing stronger, data-driven partnerships with state and national authorities, local planning officials – in the words of one critic – could be readily “persuaded that a data bank is a prime necessity for their and the community's good.”[433]

Nixon White House efforts to abolish Model Cities entirely beginning in 1969 proved ineffectual, meeting resistance from mayors who had invested in considerable administrative reorganization at the municipal level to contort their cities into eligibility for lucrative federal funds. By 1971, forced retention of the program had found a niche in Nixon’s New Federalism agenda, a testing ground for block grant and revenue sharing protocols. Even here the specter of the computer loomed: complex data requirements for eligibility and monitoring had embedded electronic data processing into the process while permitting proliferation of concurrent federal and state programs that masked how many dollars might actually be flowing into a given city from Washington. Floyd H. Hyde, HUD Assistant Secretary, joked to reporters “We blew up two computers trying to find out” which funds had been allocated to specific municipalities versus particular congressional districts.[434] His joke masks the integral nature of data processing to the entire urban grant ecosystem – only a computerized system could accurately and consistently retrieve such granular information as difference of funds sent to cities versus congressional

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[432] William H. Dutton and Kenneth L. Kraemer. "Technology and Urban Management: The Power Payoffs of Computing," *Administration & Society* 9, no. 3 (1977): 305-340.

[433] Ida R. Hoos, “Information Systems and Public Planning,” *Management Science*, Vol. 17, No. 10 (June 1971): 665.

[434] John Herbers, "Officials of Cities Praising President's New Aid Plan." *New York Times*, Nov 07, 1971, p. 1.

district. Those sorts of data extractions fueled the countless permutations of models that balanced effects of fund dispersal to particular legislative districts or key demographic constituencies.

Line-level staffers within the Model Cities division had the previous year generated and presented to the White House a proposal calling for some 45,000 unemployed engineers and physicists in the United States to be drafted into an emergency training and recruitment program designed to rush bright, scientific minds to the trenches of urban policy. “Cities trying to come to grips with increasing urban problems have been short of planners, systems analysts, and technologists of various kinds,” noted a December 1970 *New York Times* article on the proposal.[435] HUD staffers depicted the initiative as a method of permitting “cities to build their own management capacity,” necessary for “the kind of decentralization and local control envisioned” by Nixon’s domestic policy agenda. Much like Model Cities itself, the (never followed-through-on) program would begin with demonstration sites (Los Angeles, Boston, and Wichita) to prove the concept. Model Cities had (in theory) employed computers to develop protocols for expanding federal funding to urban centers in need. This proposed, untitled initiative would directly transfer the computer-abetted knowledge of the systems-management class to those zones of municipal government that had yet to embrace data-driven urban policy. The representative sample case repeated in news accounts of the proposal featured a hypothetical, laid-off aerospace engineer from Boston’s Route 128 Corridor who might take his “technical and business background, who had worked in the Apollo space program” to the struggling mill town of Lowell, Massachusetts, where he might engage in urban administrative acts “from computerizing the tax collection system to improving the transportation system.”

[435] John Herbers, "Federal Plan would Put Unemployed Scientists to Work on Urban Problems." *New York Times*, Dec 13, 1970, p. 83.

Non-State Actors and Promotion of Urban Computing

A few months after leaving his post as Secretary of Housing and Urban Development, Robert Weaver, now president of Baruch College, addressed an audience in California on institutional responses to the "dilemmas of urban America." Asserting to his audience and reporters that computerized systems held "a promise of unprecedented potential" for planning the future of America's cities, the former cabinet member cited "computers, simulation, modeling, experimentation, and development" as facets of systems analysis that might offer "comprehensive solutions to urban problems." For Weaver, the analytic power of such systems could match the passion and eagerness exhibited by militant groups and community leaders advocating aid for inner cities: "This analytical technique will make manageable the will to change our urban environment."[436] With increasing regularity from the mid-1960s onward, non-governmental actors with vested interests in combatting the urban crisis would embrace computers as tools for civil society action.

For moneyed philanthropic foundations and metropolitan associations with qualms about how best to sink their cash into revitalizing America's urban cores, the systems-derived reports of think tanks provided a data-centric solution: massive, computer-driven research programs to determine precisely where and how to target assistance. The Metropolitan Housing and Planning Council of Chicago called for "comparable research on urban problems comparable to the Manhattan project of World War II" in order to generate "managed integration" and alter "ghetto

[436] "Computer Assistance to Ghettos Foreseen: Systems Analysis Can Help Solve Urban Crisis, Negro Leader Tells UCI Audience," *Los Angeles Times,* 18 Apr. 1969, p. D10.

patterns of living."[437] For moderate African American leaders, cautious embrace of computerized systems could combat the "short-term" appeal of "Negro militancy" by offering a blueprint for "long range objectives." As Robert Weaver asserted, "If those concerned with urban affairs tame the lion of systems analysis, remembering that it must be programmed carefully and creatively, we shall be able to inaugurate a new era of urban research." [438]

Computers could be emblematic of the impersonal divide between largely white institutions and largely black urban populations. Newspaper accounts from the late sixties and early seventies reveal this incompatible worldview in the case of computer-directed police helicopter patrols in cities such as Los Angles, Memphis and Lakewood, California. Law enforcement and municipal officials would shower praise ("The police credit their computers . . .") on electronic data systems that logistically supported helicopter patrols and analyzed crime statistics to recommend area of concentrated crime, implying that controversial policing actions were guided by impartial, machine-directed data analysis: "The city's computer often vectors helicopters to a 12 square block area on the city's east side that has a high crime rate. Most people who live there are black." Media reports noted "complaints of aerial persecution by blacks and militant groups" in communities such as Oakland and Kansas who felt computer-aided policing targeted minority communities.[439]

The sometimes convoluted process of negotiating city hall through reams of dot matrix-print out could unify even rival community factions in their frustrations with computerized urban

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[437] Robert G. Biesel, Metropolitan Housing and Planning Council letter to Lyndon Johnson, 25 October 1967, Records of the Office of Housing and Urban Development, Record Group 207, Series 207.7.1 General Records, box 049-104N, folder 6669.

[438] "Computer Assistance to Ghettos Foreseen: Systems Analysis Can Help Solve Urban Crisis, Negro Leader Tells UCI Audience," *Los Angeles Times*, 18 Apr. 1969, p. D10.

[439] Robert Lindsey, "Police Send up Copters in Fight on Urban Crime," *New York Times*, 9 Dec. 1970, p. 37.

governance. In New York City of the early 1970s, representatives of landlords and advocates for tenants briefly found common cause in their mutual disdain for the city's newly adopted "computerized Maximum Base Rent system," an effort to rationalize rent control practices through carefully calibrated database management. Devised by the City Council in the summer of 1970 as a means of addressing the "rent gap" between landlords' cost of building maintenance and the fees paid by those who occupied rent-controlled housing, the MBR-system was intended to relieve pressure on the metropolis's strained housing supply through a "massive and complex project . . . of collecting data from which fair rents could be compiled."[440] Beginning with data-derived from the RAND Report on Housing, the new system sought to balance tenants' concerns about being priced out of their apartments with property owners' needs to increase revenue for maintaining deteriorating housing stock. Five variables – water and sewer rates, operating and maintenance expenses, property taxes, and approximations of vacancy losses and fair return on investment – were fed into a contractor-designed computer program, with individual apartments receiving variables adjustments for specific desirable features (location, room count, access to elevator, etc.). The resulting Maximum Base Rent, or MBR, calculated for each apartment unit the baseline (up to 7.5 percent) by which landlords might raise rent. (Accompanying the new mandate was a processing fee of five dollars per apartment that supplied the cash-strapped city an additional $4.6 million in revenue). The intent was to employ the processing powers of the electronic computer to keep rents as low as possible for as many apartment-dwellers while providing an exact stream of income to building owners sufficient to cover deferred maintenance.

[440] Lee Rosenbaum "City Battling Turmoil in New Rent System," *New York Times*, 19 Nov. 1972, p. R1 and R12.

Within two years the scheme had become an administrative nightmare. A full ten months after implementation of the program, forty-five percent of the city's 1.1 million rent controlled apartments "had not been issued a final rent order, or MBR, by the computer," noted the *New York Times*. Daily hundreds of irate tenants and befuddled landlords crowded the second floor of the former A. T. Stewart Dry Goods store, now home to the municipal Office of Rent Control, to seek clarification over muddled rent determinations or challenge incorrect rent orders. Approximately a thousand calls a day inundated the office's twenty-eight telephone lines.[441] "It's like the whole city is protesting at once," exclaimed one rent administration employee. Agency employees could sympathize with members of the public contesting rent bills wrongly inflated by incorrect MBR-input data, but could offer no succor: departmental policy required readjustments and refunds to be processed through the computer again before returning funds to tenants, leaving some apartment-dwellers paying unmerited extra rent for months at a time.

A program designed to employ city managerial expertise to make more transparent rent determination and collection standards for landlord and tenant alike ended up exacerbating tensions between the two groups, until it temporarily united them in opposition to the entire computerized MBR process.[442] The two sides differed on the best proposal to address housing issues but converged when pointing fingers: "The computer operators are a favorite among the many culprits blamed for what nearly all sides concede is the state of turmoil prevailing in the attempt to convert rent control to computer control," reported *The Times*. City employees sought to redirect citizens' anger with the frequent refrain, "The computer operator made a mistake." City officials likewise foisted blame on the computer subcontractor, Volt Information Sciences,

[441] Will Lissner, "Indignant Protesters Keep Base Rent Unit Busy," 10 Feb. 1972, *New York Times*, p. 38.

[442] John M. Clapp, "The Formation of Housing Policy in New York City, 1960-1970," *Policy Sciences*, Vol. 7, No. 1 (Mar. 1976): 88-89.

by pointing out keypunching errors prior to MBR data being fed into computers. The revolving cycle of blame continued with the computing firm accusing city officials of sloppily forwarding "forms they knew contained vague, inaccurate, or incomplete information"; housing agency officials then pivoted their accusations to the landlords, insisting the majority had submitted such faulty information in required forms that "the computers then cranked out thousands of error-correction requests" out of necessity, drowning all participants in paperwork. Landlords responded by faulting poorly designed forms and their difficulty in obtaining sometimes obscure information the city mandated as data inputs. The result, as one reporter summarized: "the city blames the landlords and the landlords blame the city and 'the computer' and the computer people are firmly exonerating themselves."

Linking the intended policy outcomes of the computerized MBR strategy to the botched bureaucratic implementation became a way for interest groups, particularly landlords, to press for alternative policy routes they argued would better alleviate the crammed city's housing crisis – namely vacancy occupation. This alternative method of re-allocating rent controlled housing stock would simply return previously-controlled properties to an open housing pool upon death or vacancy of the current tenant, eliminating the need for complex computer calculations to determine how controlled a property's rent should remain from year to year. In a typical newspaper letter to the editor on the issue in 1972, James M. Peck of the Community Housing Improvement Program (CHIP), a trade association for landlords in the five boroughs, asserted that errors with the MBR strategy "involve[d] computer keypunch mistakes and not landlord errors."[443] Railing against "the city's administration of the MBR program" as a "cruel hoax perpetrated on both owners and tenants," Peck's letter called for Albany lawmakers to strip rent

[443] James M. Peck, letter to the editor, *New York Times*, 26. Nov. 1972, p. R8.

control administration from the city's control as "a sensible means of administering the program." His assertions that the "rent office is hopelessly bogged down with the [MBR] program" concluded that "the program will never be fully implemented." The damning evidence of computer-rotted backlogs demonized not just the particular software program employed to process MBR, but the entire policy as a programmatic idea. HDA Commissioner Nathan Leventhal feebly conceded flaws in the system's operation while still defending the underlying idea of a computerized solution to the task of allocating housing prices: "The system is logical . . . but very difficult to implement." In the eyes of the press, the public, and the purse (panicked Albany legislators), MBR as practice was inextricably linked to the processing fiasco of its unveiling: "The whole business, [landlords] maintain, was doomed to failure from the start."

Computing for the People

In a 1967 newspaper column, Roy Wilkins posed the provocative headline, "Computerize Race Problem?" Comparing urban African-American populations in an emerging information age with farm workers displaced by automated farm machines, the NAACP chief noted, "For the Negro . . . the computer is but one more signal that he has been kept at arms' length while the rest of America pressed forward into the computer era. In the past he never got a chance to acquire the learning and the skills which would have enabled him to progress toward the use of data processing." Referencing that preceding summer's urban riots and a recent news item in which the dairy industry had contracted with computer firms to digitally identify the optimal milk-producing traits in cows, Wilkins concluded, "After the computer has defined, on tape, the ideal Holstein, could it then turn its impersonal, unprejudiced magic upon our agonizing race problem? Could it not, after digesting the facts which both whites and blacks have fogged over for so long, give us an outline of our obligations? Instead of being a measure of the Negro's lag, cannot the computer become a guidepost to interracial justice and peace?"[444]

By the late 1970s and early 1980s, a new generation of relatively inexpensive microcomputers, and increasingly familiarity with electronic data processing across large swathes of the American population, suggested a democratizing effect might be accomplished through smaller scale computing. Computers were no longer exclusively mainframes, and computing was no longer the solely an act of centralized government offices. As one news report noted, "The long-term promise of the advanced microcomputer is to make it feasible for almost anyone with several thousand dollars to campaign for public office. The short term potential . . . is to elect candidates in close races whose opponents do not have computers."[445] This stratagem played out in Charlotte, North Carolina, where Harvey Gantt became the city's first black mayor after campaigning with the assistance of a "specially programmed computer that helped to deploy platoons of volunteers to find black voters and get them to the polls. . . ."

No case better exemplified the ways in which aggressive solution-seeking through computerized means colored American civil society approaches to urban issues than the push beginning in the mid-1960s to foster job growth in inner cities through data processing-derived employment. Emergent dataocracy – specifically a desire to employ information technology to effect major and substantive change to the economic fabric of decaying American cities – fostered an unlikely relationship between the information technology sector and the network of urban planners, African American community leaders, and policy makers who shaped public sector attitudes about the fate of America's cities during the height of the 1960s urban crisis. In

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[444] Roy Wilkins, "Computerize Race Problem," *Los Angeles Times*, 11 Sept. 1967, p. A5.

[445] Dudley Clendinen, "Small computers open politics to citizens with little money," *New York Times*, Feb 15, 1984, p. A14.

this narrative, computer manufacturers and related information technology firms become increasingly involved in urban issues throughout the early and mid-1960s, ultimately promoting in that decade and the next a path to resolving the nation's urban woes centered on high tech job programs and the development of urban cores as manufacturing and design hubs in the booming computer industry. This vision of urban renewal through computer-industry driven employment paralleled a growing conviction among many in industry and the public policy sector that private firms could engage in acts of corporate social responsibility that demonstrated new and alternative, private-sector driven solutions to the nation's most perplexing domestic policy dilemmas.

State-generated programs made stabs at socially-conscious computer training during this period. With much fanfare, the warden of Sing-Sing in 1968 shepherded a class of twelve convicts through a seven-month course in computer programming; those granted parole found information processing employment outside the prison and those who remained incarcerated were put to work writing programs for the State of New York's computer network rather than punching folderol license plates.[446] Though politicians at state and federal levels routinely spoke of computer training in general terms of labor mobilization, the bulk of efforts to link high-tech employment training to improving conditions in economically-depressed metropolitan zones sprang from non-governmental actors – corporations, advocacy groups, and philanthropic organizations – engaging in civil society partnerships with the approval of urban governments (and frequently with supplemental funding and publicity provided by HUD). For the most part, large scale efforts in the 190s and 1970s to engender computer skills training as economic enhancement among underserved, frequently minority populations existed as a parallel urban

[446] John Fisher, "The Easy Chair," *Harper's Magazine*, Dec. 1968, p. 13.

policy initiative to that of federal urban development authorities, one fueled by private dollars and predicated on producing information society jobs rather than relying on information technology to reallocate urban space.

IBM's particular interest in the so-called "urban crisis" stemmed in large part from its privileged place among postwar American corporations as a firm with distinctive entrée to the realm of policy and policymakers. As columnist William Safire noted during the Carter administration, "Never in American political history has one corporation so completely dominated the top levels of any administration," citing the background of Secretary of State Cyrus Vance, Secretary of Defense Harold Brown, and Secretary of Housing and Urban development Patricia Harris, all onetime IBM directors, as well as presidential technology advisor Louis Branscomb, an IBM research scientist.[447] Such cozy relations had existed for decades. Great Society-era Attorney General Nicholas Katzenbach easily sidled from the Johnson Administration into the role of IBM general counsel. From the fifties onward IBM had maintained a sales office – not a repair outpost, but an actual sales office – in the Social Security Administration headquarters in Baltimore.

IBM, as a firm with far-flung interests that spilled beyond the manufacture and rental of mainframes into the promotion of systems techniques and the perfection of data analysis as general organizational behavior, naturally gravitated to a complex social issue seemingly suited for the massive computational capacity of the data processing era. Like other major systems-oriented companies and think tanks of the era, the firm employed social scientists who applied techniques devised for defense contracts to the thornier realm of American society. IBM urban experts published frequently and spoke openly to the press about the need for a national urban

[447] William Safire, "The United States of IBM," *The Cleveland Plain Dealer*, 22 January 1977, p. 15.

revitalization rooted in the coming computer age. As John H. Strange, an IBM political scientist noted in 1968, "City officials must participate vigorously in the search for new and expanded resources to apply to the solution of urban problems."[448] Another IBM employee noted in 1972 that "we hope to give information on urban growth to everyone from cities to sewer districts."[449] Strange and his colleagues asserted that the root of jobs crisis in cities such as Philadelphia and Detroit lay with "among other things, a location-mismatch of jobs and people" that could be alleviated both through the creation of high-technology employment in labor market deserts and the application of new computer technologies to plan smarter urban development policies that took account of the urban poor's real life circumstances, regardless of cost.[450] In a distinctive position for a taxable corporation, Strange spoke on behalf of widespread attitudes within IBM when he called for increased federal spending on targeted programs to boost inner cities, noting that "concern should not be saving dollars but saving cities and saving people."

That IBM's focus would attune to the question of urban unemployment was not unexpected. For most observers at the time, saving people meant salvaging jobs. For the range of deep structural causes of urban decay during the sixties and seventies, perception among the general public and national policymakers fixated on the "problem of jobs," the idea that maximizing the labor force would salve a nation turn apart by racial strife and urban unrest. Stopping the inner cities from burning meant finding gainful employment for dispossessed minority populations. Traditional manufacturing had left the urban core behind; perhaps a nascent, circuit-driven industry could salvage what remained.

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[448] "Government Recognizes Problem of 'Spillovers'." *Times Picayune,* 4 December 1968, p. 14.

[449] "Growth topic of Salem meet," *The Oregonian*, 10 November 1972, p. 24.

[450] For context on debates over employment, see Guian A. McKee, *The Problem of Jobs: Liberalism, Race, and Deindustrialization in Philadelphia* (Chicago: University of Chicago Press, 2008).

Some the nation's most outspoken activist and social movement groups found themselves embracing the rhetoric of automated urban solutions just as readily as did major American corporations.[451] Social scientists surveying use of computers by community groups in the 1970s and early 1980s affirmed that among such politically-active organizations, "The political power of information, as an idea, enjoys a great deal of support. Despite high barriers to entry adoption of new technologies, effective deployment of computerization was generally seen as "hav[ing] serious consequences for the distribution of political power."[452]

Their motivation? Jobs. Period essayists made explicit the connection between the growth potential of the computer industry and the employment woes of inner city blacks. As a pair of activist sociologists noted in 1967, "Business publications report that the growth of the computer industry is limited only by the drastic shortage of programmers. What does all this mean for the Negro?"[453] The answer, as proposed in a series of boisterous, community-activist-led panels at the that year's joint annual meeting of the National Conference on Social Welfare, the American Social Science Association, and the National Conference of Charities and Corrections, was to propose "an alternative" to current government-backed schemes for economic integration of the urban poor and instead partner job-creating firms directly with community activists who knew where to target urban development programs.[454] The few examples where computer systems had

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[451] Nathan Ensmenger, "Power to the People: Toward a Social History of Computing," *IEEE Annals of the History of Computing* 26:1(2004:, 95-96.

[452] T. R. Haight and Robert M. Rubinyi, "How Community Groups Use Computers," *Journal of Communication* vol. 33 (1983): 109.

[453] Richard A. Cloward and Frances Fox Piven, "The Case Against Urban Desegregation," 1967, in *The Politics of Turmoil: Essays on Poverty, Race, and the Urban Crisis* (New York: Pantheon Books, 1974), 219.

[454] National Conference on Social Welfare Proceedings, *Official Proceedings of the Annual Meeting: 1967* (Ann Arbor: University Microfilms, 1971), 194.

been applied to the problem of managing social welfare conditions were widely lauded, as in the case of the Dallas/Fort Worth Metroplex's mid-1960s database of families served by social welfare agencies.[455]

Among the proposals to emerge from this dialogue was the notion that technology sector companies could reassert their commitment to urban cores and directly spark employment by opening plants and research facilities in decaying slums long vacated by other industry. As the decade progressed, major firms in the electronics, computer, and systems aero-space fields would experiment with this route. Defense contractor Avco situated a facility in the Roxbury neighborhood of Boston.[456] At the urging of Senator Robert Kennedy, IBM opened a 240-employee plant in the Bedford-Stuyvesant neighborhood of New York. [457] William Norris of Control Data Corporation seemingly made it his personal mission to resurrect downtown Minneapolis through strategic placement of his firm's plants. AeroJet General constructed an electronics plant in Watts and loaned the vice president in charge of the project to the Commerce Department to foster similar initiatives among other companies. Southern California businessman Ben Smith – the same financier who proposed transforming the Antelope Valley into futuristic planned city where "all functions would be computerized" – also donated electronic machinery to a Watts-based job-training program.[458]

What distinguished these urban renewal projects backed by data processing and technology firms from similar job creation proposals fronted by older manufacturing concerns or

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[455] National Conference on Social Welfare Proceedings, *Official Proceedings of the Annual Meeting: 1967*, (Washington: National Conference on Social Welfare, 1968), 82.

[456] Lawrence S. Ritter, "A Capital Market Plan for the Urban Areas," *California Management Review*, vol. 11, no. 4, p. 44.

[457] "National Report," *Cleveland Plain Dealer*, 14 September 1971, p. 70.

[458] "Financier Envisions Computerized City," *Los Angeles Times*, 28 Sept. 1969, p. 116.

local retail interests? The tone. To achieve this union of technocratic promise and social ambition, beginning in the 1960s IBM and other firms largely embraced proposals from Washington to rebuild urban cores through federal job, education, and welfare programs. Following passage of the 1964 Equal Opportunity Act, IBM submitted an application to found an urban job training center in Chicago.[459] Far more distinctive, however, was the willingness of the midcentury computer sector to bypass federally-devised urban improvement programs in favor of simultaneous public-private partnerships with minority-led community activist and civil rights groups. Powerful technology firms of the era began to realize by the mid-1960s that they could influence patterns of urban development through their business practices, independent of larger government urban revitalization programs. IBM would supply the men, machines, and systems analysis know-how to fuel Johnson and Nixon era federal urban revitalization programs, but it would also seek to carve its own path to remaking America's cities by directly shaping the urban labor market.

Local business leaders frequently aligned themselves as fellow travelers of IBM's ambitious vision, seeing the company's systems expertise as the Sputnik-era solution to stemming the decay of their home cities. As prominent Seattle lawyer James Ellis, who deliberately situated his offices in the city's new IBM building, noted in 1968, "The stand-pat critic of urban change is today's impractical visionary."[460] IBM's Robert McAullife would become head of HUD's new office of Business Participation. The Ford Foundation encouraged private sector firms in late 1960s to support Civil Rights organization CORE. By funding voter

[459] Christian E. Bruckel, "What is Jobs Corps," *Cleveland Plain Dealer,* 6 December 1964, p. 159.

[460] Gerry Pratt, "Forward Thruster Analyzes Campaign," *The Oregonian,* 22 May 1968, p. 27.

registration efforts in Cleveland, the Foundation, acting in tandem IBM and other companies, tacitly endorsed the election of Carl Stokes as the nation's first black big city mayor.

In August of 1967 leaders of a number of the nation's leading corporations, including prominent firms in the computer, aerospace, and systems management sectors, announced their willingness to partner with leaders from the African American community to create job training programs aimed at inner city minority populations and predicated on high technology.[461] One partnership that would emerge from this initiative was to be a two-decade plus pairing of one of the nation's leading industrial concerns, IBM, with a minority advocacy group, the National Urban League, in their efforts to establish a series of job training programs aimed at underemployed African Americans residing in the troubled inner cities of the sixties and seventies. While seeking both positive publicity and the expected local economic boosts that such a partnership could foster in targeted communities, IBM and the Urban League also saw their partnership embodying a bold prescription for directly addressing the jobs crisis at the core of inner city woes in the 1960s and 1970s. For both organizations, their technology job training experiments were rooted in an idea that the computer industry itself could fundamentally alter the fate of American cities by bypassing federal social programs and working directly with minority-led community groups that saw themselves as best suited for identifying the needs of urban populations.

As early as 1961 minority-audience newspapers in Chicago and New York reported on an Urban League "drive to get Negroes in new fields" that explicitly mentioned International Business Machines Corporation as a target firm for qualified "young men [seeking] to be trained

[461] Peter Wiley and Beverly Leman, "The Business of Urban Reform," 1969, reprinted in *How We Lost the War on Poverty*, Marc Pilisuk and Phyllis Pilisuk, eds. (New Brunswick, New Jersey: Transaction Books, 1973).

as customer engineers."[462] Throughout the sixties and seventies, IBM partnered with Urban League chapters in major cities to conduct periodic recruiting drives aimed at placing African Americans, particularly those with college degrees, in administrative and technical jobs with the firm. As Chicago League Executive Director Edwin C. Berry noted in 1967, "IBM has the job openings and we believe there are Negros qualified to fill them. It is our job to help IBM find those qualified people."[463] Recruiting agents from the League's "On the Job Training Project" would visit inner city community centers, interviewing school graduates with two years of math classes and an interest in electronics for positions as IBM Customer Service Engineers. Those selected for further evaluation would meet with company representatives and receive what was described as an "undercover" look at IBM equipment and the repair process required to keep such machines humming.[464]

The core of the two organizations' partnership would begin in the mid-1960s with the creation of the Job Training Center program. By the early 1980s, the height of the program, IBM would finance in part or whole some 46 training centers around the country, providing training in data entry and word processing, computer installation and repair, computer programming, and systems analysis. Each center was operated on the local level by a non-profit community group, frequently with a civil rights affiliation. Twenty of the centers were affiliated with the Urban League.[465] Standard operating procedure saw IBM supply equipment – typewriters and word

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[462] "League Opens Drive to Get Negroes in New Fields," *The Chicago Defender* (National Edition), 23 December 1961, p. 1.

[463] "Urban League-IBM Conduct 2-Week Recruiting Drive," *The Chicago Defender* (National Edition), 29 July 1969, p. 4.

[464] Hampton McKinney, "Chicago Urban League Employment and Guidance," *Chicago Daily Defender*, 17 October 1967, p. 21.

[465] Arthur Roane, "Urban League offers office skills," *Times-Picayune*, 26 May 1985, p. 128

processors, access to computers and terminals, software and training manuals -- and a pair of instructors, drawn from the pool of the firm's local executives. The partner local agencies, predominantly chapters of the National Urban League, supplied the center director and administrative staff and were charged with soliciting additional financial, material, and instructional support from local firms. Space for the training centers was typically donated by local firms with excess downtown square footage (often department stores and insurance companies). Urban League staff oversaw the physical plant, advertised the program, enrolled and registered students, and processed payments in the cases of centers where students were required to contribute some tuition or scholarship money. IBM representatives designed the curriculum, ran training sessions, and in the case of programs aimed at youth, screened would-be applicants.

Though IBM and the Urban League presented themselves as joint custodians in charge of the entire operation, a plurality of funding typically came from external sources, particularly once a job training center had been established a few years. At the New Orleans center, 55 percent of the financing was supplied through federal grants; the remaining 45 percent consisted of corporate funds only partly from IBM's coffers; local firms supplied the rest.[466] Local Training Center executives, often rising stars in a local Urban League, were required to hustle for funds from local businesses given the frequent turnover in community corporate support. Some local businesses found the practice of corporate social responsibility in the case of donating to a local job training center netted little in the way of popular recognition for the contributions by press or public, who almost exclusively associated the centers with the Urban League and Big Blue. All promotional materials prominently displayed the two organizations' names, and

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[466] Joan Kent, "Hired! Training Center Helps the Jobless," *Times-Picayune,* 28 October 1986, p. 22.

recruitment materials made explicit mention that trainees would receive experience on IBM machines and be exposed to IBM methods and corporate practices.

The League-provided training center staffers were additionally tasked with pacing program graduates, an occupation that varied in success by chapter and sometimes necessitated that local IBM officials pitch their program's graduates to fellow local business leaders. Some training center correspondence suggests that in cities like Chicago and Atlanta, having center graduates report directly to local executives as private typists or systems analysts was briefly fashionable among progressive firms. Unspoken in both partners' placement efforts was the key selling point for firms wishing to hire in an era of increased social consciousness and enhanced government scrutiny of private hiring practices in an era of civil rights: the vast majority of training center graduates were inner city minorities. Hiring these workers who had been trained and certified by IBM simultaneously provided a helping hand to a fellow American among the neediest and validated one of the nation's leading civil rights organizations in its efforts to remake the nation's urban cores. Responding to race without overtly addressing it, the job training centers portrayed technological skills as vessels of opportunity that could diminish urban desperation one hire at a time. The unspoken ambition held by IBM and the Urban League was resolution of the "race question" element of the urban crisis through civil society cooperation.

By the early 1970s the partnership had evolved to include computerized "skills banks," described as tools "to locate members of minority groups who have skills for sale and to place them in rewarding jobs."[467] Under Vernon Jordan, Whitney Young's charismatic successor as League head, the advocacy group would facilitate a program by which IBM engineers and scientists were provided with paid leave in exchange for taking visiting instructorships at

[467] "National Report," *Cleveland Plain Dealer,* 14 September 1971, p. 70.

historically black colleges and universities with the intent driving the creation of self-sustaining computer science and systems analysis programs.[468]

IBM had been relatively progressive on matters of race in the postwar years, hiring its first black salesmen and data processing interns in 1946, with its first black engineer coming on board in 1952. In 1957 the Chicago Cosmopolitan Chamber of Commerce (formerly the Negro Chamber of Commerce) matter-of-factly lauded IBM employee Lionel Fultz for "proving that Negro salesmen are capable of handling complete districts despite the opinions of persons who think otherwise."[469] Allying itself with a respected civil rights organization while also training future job applicants to "Big Blue" specifications would offer the computing giant tangible public relations and workforce management benefits. By the mid-1960s, IBM would count itself among a select number of American corporations (including DuPont, GM, Ford, and Taconic) that supplied upwards of forty percent of the Urban League's annual budget.[470] Urban League Fellows, young community activists being groomed as future civil rights leaders, were routinely awarded summer fellowships to the IBM facility at Franklin Lakes, New Jersey to intermingle "with the corporation's forecasting and planning staff."[471], The advocacy group would reciprocate by awarding IBM Chairman Thomas J. Watson its prestigious Equal Opportunity Day Award for his "significant contributions to the realization of the Urban League's goal of equal opportunity for all Americans."[472] The commendation placed corporate titan Watson in the

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[468] "National Report," *The Plain Dealer,* 8 February 1972, p. 56.

[469] A. L. Foster, "Other People's Business," *The Chicago Defender* (National Edition), 23 November 1957, p. 4.

[470] "The Urban League Turns a Corner," *Cleveland Plain Dealer¸14 August 1966, p. 277.*

[471] "Thompson Earns IBM Study Funds," *Times=Picayune*, 25 August 1973, p. 39.

[472] Another technology sector executive thusly honored was RCA President Robert W. Sarnoff. "Urban Unit Hails Stokes," *Plain Dealer*, 19 November 1970, p. 1.

unlikely company of Walter Reuther, contrarian union boss, and Carl Stokes, feisty black mayor of Cleveland.

IBM would aggressively cite its job training partnerships as public evidence of its broader civic mission. In Portland, Oregon, in 1968, the company agreed to procure more space for parking at its facility near the city's South Auditorium Urban Renewal Site after hostile planning commissioners chastised the company for running a "school" out of its building.[473] When the Cleveland IBM office was accused by local daily *The Plain Dealer* of needless waste for destroying outmoded electric typewriters that could have been donated to shoestring-budget community groups, Senior Location Manager George Janik responded with a letter highlighting donations to the United Way, loans of personnel to area schools, and most importantly, the commitment of over a million dollars to an "IBM-Urban League Job Training Center . . . [that had] trained nearly 200 young people over the past two years."[474] In classic social responsibility language, Janik presented the partnership with the League as evidence that "IBM tries both to operate its business soundly and rationally and to try to support the communities in which we live and work." Finding "appropriate jobs" in the tech sector for needy youth was good for business and broader society.

Not directly related to the series of job training partnerships was IBM's ongoing effort from the mid-seventies onward, tied to the introduction of microcomputers and then personal computers, to foster computer literacy in urban schools across the country through technology donations. The social impulses were same as the more established Urban League programs: to supply software, hardware, and training to underprivileged youths with the intent of preparing

[473] "Real Estate Sale Approval Finishes S. Auditorium Projct Development," *The Oregonian*, 30 April 1968, p. 20.
[474] George Janik, "IBM Contributions," *Cleveland Plain Dealer*, 7 February 1985, p. 44.

them for employment in an information economy. Through intensive, IBM training seminars, inner city teachers could develop from not "know[ing] a monitor from a hole in the wall" to become devoted proponents of IBM brand technology.[475]

How successful was the partnership between the Urban League and IBM? Grand society-reshaping ambitions aside, did it secure its fundamental premise of training inner city residents for technological careers? The results are difficult to ascertain, as Urban League records are dispersed by local chapters and both partners were more inclined to publicly tout the commencement of different job training programs than their ultimate cessation. In 1985 the Houston-based national job training manager for IBM, R. E. Loechel, asserted to a reporter that over the prior two years, 85 percent of the program's national graduates had found employment, with even those only trained as entry-level word processors securing wages averaging $13,000.[476]

That the program yielded any success is remarkable given fundamental divergences in the two organization's operational approaches. IBM's buttoned-down, company-first approach sometimes clashed with local Urban League offices manned by outspoken community activists, many of whom saw involvement the high-profile job training program as a ticket to greener pastures in local politics or the non-profit world. IBM's partnership with the Urban League would continue into the 1980s, though as that decade progressed the grand, society-remaking language receded and the jobs-training program came to be framed in terms of promotion of deserving individuals underserved by society, helped along the road to success by a corporation with a social conscience and an activist group with a pragmatic community focus. An example of

[475] "IBM Taps into City Schools," *Times-Picayune*, 25 July 1984.

[476] Arthur Roane, "Urban League offers office skills," *Times-Picayune*, 26 May 1985, p. 128.

the scaled back scope was IBM's local office presenting the New Orleans chapter of the League with an annual $25,000 check through the mid-1980s in support of a word-processing center where youths between the ages of 16 and 25 could pay a nominal fee to gain access to word processing training. [477]

For African American urban political activists in the 1980s and beyond, the route to policy influence would not lie with an unlikely union of community activist groups and titans of high technology that gripped the imagination of many beginning in the mid-1960s. Their conduits to the levers of social transformation would continue to run through HUD, through elected Congressmen from minority districts, and from the power of community activism and social movements.[478] Dataocracy as a tool of urban policymaking, much like funding for urban community priorities, would remain an extension of the institutional state, not a viable tool of ground-up social movements seeking informational or technological levers to provoking socioeconomic transformation. Ironically, even as the groundwork was being laid for the emergence of personal computing and associated counter-cultural challenges centralized mainframe computing on the West Coast, no politically-motivated urban social movements or groups of the 1960s or 1970s would find a way to harness information technology, alone or in partnership with private firms, to effect serious policy transformation or even alter the way computers were deployed in the urban policymaking realm. Motivation was present and efforts were made, but no lasting popular expression of how computers might reorder urban policy from the bottom up replaced the centralized computer modeling and grant disbursement that marked the period. Computers continued to be employed by policy officials to study, describe, and make

[477] "IBM Sends Grant to Train Youths," *Times-Picayune,* 4 April 1987, p. 28.

[478] Adam Greenfield and Mark Shepard, *Urban Computing and its Discontents* (New York: Architectural League of New York, 2007).

changes affecting urban residents without necessarily granting those residents direct say in the process.

Roughly contemporaneously, another broad category of policy debate found itself addressing many of the same concerns of complexity, conflicting interests, and technological influence as did the realm of urban policy. For environmental policy in the U.S. during the 1970s, though, dataocracy proved both an effective tool for implementing lasting regulatory change and a contested venue for political interests seeking to harness digital information to model rival visions for the future.

Chapter Four

The Machine that Defined the Garden:

Big Data, the EPA, and Formulation of a Digitized Landscape

For nine months in 1977 and 1978 at high school auditoriums, businessmen club lunches, and trade shows across the state of Montana, citizens of all ages were test subjects in a high-minded exercise: following a brief "slide presentation . . . on the historical development of energy utilization, energy supply/demand relationships, and current and future use of new technology" in the field of environmental resource management, audience members were invited to participate in an interactive simulation using a portable minicomputer. Representatives of the Department of Energy's Citizens Workshop Program would wheel out the light- and dial-festooned Energy Environment Simulator and encourage members of the public to engage with the machine, playing out simulated scenarios on energy use, resource management, and environmental degradation that responded to commands the audience imputed. This "energy games concept . . . enable[d] participants to become actively involved in hypothetical control of numerous factors regarding supply/demand fluctuations and environmental quality and their interaction."[479]

More crucially, it exposed these Continental Divide residents – and thousands of other Americans who participated in similar public outreach exercises in other states – to a particular way of looking at the complexity of decision-making for energy and environmental issues: through the lens of a computer. The simple act of employing electronic data-processing machines

[479] The Montana Energy and MHD Research and Development Institute, "Final Report: Energy Environment Simulator Field Program" (Butte, Montana: The Institute, 1978), 1, 5.

and computerized systems language as vehicles for introducing ordinary Americans to the constituent elements of environmental policy reflected a broader tendency in the scientific, regulatory, and activist communities from the late 1960s through the 1980s. Computers – from the data they collected and processed, the models and simulations they generated, and quantitative analysis policy options they proposed in response to the contested inputs they were offered – became key elements of the broader national dialogue on how best to define and regulate natural resources and the broader environment.

UC-Berkeley scientist Lee Shiller with an Energy-Environment-Simulator

Beginning in the mid-1960s, the American political sphere underwent a dramatic evolution in how it considered and adjusted governmental policy related to the natural environment. Over the following two decades, this transformation in the degree and nature of the American state's relationship to matters environmental would occur in conjunction with the spread of dataocracy and increasing governmental use of systems analysis, electronic data processing, and computerized management. The agency most associated in the public mind with the rise of governmental interest in environmental matters, the Environmental Protection Agency, became over the course of the 1970s and 1980s a surprising exemplar of the complex ways in which use of computer data shaped approaches to policymaking in the environmental realm. Though neither the earliest environmentally focused governmental agency to make extensive use of computers in the course of its business (a honor accorded to various state regulatory bodies and constituent federal bureaus it inherited from the Agriculture, Commerce, and Health-Education-Welfare Departments) nor as aggressive an adopter of the language of dataocracy as federal agencies previously encountered in this volume (the Social Security Administration, the Bureau of the Budget), the EPA soon found its basic daily existence and its public image deeply intertwined with the production, dissemination, and legal promotion of computer-manipulated environmental data sets and models. This legacy would shape the agency's institutional development; its relationship with environmental activists, regulated industries, and other governmental entities; and its interactions with a court system that became interpreter of the emerging realm of environmental policymaking.

Relationship between environment and technology is structured into the foundational code of the EPA. The Agency's water pollution control programs in the 1970s were guided by the 1972 Amendments to the Federal Water Pollution control Act, which directed that limitation of pollutants be achieved through application of the “best practicable control technology.”[480] This emphasis on technology as a mechanism of practice traces in part to earlier military command-and-control computer applications (where SAGE tracked incoming bombers, the EPA tracked soil runoff and migratory patterns of snails), but more subtly reflects a focus on materiality. For all the reams of formless electronic data and quantitative models that would come to define dataocracy’s presence in the realm of environmental policy-making, computers as objects still had a very real materiality that slotted nicely with environmental scientists’ and administrators’ professional preoccupation with the limits of the physical world. Computers, objects that made manifest the abstraction of calculation, also enabled visualization of complex data relationships, permitting ambitious environmental policymakers to chart on a graph of dollars the nebulous concept of nature.[481] Likewise, the expenses associated with environmental policy computing – purchasing, operating, staffing – manifested as very real line items on agency budgets.

Establishing the EPA

Interest in using the analytical power of automated information systems to render some order unto the complexity of the natural world and its resources dates back almost to the inception of the computer. As early as 1950 the U.S. Fish and Wildlife Service published a report outlining a “punch-card system suitable for use with small samples in wildlife management and research.” According to the report’s author, biologist Lowell Adams, “With the increased use of

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[480] “The Environmental Protection Agency: Legislation, Programs, and Organization,” Environmental Protection Agency (1974), National Service Center for Environmental Publications.

[481] Regarding the business history context of materiality, see Kenneth Lipartito, “Connecting the Cultural and Material in Business History,” *Enterprise & Society*, December 2013, Vol. 14, No. 4: 686-704.

quantitative refinements in wildlife research and management, there is need for techniques to speed the handling of masses of statistical data."[482] Adams' simple, forward-thinking proposal – the product of a field scientist frustrated by the absence of a convenient method for "sorting and tallying" the rapidly accumulating pages of wildlife observations generated by his research – sought to merge the traditional practices of his discipline with the promise of a device successfully employed to manage the "larger collections of data" routinely handled by the defense, aerospace, and business accounting realms. Surely devices as malleable and useful as the computer could be readily adapted for the smaller batches of information generated in a standard wildlife population study.

His enthusiasm was a harbinger for a dramatic transformation that would ultimately remake the task of analyzing and regulating man's relationship with the natural world during the era of dataocracy. Computerized analysis of data would over a few short decades morph from a short-hand tool for speeding up traditional environmental science techniques to the fundamental basis for an elaborate regulatory regime based on the generation, dissemination, and contested interpretation of digital data that purported to describe the exact condition of the natural world.

Adams worried about the prospect of there being enough information generated by environmental field research to justify the expense and complexity of a computing machine, and observed that to be truly effective, any data processing analysis of collected environmental information would require organization via previously determined coding categories.[483] Within a few short decades, policymakers seeking to define and legislate human interactions with the natural world be deluged by reams of information and confronted with a realization that Adams'

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[482] Lowell W. Adams, *A Punch-Card System Suitable for Use With Small Samples in Wildlife Management and Research*, (Washington: U.S. Fish and Wildlife Service, 1950), 2.

[483] Ibid, 14.

observation held doubly true: the very act of coding, sorting, and analyzing environmental information could become a political act with serious economic, policy, and regulatory ramifications. As a new federal agency focused on examining pollution controls and applying regulatory stop-breaks to ecological damage by industry began to take shape in the late 1960s and early 1970s, it would be caught up in a formative debate over the nature and uses of environmental data.[484]

The EPA was born of the principles of administrative management deeply rooted in dataocracy. The same computer systems that guided impulses that directed Robert MacNamara's embrace of planning-programming-budgeting methods at the Pentagon and encouraged Bureau of the Budget officials under multiple presidents to embrace computers as tools of organizational transformation and information control marked the EPA from its inception in the National Environmental Protection Act of January 1970 and its eventual establishment in December of that year. As guardians of a new, "modern" agency charged with the thorny, ambiguous task of implementing an ill-defined agenda of "environmental protection," it is unsurprising that early EPA administrators would embrace technological systems of management that carried credence both with the scientific community so central to environmental study and activisim and the data management-focused business executives who populated the Nixon White House and the nation's leading think tanks.[485] Data processing was described in early EPA publications as a force significant to the Agency's perceived mission: "It is important to understand the emerging

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[484] This debate cannot be divorced from the broader economic context of the 1970s. For more on this broader theme, see Judith Stein, *Pivotal Decade: How the United States Traded Factories for Finance in the Seventies* (New Haven: Yale University Press, 2010); Jefferson Cowie, *Stayin' Alive: The 1970s and the Last Days of the Working Class* (New York: The New Press, 2010).
[485] *Time*, Vol. 99 Issue 7, (Feb. 14, 1972), 52.

technologies of the future and their implications for the environment and our way of life. . . Computers are able to manipulate data in ways that the human minds cannot."[486]

The period of political ferment that saw the late-sixties rise of the environmental movement and pressure on President Nixon to expand the purely advisory Commission on Environmental Quality into a regulatory agency also witnessed a concurrent push to restructure the entire federal government, as previously in the case of the Bureau of the Budget (BOB). Influential Nixon staffer Roy Ash, who chaired the President's Advisory Council on Executive Organization that transformed the BOB into the systems-focused Office of Management and Budget (OMB) had established a preference among Nixon White House officials for administrative practices that embraced systems-rich, information-based modern management techniques. In seeking to define a new agency in an era of tight budgets and skeptical Presidents, the agency's first administrator (William Ruckelshaus) and his successors would find it necessary to balance a mandate to regulate with the political necessity of projecting expertise, competence, and stability.[487]

Typical of the vague wording in Nixon White House directives to the nascent agency was the order of transfer shifting pesticide regulation programs from the Department of Agriculture to the EPA, effective December 1970: "Consolidation of related activities in the new

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[486] 3 *Environmental Quality: Annual Report of the Council on Environmental Quality*, vol. 3 (1972) ; "The Environment, 1972 - A Perspective," (Washington: Council on Environmental Quality, 1973), 344.

[487] For more on the political context of EPA operations, see Robert F. Durant, *When Government Regulates Itself: EPA, TVA, and Pollution Control in the 1970s* (Knoxville: University of Tennessee Press, 1985); Bruce Ackerman and William Hassler, *Clean Coal/ Dirty Air: or How the Clean Air Act Became a Multibillion-Dollar Bail-Out for High-Sulfur Coal Producers* (New Haven, CT: Yale University Press, 1981); Brian J. Cook, *Bureaucratic Politics and Regulatory Reform: The EPA and Emissions Trading* (Westport, CT: Greenwood Press, 1988); and Marc Landy, Marc Roberts, and Stephen Thomas, *The Environmental Protection Agency: Asking the Wrong Questions* (New York: Oxford University Press, 1990).

environmental agency will advance the administration's efforts to control pollution and enhance the quality of both the rural and the urban environment."[488] Little additional guidance was proffered on how to facilitate this consolidation of an established government office with its own methods for managing information into a larger amalgamation of similarly established federal entities. Ash's own memo on "Federal organization for environmental protection" similarly directed the nascent agency to "gather data on trends which are affecting, or which may affect, the environment," while reminding its central administrators to "[recognize] existing departmental skills . . . in gathering data for the formulation of standards." Whatever formula might be employed to create that balance, the final data-driven product would be expected to supply "information [with which] the Administration should be able to recommend changes in program and national policy well in advance of the expected consequence of the trend."[489] Formal legislation was no clearer in its mandate. The Clean Air Act required that Administrator Ruckelshaus "set pollution limits at levels that protect the public health and provide an adequate margin of safety" without clearly defining the source, calculation, or implementation of those standards. [490]

One way of successfully merging into a single agency the scattered programmatic environmental offices of five different federal entities (the Departments of Agriculture, Interior, and Health, Education and Welfare; the Council on Environmental Quality; and the Atomic Energy Commission's radiation monitoring offices) was to find a unifying organizational

[488] "Federal Program by Function," 1972 Budget of the United States Government (Washington: Government Printing Office, 1972), p. 111.

[489] Ash memo, 29 April 1970, Records of the Environmental Protection Agency, Record Group 412, Subseries 412.5.2 Records of the Office of the Administrator. National Archives II, College Park, MD.

[490] EPA Press Release, 30 April 1971, Records of the Environmental Protection Agency, Record Group 412, Subseries 412.5.2 Records of the Office of the Administrator. National Archives II, College Park, MD.

principle. [491] Embrace of data and technological systems as a means to achieving improved environmental quality would fit into a larger systemized management process intended to match the recommendations of Ash's "Reorganization Plan no. 4" and make the agency invaluable to its state government, federal agency, and general public constituencies, and would be that principle.

Early EPA officials, cognizant of the successes and failures experienced by dataocracy-embracing officials at Social Security and the Department of Housing and Urban Development over the past decade, recognized that a cautious, almost targeted method of employing computers to manage information would align them with the attitudes of many environmental quality constituent groups intrigued by the prospect of employing automated data processing technologies to lessen the effects of environmental deterioration. As a spokesman for pro-environment group "Businessmen for the Public Interest" noted in 1970, "I have the feeling that the climate in the nation is slowly switching more toward a recognition of . . . the need to take account of all perspectives with regard to information flow, just as we are beginning to take account of all perspective with regard to environmental pollution and consumerism."[492] Could computers supply that perspective?

Institutional precedents for such analysis did exist, at least at the state level in some parts of the United States. Conveniently for soon-to-be EPA administrators, the model example of a state environmental regulatory body adopting techniques of electronic data processing emanated

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[491] Edmund Russell, "Lost Among the Parts Per Billion: Ecological Protection at the United States Environmental Protection Agency, 1970-1993," *Environmental History* 2 (January 1997):. 32; Dennis C. Williams, *The Guardian: EPA's Formative Years, 1970-1973, (*Washington: Environmental Protection Agency, 1993), 2.

[492] Public Interest Hearing, 1974, p. 27; Records of the Environmental Protection Agency, Record Group 412, Subseries 412.5.2 Records of the Office of the Administrator. National Archives II, College Park, MD..

from Maine, home state of the Senate's Edmund Muskie, that chamber's most ardent advocate of pollution controls and environmental legislation.[493] With Muskie's political muscle and the assistance of copious federal funds directed to Augusta, the Maine Department of Environmental Protection embarked in the late 1960s on an ambitious test of an operations research, planning-programming-budgeting-compatible model for centralized environmental regulation. As a state report later presented to Congress as evidence of Maine's success noted, "By applying evaluation criteria, analysis, and the rise of large scale computers, a design of an environmental resource system which responds to policy-planning and specific needs of the resource planners was developed."[494] Maine's system, which from 1970 onward required permits for land development to undergo evaluation under statutory criteria of traffic circulation, soil conditions, and effect on the natural environment, with resultant evaluation designed to "control and mold the physical growth of the state."[495] Augusta-instigated 1967 efforts to bring all internal waterways up to cleaner standards in a decade, though ambitiously comprehensive for the product of a statehouse, lacked teeth to close loopholes on many existing Maine polluters because the legislation lacked precise wording of discharge conditions. Senator Muskie, floor manager for the 1972 Clean Water Act, vowed to correct his state's miscalculations through the impending federal legislation, in the words of one scholar, creating "a rigorous national framework of data collection, goal setting, and effluent limitations designed to meet specific water quality

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[493] For more on Muskie and his legislative peers, see Paul Milazzo, *Unlikely Environmentalists* (Lawrence: University Press of Kansas, 2006), chapter 3.

[494] Maine report, cited in National Environmental Policy Act Hearing, Senate Committee on Interior and Insular Affairs, 92nd Congress, 19 November 1971, 243

[495] Environmental Studies Center, "Final Conference Report: National Conference on Managing the Environment," (Washington: EPA, 1973), p. III-32.

standards. . . ."[496] A laudatory but flawed administrative system in his home state inspired the senator to hard-bake the need for comprehensive data parameters and data-driven evaluative systems into his pet national legislation. Federal regulatory policy on storm water drainage and river effluents was deliberately structured to close status quo loopholes by mandating specific site evaluations be compared to larger pools of data.

From its inception, the EPA's identity was wrapped in part in its awareness of its obligation to collect and assess information. As the members of the President's Commission on Environmental Quality noted in their 1970 report, anticipating the end-of-the-year establishment of the EPA,

> We are under mandate by the Congress to report in detail on the condition of the various environments, and to identify trends, and I think we have done this to a considerable extent. At the same time, we point out in the report, as does the President in his message, that our monitoring systems and our data systems are today really very inadequate to the task of environmental measurement and prediction. And, of course, it will be some time before these systems are available to us, so that this is one of the limitations which I think it is important to bear in mind in.[497]

In an internal assessment following Reorganization Plan No. 4 and the creation of NOAA, the Department of Commerce noted it would expand the National Bureau of Standards' program dedicated to "advancement in computer technology and pollution abatement technology"[498] The implication of their bureaucrat-speak was clear – the two technologies, that of computers and that intended to reign in environmental pollution – were indivisible, and it was expected by other federal offices that the newly established EPA would be a heavy and cutting-edge user of

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[496] Andrew Fisk, "The Clean Water Act in Maine: Goals and Financing," *Maine Policy Review* 17.1 (2008): 28.

[497] First Annual Environmental Quality Report, 1970, p. 15; Records of the Environmental Protection Agency, Record Group 412, Subseries 412.5.2 Records of the Office of the Administrator. "Environmental Quality – 1970" folder; National Archives II, College Park, MD.

[498] "Special Aspects of Federal Programs," 1972 Budget of the United States Government (Washington: Government Printing Office, 1972), 283.

computerized data. In the 1971 Annual Report of the Council on Environmental Quality, EPA presented an almost apologetic defense of their increased budgetary demands, using the lens of data: "The Environmental Protection Agency has undertaken a broad study of its environmental data requirements and of its existing monitoring systems. EPA hopes to develop an integrated system to provide data required for pollution control."[499]

The push for systems-planning based environmental regulation was closely related to the 1960s fascination with data-processing based solutions applied to the urban policy sphere. Both a major 1969 study commissioned by the National Air Pollution Control Administration and the Council on Environmental Quality's 1971 edition of its annual report emphasized the correlation between sulfur-oxide choked urban cores and population densities anchored by the urban poor. Studies of traffic circulation and industrial density that marked systematized efforts to understand changing cities lead naturally to systematized evaluations of the environmental impacts of those facets of metropolitan life. The 1971 study made repeated references to "air pollution computer model(s)" as a basis for its recommendations on how government agencies might proceed to improve urban air quality.[500] The assumption was that somehow a new Environmental Protection Agency could take this collected data and transform it into a plan for action – in other words, regulation.

The University of Southern California's School of Public Administration tested this notion under the auspices of a 1970 grant provided by HEW. An Air Pollution Control Institute

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[499] "Status and Trends," *Environmental Quality: Annual Report of the Council on Environmental Quality* (Washington: Council on Environmental Quality, 1971), 211.

[500] "Inner City Environment," *Environmental Quality: Annual Report of the Council on Environmental Quality* (Washington: Council on Environmental Quality, 1971) , 192.

organized around COMEX, a computer research project, sought to "prepare students for careers involving the planning, supervision, and management of air pollution control" through data systems-based exercises in operations, planning, and management. A "computer simulation of the environment" of "the social, economic, demographic, and political factors encountered in a major city" were run through a selection of thirty submodels, each "simulating one component of the total system," and responding to student inputs of variable ecological conditions. As one participant's summary of the simulation, dubbed "Pollex," noted, "Inputs to the computer simulation are provided not only by the role of an air pollution control officer but also by a politician and an industrialist."[501] These students, trained in a policy program to become the bureaucratic foot soldiers of future regulatory battles, had been instructed to conceptualize the complex political relations of businessman, regulator, and office holder as variables that might be modeled in a mainframe.

Throughout the agency's first three years, its continued existence was even in question, and many in Congress and the environmental agency itself pressed for a more comprehensive, Cabinet level Department of Natural Resources.[502] Criticisms leveled against the newly established EPA focused on the relative inexperience and general lack of scientific background of its highest ranking administrators. Including Ruckelshaus, who had at least evidenced a degree of interest in pollution legislation during his time in the Nixon administration, a full half of the Agency's top tier of six administrators seemed to boast as their chief qualifications close ties to

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[501] Public Health Service, "Highlights of Selected Air Pollution Research Grants" (Washington: HEW, 1970) , p. 48

[502] "Earl L. Butz, Counselor for Natural Resources: President's Choice a Surprise for Environmentalists," Luther J. Carter, *Science*, Vol. 179, No. 4071 (Jan. 26, 1973): 358.

the Indiana Republican Party.[503] To counter these claims, additional experts on scientific assessment of environment were recruited for agency leadership; several of these men brought with them in interest in or predilection for computerized management systems and information databanks. The lone Democrat among the bunch, Stanley Greenfield, had headed the RAND Corporation's environmental studies program for the entirety of the 1960s before being hired to oversee EPA research and monitoring. Alvin Alm (who would later himself become EPA Administrator) was recruited by way of the Bureau of the Budget and Russell Train's administrative staff at the Council on Environmental Quality to become Assistant Administrator for Planning and Management – the in-house systems management figure. Among those who migrated with Ruckelshaus from the Justice Department to the Environmental Protection Agency's temporary new home in the District of Columbia's Waterside Shopping Mall was data expert James Devine, former head of the Interdivision Information Unit that employed computers and elaborate, cross-referenced databases to assist the Justice Department in tracking individuals and groups suspected of being "subversive." His expertise in digitizing salient facts about student radicals, civil rights protestors, and anti-war activists would now be turned upon the task of devising systems for tracking repeat pollution offenders. Alain Enthoven, one of Robert McNamara's most accomplished "whiz-kids" and Assistant Secretary of Defense for Systems Analysis from 1965 to 1969, consulted with Ruckelshaus on systems-derived schema

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[503] "Environmental Protection Agency: Chaos or "Creative Tension?" Robert Gillette, *Science*, Vol. 173, No. 3998 (Aug. 20, 1971): 704.

for optimal organizational structure for the new agency, as did former Ash Council member (and future EPA head) Douglas Costle.[504]

Establishing a voice of impartial expertise derived from scientific credibility and the cold logic of computer databanks could also help shore up Agency adversaries who were themselves veterans of the rise of governmental dataocracy. Maurice Stans, formerly encountered in his role as Eisenhower's final Bureau of the Budget director and a keen observer of the power of institutional control of computerized data, left his post as Nixon Administration Commerce Secretary in February of 1972 to become finance chair for the unfortunately titled Committee to Re-Elect the President (CREEP). He leveraged his new status as private citizen (and collector of campaign funds from major industrialists) into the additional role of unofficial spokesman for a loose coalition of industrial concerns ready to charge that "environmentalists in Congress, the members of the White House Council on Environmental Quality, and officials in the Environmental Protection Agency, in their zeal for abating pollution, [had] given insufficient attention to the impact on costs, prices, and employment."[505] More than a pure economic criticism, Stan's relentless comments reframed the data promoted by ecologically-minded legislators and administrators as incomplete, and thus unserious, for neglecting cost-benefit factors in their supposedly complex environmental models.

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[504]Dennis C. Williams, *The Guardian: The EPA's Formative Years, 1970-1973* (Washington: Environmental Protection Agency, 1993), p. 5. For more on Enthoven and Costle's innovative suggestions for balancing functional needs of proposed agency structure with established bureaucracy based on environmental medium categories (e.g. land, water, air, etc.), see Alfred A. Marcus, *Promise and Performance: Choosing and Implementing an Environmental Policy* (Westport, Connecticut: Greenwood Press, 1980).

[505] E. W. Kenworthy, "Curbs on Pollution Costly but Feasible, Industry is Advised." *New York Times*, Mar 13, 1972, p. 1.

In response, the EPA, assisted by the Council on Environmental Quality, the White House Council of Economic Advisors, and – ironically – Stans' own Commerce Department, hired several firms of private contractors in the spring of that year for $350,000 to develop systems-based models that countered Stans' claims while incorporating more economic factors like job loss, increased cost of production, and infrastructure upgrade into their proposals for scientific pollution control. While conceding that economic costs would be considerable, "The Economic Impact of Pollution Control" asserted that even with inevitable price increases resulting from more expansive raw-material extraction and industrial production, total benefits to the economy of "cleaner air and water" would dwarf the $31.6 billion cost (in constant 1971 dollars) stemming from implementation of air and water pollution controls. EPA consultants deflated Stans' critique by willingly incorporating his estimated "abatement costs" into their projections and then generating models that predicted higher annual marginal health and productivity costs associated with undiminished pollutants. As a front-page *New York Times* article on DC-area responses to the report's release noted, "Because of the mounting controversy between environmentalists and industry spokesmen over the cost-benefit ratio of Federal antipollution laws and regulations, the conclusions of this computerized study made for the Federal Government by private contractors were regarded here as having considerable importance."[506] EPA officials had blunted an existential challenge by simultaneously conceding their data was incomplete and presenting as compelling evidence revised, computerized data backing up the agency's very *Raison d'être*.

1972 was not 1952, or even 1962, though, and the computer held a different place among the policy classes in Nixon-era Washington than it did twenty years. The mere presence of a

[506] Ibid, 1.

computer no longer conveyed authority, and turf wars over access to and use of information systems no longer merited the same stakes in an era of dominated by growing distrust of the function and trustworthiness of the national state itself. The nature of dataocracy itself evolved in the 1970s above and beyond a progressive promotion of data processing (as in the Bureau of the Budget of the 190s) and efforts to re-conceptualize and centralize administrative hierarchies around flows of data (as in the Social Security Administration of the 1960s). While not quite as ubiquitous as air conditioners, mainframe computers, and their nascent offspring, desk-sized minicomputers, were increasingly commonplace across the federal government. Dataocracy in the 1970s, reflecting the etymology of its naming, was largely no longer about the computer as an object, per se, nor even about the computer as administrative process. It was about Data.

Particularly in this decade, and especially in the realm of environmental research and regulatory policymaking, dataocracy focused attitudes about the malleability and transformation of information by large institutions such as government agencies achieved through speculative endeavors such as computer modeling. The rise of computer modelling as a commonplace tool of computerized policymaking reflected greater capacity to collect and organize data, as well as a methodology of working around the questions of “complete data” that bedeviled mainframe pioneers in the social insurance and urban policy spheres. Modeling meant a new type of control, in which quantity of collected observations could be rewarded, gaps could be worked around, and elaborately complex scenarios devised, reflecting the view of the environment as a thing of interlocking complexity. EPA officials developed an understanding of data that presented pools of quantified information as testable and transmutable, components in a stepped process of environmental observation-scientific analysis-systematic theorizing of policy options-modeling of options-implementation of the most feasible model. A consortium of power utilities commenting on proposed changes to the Agency's regulatory guidance manual in 1974 acknowledged this state in their appeal to regulators for less stringent links between data inputs and model-rooted policy outcomes:

> The regulations should provide that the information to establish . . . limitations in each case must be related to (i) data and information reasonably available at the time the showing must be made and (ii) the effective period of the permit. We believe it would be sound administrative policy to, well within the Agency's discretion, to require . . . applicants to provide increasingly extensive information for subsequent determinations as more detailed and sophisticated data become available. . . . The decision makers would be directed to accept a reasonable quantum of evidence . . . the duration of a discharge permit . . . should reflect the extent of the data provided.[507]

Those who were regulated recognized that computer-generated models and interlinked databases of recorded environmental observations formed the basis for EPA's arguments of increased scrutiny and oversight. EPA let the scale of accumulated data and the seeming autonomy of computer-generated simulations provide the evidentiary framework for its policy conceptualizations.

What Computers in the EPA and Other Environmental Agencies Actually Did

According to an in-house EPA training manual, by 1977 "approximately one out of five employees [were] responsible for putting data into computer systems or evaluating and using computerized reports."[508] Just precisely what tasks were computers and information systems performing in the newly established agency to make their presence so nearly inescapable?

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[507] Edison Electric Institute, et al, "Comments on EPA's Proposed 316(a) Regulation and Draft Guidance Manual," (1974), (Washington: National Service Center for Environmental Publications, 1974), 16-17.

[508] *ADP Training Guide*, EPA Management Information and Data System Division, July 1977, 2. Records of the Environmental Protection Agency, Record Group 412, Subseries 412.5.2 Records of the Office of the Administrator, "ADP" folder. National Archives II, College Park, MD.

To understand why data systems were so central to the growth and operations of the EPA requires awareness of the breadth of its activities. The manner in which the Agency was awkwardly cobbled together from existing environmental offices scraped from other executive branch homes has been discussed; the broad range of duties assigned the Agency by its legislative mandates and President Nixon's vague imperatives for environmental improvement meant the agency dealt with a staggering breadth of natural issues, ranging from micro-level, highly-localized, on-the ground regulation and litigating even as it struggled to develop a macro-level vocabulary and policy for broader American social discussion of environmental issues. Linking these extremes were a slew of quasi-autonomous scientific laboratories.

Russell Train described an average week for the Agency in 1973 in an address before the National Press Club. Bracketed by a Congressional hearing on the Clean Air Act and a Presidential statement on fuel oil shortages, the Agency's activities included participation in court-mandated hearings on national air quality standards, implementation of a voluntary fuel efficiency labeling standard for new automobiles, serving of notice on three utilities for violating sulfur removal regulations, addressing public outcry over the effect on commuters of proposed smog-reducing transportation regulations in major cities, and dispatching a "team of experts" to determine whether a waiver might be granted in the Pacific Northwest to permit onetime use of DDT to eliminate an infestation of tussock moths in Douglas fir forests.[509] Under standard operating procedures for virtually any high-level federal agency, each of these activities would have encountered clerical, administrative, management analysis, and – given the EPA's technical focus, likely scientific – computer attention as it wound its way through the bureaucracy.

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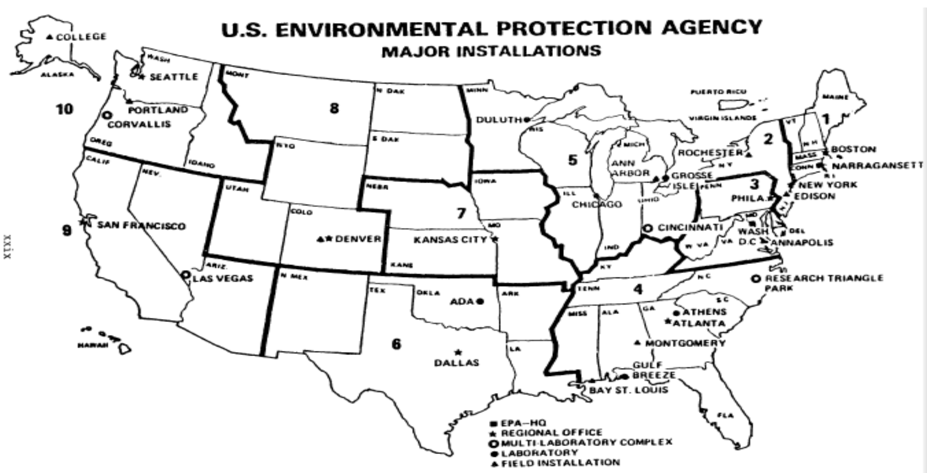
[509] R. Train speech, 18 September 1973, 1. Records of the Environmental Protection Agency, Record Group 412, Subseries 412.5.2 Records of the Office of the Administrator. "Train Speeches 1" folder; National Archives II, College Park, MD.

Specific program areas of the agency necessitated dedicated equipment that could both batch process environmental data on short notice for Congressional reports or regulatory hearings while engaging in routine assembling and analysis of scientific data collected on a daily basis by EPA and state-operated air, water, and radiation monitoring stations. Thomas E. Carroll, the Assistant Administrator for Planning and Management, described to the Federal Supply Service in March of 1971 the type of "automatic data processing equipment [required] for the air pollution program of this agency": "a large scale sophisticated system with approximately 40 terminals connected to the central processor(s)."[510] Similar installations, varying in size and complexity based on the anticipated processing load, existed at the each of the program offices at the national headquarters, at select regional offices, and at the assorted environmental research laboratories the EPA operated independently or in conjunction with the Agriculture Department, Atomic Energy Commission, or Interior Department. Though large installations could be found in Pullman, Washington, and Cincinnati, Ohio, as well as in shared lab space at AEC facilities in the Southwest, the true nexus of EPA computing emanated from the agency's Research Triangle office park facility in North Carolina. Beginning with a medium-sized atmospheric analysis facility inherited from the Commerce Department, what would become EPA's National Computing Center would by the mid-1980s sprawl across several buildings and provide data services to all of the Agency's branches.

Throughout the agency's early years, computing was simultaneously centralized and dispersed (according to both operational function and shifting organizational authority). Protocols for certain data processing policies might emerge from Agency headquarters in

[510] Thomas E. Carroll to H. A. Abersfellow, 8 March 1971, Records of the Environmental Protection Agency, Record Group 412, Records of the Office of the Administrator, , Office of the Administrator, General Correspondence, 1971-1982, Box 1, folder "Aa-Ae" National Archives II, College Park, MD.

Washington or a Regional Office in Atlanta or Denver (for instance), but depending on function, age of equipment, and degree of autonomy exercised by individual bureaus, offices, or labs, the information gathering, analysis, and modeling that shaped nationwide environmental policy might emanate from a field lab in Gulf Breeze, Florida; the computing centers of Research Triangle Park; or a Las Vegas research installation inherited from a predecessor agency.[511]



EPA Computing Installations, 1979

An internal "Systems Directory" from 1979 and 1980 reveals the scope of clerical, managerial, administrative analysis, scientific assessment, and regulatory preparation tasks

[511] The EPA's Las Vegas installation, a six building cluster on the campus of the city's branch of the University of Nevada, also received considerable budgetary support/oversight from the Atomic Energy Commission, which provided over sixty percent of the combined facility's operating budget per annum. The AEC at this time was, of course, a heavily computer-centric entity. For statistics, see Jongmin, p. 52, and Moore, "EPA Las Vegas Laboratory Early History"; "Chronological History of EMSL-Las Vegas," EPA Organizational History, Box 7, EPA Historical Document Collection; EPA, Western Environmental Research Laboratory: Annual Report 1970 (Las Vegas, NV: EPA, Office of Research and Monitoring, Western Environmental Research Laboratory, 1971); EPA, Western Environmental Research Laboratory: Annual Report 1971 (Las Vegas, NV: EPA, Office of Research and Monitoring, Western Environmental Research Laboratory, 1972), 4.

allocated to computers within the EPA's many bureaus, offices, and divisions. From an electronic National Environmental Policy Act (NEPA) filing system in the Office of the Administrator through a computerized "financial management systems" and "personal property data entry system" in the Office of Planning and Management through an "emissions data base," "permit compliance system," and "emissions data base" in the Office of Enforcement, the directory numbered some 254 automated data processing (ADP) systems in use agency-wide or in specific administrative regions.[512] While some admittedly overlapped, all performed functions at the core of daily agency life. Clusters of computers at the EPA grew in scope, complexity, and ubiquity as the agency matured, particularly with frequent administrative restructurings that saw systems and information management bureaus enhance their stature on the agency organizational chart roughly every three years.[513] Computer functionality at the agency in the 1970s and 1980s could be slotted into four loose families.

The first cluster of data processing devices, for clerical, financial, and personnel management purposes, were ultimately not that different than pre-electronic computer devices employed by offices for running their payroll and purchasing requirements, save for the factor of cost, complexity, and need for advanced training to operate them. Similar clattering electronic punch card readers and computer databases accessing files of contracts could be found at scores of government agencies, insurance firms, or aerospace companies. One distinctly EPA-type wrinkle could be seen in the relative autonomy granted to the agency's regional offices in terms of operational procedure; certain human resources, contracting, and supply methods might be

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[512] "Systems Information 1980," iv-ix. Records of the Environmental Protection Agency, Record Group 412, "Systems 1980" folder. National Archives II, College Park, MD.

[513] "Organizational overview," Records of the Environmental Protection Agency, Record Group 412, Box 5, systems folder; National Archives II, College Park, MD.

employed at the Washington headquarters, with vastly different techniques, machines, and software programs doing the same tasks at EPA facilities in Denver, Atlanta, or Boston.

A second realm of EPA computing should again be familiar from previous accounts of dataocracy: administrative management and systems planning. At both the national and regional office level, systems administrators employed elaborate computer models to structure and organize agency operations with the assistance of data processing machines. More prosaically, business type computer systems generated the reams of protocols necessary for administering environmental grants and tracked the progress of pilot programs seeded by the agency across the country. Similar techniques powered databases that crossed from program administration to policy analysis. The Strategic Environmental Assessment System (SEAS) of the mid 1970s was culmination of a half-decade's work incrementally applying quantitative techniques to ever larger questions of environmental policy outcomes. "Designed to assist national policymakers in environmental forecasting and policy impact analysis," the agency boasted how "user application guides were designed to assist the transition of SEAS from a research mode to an operational system" capable of directly informing policy uncertainties either legislators or program administrators might have.[514]

Information retrieval databases constituted the third major category of EPA computing. The Agency's regulatory lawman, the Office of Enforcement, employed a considerable staff of systems analysts and data mangers to supplement its cadre of litigators. The division made extensive use of databases to track both the records of current cases and prior offenders, but also maintained constantly updated databases fed from work done by the Program Bureaus (Air,

[514] EPA, "Justification of Appropriation Estimates for Committee on Appropriations, Fiscal Year 1978," (1977), (Washington: National Service Center for Environmental Publications, 1977), I-30

Water, Solid Waste, etc.) indicating when violations of pre-determined enforcement levels might require investigation. Supplemented by an extensive central library database seeking to catalog the titles and subjects of all relevant academic articles on pollution control (modeled in part on a similar cancer-study focused effort at the National Institutes of Health), Enforcement Office regulators could slot in information as needed along their digital management system, in theory making simpler the case of presenting evidence of violations.

Scientific computers engaged in elaborate research activities not that dissimilar to those being performed at NASA, the Atomic Energy Commission, the Agriculture Department, and government-funded labs at universities across the country comprised a fourth and final group of EPA data processing devices. Such machines included not only computer-directed monitoring devices that gathered samples at thousands of sites across the country, but lab-based computers that analyzed the collected samples and subsequently collated, processed, and cross-referenced the findings with existing EPA data. The process was far more fragmentary than a unified or "total system" as might have been envisioned by a Great Society technocrat or even a Congressman who might presume his appropriation votes had supported a more unified system. Most water quality samples, for instance, continued to be collected manually at thousands of pre-determined testing sites across the country, though at some point during their analysis or testing phases the samples would encounter an automated data system.[515] By the 1980s, environmental observers could note, "In recent years, a wide variety of individuals with widely varying educational and experience backgrounds are "practicing" systems analysis in water quality

[515] 1976, Cawley to Sonneville memo, Records of the Environmental Protection Agency, Record Group 412, Subseries 412.5.2 Records of the Office of the Administrator, folder 4505.

management. . . . They have been placed with the responsibility of doing calculations to support the decision-making process."[516]

These consisted of more than just the blinking boxes of computer hardware. According to consulting firm CAI and the state of Maine (home to Senator Muskie and one of the earliest users of data processing for ecological evaluation), a proposed national environmental computer system should "include an overall plan of action, a system analysis process (oriented toward resource planning), data selection and evaluation criteria, master data resource element indices (computer loaded), management control procedures (collection, processing, update), a uniform coding process, a master geographic system, and an English language computer capability which is simple from the user viewpoint yet sophisticated in application."[517] Hidden costs were embedded in the system of analysis and data retrieval, including systems analysts and policy analysts to convert data model readouts into actionable political proposals, administrators to monitor systems workflows and devise new uses for the ever-more elaborate computer hardware and software, and the extensive training and evaluation infrastructure designed to introduce federal employees to latest computer processing techniques and ensure that those procedures were finding themselves into the reports generated by EPA offices. Machines were part of a larger context, extending the notion of "computer" beyond the encased metal box and tape reels to incorporate the people, administrative processes, intuitional structures, constituent data, and informational products generated by data processing.

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[516] Robert V. Thomann, "Systems Analysis in Water Quality Management – A 25 Year Retrospect", in *Systems Analysis in Water Quality Management,* M. B. Beck, ed. (Oxford: Pergamon Press, 1987): 9.

[517] "Maine Report on Slotnick hearing," (1971), 242; Records of the Environmental Protection Agency, Record Group 412, Subseries 412.5.2 Records of the Office of the Administrator. National Archives II, College Park, MD.

For instance, in 1981 and 1982 the Office of Management Systems underwent yet another of its regular reshufflings. The Division employed 114 people over seven branches, including 4 computer programmers, 2 program analysts, 4 management analysts, a computer technician, a computer equipment specialist, a physical scientist, a budget analyst, 26 computer specialists, 34 systems analysts, and one each of the nebulously titled "consultant" and "expert."[518] The eventual restructuring would expand the Division to ten branches, each with a fragmented but purportedly essential task in either the daily operations of the agency or the business of "collecting good quality environmental data." [519]

Throughout the 1970s and 1980s, EPA publications listed as central to the Agency's mission the "application of system analysis and computer technology for environmental planning."[520] Intra-departmental memoranda frequently drew their communication cues not from personal names, but rather occupational titles defined by their relation to a data-driven hierarchy. A representative spring 1976 report from an unnamed "Senior Systems Analyst" to the "Director, Monitoring Technology" enthusiastically described the findings of a Las Vegas workshop on the creation of a comprehensive air pollution index, noting, "The computer evaluation is proceeding well, and [the Office of Air and Waste Management] has suggested enlarging the project to take into account trends and to experiment with more deluxe ways to present the data."[521] Despite

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[518] 1982 OMS Report, Records of the Environmental Protection Agency, Record Group 412, Subseries 412.5.2 Records of the Office of the Administrator, folder 5435.

[519] "1983 overview," Records of the Environmental Protection Agency, Record Group 412, Subseries 412.5.2 Records of the Office of the Administrator, Systems folder, subfolder N4562.

[520] EPA Systems Manual, 1975, 241, Records of the Environmental Protection Agency, Record Group 412, Subseries 412.5.2 Records of the Office of the Administrator.

[521] Memo on "Trip Report for March 2-3, 1976," Records of the Environmental Protection Agency, Record Group 412, Subseries 412.5.2 Records of the Office of the Administrator., Office of Research and Development, Studies and Other Related Records Regarding Monitoring and Technical Support, 1971-77, Box 1.

requiring an estimated "three man-days of computer programming effort" on his part to reconfigure the existing INDEX.PLOT program and other computer software that permitted air pollution and ozone levels to be displayed in accessible graph form, the analyst considered unquestionably "worthwhile" the extension of a "powerful means for displaying data by reducing a vast quantity of data to a relatively simple figure."[522]

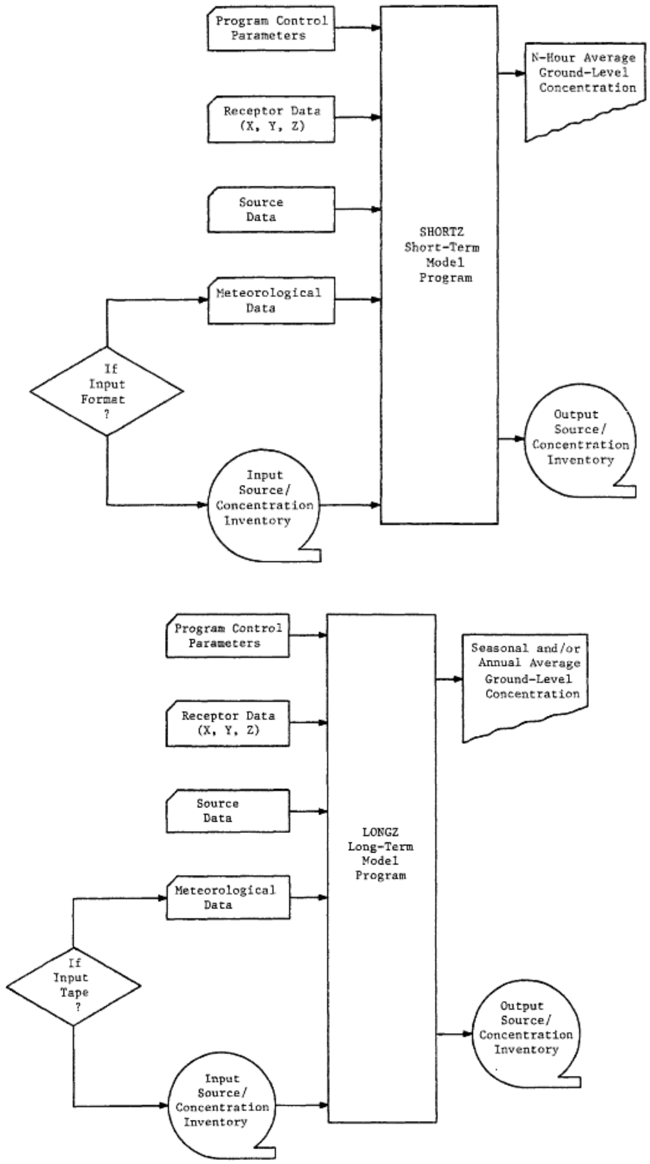
An example of the way in which policy imperatives, legislative directives, and technological capacity combined to effect model outcomes can be seen in a pair of late 1970s EPA computer systems, SHORTZ and LONGZ. This amusingly titled pair of "computerized atmospheric dispersion models" was developed by the H. E. Cramer Company under EPA Contract No. 68-05-2547, as post-1975 follow-up to a task order intended to improve analysis of sulfur-dioxide in Allegheny County, Pennsylvania.[523] By 1979 the contract had yielded an initial report, a training seminar for EPA meteorologists, a second report reviewing the technical details of the prepared computer model and its probable effects on sulfur dispersion analysis, and a pair of detailed computer codes (SHORTZ and LONGZ) designed to be run on the UNIVAC 1110 computer housed at EPA's Research Triangle Park facility in North Carolina. In the words of the software's creators, SHORTZ and LONGZ "were designed to calculate the short-term and long-term ground-level pollutant concentrations produced at a large number of receptors by emissions from multiple stack, building, and area sources"; the two essentially crunched meteorological data summaries and statistical wind inputs in tandem to model the movement, composition, and dissipation of short-term (hourly or weekly) and long-term (seasonal or annual) sulfur concentrations in the atmosphere, while taking into account factors of terrain. Highly

[522] Ibid.

[523] EPA, "Shortz/Longz Report," 1976; Records of the Environmental Protection Agency, Record Group 412, Subseries 412.5.2 Records of the Office of the Administrator.

sophisticated for their time, the programs required a then considerable 55,000 and 50,000 words of core memory each to function on the UNIVAC computer; data was drawn from 1800 receptors representing a maximum of 300 (for SHORTZ) or 14,000 (for LONGZ) individual data source sites. Commissioning such a substantial database could only have been undertaken by a government agency with little concern for immediate return of its investment for its capital outlay; similarly, only an institution with national reach could gather and sort the variety of air pattern inputs that would generate most effective modeling results. The SHORTZ and LONGZ systems were apparently particularly suited for elaborate metropolitan-area studies that required complex accounting for variations in terrain, elevation, and population density.[524] Output could be quickly written to magnetic tape and quickly dispatched to other EPA facilities across the country requiring air pollution data.

[524] S-L Report, p. 1-1. Records of the Environmental Protection Agency, Record Group 412, Subseries 412.5.2 Records of the Office of the Administrator., Administrative Series, Monitoring Folder.



Schematics for SHORTZ and LONGZ Computer Systems

Control of Data and Agency Identity

Lynton Caldwell, the principal crafter of the 1969 National Environmental Policy Act, noted in 1966 that "[t]he computer now affords a method for the analysis and projection of complex ecological data." The ability to project "multi-variable, slow-moving ecological processes at highly accelerated rates" through computer simulation could provide a demonstrative means of illustrating the outcomes of slight tweaks to environmental factors that might otherwise be overlooked. The computer was an operational tool suited to "the practical problem of translating environmental or ecological policies into action."[525] Debates soon arose over how to properly exploit these "operational tools" and how best to integrate them into an agency structure itself cobbled together from disparate scientific, legal regulatory, and policy assessment offices with their own ingrained approaches to information management. Official John J. Hart noted the "enormous information and data explosion" confronting the Agency. "Consider the possible outcome if EPA were limited to the technology available in the 1950s. An enormous number of people would be performing statistical calculations with electromechanical calculators and slide rules, the overall productivity would be low, and the error rates would be extremely high. The ability to implement and effectively use sophisticated modeling and simulation would also be severely restricted."[526] The difficulty, he cautioned, lay in reconciling scientific and managerial approaches to data use and control: "The scientific community is usually too busy promulgating the Agency's technical missions to become intimately involved with the proper planning of ADP resources."[527]

Disproportionate expenditure on data processing only exacerbated tensions: because the scientific bureaus were less inclined to aggressively push for expanded computer systems, administrative and policy implementation offices instead received the lion's share of funds to construct machines to better reorder data received from the scientific offices, rather than letting

[525] Lynton K. Caldwell, "Problems of Applied Ecology: Perceptions, Institutions, Methods, and Operational Tools," *BioScience*, Vol. 16, No. 8 (Aug. 1966): 526-7.

[526] John J. Hart, "Exploitation of EPA's ADP Resources: Optimal or Minimal?" *ORD ADP Workshop Proceedings No. 2* (Washington: U.S. Environmental Protection Agency, Office of Research and Development, April 1976), 86.

[527] Ibid, 87.

the front line data producers comprehensively order their own findings. Environmental scientists, statisticians, and computer technology specialists jockeyed over the "redundancy of statistical software packages installed on Agency computer systems," leading internal critics to decry the loss of both credibility and end mission. As one official noted, squabbles over who should control data flows obscured the EPA's true mission of enforcement: "the data we produce must serve this end [enforcement]."[528] Agency guidelines for "flow and auditing of air quality data" from 1976 suggested the essential but uneasy relationship between those who collected and scientifically modeled data and those who evaluated and administratively modeled the aggregated statistics. The Agency's implementation plans for air quality enforcement at the state level contained a feedback linking data in and evaluative data out; the Plan Revision Management System consolidated databases of scientific observations (actual air quality measurements), identities of source emissions (the rolls and statuses of the regulated), and the enforcement and compliance guidelines into a single system "to compare measured progress against expected progress." Databases of accumulated air quality data provided the baseline on which the regulatory standards had been based, and the standards shaped the nature of data collected from that point onward, data that then could be used through modeling to revise the standards. Both data and policy existed in a mutually-dependent, ever-shifting state in which results of measurement changed the guidelines for measurement and vice versa, a sort of sulfur-belching smokestack version of "Schroedinger's cat." As the guidelines noted when describing how to monitor actual air quality levels against anticipated air quality levels derived from models and mandated by emission levels, "It is difficult to develop comprehensive guidance on exactly

[528] Ibid, 89.

how to determine whether a control strategy will need to be revised. . . in general it will be a difficult task to determine that a plan is inadequate to attain the standards prior to the established attainment data."[529]

Astute observers within the agency recognized that discord stemmed partly from competing definitions of what a computer data system precisely was. Donald Worley, describing early clashes over the STORENET Univac system, noted a hardware-software, machine-data divide: some saw "a collection of computer programs written for IBM equipment and converted to Univac equipment," others defined the system as the "17 magnetic tapes of air quality data."[530] Within the office of administration, the prevailing attitude mandated "An organization method must be chosen to suit the computer hardware, the data characteristics, and use requirements of the data."[531] Worley and others pushed a compromise that embraced all uses of data within the agency within a self-conscious reassertion of the EPA's regulatory statute: computers in the EPA were part of a larger, interconnected system of data sources, processing hardware, users, and end constituents (the American public) unified by funding – a data network "planned with Federal assistance and implemented by Federal money." [532] If dataocracy of the 1950s and 1960s had funded itself through purchase of expensive computer installations to secure control over policy zones and their associated funds, the EPA of the 1970s recognized that

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[529] Office of Air Quality Planning and Standards, EPA, "Procedures for Flow and Auditing of Air Quality Data," (1974), p. 37. National Service Center for Environmental Publications.

[530] Donald Worley, "Improving the Utility of Environmental Systems," *ORD ADP Workshop, Proceedings No .2* (Washington: EPA, 1975), 121.

[531] "Data Systems Usage" document, (1975), p. 107National Service Center for Environmental Publications collection; Records of the Environmental Protection Agency, Record Group 412, Subseries 412.5.2 Records of the Office of the Administrator.

[532] Worley, 121.

federal dollars, particularly in a research and grant heavy realm such as environmental science and policy making, also accompanied particular strings of information. To a degree, the statistical bases of the EPA's operations self-funded, with specific scientific investigations garnering grant money or earmarked appropriations and data-driven assessments of regulatory violation yielding fines transmitted to government coffers.

By November of 1976, research scientist D. M. Cline of the Agency's Athens, Georgia, Environmental Research Laboratory articulated his colleagues' frustrations with reliance on other bureaus, agencies, and branches of government for access to the computers they required to engage in complex environmental modeling. Likening his agenda to President Nixon's call for energy independence during the Mideast Oil Crisis, Cline "proclaimed Project Independence for data processing capability . . . ."[533] If the EPA and its constituent laboratories and bureaus could just secure some degree of computing autonomy, this line of reasoning asserted, the agency could fulfil its most grandiose ambitions of comprehensive environmental monitoring, regulation, and policy analysis. Official Melvin L. Myers noted, "EPA will benefit from this trend . . . [of[recent breakthroughs in electronics technology" and suggested that "the technology which this represents shows every promise of bringing about the benefits that computers have been expected to deliver since their acceptance more than 20 years ago."[534]

Like the Bureau of the Budget two decades before, the EPA entered into computer adoption in the context of a Washington populated by institutional contemporaries with their

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[533] D. M. Cline, "Project Independence: Data Processing Capability," *Proceedings of the Second Annual ADP Conference* (Washington: EPA, 1977), 45.

[534] Melvin L. Myers, "Agency Needs and Federal Policy" document, National Service Center for Environmental Publications collection, p. 178; Records of the Environmental Protection Agency, Record Group 412, Subseries 412.5.2 Records of the Office of the Administrator.

own agendas for shaping the course of federal data processing. Dramatic transformations political, managerial, and technological had rendered that context entirely different from that in which the BOB had operated in the 1950s. The computer, and dataocracy, had evolved.

As one EPA staffer noted, the agency was operating from a position of "relative inexperience[e]" when it arranged in 1971 for the GSA to act as its "administrative and contracting agent in the procurement" of data processing equipment and services. With its traditional focus on efficient – and cost-defined -- procurement of equipment rather than on the end purposes for which the computer systems were being acquired, the GSA viewed EPA-requested systems as budget line-items, pressuring for lower cost alternatives when environmental science bureaus could not in clear fashion "absolutely justify certain capacity and speed requirements." Resultant purchases at times more closely resembled off-the-shelf payroll management or military procurement devices than the tools for complex environmental modeling anticipated by EPA scientists. Delays and setbacks plagued efforts to refine Agency vision into ill-suited data manipulation tools. A mid-1970s assessment of EPA information management concluded, "GSA modifications may be directly responsible for the throughput bottlenecks experienced after installation."[535] Such bottlenecks took the form of re-cording data from the existing IBM 360-50 system to the newly acquired UNIVAC 1110, a time- and labor-intensive task.[536]

As the decade progressed, the Agency more aggressively pushed for its own computing agenda – one that aligned with broader internal discussions of overall research and regulatory

[535] M. Steinacher, "UNIVAC 1110 Upgrade," *ORD ADP Workshop, Proceedings No. 2* (Washington: EPA, 1975), 181.

[536] Andrea Kelsey, Gene R. Lowrimore, and Jane Smith, "The Conversion of CHESS and Other Systems," in *Proceedings Number 1 of the OR&D ADP Workshop* (Washington, DC: EPA, 1975): 282-288.

mission. By 1974 and 1975, plans were underway for a "permanent" Washington Computer Center to return certain elements of Agency computing from the Research Triangle facility to closer proximity of top officials. Seeking "to avoid massive conversion problems," EPA officials sought to acquire particular brands and configurations of computer equipment in spite of the GSA's mandated "full competition policy" that typically awarded contracts to the most competitive bidder regardless of the destination agency's preference. The Brooks Bill-derived practice stemmed in part from the prior decade's proliferation of government offices dependent on a single vendor and the subsequent tendency "to place the Government at a great disadvantage in receiving price and service from that vendor."[537] EPA officials invoked a clause in the Brooks Bill, asserting that their agency's mission would suffer interference from strict adherence to GSA guidelines. [538] The two agencies brokered an agreement whereby "interim procurements" from EPA-specified vendors would be followed by reassessments, permitting conversion to a new computer organization on EPA terms. As one report noted, "EPA is allowed by GSA to do what it feels necessary."[539]

Economic quantification paired with detailed, data-driven evidence and elaborate computer-generated graphs became primary weapons when the Agency chose to press regulatory imperatives that might be at odds with the Commerce Department or White House domestic policy staff, particularly during the Nixon and Ford years. Deputy Administrator Alvin Alm was credited by mid-seventies Administrator Russell Train and others for success in marshalling the

[537] The textbook example being the 1960s relationship between IBM and the Social Security Administration.

[538] K. Byram, "Status of the Interim Data Center," *ORD ADP Workshop, Proceedings No. 2* (Washington: EPA, 1975): 185-6.

[539] "Summary of Discussion Period, Panel VI," *ORD ADP Workshop, Proceedings No. 2* (Washington: EPA, 1975), p. 189.

agency's data resources when engaged in turf battles with other federal entities, particularly the Department of Commerce over thorny questions of emissions regulations. As Train later recalled,

> A major factor we had going for us was good economic analysis. One of the most important things Al Alm did for us was to build a strong economic analysis capability. I think we had about the best in the government . . . As a result, when I would go into a meeting at the White House on auto emissions or other subjects, we always had better economic data than the other side. We even did better than the Department of Commerce. I always thought this fact was extremely influential in our successes."[540]

In framing its administrative fights in terms of comparative data sets and dueling computer models, the EPA selectively picked the battles it was most likely to win through overwhelming preponderance of quantifiable data. Reagan appointee Lee M. Thomas described the process of environmental regulation as "a science fiction chess game with a nine-dimensional board, independently motivated pieces, and rules that change arbitrarily."[541] Basing one's policy recommendations on solid computer data provided some semblance of fallback stability in such an arbitrary game.

A 1975 report from the EPA's National Environmental Research Center in Cincinnati exemplifies this approach, illustrating how EPA scientists and administrators could simultaneously consider models and computer simulations as comprehensive surveyors of the ecological and political parameters of natural resources and as mathematically neutral expressions of data capable of circumventing most explicitly political challenges. The research

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[540] R. Train Oral History Transcript, 1983; Records of the Environmental Protection Agency, Record Group 412, Subseries 412.5.2 Records of the Office of the Administrator., "Oral History folder."

[541] "Past, Present, and Future: An Interview with Lee. M. Thomas," *EPA Journal*, November 1985. Records of the Environmental Protection Agency, Record Group 412, Subseries 412.5.2 Records of the Office of the Administrator, "Press" folder.

center's director, A. W. Breidenbaugh inveighed on the necessity of protecting "man and his environment from the adverse effects of pesticides, radiation, noise, and other forms of pollution, and the unwise management of solid waste." Though each of those scourges stemmed from undeniable societal and institutional magnification, the Center's report framed the solution as an examination of the "interplay between the components of our physical environment – air, water, and the land." An interlaboratory method analysis of "paired sets of data," nicknamed SCAT, was intended to model complex and contextualized ecological interactions, but the research center's description of the process buried political calculations in mundane descriptions of aggregated statistics run in FORTRAN language on an IBM 1130 computer: "The main program, SCAT, utilizes 12 subroutines through which data were screened and edited by the removal of statistically rejected data, the pairing of two data vectors, the application of an arbitrary upper limit for plotting, and the plotting of data."[542] Chemical interactions, produced by tangible industrial processes, leeched into the environment in visible form, and generating real environmental consequences, are thus in this format broken down into mere numeric plotter points, results of mathematically neutral subroutines. To extend the chess metaphor invoked by Lee Thomas, EPA scientific administrators sought to bypass the politically-charged opening moves of the game by presenting their regulatory counterparts with reams of statistics suitable for policy definition that obscured their endgame. The EPA as chess player hoped to obscure the significance of moving its regulatory queen in range of a polluter's king by drawing attention to the algebraic notation of the move rather than the consequences. Throughout the 1970s, EPA

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[542] Elmo C. Julian, "Fortan Programs for Analyzing Collaborative Test Data Part II: Scatter Diagrams," EPA Methods Development and Quality Assurance Laboratory (April 1975), EPA document EPA-670/4-75-004b; Records of the Environmental Protection Agency, Record Group 412, Subseries 412.5.2 Records of the Office of the Administrator, "Data" folder.

officials expressed frustration that counterparts in other agencies missed the malleability of models to express broader environmental conditions beyond cost: "Economists don't know how to 'model' the quality of life."[543]

Even acknowledging its critics' most compelling charges took the form of a data-centric exercise for the Agency's public relations arm. Writing for the *EPA Journal* in January of 1979, Agency Administrator Douglas M. Castle conceded that environmental regulation had an economic cost: an analysis done for EPA by Data Resources, Inc., suggested the water and air pollution control programs administered by the agency would add an annual average of 0.3 percentage points of inflation to the consumer Price Index through the mid-1980s.[544] By the end of the 1970s, in an effort to improve the regulatory development process, the EPA subjected proposed new regulations, generally themselves the product of extensive modeling, to a model-like "regulatory analysis . . . studying the environmental, economic, and energy effects of each proposal and of alternative options."[545]

Issues of computers and data processing supplied a regular melody to the often tortured dance engaged in by the agency with its Congressional overseers. In 1974 the House Subcommittee on appropriations grilled EPA officials and members of the Council on Water Quality on the use of computers. Congressman Whitten of Mississippi complained, "This is a statement about computers that we hear a whole lot. Every time something goes wrong, it is because of the computer. Every time things go right, it is because of a person."[546] In testimony before Congress in 1978, C. H. Ward, the chairman of Rice University's environmental sciences

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[543] Douglas M. Costle, "The Benefits of a Cleaner Environment," *EPA Journal*, vol. 5, no. 1 (January 1979), p. 3
[544] Ibid, 4.
[545] William Drayton, "The Economy and Regulatory Reform," *EPA Journal*, vol. 5, no. 1 (January 1979), p. 11.
[546] "Agriculture – Environmental and Consumer Protection Appropriations for 1975," 93rd Congress , s2, p. 46.

department griped that despite expenditures on data collection of greater than $400 million by the EPA and related environmentally-focused federal agencies over the past five years, "the data obtained, much of which is excellent, have had little visible impact on decision-making and public policy."[547]

The agency fought back by protesting that its data had not found total acceptance in certain state and legislative circles because it was neither expansive enough in scope nor as widely interconnected as it might be with state and regional databases employed for environmental assessment. For the EPA, such limitations of access should not diminish the assumption that data could and did transform implementation of environmental policy.[548] As the summary of an agency study on transportation controls targeting at reducing vehicle emissions in Spokane in 1972 noted, accrued information should flow into the policy development process: "a framework upon which an optimum on-going program can be built as new data and techniques become available, as legal and political decisions are made, and as the assumptions as to future events are, or are not, validated."[549] In a 1976 report on automotive emission regulation, the agency asserted "we must rely on the empirical study [over contradictory qualitative policy analyses] . . . to determine the direction of the policy impact." A consultant commissioned by the Agency to study the question of whether stricter emissions standards for new automobiles (and accompanying higher new car prices) would only serve to prolong the lifespan of existing, less

[547] C. H. Ward statement, Hearing before the Subcommittee on the Environment and Atmosphere, Committee of Science and Technology, House of Representatives, 95th Congress, 1st Session, volume II, p. 34

[548] For more on the legacy of this attitude, see Nina R. Hardman, "Impact of the Data Quality Act on Decision-making at the Environmental Protection Agency," Master's Thesis, Virginia Polytechnic Institute and State University (April 2006).

[549] Fred Winkler, et al, "Transportation Controls to Reduce Motor Vehicle Emissions in Spokane, Washington," Environmental Protection Agency (December 1972), p. 12. National Service Center for Environmental Publications.

efficient vehicles, and thus negating emissions savings, argued that qualitative analysis alone "not possible to resolve [the] ambiguity" raised by conflicting energy and emissions policy goals.[550] Elaborate calculations such as those he performed would shape the Agency's deliberative process and effectively frame the proposed regulatory structure for tailpipe controls the EPA would present to Congress in the run-up to the 1977 Clean Air Act amendments. Tangible policy impact on the specification of parts automotive manufacturers stemmed from years-earlier thought exercises on how to quantify the relationship between auto prices and cost of burning hydrocarbons.

[1]If auto prices are stationary and the policy has been in effec for a "long time" then gas savings is proportional to

$$\left[-h(\delta P_a)\left[\sum_{j=1}^{m}\bar{f}_j\pi(P)\right]\sum_{i=0}^{n}\prod_{k=0}^{i}(1-\lambda_{i-k}(\delta P_a))\right.$$

$$\left.+\,h(P_a)\left[\sum_{j=1}^{m}\Pi_j(P)f_j\right]\sum_{i=0}^{n}\prod_{k=0}^{i}(1-\lambda_{i-k}(P_a))\right]$$

since $\delta > 1$ and $\left[\sum_{j=1}^{m}\Pi_j(P)f_j\right] < \left[\sum_{j=1}^{m}\Pi_j(P)f_j\right]$ this is a positive number.

[2] There are actually three different pollutants whose impact on air quality is studied in this report: hydrocarbons, carbon monoxide and oxides of nitrogen. We will procede (in this qualitative analysis) as though there were only one. However, if one reinterprets $e_{i,t}$ as an ordered triple of numbers, each one corresponding to emissions per mile of a particular pollutant by an age i vehicle manufactured in year t, we can carry through the same analysis for all three pollutant types simultaneously. Thus no loss of generality is incurred when we speak as though there were but one pollutant type.

An excerpt from 1976's Effects of Automotive Fuel Conservation Measures On Air Pollution

[550] Robin Landis, "The Effect of Automotive Fuel Conservation Measures on Air Pollution," (Washington: EPA, September 1976), 182.

The solution for the dilemma of high-quality computerized data not being considered as fully as a source of guidance by elected officials lay in further expansion of the computerized data system. Besides, it was implied, a closer reading of Ward's statement suggested that fault lay in large part not with the agency that generated substantial, computer-modulated data, but the lawmakers who at times seemed to favor traditional political imperatives over data simulations.

EPA regulators and scientists seemed so enthusiastic in their promotions of computer data systems precisely because they noted tangible successes in many of the ambitious systems programs the Agency authorized. Each instance of a computer corralling unwieldy data into a blueprint for additional research or regulation validated the faith EPA staffers placed in data systems. The 1972 Amendments to the Federal Water Pollution Control Act, for instance, mandated that by October 1973 the EPA "develop and issue . . . information" relating to the nature, extent, and potential control of "nonpoint" water pollution, the scattered, small-scale runoff from farms, dispersed urban and rural sanitation, small logging operations, and other individually miniscule sources that aggregated into as much as one-third of the nation's water pollution load. The agency successfully developed on a short time table data systems to aggregate observations collected from variegated pollutions sources and produce models to inform a policy statement (a formal "Administrator's Decision Statement") on subsurface fluid emplacement. A report on "significant accomplishments" associated with the project suggested the eight "informational reports" it generated would directly influence "a coordinated Federal/State/areawide approach to nonpoint [pollution] source control" and "[lay] the basis for subsequent full scale . . . control planning and action through problem assessment, defining technical and institutional remedial approaches."[551]

In the case of industrial atmospheric pollution, the awkwardly-titled Office of Air and Waste Management of Air Quality Planning and Standards, based at the Agency's Research Triangle computing facility, explicitly linked data evaluation and successful policy definition in a feedback loop. "Proper emission control strategy for a specific air pollution problem is dependent on an adequate assessment of the nature and extent of the pollution . . . and this information, in turn, directs the thrust of control efforts," the Office noted. Potential policy solution for controlling emissions generated based on the data could then be tested via "diffusion simulation model or other systemic, quantitative procedure to determine which strategies are capable of bringing about acceptable air quality" defined by legislative standards. The cycle would continue as the "measure of the effectiveness and success of the control program and could be used to indicate areas where program modification would be useful."[552] In the case of redefining emission standards, "maximum return on usable data" was seen both as a procedural success and a crucial element of successful policy outcomes.

Looking back on a decade's worth of regulatory actions under the 1972 revisions to the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), an EPA program evaluation document from the 1980s gave equal weight as "measures of success" to "number, promptness, success, and adequacy of enforcement actions," "adherence to output commitments" as measured

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[551] Environmental Protection Agency, *Justification of Appropriation Estimates for Committee on Appropriations, Fiscal Year 1975* (1974), National Service Center for Environmental Publications, p. AC 30.

[552] Environmental Protection Agency, "Guide for Compiling a Comprehensive Emission Inventory," Second Edition, (December 1974), National Service Center for Environmental Publications, p. 2.

by administrative systems, and “accuracy and timelines of compliance data entry.”[553] In outlining the origins of impressive regulatory accomplishments in the labeling of pesticides that following transfer of FIFRA jurisdiction from the Department of Agriculture to the EPA, Don R. Clay, the Assistant Administrator charged with overseeing pesticides and toxic chemicals, indicated resultant 1970s regulatory success was aided considerably by the Compliance Monitoring Staff’s two data processing systems, the Pesticide Enforcement Management System (PEMS) and the Establishment Registration Support System (ERSS).[554] Evaluating regulatory efficacy came down to linking achievements in the data models that informed regulation to compliance outcomes of the implemented policies. As he noted, “The Agency can best measure its success in achieving compliance when it has developed 1) an adequate data base for identifying members of the regulated community and 2) predictive models designed to select those members most likely to be in violation.”[555]

In testimony before Congress, an agency consultant predicated the success of environmental impact statements on the availability of federal regulatory officials to acquire and operate at full capacity the latest technology essential for making manageable an otherwise impossible task of environmental evaluation:[556]

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[553]“Compliance/Enforcement Strategy,” Don R. Clay memo to Alvin L. Alm, 22 Nov. 1983, p. 36. National Service Center for Environmental Publications. ecords of the Environmental Protection Agency, Record Group 412, Subseries 412.5.2 Records of the Office of the Administrator. “Compliance” folder.

[554] The two systems were merged in 1979 into an acronym of acronyms: FATES (FIFRA and TCSA Enforcement System).

[555] “Compliance/Enforcement Strategy,” Don R. Clay memo to Alvin L. Alm, 22 Nov. 1983, p. 36. National Service Center for Environmental Publications. Records of the Environmental Protection Agency, Record Group 412, Subseries 412.5.2 Records of the Office of the Administrator. “Compliance” folder.

[556] One reason why EPA officials and consultants were constantly re-describing their Agency’s technological bona fides before congressional overseers was the staggering overlap in committee oversight for the agency, based on the House and Senate’s then-antiquated organizational structure. Even modernization of committee structure did little to

> Under existing legislation, Federal agencies are required to evaluate the potential impact of their actions on the environment. However, reliable methods for impact assessment are not widely available to environmental programs. Such methodology generally involves the use of computer simulation or modeling. These techniques should be developed and adopted to give environmental quality information and data centers a 'predictive capability.[557]

In order to fulfill the basic obligations delegated to them by the President and Capitol Hill, it was argued, the newly established EPA would have to invest heavily in the technology, personnel, and organizational capacity necessary to support elaborate computer-generated models that predicted environmental outcomes (air pollution, rates of water contamination, radioactivity levels, pace of development or deforestation) based on mathematical extrapolations of current environmental collections, as gathered from field observations, technical reading devices, or accumulated statistics provided by federal bureaus charged with collecting statistics. Experts described the process to congressional overseers. As one scientist noted, assessment of the environment was a slow, "iterative process. One builds a mathematical model, generally computer-based, using physical-chemical principles."[558]

Crucial appropriation committee chairs bought into the argument, shoveling ever larger sums at the EPA in order to purchase new computers and expand existing information systems. As one representative who endorsed a digitized information exchange noted, "The field of environmental management is one where many important and weighty decisions are made daily.

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lessen the number of cooks in the Congressional kitchen. Thanks to committees that could claim natural resource, agricultural, commercial, water-based, or urban-based aspects of EPA's portfolio, by 1993, EPA answered to 13 Congressional committees and 26 subcommittees. Noted in Dennis C. Williams, *The Guardian*, p. 4.

[557] Roth hearing, cited in Hearings in Bills amending or related to the National Environmental Policy Act, H.R. 56, 19 November 1971, 1972, p. 88

[558] EPA DDP, cited in Hearing before Subcommittee of Committee on Appropriations, House of Representatives, 94th Congress, first session, vol. VI, p. 209.

These include decisions about legislation, regulations, guidelines, strategies, priorities, grants, plans, permits, standards, and criteria. To make these decisions wisely requires sound information."[559] Michigan Congressmen John Dingell summarized the pro-systems stance by explaining why a multimillion dollar, nation-wide network of digitized pollution-collection stations linked to elaborate computer data banks would be of merit despite the cost: "It seeks to provide a device for evaluating so that useful stuff comes from it."[560]

Similarly, as the Council on Environmental Quality conceded in its 1972 annual report, technological capacity and instructional structure were inseparable for such a delicate task. The EPA must become a data-centric agency. Only by better sorting of scientific knowledge could effective regulation emerge:

> We must develop the institutional mechanisms capable of making technology assessments. The environmental impact statement process under the National Environmental Policy Act and the advanced testing requirements in the proposed Toxic Substances Control Act are two examples of such institutional mechanisms. A variety of other mechanisms exist, but their effectiveness in examining secondary and tertiary effects must be improved, and the knowledge this brings must be better used.[561]

Based on early successes with both the Council and Congress, the EPA submitted progressively more assertive (albeit simply-worded) budget requests for computers, systems training, consulting fees, and rented computer time, using the lens of data: "The Environmental Protection Agency has undertaken a broad study of its environmental data requirements and of

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[559] Lyon, quoted in Subcommittee on Environment and Atmosphere, Committee on Science and Technology, House of Representatives, 95th Congress, second session, vol. II, p. 122.

[560] J. Dingell, Hearing I on H.R. 56, S. 1216 and S. 681, 19 November 1971,, p. 63

[561] 3 Environmental Quality: Annual Report of the Council on Environmental Quality 344 (1972); "Environment, 1972 - A Perspective," 344-5.

its existing monitoring systems. EPA hopes to develop an integrated system to provide data required for pollution control."[562]

For Stanley Greenfield, the EPA's Assistant Administrator for Research and Development, the agency's mission was one of organization-building rooted in expert-driven analysis: "We should build the capacity to assess the impact of man's actions and provide the institutions to take the necessary steps."[563] Computers were central to an environmental strategy of "understanding the problem sufficiently to allow us to state our goals for the future, and decide on optimum strategies for their achievement." Even advocacy groups, like Businessmen for the Public Interest, heartily endorsed this approach: "Government will require more, not less, data – much of it about individuals – in order to plan for the future of our cities, and for writing other constructive social and environmental legislation."[564]

By the late 1970s, the agency estimated that one-fourth of its 1600 management-oriented employees were in some form or fashion "computer professionals"; according to agency training manuals, the other "non-ADP employees" were routinely exposed to a network of "large IBM and UNIVAC computer complexes, 130 general purpose and process control minicomputers, and more than 300 terminals."[565]

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[562] 2 Environmental Quality: Annual Report of the Council on Environmental Quality 211 (1971); "Status and Trends," p. 211. Records of the Environmental Protection Agency, Record Group 412, Subseries 412.5.2 Records of the Office of the Administrator. "EQ" folder.

[563] S. Greenfield Speech, 26 September 1973, p. 2; ecords of the Environmental Protection Agency, Record Group 412, Subseries 412.5.2 Records of the Office of the Administrator. "Compliance" folder, "Speeches" folder

[564] Hearing, Senate Judiciary Committee, Thursday, Feb. 25, 1971, p. 587.

[565] *Training Guide*, EPA Management Information and Data System Division, July 1977, p. 2. Records of the Environmental Protection Agency, Record Group 412, Subseries 412.5.2 Records of the Office of the Administrator. "Training" folder.

As an ad hoc committee on employee training concluded in 1976, "The diversity of automation and data processing activities within EPA make it extremely important that employees are informed of the ADP capabilities of the Agency and are trained to make optimum use of these facilities."[566] How agency employees ultimately made use of those technologies in the service of environmental regulation reflects a fascinating tension between the EPA's statutory mandate and the political reality of an environmental sphere constrained by a series of conservative presidents, fickle legislators, and entrenched industrial interests. Beset by special interests and a public still uncertain as to the economic and policy tradeoffs acceptable for enhanced environmental quality, EPA administrators such as Train committed themselves to a regime of flexibility: "I believe we should avoid rigidity and inflexibility in the choices we offer."[567] An approach that favored regulatory battles deemed as "winnable" based on weight of computer models might have engendered fewer losses in open court but appeared to many – particularly environmental activists and Congressmen weary of "risk management" justifications" -- to pass on acceptable chances to press the boundaries of environmental oversight. Even the Agency's own commissioned histories acknowledge its early years as a series of "acceptable compromises . . . seldom satisfactory to everyone. . . "[568]

Models were chosen as the basis of much of proposed agency policy "because they were thought to represent a reasonably complete spectrum" – an achievable middle path. [569] The

566 Ibid, 2.

567 R. Train speech, (Aug. 1973), p. 3. Records of the Environmental Protection Agency, Record Group 412, Subseries 412.5.2 Records of the Office of the Administrator. "R. Train – Speeches 3" folder.

568 Dennis C. Williams, *The Guardian: EPA's Formative Years, 1970-1973,* September 1973.

569 3 Environmental Quality: Annual Report of the Council on Environmental Quality 284 (1972); "The Costs and Economic Impacts of Environmental Improvement," 284. Records of the Environmental Protection Agency, Record Group 412, Subseries 412.5.2 Records of the Office of the Administrator, "EQ Reports" folder.

goals of regulation, in the words of one official, should be “rational, sensible, and timely.”[570] Keen awareness for shifting political currents meant that EPA administrative systems, like all federal agency systems during the era of dataocracy, were compromised from inception by the inclusion (sometimes unconsciously, but typically on purpose) of inputted data calculated to avoid certain controversial political outcomes. Not only was environmental data used to define the limits of regulations before they were implemented, but political scientists were contracted to examine data indicating efficacy of regulations once in effect. A supposedly purely impartial collection of data banks reflected instead the political agency of the bosses of those who programmed the machines. What could have been an esoteric, purely ecological argument on the merits of select environmental policies was in large part driven by interpretation of analyzed data that the majority of involved parties agreed to pretend was neutral and apolitical. In the mid-1970s, even as the agency faced pressure from commercial interests and the White House to contribute findings supporting greater national energy self-sufficiency, EPA research responded to public anxiety over nuclear power and the health effects of radiation. The agency’s radiation research and modeling provided the “information for standards setting and regulatory actions” while explicitly fostering “acceleration of research on the health and ecological implications of new and advanced energy production techniques. . . .”[571] The implication expressed in one 1975 Agency document that “improved sampling, analytical, data handling, and quality assurance methodologies” would “produce the scientific information and technical tools on which to base guidelines, standards, and strategies to control environmental pollution” masked the deliberate

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[570] EPA memo, 1975, p. 40; Records of the Environmental Protection Agency, Record Group 412, Subseries 412.5.2 Records of the Office of the Administrator, Systems Box, folder 4565

[571] Ibid, 43.

choices about what sorts of data to emphasize when categorizing radiation as pollution.[572] A decision to emphasize modeling of "the probabilities and potential consequences of accidental release of radioactive material" in the agency's investigations of proposed plutonium-using Liquid Metal Fast Breeder nuclear reactors in 1973 and 1974 contributed to very really policy reevaluations of that project and a reshaping of mid-1970s American energy policy. The Atomic Energy Commission in March 1974 had endorsed the liquid metal fast breeder reactor model as a low-environmental impact, high-cost return method for meeting the nation's energy needs; the EPA indicated its models suggested further study on the radiation release potential of that class of reactors would be required while raising concerns about the environmental and public health risks of plutonium as a basis for energy strategy. Though not the deciding factor, the EPA's reticence – motivated by environmental concerns and articulated through neutral language noting the AEC's "statement was not sufficiently quantitative" – contributed to a broader political backlash against the reactor project.[573]

An example of this tendency arose in the late 1970s when EPA officials decided, over the vociferous objections of environmentalist groups, to exempt from Clean Air Act requirements particulate pollution dust resulting from strip mining operations. While citing the isolated location and generally short airborne trajectory of mine dust particles as rationales for the ruling, agency officials leaned most heavily on a model-based justification for the

[572] Ibid, 40.

[573] EPA, "EPA Review of Radiation Protection Activities - 1974: A Prototype for Subsequent Annual Reports" (1975), p. 32, National Service Center for Environmental Publications; EPA, "Radiation Protection Activities: 1975," (1975), p. 120, National Service Center for Environmental Publications; EPA, "The Environmental Protection Agency: Legislation, Programs and Organization," (1975), p. 32; National Service Center for Environmental Publications; Leland Johnson and Daniel Schaffer, "Chapter 6: Responding to Social Needs," *Oak Ridge National Laboratory Review*, vol. 25, nos. 3 and 4 (1992), 147-177.

controversial decision. As one newspaper noted, “spokesmen for the agency said that computer techniques for understanding how fugitive dust travels are currently inadequate. It would be difficult to sort out, from a monitoring standpoint, what dust comes from a mine and what blows up naturally . . . .” Strip mine operators would be subject to less stringent dust control practices “until better computer models are available . . . .”[574] Opponents saw regulatory capture and an agency bowing to powerful mining interests even as it insisted its decisions were guided by interest-free computer models.

Other critics rebuked the agency for not embracing enhanced data collection as the solution to perceived short fallings of computer models. The Committee on National Statistics of the Assembly of Mathematical and Physical Sciences issued a report in response to the EPA’s ruling that urged the agency to “avoid premature fixed commitments and invest in prototype examples and research to improve monitoring.” Rather than react to atmospheric particle counts by wringing hands over indeterminate models, the committee asserted, regulatory bodies should obtain “data before the predicted pollution occurred was recognized,” aggressively accumulating and processing environmental data from a range of locales. Only constant data accumulation sufficient to yield a base for comparison could lead to effective models capable to determining degree of pollution. “Given the complexity of the environment,” the report continued,” it is not likely that a single monitoring strategy will be satisfactory for all places at all times.”[575] Only aggregating vast quantities of data could yield an accurate base for models, and thus a viable snapshot of the environment. For these critics, the EPA’s fidelity to the concept of computer modeling as a basis for regulatory suggestions was tainted by top-down political pressures that

[574] Sandra Blakeslee, “Strip Mine Debate Kicks Up Dust,” *Los Angeles Times* (3 Dec. 1978), p. B1.

[575] “Environmental Monitoring,” Report of the Study Group on Environmental Monitoring, Committee on National Statistics, Environmental Studies Board, Numerical Data Advisory Board, (1978), 240-241.

obscured truly neutral results that would stem directly from enhanced data collection. Their assessment may have been correct, as two years later, in the midst of pervasive acid rain and the pressure of Rust Belt mayors and governors, the agency rendered a strict limitation on sulfur dioxide emissions of two Ohio coal power planets "arrived at by a refiguring of the computer models. . . ."[576]

Those who routinely dealt with the environmental regulatory agency doubtlessly recognized this dynamic; yet public descriptions of the tendency typically downplayed its ubiquity and impact. According Kenneth Hampton, Deputy Conservation Director for the National Wildlife Federation, in the 1970s, "Occasionally, it appears that monitoring data may be unwittingly or unwittingly shaped to fit some particular regulatory policy or other."[577] Others reflected on the irony of resigned remarks by frustrated systems analyst Robert White: "Sometimes one feels that data management has come to mean all things to all people. It's becoming one of those convenient catchall terms like 'the environment'."[578]

The ubiquity of electronic computers in executive branch agencies by the mid-1970s was difficult to miss. Though not every bureau or office in the branch had adopted use of the devices by the bicentennial year, some 15,000 employees directly operated approximately 10,000 computers at 1,200 sites, at an estimated cost of $4 billion dollars.[579] The EPA reflected its context.

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[576] Joanne Omang, "2 Plants told to Cut Emmissions Causing Acid Rain," *Washington Post* (18 June 1980), p. A14.

[577] "Statement of Kenneth R. Hampton (1974), 54; Records of the Environmental Protection Agency, Record Group 412, Subseries 412.5.2 Records of the Office of the Administrator, "Public Statements" folder.

[578] Robert White, "Geophysical Data Management – Why? And How?" *Computers and Automation*, 1 April 1969, p. 20.

[579] Haider, Donald. "Presidential Management Initiatives: A Ford Legacy to Executive Management Improvement." *Public Administration Review* 39, no. 3 (1979): 253.

Data and Models

Questions of managing and interpreting data had dogged the emerging environmental regulatory community in the years before the establishment of the EPA. As former Interior Secretary Stu Udall noted, "As a former Cabinet officer who had . . . the major responsibility in environmental matters, one of the things that was always confronting you was not only the complexity of environmental problems, but the great mass of data that was available and the failure even in a department such as my own – the difficulty, simply, of bringing the data, the information together in an organized, rational way. . ."[580] As early as the Kennedy Administration a congressional panel investigation pollution had called for a national survey agency capable of organizing in some comprehensive fashion relevant statistical facts, scientific findings, and citizen responses related to concerns over environmental quality. [581]

Scientists coming into the newly formed agency in December 1970 frequently concurred that among the EPA's primary tasks would be effective meshing together in some systematic fashion an array of useful but disparate environmental quality findings gather by the agency's constituent bureaus during their former lives in the Departments of Agriculture, Health-Education-Welfare, and Commerce: "We agree that the application of new statistical methodologies to the unique characteristics of environmental problems – large amounts of data

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[580] Udall cited in Hearings before House Subcommittee on Fisheries and Wildlife Conservation, June 2, 1970, p. 254; copy in Records of the Environmental Protection Agency, Record Group 412, Subseries 412.5.2 Records of the Office of the Administrator; "Hearings-1970" folder.

[581] George Hegevik, Environmental Monitoring Hearings, House Committee on Science and Technology, 95^{th} Congress, second session, 1978, p. 118; copy in Records of the Environmental Protection Agency, Record Group 412, Subseries 412.5.2 Records of the Office of the Administrator, "Hearings 1978" folder.

on environmental quality variables that vary both in time and space and complex health-related variables – has been a greatly neglected area of study."[582]

EPA's credibility and scientific authority would come in large part from its status as an effective collector of data, which then might be impartially analyzed to produce effective understandings of future environmental behavior (and from those, generate reasonable regulatory policies and pollution enforcement standards). Data, and the promise of computer-generated models, took center stage. Not just limited to questions of "air quality management, air and water pollutant transport process, water runoff, water supply. [and] solid wastes . . ," environmental models increasingly addressed more subjective categories of "environmental management and planning, environmental economics, environmental statistics, ecology, noise, radiation, and health." [583] Resultant data was the primary justification for the elaborate environmental observation devices and stations the agency maintained. As one water quality scientist observed, "It is only through the use of computer technology that EPA scientists will be able to fully exploit the outposts of remote sensors and realize their potential in the area of environmental monitoring."[584] EPA employees took particular pride in the regulatory consequences that resulted from their carefully gathered and processed reels of environmental information. One proclaimed, "EPA data systems accomplish more than just storage of data."[585]

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[582] Data Report, 2 June 1976, Records of the Environmental Protection Agency, Record Group 412, Subseries 412.5.2 Records of the Office of the Administrator; folder N4352.

[583] 1975 memo, H folder, Records of the Environmental Protection Agency, Record Group 412, Subseries 412.5.2 Records of the Office of the Administrator, folder H-4563

[584] J. Koutsandreas, "Automatic Data Processing Requirements in Remote Monitoring," p. 151.

[585] "Data Systems Usage" document, National Service Center for Environmental Publications collection, p. 103. Records of the Environmental Protection Agency, Record Group 412, Subseries 412.5.2 Records of the Office of the Administrator; "Data" folder.

The computing complex that supported the rise of dataocracy at other civilian federal agencies facilitated the establishment of a normalized computing culture at the new agency. The EPA would find many willing partners in the 1970s and 1980s to assist with its agenda of constructing and using elaborate computer systems, from think tanks and consulting firms to university research institutes and military training programs eager to share their latest information management innovations. Scientists – within the government, in federally-supported research universities, and as affiliates of increasingly active non-profit environmental advocacy groups – expressed great favorability towards this approach. The journal *Bioscience* editorialized,

> The computer now affords a method for the analysis and projection of complex ecological data. It may afford an invaluable means of simulating multivariable, slow-moving ecological processes at highly accelerated rates. If the predictive value of ecology can in this way be increased, its operational utility will correspondingly be heightened. . . New types of instruments are being developed that may have unforeseen potential as tools of environmental research and administration [586]

Writing in the *Bulletin of the Ecological Society of America*, Congressman George P. Miller laid out a vision of international scientific cooperation predicated on experimenting with a computerized, cybernetic approach:

> . . . the deep and detailed relations between pollution and production may not emerge from the elegant system analyses designed by the IBP scientists. On the other hand, the need for understanding is crucial enough to make it worth a try. If ecology isn't ready for the computer age – if the mathematical models don't really tell us how our great ecosystems operate – then we shall simply have to go back to the drawing boards as we have done so many times before.[587]

[586] *Biosence clipping* (June 1976), 526. Records of the Environmental Protection Agency, Record Group 412, Subseries 412.5.2 Records of the Office of the Administrator; "Bioscience" folder.

[587] Miller, "The Nation Needs the International Biological Program," *Bulletin of the Ecological Society of America*

From the agency's earliest years it sponsored regular "Conferences on Environmental Modeling and Simulation" [588]. One such gathering, giddily noted Wayne R. Ott, head of the Agency's Monitoring Technology Division, featured over 164 "state of the art mathematical and statistical models in the air, water, and land environments."[589] Symposium abstracts regularly touted conclusions such as this: "Finally, concepts and techniques associated with cybernetics, information science, and computer technology provide improved tools for environmental management and facilitate the handling of comprehensive, complex data across traditional jurisdictional and disciplinary lines."[590] High level EPA officials were active participants in AMAOG, the Agency Management Analysis Officers Group. This interest group for executive branch officials with an interest in applying the latest systems management and computerized analysis techniques to federal administration met weekly (typically at the favorite haunt of DC's systems analysts, Blackie's House of Beef at 22nd and M Streets).[591] Top level brass, including assistant administrators, division directors, and central management staffs were encouraged to

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[588]Program, Records of the Environmental Protection Agency, Record Group 412, Subseries 412.5.2 Records of the Office of the Administrator; Conferences folder- N4562.

[589] Letter, Conferences folder, Records of the Environmental Protection Agency, Record Group 412, Subseries 412.5.2 Records of the Office of the Administrator; Conferences folder- N4562.

[590] *A Symposium Environmental Policy: New Directions in Federal Action*. Records of the Environmental Protection Agency, Record Group 412, Subseries 412.5.2 Records of the Office of the Administrator; Conferences folder- N4562.

[591] A typical agenda was that of 6 September 1974, which featured both a discussion led by James E. Spates, of the Army's Harry Diamond Laboratories," on the RESFLEX system, billed as "the single most important management innovation instituted into the Federal work system in the last decade," and a menu choice of steamship round of beef or top sirloin for $4.50. AMAOG memo, 6 September 1974, . Records of the Office of Management and Budget, Record Group 51, Series 51.8.1 Records of the Director's Office, Subject Files of the Director, "AMAOG" folder.

make active use of management information systems. According to one internal document, “Funds for supporting their ADP activities are substantial.”[592]

Training sessions in systems management techniques, information guided executive management practices, and fundamentals of data processing and management were offered on a regular contract basis to EPA mid-level and officials by some familiar faces in the Washington computing complex, including the Army Management Engineering Training Agency, the Department of Defense Computer Institute, and private firms like Sperry Univac, MRI Corporation, and the Computer Network Corporation.[593] Regional data consulting firms latched onto the prospects of the EPA’s unquenchable information appetite. For instance, Computer Data Systems, Inc., founded in Rockville, Maryland, in 1968, was one of a number of Washington-area data systems firms to latch onto the promise of environmentally-focused computing. By 1972 the firm had a renewable contract with the EPA. The agency routinely called on outside experts in systems management, such as professors from Harvard Business School, to participate in its “Five Year EDP Plan” committees.[594]

Even the basic “task” of appraisal of environmental status as described in routine agency documents was couched in the language of electronic systems: “Relying heavily on upon data

[592] *Training Guide*, EPA Management Information and Data System Division, July 1977, p. 5 Records of the Environmental Protection Agency, Record Group 412, Subseries 412.5.2 Records of the Office of the Administrator “EPA loose files” folder.

[593] *Training Guide*, EPA Management Information and Data System Division, July 1977, p. 67. Records of the Environmental Protection Agency, Record Group 412, Subseries 412.5.2 Records of the Office of the Administrator.

[594] Richard Nolan to Michael Springer, 11 November 1974, Records of the Environmental Protection Agency, Record Group 412, Subseries 412.5.2 Records of the Office of the Administrator, “Management Information and Data Systems” folder.

and information produced in the technological assessment . . . ."[595] Though EPA internal documents acknowledged that project managers, data technicians, and scientists engaged in "data analysis, mathematical modeling, laboratory automation, and other scientific computing applications" were the most likely agency personnel to regularly encounter electronic computers, they expansively concluded that any agency employees who were "responsible for providing input data to national and regional data bases" or who in some fashion encountered "output from data base systems in carrying out program act ivies and missions" should be labeled "data system users."[596] John Diebold suggested environmental data presented in these terms had a special appeal for policymakers:

> The engineer is also more likely to define his problem explicitly as a system, or at least attempt such an explicit definition. Such formal outlines of scope have obvious appeal to a pragmatic policy maker. The engineer is almost always familiar with numerical analysis and computer technology as research tools -- capabilities missing from the tool kits of most ecologists over 35. . . it should be clear that the approaches of engineers to environmental problems are catching on for compelling reasons.[597]

As scholars have noted, the EPA by the mid-1970s largely became a "Cancer-busting" agency, devoted to framing regulatory control of carcinogenic substances in a public health light.[598] Yet even this stance was fraught with internal angst among environmental scientists over how precise data need be.[599] "Data processing" had long been part of the cancer-fighting

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[595] National Commission on Water Quality, Fiscal Year 1975 Budget Justification, p. 4; Records of the Environmental Protection Agency, Record Group 412, Subseries 412.5.2 Records of the Office of the Administrator; "1975 budget folder."

[596] *Training Guide*, EPA Management Information and Data System Division, July 1977, p. 5. NARA RG 412.

[597] Diebold clipping; Records of the Environmental Protection Agency, Record Group 412, Subseries 412.5.2 Records of the Office of the Administrator; "Clippings folder."

[598] E. Russell, "Lost Among the Parts per Billion: Ecological Protection at the United States Environmental Protection Agency, 1970-1993," *Environmental History* 2 (January 1997): 34.

[599] *Food and Cosmetics Toxicology*, 1980, Vol.18(6): 711-734.

scientific regime. In fiscal year 1969 the National Cancer Institute numbered “data processing” as one of the fundamental categories – along with “testing laboratories” and “pharmaceutical manufacturers” – for which external businesses could compete for some of its over 120 contracts.[600] A major part of the appeal of computer models lay in their promise of their eventual certainty, if enough input could be obtained and enough simulation permutations run. C. V. Lyle, Chief Economist for the Federal Water Quality Administration in January 1971 conceded that “much of the data we use as factual are actually out of date before becoming available . . . about all we can be reasonably certain of is that which we can see.” Despite this acknowledgement of the compelling claim of observationists over modelers, he argued that true planning required modeling: “It is patently impossible to plan without some form of projection.”[601]

To frame the circumstances in a field-relevant pun, by the early 1970s an entire ecosystem had sprung up supporting evolutionary growth in several species of environmental regulatory bodies. Private consulting firms, systems-focused trade groups, and University research labs sold their services and devised ever more intricate computer-based models for tracking environmental change, analyzing that change over time, and projecting those findings into predictive simulations. *Ecological Modeling* soon became an established industry journal alongside *Environmental Impact Assessment Review*. Data became the public face of environmental awareness as embodied by the EPA. Using EPA disseminated data, scientists at UC-Riverside’s Air Pollution Research Center spent fourteen months crafting detailed computer models illustrating daily migrations of smog across greater Los Angeles; images derived from

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[600] House hearing, Y4.Ap6/1:L11/970/pt.4, p. 55.

[601] C. V. Lyle, cited in “Proposal for Meeting the Basic Requirements for Resource Planning,” Federal Water Quality Administration, January 1971, p.4. Records of the Environmental Protection Agency, Record Group 412, Subseries 412.5.2 Records of the Office of the Administrator. “Water Resources” folder.

the results were splashed across the Los Angeles Times, generating considerable discussion among southern Californians eager to have expert-produced scientific visualization of the hazy clouds they encountered on a daily basis.[602]

The agency's prudent (or in the eyes of some, overly cautious) tradition of balancing proposed environmental regulations against modeled economic costs and benefits remained both a feature and justification of the organization's advanced modeling techniques. In countless speeches, EPA officials evidenced a clear preference for a data collection and dissemination policies that "internalized" environmental/economic costs of development within existing private market frameworks: "They make it unnecessary to make arbitrary judgments about which activities should be allowed to continue to grow and which should not; they encourage the development of pollution control technology by the polluting industry itself . . . and they will more directly solve existing environmental problems rather than merely trying to prevent hypothetical future ones."[603] As some contemporary observers noted, use of computer-guided environmental modeling could provide a serendipitous understanding of the natural world, where "systems techniques reveal previously undetected mechanisms or interactions that have a bearing on the degree and kind of environmental control."[604] Referencing the discovery of "pH mediated release of phosphorous from the sediments of the Potomac estuary," one observer asserted that "if systems techniques on occasion indicate such serendipitous results then indeed it is worthwhile to use such techniques in the decision-making process."

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[602] John Dreyfuss, "Computer Maps Help Clear Air in Smog War." *Los Angeles Times,* Jul 11, 1971, p. B1.

[603] S. Greenfield Speech, 26 September 1973, p. 8. Records of the Environmental Protection Agency, Record Group 412, Subseries 412.5.2 Records of the Office of the Administrator. "speeches – 1973" folder.

[604] Robert V. Thomann, "Systems Analysis in Water Quality Management – A 25 Year Retrospect", in *Systems Analysis in Water Quality Management,* M. B. Beck, ed. (Oxford: Pergamon Press, 1987), p. 9.

Willingness to rely on the seeming impartiality of computer-generated data helped shield the EPA in part from external criticisms of ineffectiveness leveled against it; willingness to share its data and incorporate findings and models developed by other organizations helped shield it from potentially more damaging accusations of “regulatory capture” by industry trade groups with large economic stakes in the development of pollution standards. The Agency in the early 1970s, for instance, supplied significant grant funding through the New York-based Coordinating Research Council, a research institute jointly supported by the EPA, the American Petroleum Institute, and the Society of Automotive Engineers. Council funds provided the primary support for the 1971 development at the Stanford Research Laboratory of the computer-derived, mathematical formula used to more effectively calculate carbon monoxide concentrations in air quality samples. By sharing information with the agency, trade groups with vested interests in pollution regulation could partially mitigate the effects of eventual EPA policy by shaping the nature of input used in the complex brew of chemical analysis, traffic-pattern calculation, demographic adjustment, weather-pattern calibration, and industrial density variations that fed the Stanford model. [605] Helping to pay for elaborate St. Louis test studies of the model – “a kind of climatology of air pollution” in the words of one researcher – would almost certainly pay dividends across the country for energy concerns and automotive manufacturers completely cognizant of the data used to shape EPA regulation.

Such modified “regulatory capture” could occur within the federal government as well. A *Time* magazine reporter expressed awe in the mid-1980s at the diligence with which Reagan era-Interior Secretary James Watt asserted his agency over the EPA by pursuing ever more esoteric

[605] Sandra Blakeslee, "Stanford Formula Aids Pollution Fight." *New York Times*, Oct 24, 1971, p. S27.

data to feed into the tape reels of his data processing array: "Above all, Watt is determined to get better data for his computers. . . . With fuller data, Watt's computer models will give scientists and politicians the information they need to plan intelligently and realistically." The agency head confirmed his organization's preoccupation with the business of determining how to assess reams of collected environmental data, stating, "One problem is that things we desperately need to measure haven't ever been measured."[606]

External experts in information systems and data management promoted this notion in testimony before Congress, in the press, and in private discussions with Washington movers and shakers. Professor Dan Slotnick, head of the University of Illinois's nationally-regarded Center for Advanced Computation, regularly asserted the necessity of a national, interconnected databank for processing environmental information and fueling advanced environmental computer models. For issues ranging from air pollution to climate studies, "the only way this can properly really be done is through an appropriate computer study relating data with regard . . . to the levels of different pollutants in the air."[607] The greatest danger lay in leaving uncollected and unanalyzed the reams of potential data computers could harvest from the environment; greater environmental degradation might occur unless federal environmental agencies could expansively collect and quickly analyze with the latest electronic computers frequent changes in air, water, and soil quality. Queried by a congressman as to whether or not computerized systems "provide the best way for sorting out the bad information we have on the environment, and holding in the

[606] *Time,* "Model Man" article, vol. 95, issue 18.,1970.

[607] Slotnick transcript, House Merchant Marine and Fisheries Hearing, June 25-6, 1970, p. 231. Copy found in Records of the Environmental Protection Agency, Record Group 412, Subseries 412.5.2 Records of the Office of the Administrator. "Hearings" folder.

good," Slotnick affirmed, "It is in fact the only way. . . I am not saying that there are other, better means. There are, in fact, none."[608]

Computerized data models did more than simply shape institutional culture, as crucial as that element was for promotion of systems techniques within the bureaucratic infrastructure of environmental regulation. Decisions to employ computers for certain tasks or to rely for administrative guidance on computer models that had been generated with certain assumptions could lead to very real policy outcomes that might have substantially differed had a simulation been programmed in an alternate fashion or had another technique been chosen as the basis for a policy determination. Just as with social security, sometimes policy definitions were limited by computer capacity, as with the case of early air pollutant simulations that could only calculate ten days' worth of atmospheric movement.[609] Computer calculating capacity lead to the framing of environmental studies in particular fashion, which seeped into administrative protocols and internal correspondence, gradually and without any apparent intent leading to ten-day intervals becoming increasingly preferred as standard temporal units for pollution evaluation, inter-bureau assessment of pollution data, etc.

Just as the Bureau of the Budget had recognized two decades earlier that control of information granted authority and entrée to power in a closed federal system, the Environmental Protection Agency became a purveyor of institutional authority in the form of quantifiable data suitable for budget projections, regulatory proposals, or policy analysis reports. Unlike the BOB, which sought to centralize and hoard expertise, the EPA embraced open protocols of information

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[608] Ibid, 237

[609] "An Analytical Diffusion Model for Long Distance Transport of Air Pollutants" Records of the Environmental Protection Agency, Record Group 412, Subseries 412.5.2 Records of the Office of the Administrator, "Air" folder.

sharing, in part to distribute away from its central leadership any extreme risk inherent in the projections prepared with such data.

True value lay neither in the actual expensive mainframe computers nor even the highly-salaried systems analysts and expert technical administrators who shuttled information and information-derived policy prescriptions back and forth between scientists and bureaucrats, though both were essential to the entire project's operation. The secret to EPA's political value – and thus its capacity to fend off critics, draw appropriations, and continue to exist – lay in its ability to generate, modify, and transfer data on a large scale; the meticulously assembled environmental data and the complex computer formulae that transmitted such data into models suitable for policy recommendations were valuable precisely because they existed in a massive shared space with other such data and models, capable of providing authoritative justification for particular environmental policy decisions with very real economic, political, and public health consequences. As keen observer of information-systems reality Dan Slotnick testified to Congress regarding EPA hardware expenditures, "The computer costs are probably moderate over the long term with comparison to the data collection cost. That is, the data would cost more money than the equipment which stored the data and made it accessible."[610]

The Council on Environmental Quality officially called for erection of a national data center to streamline the process of collecting and aggregating environmental information, arguing that the difficulty inherent in attempting to quantify as many elements of the environment as possible accentuated the likely benefits to accrue from such a database. In their words,

> All of these difficulties do not lessen the vital need to collect and analyze environmental data. Without valid data we cannot accurately determine the most important problems or

[610] Slotnick testimony, 226-227.

> the most cost-effective methods of attacking them. Nor can we evaluate the success of efforts to correct problems. Monitoring is not a substitute for action. But in the long run, action without the knowledge provided by adequate monitoring is likely to be ineffective. . . . This is only one step in an evolving program. The goal is to be able to paint an accurate picture of the status and trends of the nation's environment. To do that will necessitate deciding upon adequate indicators of environmental quality, determining and evaluating specific data requirements, and improving data collection methods. [611]

Firebrand systems consultant Slotnick framed it even more succinctly in testimony to a house subcommittee: "The data are buried in file cabinets, buried in people's drawers, buried in computer systems to which nobody else has access. This must be changed. We need the data."[612]

***E. Pluribus Datum*: Environmental Computing and New Federalism**

Just as the press for environmental legislation in the United States Congress in the 1960s and 1970s was frequently abetted by legislators with strong regional identities – such as Maine's Edmund Muskie, father of the 1970 Clean Air Extension Act – the institutional formation of the EPA as an agency in the 1970s and 1980s would be shaped in part by new approaches to federal-state relations that gained credence during the Nixon, Ford, and Carter administrations. [613] The New Federalist school of thought broadly sought to devolve certain responsibilities for domestic and social program administration to state and local authorities while retaining a degree of control for federal administrators through the stick/carrot device of funding competitions. The most frequently employed format was the block grant, wherein a sizeable chunk of money (for

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[611] 2 Environmental Quality: Annual Report of the Council on Environmental Quality (1971) ; "Status and Trends," p. 211. Included in Records of the Environmental Protection Agency, Record Group 412, Subseries 412.5.2 Records of the Office of the Administrator, "EQ Folder 3."

[612] Slotnick testimony, 226.

[613] For more on Nixonian federalism, see Dwight Ink, "Nixon's Version of Reinventing Government," Timothy J. Conlan, "The Politics of Block Grants: From Nixon to Reagan," and *New Federalism from Nixon to Reagan*.

welfare payments, education improvement, environmental cleanup, etc.) would be allocated to a state or municipality on the basis of elaborate, data-driven applications. The program's origins lay in Johnson-era Great Society fund disbursements, but during the 1970s achieved unparalleled heights of complexity.

For many within the agency, the ascension of digital technology presaged a welcome decentralization of regulatory focus. As Deputy Commissioner Alvin Alm noted, "EPA is going to have to decentralize in some creative ways. For instance, we have technology, through geographical information systems, to plot all the environmental problems, by state, or county, or whatever. So we need to begin the process of thinking through, and transitioning to, an entirely different management structure for the environment."[614] A major part of the EPA administrator's job consisted of lobbying state governors to adopt state regulations (on such controversial topics as oil power emissions) that supplemented federal laws while providing enough variance and flexibility so as not to completely alienate the energy industry.[615] Talk of joint data operations that shifted significant computing costs off of states and to the feds likely mollified many of these state officials.

As agency consultants testified before Congress, states and regional regulatory authorities could be "provided with computers of their own, so that they could be given access to this new data bank electronically by an appropriate hookup . . . and in so doing would not have to

[614] Alvin L. Alm Oral History transcript, EPA records, Records of the Environmental Protection Agency, Record Group 412, Subseries 412.5.2 Records of the Office of the Administrator, "Oral History" folder.

[615] Russell E. Train remarks, 3 December 1973, p. 5. Records of the Environmental Protection Agency, Record Group 412, Subseries 412.5.2 Records of the Office of the Administrator, Records of the Office of Planning and Management, 1971-75, Box 4, Folder "Speeches, EPA – 1973."

centralize the system . . ."[616] Directly referencing the decentralization ideology at the heart of Nixon-Ford new federalist belief, this model seemed a win for all parties, granting some degree of autonomy (and significant financial assistance) to regional authorities while permitting central EPA officials to share in and access all generated data. White House political advisors such as Eric R. Zausner, a former computer specialist at consulting firm Booz Allen Hamilton who headed Nixon's "Project Independence" energy policy formulation task force, could embrace the EPA's willingness act on administration imperatives, lessening somewhat tensions over frequent White House pressure to further slow power plant emission regulation. [617]

The decision of EPA administrators to embed their agency's systems management protocols within a framework of expansive federal and enhanced state-local-federal cooperation drew explicitly on the lessons of several Great Society-era executive agencies charged with combating poverty and urban decay through technocratic means. A 1971 study commissioned by the Council on Environmental Quality described the NEEDS (Neighborhood Environmental Evaluation and Decision Systems) program from HEW's Bureau of Community Environmental Management (designed to "recognize the cause-effect relationship of environmental and social stresses") as a superior alternative to the Model Cities approach because it provided local cities with "the ongoing capability to analyze both the severity of existing problems and the areas of potential crisis," a capability enabled by a "computer analysis . . . developed to produce information leading to solutions tailored to the specific problems and priorities within the target

[616] House. Hearing on Environmental Data Bank, 1970, p. 227. Included in Records of the Environmental Protection Agency, Record Group 412, Subseries 412.5.2 Records of the Office of the Administrator, "Hearings-1970" folder.
[617] "Project Independence" memo, Records of the Environmental Protection Agency, Record Group 412, Subseries 412.5.2 Records of the Office of the Administrator, "Energy folder 2083".

area," as determined by "community participation" and extensive surveys compiled through "locally recruited interviewers."[618]

States that could frame their regulations and budgetary requests to the EPA in datafied terms complimentary to the Nixon administration's goals frequently found themselves both with greater administrative autonomy and the cash to implement ambitious environmental regulation or preservation schemes. Specificity, and adherence to the authority of computerized data models, was the price of increased independence from Washington's leash. This policy was abetted by ambitious regional administrators eager to collect as much autonomy for their geographic zones from the EPA central office as possible. Their price was acquiescence to elaborate information exchange among regions. As Dennis C. Williams noted in his account of the agency's formative years, *The Guardian*, "Ruckelshaus expected the regional offices to act as the agency's cutting edge, using them to collect the pollution information by which headquarters set national criteria."[619]

Complicating this trajectory was the impressive legacy certain individual states had in promoting computerized-, data-driven environmental policymaking at the local and regional level. In 1976 Lynn Brooks of the Connecticut Commission of Planning and Energy Affairs testified regarding his frustration regarding his state's environmental data accomplishments – leadership of a New England-wide energy management information system --being subsumed by the changing nature of state-federal relations in realms technological and environmental. Acknowledging that "the volume and flow of information and the kinds of things that come out of the administration" of complex policy recommendations were the chief frustration of any

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[618] 2 Environmental Quality: Annual Report of the Council on Environmental Quality (1971), section "The Inner City Environment," p. 205.

[619] Dennis C. Williams, *The Guardian*, p. 12.

environmental regulatory scheme, Commissioner Brooks expressed both apprehension over increased centralization of energy information analysis in one federal department and a grudging enthusiasm for the potential of a true nationally-directed data analysis network.

As data and data-derived analysis of environmental issues flowed from states to federal offices, from federal agencies to states, and within the federal ecosystem, Brooks and many environmental policy officials expressed concern over a blurring of lines between development and implementation of environmental policy, suggesting that flows of data contributed to an erasure of the gap between analytical "coordinators, develops of policy" and implementers. What was needed, Brooks suggested, was "a central data group" where computer systems "take basic data and rearrange it and manipulate it to get the kinds of things you need."[620]

A representative chart from a 1978 Congressional hearing illustrates the bewildering overlap of state and EPA-operated water quality computer programs in practice. Spread across fourteen different programmatic areas from "stream modeling" and analysis of regional wastewater economic systems to "ambient water quality" monitoring, the programs reflected either sole control by the EPA, a particular state, or a joint partnership of the two.[621]

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[620] Lynn Brooks, "Federal Energy Reorganization" Report to the Committee on Government Operations, United States Senate (September 1976), p. 38-39.

[621] Data Inexperience manual, Records of the Environmental Protection Agency, Record Group 412, Subseries 412.5.2 Records of the Office of the Administrator, "Data" folder.

TABLE 7: Tabulation of Information Obtained from Survey of Use of Water Quality Computer Programs

PROGRAM	1 OPER E S B	1 PLAN E S B	2 OPER E S B	2 PLAN E S B	3 OPER E S B	3 PLAN E S B	4 OPER E S B	4 PLAN E S B	5 OPER E S B	5 PLAN E S B	6 OPER E S B	6 PLAN E S B	7 OPER E S B	7 PLAN E S B	8 OPER E S B	8 PLAN E S B	9 OPER E S B	9 PLAN E S B	10 OPER E S B	10 PLAN E S B	11 OPER E S B	11 PLAN E S B	12 OPER E S B	12 PLAN E S B	13 OPER E S B	13 PLAN E S B	14 OPER E S B	14 PLAN E S B
Alaska	X		X		X X 2								X										X 2 3					
Arizona	X X	X	X X	X			X	X	X	X		X		X		X				X			X	X				
California	X	X	X	X	X	X	X X		5	10	X	X	X	X	X	X	X	X	X	X					X	X		
Colorado							X		X								X											
Connecticut	2	X			X		X		2		X				X													
Delaware	X		X				X																X					
Florida	2						X X		3										2									
Georgia	X		X				X		2				X		X								X					
Hawaii							X																					
Idaho		X X		X		X	X		X						X	X				X								
Illinois	2		X		X		2	X X	2				X	X		X	X		2				3	X		3		
Indiana	2	X	X	X	X		X X		3 X						X	X			X		X							
Iowa	X		X		X		X		X										X				X					
Louisiana	X				X		X		X	X									X				X	X			X	
Maine	3	X	3	X			X	X	2				3	3	3	3				X				X				
Maryland	5		4				X				4		4		4				3	4			X					
Massachusetts	2 X		X X		X X		X X		X X X		X X		X X		X X		X X						X X					
Michigan	X		X		X X		X X		X			X	X		X			X	X				X	X	X X	X		
Minnesota	2	3		2	2	X			X X	2			X		X	3				X		X						X
Mississippi	X		X			X	X		3		X		X		X		X			X			X			X		
Missouri	3		X				X		2				X		X								X		X			
Montana	X	X		X	X	X	X X			2		X		X					X				X X		X			
Nebraska	X			X			X									X				X			X					
New Jersey	X	X		X			X		X			X			X			X	X			X		X		X		X
New Mexico	X X		X		X X		X		2				X		X		X X		X		X X		X				X	
New York, Dept. of Health														X		X	X		X				X					
New York, Dept. of Env. Cons.	X		X		X	X							X		X			X		X				X				
North Carolina	X		X		X		X		8 4		X		X		X				X			X	X			X X		X
Oklahoma	X X 2		X				X X											X	X				X	X				
Oregon							X		X																			
Pennsylvania	3	X	X X	X X	X	X	X X	X X	X	X		X	X	X	X	X		X	X	X	X	X		X	X	X X		X
Rhode Island	X				X		X		X												X				X		X	
South Carolina	X		X		X		X		X		X		X			X			X							X		X
South Dakota	X		X		X		X		X						X												X	
Tennessee	X	X	X	X	X	X	X	X	X	X	X	X							X	X			X	X	X	X		
Texas	2	X	X				X	2	10	2	X		X		2				X									
Utah	2																X											
Vermont	X			X	X		X		X						X													
Virginia		X					X X		10							X	X											
Washington	2 2		X		X		X		X						X		X		X		X							
West Virginia	2			X			X		2					X	2								X		X			
Wisconsin	5		X X 2	X	X	X	X X	X	3			2	X	X	X	X			2	X	2 X		X 2	2	3		X	X
District of Columbia			X	X			X																X					
Delaware River Basin Commission	X		X				X		X				X													X		
N.Y. Interstate Sanitation Comm.																												
Ohio River Valley Water Sanitation Commission	X						2	X X	X																			
Potomac River Basin Interstate Commission	X		X		X		X		X			X						X			X				X	X	X	

OPER = Operational
PLAN = Planned
E = EPA
S = State
B = Both

Example of Distribution of Water-Quality Assessment Computers among Federal, State, and Joint Jurisdictions, 1978

Proponents of decentralization and Congressmen whose districts might benefit from the largess of constructing a disbursed data processing network embraced the practicality of a federalist approach to data collection and analysis. As Michigan Representative John Dingell noted regarding environmental legislation and centralization,

> The bill was not drafted to set up a national environmental data bank. To set up one gigantic bank of computers would be foolish. What it seeks to do is provide an inter-tied set of data centers around the country, seeking a generally compatible computer system, so that every State legislature, local government, the National Government, administrative agency, the executive branch, would have access to this information quickly and easily.[622]

[622] House. Hearing on Environmental Data Bank, 1970, p. 63; included in Records of the Environmental Protection Agency, Record Group 412, Subseries 412.5.2 Records of the Office of the Administrator; "Hearings 1970" folder.

Decentralization would not necessarily marginalize the influence of the EPA as central entity in the schema. The most crucial element in compiling and interlinking a nationwide network of environmental data collection points and assessment centers would be discernment, the sort of experienced, elevated view available only to the central node in the system. As EPA consultant Dan Slotnick noted, "Computers have been used in very large scale planning activities before but in the scale that we are discussing now, I think we have to be particularly attendant to data quality problem, to the reliability of the data, to the reliability of the calculations made on the data."[623] The EPA could ensure both centrality and a degree of impartially by casting itself as the curator of carefully assembled, analytically-verified, peer-reviewed environmental data, drawn from a variety of federal, state, and local sources and generously parceled out on request to the universities, think tanks, trade groups, and environmentalist organizations with a stake in developing their own computer projections of pollution and environmental change. Models produced from data would admittedly reflect the biases and preconceived choices of their programmers, but the source data itself could be held up (rightly or not) as an impartial trust collected and collated by a new expert environmental agency that had wrought order from administrative chaos.[624]

[623] Slotnick transcript, p. 226

[624] Potentially worth consideration in this analysis is the remarkable similarity in this open data, decentralized approach to that of the general attitudes towards data held by the counterculture computing centered on the West Coast. Unlike the total systems push of the mid 1960s which favored centralizing all data for a cadre of priest like technicians to examine, the environmental databank movement was premised on complete openness and universal access so that on-the-ground individuals might facilitate their own outcomes. Not surprisingly, considerable overlap existed between those interested in environmental issues and those with a penchant for homebrew computing. See Fred Turner's *From Counterculture to Cyberculture* for more on the West Coast angle.

Computer-Energy Nexus

The debates surrounding natural gas extraction and regulation during the energy crisis year of 1978 reflect this tendency. [625] Democratic Senator James Abourezk of South Dakota assailed his colleague Ed Muskie for "having denied the accuracy of the statistics" and having "put his faith in the . . . warmed-over data supplied by congressional supporters" of the Congressional Budget Office's energy models, computer derived-formulations Abourezk found unconvincing as a basis for potential federal de-regulation of the natural gas industry. Abourezk accused Energy Secretary James Schlessinger of "manipulate[ing] both the database and the statistics concerning the conference report to suit his own political arguments" and asserted that White House calculations of potential influence of energy prices on inflation flew in the face of common sense "even if one does not have access to a computer."[626]

After the Department of Defense, the Energy Research and Development Administration was the second largest user of electronic computers in the federal government in 1976 – its multiple mainframes corralled for, as one newspaper described, "such ponderous problems as estimating how many trillions of cubic feet of reserves of natural gas are left in any year."[627] It was an open secret around 1977 Washington that the Carter Administration's environmental and energy policies were "the product of intense secretive work by a tight circle of officials who drew heavily on ideas and statistical models inherited from the Ford and Nixon administrations."[628] Both sides in the energy debates appealed to the authority and supposed

[625] For more on U.S. energy policy in the United States during this period, see Meg Jacobs, *Panic at the pump : the energy crisis and the transformation of American politics in the 1970s* (New York: Hill and Wang, 2016).

[626] James Abourek, "Is the Natural-Gas bill Better Than Nothing?" Ope-ed in *The Washington Post* (1 Sept. 1978), p. A15.

[627] Nancy L. Ross, "Government Still Biggest Customer," *Washington Post* (11 October 1977), p. D11.

[628] Robert G. Kaiser, "The Birth of a Policy," *Washington Post* (23 April 1977), p. A1.

neutrality of computer generated data while critiquing rival proposals as the products of flawed data analysis. President Carter touted "some computer models" that suggested his energy plan would "actually increase the number of jobs by several hundred thousand and have a beneficial effect on the economy."[629]

That members of the general public should come to associate computerized calculations with a logical extension of the way electronic data devices recurred in popular discussion of the energy crisis. Newspapers and evening news broadcasts recounted novel firms such as Energy Inspection Services, where for $50 a technician with an infrared scanner and microcomputer ready to plug into a home telephone jack could come to a residence, locate heat leaks, and offer the homeowner "a computer printout on the spot, analyzing their energy use and prospective savings."[630] IBM and other firms marketed internal climate-controlling computers to managers of office complexes, hotels, and hundred-plus unit apartment complexes, promising silent, precise electronic regulators of central heating and air conditioning units guaranteed to slash electric and heating oil bills each month.[631]

Consequences of Environmental Dataocracy: Computer Evidence and the Courts

Since the turn of the twenty-first century, copyright and intellectual property lawyers have aggressively argued that a digital revolution began remaking the world of jurisprudence in the 1990s, as civil proceedings increasingly focused on the particulars of software and data

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[629] Austin Scott, "Energy Plan Now Pictured as Consumer Boon," *Washington Post* (23 April 1977), p. A1.

[630] Phil McCombs, "Energy Saving Ideas Work," *Washington Post* (14 April 1980), p. B1.

[631] Phil McCombs, "After Caulking and Weatherstripping, Turn to Computers," *Washington Post* (24 June 1980), p. B1; Phil McCombs and Joseph D. Whitaker, "Soaring Bills Chill the Rich and the Poor," *Washington Post* (14 Feb. 1981), B1.

transfer that undergirded digital media. As noted legal intellectual Lawrence Lessig cheekily observed in 1999, "Code is law."[632] As debates over software design, functionality, and protocol become increasingly central to court cases, technological records of data manipulation enter the permanent legal record and become subject to intricate debates over legal precedence.

Transformation of the legal regime into a full-fledged embodiment of dataocracy actually came some two decades earlier, in the circa-early 1970s era of the establishment of the EPA. As the field of environmental law professionalized during this period, it took cues on the value of quantifiable data, systems management approaches to environmental assessment, and computer models from the EPA and similar dataocracy-embracing state environmental regulatory bodies. More crucially, a deferential attitude towards computer data and simulated models as expert evidence increasingly asserted itself in litigation procedures and court rulings during the 1970s and 1980s, resulting in environmental law court cases and regulatory hearings that increasingly focused on the technical language and findings of data systems to assert their claims regarding pollution, regulation, or land use.

By 1985, the system could be described by two noted legal scholars as "our extraordinarily crude, costly, litigious, and counterproductive system of technology-based environmental controls."[633] In many cases, opposing sides, or even trifectas of regulatory bodies, environmental groups, and industrial interests would engage in the litigation equivalent of open brawls over the veracity, provenance, admissibility, or relevance of environmental data,

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[632] Lessig's pun played on the notion of both "computer code" and "legal code" as created body of texts that in the digital era increasingly responded to one another at the behest of corporations and the courts who arbitrated among them. Lawrence Lessig, *Code and Other Laws of Cyberspace,* 1999. Since 2006, Lessig has reformulated his original volume into an open-source, web-based book project, *Code v.2*.

[633] Bruce A. Ackerman and Richard B. Stewart, "Reforming Environmental Law," *Stanford Law Review* , Vol. 37, No. 5 (May, 1985), pp. 1333-1365

particularly data that could be employed to generate computer models favoring the claims of one litigant.

The stakes were so high in part because of the apparent willingness of judges, juries, and regulatory entities that conducted legal hearings (including the EPA itself) to rely on expert data to clarify thorny ecological issues. Deputy EPA Commissioner Alvin Alm recalled in an oral interview the many blue ribbon commissions of federal jurists and environmental experts that met throughout the 1970s and 1980s to strategize on the inclusion of highly technical evidence in legal proceedings: "We talked about the relationship of courts and what kind of technical information they need or how they can make these decisions. All I can say is it is a real quandary when the courts begin to try and understand the technical data outside their areas of expertise."[634]

For many in the legal profession, that the field and public interest would gravitate to environmental issues was a given. One regional bar magazine claimed that "advocates must recognize an expanded environmental dimension to their client responsibility. . . Growing public concern and pressure at all levels of government for acceptable environmental conditions cannot be judged by past inaction." In their view, attorneys and law schools must have a say in the shaping of the emerging political discussion surrounding environmental regulation in order to "prevent the adoption of premature regulation and to meet the growing public demand for increased control of human environment which could produce devastating economic realignment of sources and markets."[635] For many attorneys, already feeling out the parameters of the new discipline of environmental law, this meant boning up on the terminology and technology of

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[634] Alvin L. Alm Oral History interview, Records of the Environmental Protection Agency, Record Group 412, Subseries 412.5.2 Records of the Office of the Administrator; "Oral History" folder.

[635] 45 L.A. B. Bull. 165 (1969-1970) ; Widow's Election - Income Tax Aspects, The; Schiller, Richard C, p. 165-6; cites Matsen, *The Broken Image,* 161-230 (1966)

electronic data systems, particularly as those systems were employed in environmental regulation litigation.

Thus the March 1972 issue of *The Transcript*, the newsletter of the South Carolina Bar Association, could devote a front page article to the topic "Weather Records in Private Litigation" and the role of NOAA's Environmental Data Service.[636] Variations of this piece, adapted from a Weather Service leaflet on environmental data and the courts, appeared in the *Michigan State Bar Journal* and a half-dozen other state barrister trade journals.[637] Other law journals offered guidance to budding environmental practitioners on the particulars of engaging in data-heavy litigation. As an Ohio journal noted in an article in preparing a commercial client for an environmental regulatory hearing, "Obviously, the earlier in the planning process environmental data is gathered and environmental concerns are taken into account . . . the more likely it will be that the developer . . . will receive a favorable response from the responsible public agency."[638]

These articles framed the hiring of systems consultants, the accumulation of data, and the preparation of reports so common to environmental regulatory hearings as an adversarial contest not unlike a trial. Articles titled "Procedural Approaches and Issues in Environmental Protection in New York" and "Preparing a United States Court for Automation" detailed tips for best presenting complex, computer-derived data. [639] (Charts were a universal.) Others took the tactic of urging their legal peers to focus on "computer-based predictions" to insure successful

[636] 16 *Transcript* 1 (1971-1972), p. 1, Issue 6.

[637] "How to Get Weather Records," 50 *Mich. St. B.J.* 448 (1971).

[638] Carl J. Seneker, II, "The Legislative Response to Friends of Mammoth: Developers Chase the Will-O'-The-Wisp," *California State Bar Journal*, Vol. 48, Issue 2 (March-April 1973), p. 189.

[639] Bermont, King, etc., *Federal Judicial Center*, 1985, vol 1, issue 1.

environmental rulings in federal court: “In other words, to use the statutory language, as ‘systematic, inter-disciplinary data integrated’ as possible.”[640]

Just as companies found backdoors into the regulatory-development process by partnering with the EPA to sponsor environmental research and support computer modeling, firms could also seek to influence future court decisions by commissioning consultant reports or promoting data models that favored their side of a legal case over that of regulators or activist plaintiffs. In a 1989 publication of recommendations by the Administrative Conference of the United States, the report authors noted that “health and environmental data are often available before EPA or USDA makes a decision because, with agency encouragement, companies are restricting their confidential information claims.”[641] The report further noted that “environmentalists concede that they currently have adequate information to participate in most cases at EPA and USDA.” For many less-well-funded plaintiff groups unable to generate their own favorable data models, such openly-shared information might actually damage their cases.

Companies could deluge environmental opposition in reams of unaggregated data supply under rules of discovery. Environmental advocacy groups concluded they had to get on the bandwagon or be unable to influence the broader ecological discussion, their voices drowned out both in established case law and data models influenced by corporate interests. Diana Dunn, Director of Research for the National Recreation and Park Association, a frequent co-litigant in environmental quality cases, asserted this in 1970: “The computer has tipped the intellectual balance of power from those who simply possess data and information to those who can efficiently process it.”[642] By the mid-1980s litigators (or advocacy groups) could obtain on

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[640] *Ibid, 598.*

[641] 1989 ACUS 535 (1989) Reports for Recommendations 89-1 through 89-10 and Statements 14 and 15, p. 535

[642] National Environmental Policy Act Senate Hearing 1,19 November 1971, p. 62

computer tape from the U.S. Department of Energy detailed statistics on scale of production for individual coal mines dating back nearly a decade.[643] Similar tape reels on arrays of topics, from soil tests to air quality averages to regional health symptoms related to toxic-substance exposure, were available from other state and federal agencies, including the EPA.

Time and again, the side that most effectively marshaled data in its favor prevailed. In a representative example, the Connecticut Department of Environmental Protection pushed through in 1974 an expensive and politically-contentious lakeside sewer diversion project by convincing the Environmental Protection Agency (and the federal magistrate arbitrating their negotiations) of the supremacy of their data projections over the federal agency's numbers. Douglas Costle, then head of the Connecticut agency, later EPA Administrator under the Carter administration, proudly proclaimed, "Our State people had to argue with EPA to apply a portion of our federal funding to the sewering, but we succeeded because we had the study data to show the water quality benefits."[644]

Sometimes environmental scientists and environmental regulators felt the products of their meticulous, data-driven research were appreciated only by those hired legal guns digging through the reams of computer printouts looking for some screw to apply to the opposition's argument. In 1980 Michael O'Hare from the Massachusetts Office of Environmental Protection described his frustration with "the environmental impact statements that sit on shelves unread (except by lawyers trying to find fault with them)."[645] For many environmental activists inside an

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[643] 8 J. Energy L. & Pol'y 90 (1987-1988) "Economic Analysis of Utility-Coal Company Relationships, "; Sievers, Mark,

[644] D. Costle, Records of the Environmental Protection Agency, Record Group 412, Subseries 412.5.2 Records of the Office of the Administrator; "Oral History" folder.

[645] "Improving the Use of Information In Environmental Decision Making," JAI Press, 1 May 1981.

outside of government, the cautious bearing and slow pace of EPA implementation of regulation was exceptionally frustrating; if congressmen were not inspired to toughen environmental policies based on exhaustive computer simulations piled on their desks, perhaps federal trial judges might be so induced.

An example of the influence of EPA computerization on actual court-based implementation environmental policy can be seen in the legal challenges surrounding the 1980 Northwest Power Act and its creation of joint federal-state regulatory body, the Pacific Northwest Electric Power Planning and Conservation Council, charged with overseeing the Bonneville Power Administration. In a lawsuit brought in late 1983 by the Seattle Master Builders' Association, that homebuilders' trade group association alleged conservation standards governing new residential construction in the Pacific Northwest as imposed by the Council were "arbitrary" and "unreasonable" as they were based largely on "computer simulations and industry standards rather than by testing the components in the field."[646] In the eyes of irate developer interests, the Council was derelict in its regulatory duties by relying on such processed models rather than observational data collected through more traditional means; as the *Journal of Energy Law and Policy* noted, "they charged that the Council's use of . . . computer simulations of energy use, instead of field testing, was an abuse of discretion."[647]

Though the case is remembered by legal scholars chiefly for the Ninth Circuit's reaffirmation of the constitutionality of joint state-federal regulatory bodies with jurisdiction over solely-federally established entities, the widely disseminated ruling also served as a

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[646] J. Energy L. & Pol'y 7 (1987-1988) "Appointments Clause, Innovative Federalism, and the Constitutionality of the Northwest Power Planning Council,"Blumm, Michael C.;

[647] 8 J. Energy L. & Pol'y 8 (1987-1988), "The Appointments Clause, Innovative Federalism, and the Constitutionality of the Northwest Power Planning Council,"; Blumm, Michael C.

resounding victory for the use of "technical, analytic process[es]" rooted in computer simulation. Deferring to the expert authority of the regional Council, the Circuit judges affirmed that the act establishing the organization, and the wording of similar legislation entered into evidence, mandated regulatory responses of a technical nature while remaining silent on the particular "testing methodology" to be employed.[648] Though one panel judge dissented on the larger question of the constitutionality of a third party, interstate compact-based body to engage in environmental regulation, none of the jurists indicated any qualms with the computer-based methodology of such regulation.

As historians who have closely examined the EPA have noted, the agency's earned reputation as a "cancer-busting," quasi-public health agency during the 1970s and 1980s arose in large part because of external political pressure (particularly from Congress), internal institutional culture and leadership focus, and schools of legal expertise and risk assessment that all dovetailed to promote a certain kind of easily transmittable, quantifiably-based environmental analysis.[649] Carcinogens could be tracked and modeled with greater ease than certain ecological factors, and unlike public health entities such as the NIH, the EPA would be unique as a "control" agency setting standards from data. An NEH official noted in the early 1970s that his agency had "no standard setting, monitoring, or all the other things that go with environmental regulation," as those elements were entirely in the purview of the EPA. NIH could supply and receive data, "but the control judgments are not ours."[650]

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[648] 8 J. Energy L. & Pol'y 15 (1987-1988) , "The Appointments Clause, Innovative Federalism, and the Constitutionality of the Northwest Power Planning Council," Blumm, Michael C.

[649] Edmund Russell, "Lost Among the Parts per Billion," p. 31.

[650] Hearing Y4.Ap6/1:L11/970/pt.4, p. 780.

Environmental Movements and the Digital Quantification of Nature

In an EPA seminar before the Edison Electrical Institute in December of 1973, Russell Train lauded the "new wave of environmental awareness" that swept the United States following Earth Day in 1970, and praised environmentalists for being among those who first recognized that "science and technology must become the servant, not the master, of man and his institutions if we are not to alter irreversibly the precarious ecological balance of our world."[651] For millions of Americans, including many at the vanguard of the environmental movement, science and technology as manifest in the images produced by computer models became the face of institutional environmental regulation.

The very scientists who had first raised alarms regarding environmental degradation were often among those who embraced a computer-centric approach that privileged their hard-gathered data and drew its authority from their expertise in deciding which variables to incorporate into simulations and models. The International Biological Program (IBP) of the International Council of Scientific Unions released several statements to the press and legislators reiterating the same theme: "The ecosystem modeling that is now being developed under the IBP has been made possible by availability of modern computers. . . with this model programmed into a computer, the computer can simulate the numerous, interrelated processes and predict changes in the system that would result from manipulation in any part of it."[652]

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[651] Russell E. Train remarks, 3 December 1973, Records of the Environmental Protection Agency, Record Group 412, Subseries 412.5.2 Records of the Office of the Administrator, Records of the Office of Planning and Management, 1971-75, Box 4, Folder "Speeches, EPA – 1973"

[652] , Excerpt from paper prepared by Special Committee for the International Biological Program for the International Council of Scientific Unions, p. 52. Found in Records of the Environmental Protection Agency, Record Group 412, Subseries 412.5.2 Records of the Office of the Administrator, "Conferences" folder.

A number of American environmental advocates embraced a 1968 theoretical text by Australian geographer J. A. Mabbutt (also popular among the new generation of late-sixties urban planners) that described a "parametric" approach to land and resource analysis. Land use planners praised his approach as one that "'achieves a more precise definition of land and that it avoids the subjectivity of the landscape method (approach); being quantitative, it allows comparison between and affords greater consistency within land evaluation projects; and it is in terms suited to automatic scanners and computers."[653]

J. W. Penfold, the conservation director of the Izaak Walton League of America, dramatically asserted that "Every agency – Federal, state, and private – should have available from some one central source all such information, knowledge, and data as it plans for any activity that might affect the environment for good or ill. . . . The technology of computers and data processing now makes this feasible."[654] Stu Udall saw embrace of advanced data processing for ecological ends as the natural next progression in the environmental movement: ". . . it always seemed to me as an environmentalist and one responsible in this field, there was a great deal of talk in the 1960s about the computer, about systems analysis, about what this was going to do." [655]

Environmentalists could also employ the relatively cautious data standards of certain federal environmental computer studies to press for more aggressive responses to pollution and encroaching development. Calling for greater protections of the Chesapeake Bay watershed,

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[653] Fish, Ackerson, and Fuller, Research Bulletin, 1978, p. 312. Records of the Environmental Protection Agency, Record Group 412, Subseries 412.5.2 Records of the Office of the Administrator. "Bulletins" folder.

[654] Penfold testimony, H.R. 17436 Hearing, 1970, p. 256. Found in Records of the Environmental Protection Agency, Record Group 412, Subseries 412.5.2 Records of the Office of the Administrator. "1970 hearings" folder.

[655] Udall testimony, p. 254. Records of the Environmental Protection Agency, Record Group 412, Subseries 412.5.2 Records of the Office of the Administrator. "Hearings" folder.

Baltimore Sun environmental reporter Tom Horton in the 1980s noted that even if Marylanders met "all water quality standards that the scientists and the computer modelers say are needed," unchecked suburban growth would lead to an untenable "environment that is legally sufficient but increasingly less pleasant in which to live."[656] Computer models could illustrate that even with regulatory oversight, effective environmental quality restoration and maintenance would entail overturning a

Some backlash to the imposition of a totally dataocratic regime on the development of environmental policy emerged as the decade progressed. In 1978 Kenneth Hampton of the National Wildlife Federation pressed for "holistic" environmental indices in a presented statement to the House Subcommittee on the Environment and the Atmosphere: "So much of environmental monitoring presently is concerned with readings from scientific instruments and computers – important readings, but limited . . . . Polluted water may spin the needle on a monitoring gauge, but a far more graphic picture of water condition is the sight of dead fish floating in it."[657] Like many activists, he feared an over-reliance on computerized data drained the passion and wonder from the impulse to protect environmental resources.

This tendency was remarked upon even by environmental scientists in other federal agencies that were themselves frequently patrons of advanced ecological modeling. In a discussion of the Willamette River Basin, scientists from the U.S. Geological Survey noted in 1976:

> Unfortunately, the proliferation of sophisticated, general-case river quality models . . . has caused a preoccupation with mathematical development, solution techniques, and computer programming. Although such technical model problems are important and

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[656] 47 Md. L. Rev. 406 (1987-1988) , Tom Horton, "Protection of the Chesapeake Bay: Environmentally Legal, Eminently Uninhabitable."

[657] Hampton, Committee on Science and Technology, 95th Congress, second session, vol. II, p. 180.

> deserve continuing attention, they tend to divert attention from analysis and understanding of river hydrology and the phenomena being modeled. [658]

Contrary to years of EPA assertions that ever-more expansive models that sought to capture as much data as possible about environmental change might increasingly successfully self-correct for the limitations of mathematical representations of complex natural phenomena, these geologists suggested that "... future efforts at applied modeling should minimize extraneous mathematical sophistication and maximize the understanding of river phenomena."[659]

Acerbic critic of over-enthused data analysis Ida R. Hoos weighed in on the proliferation computer model-based regulatory proposals in her native California and across the nation. Despite streams of numbers "pouring out of computers" with the intent of providing environmental insight on the late-seventies energy crisis, many essential structural factors undergirding the issue went unaddressed.[660] If anything, she feared the complexity of the problem had assured the dominance of mainframe-wielding systems analysts as central policy figures on this issue: "But rising energy prices have put an end to simple forecasts, so now we do complicated ones with computers instead of rulers."[661] Amory B. Lovins, a fellow Berkeley lecturer and a consultant to Friends of the Earth, Inc., agreed in article prepared for the *George Washington Law Review* and entered into the record before a 1977 House Special Committee on "Long Range Energy Strategies." To Lovins and other critics, all discussion on national energy policy had been hijacked by an "approach, in which the political process becomes a mere

[658] Hines, "Significant Issues in Water Resources Policy," 1975. Records of the Environmental Protection Agency, Record Group 412, Subseries 412.5.2 Records of the Office of the Administrator. "Water Policy" folder.
[659] Ibid."
[660] Hoos, "America's Investment," cited in S. Hearing, Small Business Committee, 1978, p. 718. Records of the Environmental Protection Agency, Record Group 412, Subseries 412.5.2 Records of the Office of the Administrator. "Hearings" folder.
[661] Hoos, "Multiple Paths for Energy Policy," cited in S. Hearing, Small Business Committee, 1978, p. 1300

appendix to expert analysis while computer printouts reign supreme. . . ."[662] Models could and should be used, he agreed, but not elevated above other forms of evidence or civic discourse on environmental matters to the point where they lost connection to environmental principles not expressed in systems analysis format. One can almost imagine a frothing Lovins reading his article: "These benefits can be obtained without deifying the results of analysis and making them into computer fodder to which policies and budgets are aligned, praises sung, and goats sacrificed daily."[663] Claiming that excessive reliance on computerized projections of air pollution in public discussions of energy policy had muddled essential details of the basic issues at hand for the American public, he pleaded, "The public does not have the expertise, time, patience, money, and computer access to alter the data or grasp the structure of these complex models. Further, the public may decline to play the 'my number is better than your number' game by refusing to choose any numbers."[664]

Other environmental activists, familiar with urban planning struggles over the previous decade and the shattered dreams of many who had placed hopes of reviving America's decaying cities through computer-designed strategies, explicitly cautioned that the environmental movement need be wary of avoiding the "Jay Forrester" approach to embracing digital models: If the "computer says so, therefore it must be so."[665] For these observers of the natural world, a more holistic approach that privileged personal observations of ecology in action and

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[662] Ibid. 1446

[663] Ibid,. 1448

[664] Ibid, 1432

[665] House hearing, Y4.Ap6/1:L11/970/pt.4, p. 813. Records of the Environmental Protection Agency, Record Group 412, Subseries 412.5.2 Records of the Office of the Administrator. "Hearings" folder.

incorporated a human element might counterbalance flaws inherent to even the best-intentioned computer models. Over-dependence on computers as the primary tools for describing and interpreting the environment might distance professional environmental scientists and those with the training to interpret computer data from the mass support among the general public for relatable improvement of environmental quality.

Conclusion

Ultimately the case study of the Environmental Protection Agency (and to some degree the broader realm of environmental policy making) can be viewed as a success story in the era of dataocracy. Unlike social welfare agencies that found their outsized Great Society ambitions thwarted by incomplete computer systems, or even early adapter budget management offices that saw their technological savvy copied and challenged by competitors seeking to control flows of quantified information within the federal government, the EPA prospered by tempering expectations, doing just enough to frame and meet technocratic expectations without committing itself to impossible data processing standards.

The EPA organizational culture of moderate progress backed by reams of protective data occasionally earned it barbs from more aggressive environmental activists and regulation-favoring legislators, but helped in part to shield the agency in its early days from furious assaults from industrial interests – even as it opened a backdoor for regulatory capture through more tailoring of freely-supplied data by the private sector. Firms with an interest in pollution controls learned to work with the EPA and state regulatory agencies to define the terms by which computer models that undergirded future regulation would be developed. Perhaps the most lasting legacy of the impact of the digital computer on the early days of institutionalized federal environmental regulation can be seen in the influence of dataocracy on environmental legal proceedings, creating an arena where regulators, activists, and industrialists routinely couch their legal strategies in data-driven computer models.

In 1986, Dr. James W. Curlin, formerly Deputy Assistant Secretary for Land and Water Resources in the Carter Administration's Department of the Interior, then of the Office of Technology Assessment, delivered the keynote address at a conference on impact assessment that echoed these concerns:

> But today we are armed with intellectual tools that were unimaginable a decade ago. An amalgam of powerful computers and equally powerful analytical methods provide us with the ability to unravel the intricacies and interactions of environmental, ecological, social, and economic systems. . . . Although technology provides us sensitive analytical tools for assessing these systems, it is questionable whether government and private institutions have kept pace with our intellectual and technological sophistication.[666]

EPA continues its tradition of touting technological capacity as the path to successful environmental control. As late as 2012, the EPA homepage proudly proclaimed its back-to-back wins of the President's Award for Management Excellence in 2007 and 2008, declaring that the agency" became a model for other federal agencies by operating with a results-oriented, data-driven performance management approach."[667] Not elaborated upon are the specifics of the nature of that approach. The "computer based econometric model to determine the impact of pollution abatement costs" introduced in the 1972 study on "Costs and Economic Impacts of Environmental Improvement" grew in prominence administratively and computationally throughout the budget conscious Carter and Reagan years even into the agency's more mature

[666] James W. Curlin, "A Janus Review of Environmental Assessment," *Impact Assessment*, 3:4 (1984): 6.

[667] "EPA Accomplishments," Environmental Protection Agency webpage (last updated 31 August 2012); accessed 30 October 2012. URL: http://www.epa.gov/aboutepa/history/accomplishments.html

1990s.[668] While frequently achieving regulatory victories inspired by the work of committed, ecology-minded staffers, EPA policy remained cautious and largely constrained by a need to temper any environmental assessments with carefully calculated, computer-verified cost-benefit analyses of the costs of regulation. It is but a small leap from the cost-benefit analysis centered on "reduction in the coefficient and in the output level . . . [to achieve] total pollution reduction" to establishment of more formal charges "per unit of pollution," leading to by the mid-1990s to increased talk of a market for pollution swaps and credits.[669]

In a bit of irony, the same agency that in the 1970s had sought to mitigate the complexity of an unwieldy organizational flow chart by focusing its diverse offices on a shared purpose of swapping and analyzing data had created an environment in which pollution and the physical state of the natural world could be completely divorced from material reality and packaged in commodifiable, swappable, easily modeled chunks of discrete data ready to be exchanged for dollars via a global network of computers.

[668] 3 Environmental Quality: Annual Report of the Council on Environmental Quality 284 (1972) Costs and Economic Impacts of Environmental Improvement, The, p. 284

[669] S. Greenfield Speech, 26 September 1973, p. 7.

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