

Chapter 2.

Upon These Foundations: The Scholarship Context for Policy World

This chapter provides an introduction to and overview of the disciplines and functional specializations that support this research, and discusses the overall fit of each within the dissertation. Drawing upon the intellectual assets of two established disciplines and three functional specializations, this research is first and foremost grounded in the theoretical insights of the policy sciences. Public administration contributes insights into implementing and administering governance while information resources management is the functional specialization and substantive area of policy concern. Virtual reality is a specialty area concerned with creating interactive and visually oriented synthetic environments to explore alternative realities, and information visualization explores approaches to using the human eye-brain system to more effectively communicate complex information. The specific literature, authors, and ideas that contribute to this research are more fully discussed below.

2.1 The Application of Knowledge: Scholarship Foundations

The policy sciences are the primary contributor to this research, providing the underlying theoretical constructs and rationale for examining and understanding the policy activities of government – in a word, for understanding governance. A key strength of the discipline, a sign of its vitality and creativity, is that the discipline provides an increasingly wide variety of approaches for studying policy phenomena. Within this research, the advocacy coalition framework, or ACF, an approach initially developed in the late 1980s, provides a framework for assessing policy change across time. This research attempts to remedy a weakness of the policy sciences, the tendency to ignore

peripheral topics like issue transformation, in favor of the “mainstream” questions of the discipline. So while issue transformation has received little research attention in the past, the topic can now be investigated using the ACF as a grounded framework for examining issue transformation and policy change over long time periods.

Closely related to the policy sciences, public administration locates policy and governance activities within the institutions and agencies of government, and provides approaches for viewing the mechanisms that translate policies into the actions of governance. But like the policy sciences, most public administration perspectives also depict policy and governance in static and decision-centric snapshots that, practitioners loudly argue, bear little if any resemblance to administrative reality. Needed are viewpoints that enhance understanding of the contemporary dynamics and complexity of politics, policy, and governance, and the resultant implications for public agencies and citizens.⁶⁰

Information resources management, in this research, is viewed both as a policy subsystem and as a functional specialization of administrative activities. It provides the substantive policy area of interest for investigating the key question of this study. “In what ways are the core issues underlying public policies transformed over time, and what is the relationship between issue transformation and policy change?” Or, stated in terms of US Federal information resources management policies, “In what ways and by what means were the issues surrounding Federal paperwork policies of the 1970's transformed into the issues, IRM policies, and e-government projects of today's agency Chief Information Officers?”

While a body of literature using the title “information resources management” is available, closer examination reveals several streams in that body of literature, each stemming from different definitions of the term. Writings about the Federal IRM community focus on the policies and processes for automating and informing program

⁶⁰ See for example, deLeon, Peter, and E. Sam Overman, “A History of the Policy Sciences,” in Rabin, Jack W., Bartley Hildreth, and Gerald J. Miller, eds. *The Handbook of Public Administration*. New York: Marcel Dekker, 1989, pp. 405-442, or Bobrow, Davis B., and John S. Dryzek. *Policy Analysis by Design*. Pittsburgh: University of Pittsburgh Press, 1987.

delivery and administrative support, using computing, networking, communications, and data technologies. The library and information sciences community uses the term in somewhat the same way. However, the underlying assumptions, value sets, and purposes of IRM reflect the disciplinary and professional value of the library science community – sharing information through libraries, archival preservation of records, and documentation of policies and processes – all of which receive scant attention in Federal IRM practice. Information resources management literature in the private sector takes on a business management flavor, with the trade press adding the distinctiveness of individual corporate cultures, management fads, and the hot technology *du jour*.

Two other important bodies of literature, exploring virtual reality and information visualization, combine to produce the second, and unique, research product that results from this effort. Virtual reality, although the subject of a small body of literature, introduces us to the technological frameworks and capabilities with which one can build virtual spaces or “worlds” for exploring phenomena such as issue transformation. Although a fair amount of technical literature exists in this category, only the portion that deals with capabilities, representation, and human interpretation of virtual artifacts is dealt with here. The last specialization, information visualization, is the subject of a small, loosely organized, but growing body of literature that focuses on the techniques and cognitive approaches to composing and visually representing complex phenomena and conceptual artifacts. These bodies of literature will now be examined in more detail, focusing primarily on the trends, ideas, and authors that relate directly to this research.

2.2 Policy Sciences: The Primary Foundation

The policy sciences have provided a rich variety of approaches to examining public policy since the field was first defined by Harold Lasswell in the mid 1950's.⁶¹ Most traditional approaches, true to their functionalist roots, view public policy as existing in static environments, with policy development progressing from phase to phase in a linear, pre-determined, and machine-like process. An early focus of the policy sciences, which were oriented primarily toward economics and statistics, involved policy forecasting: efforts geared to expanding the decision-maker's horizon, to help predict an unknown future by linearly extrapolating from the past and present.⁶² Another focus of the policy sciences was analysis, looking for associations or causation in policy activities as a means toward enlightened decision-making.⁶³ Both these approaches to policy activities employed a phase-based model of the policy process, beginning by agenda setting and progressing through policy formulation, adoption, implementation, and assessment phases in a linked and linear fashion.⁶⁴ In both the policy forecasting and policy analysis modes, the policy problem at hand was assumed to be comprehensible and solvable. Chastened by the unsatisfactory policy experiences of the 1980's,⁶⁵ policy scholars have been exploring new approaches to understanding public policy processes with the aim of improving public policy.⁶⁶

⁶¹ Lasswell, Harold D. "The Policy Orientation." In *The Policy Sciences: Recent Developments in Scope and Methods*, eds. Daniel Lerner and Harold D. Lasswell. Stanford: Stanford University Press, pp. 3-15.

⁶² Such as Heyne, Paul. *The Economic Way of Thinking*, 7th ed. New York: Macmillan College Publishing Company, 1994, or Downs, George W., and Patrick D. Larkey. *The Search for Government Efficiency: From Hubris to Helplessness*. New York: Random House, 1986.

⁶³ Such as Dunn, W. N. *Public Policy Analysis: An Introduction*. 2nd. Englewood Cliffs: Prentice Hall, 1994, and Weimer, David L., and Aidan R. Vining. *Policy Analysis: Concepts and Practice*, 2nd. Englewood Cliffs: Prentice Hall, 1992.

⁶⁴ Dunn, *Public Policy Analysis*, p. 16.

⁶⁵ See deLeon and Overman, "A History of the Policy Sciences," or Bobrow, Davis B., and John S. Dryzek. *Policy Analysis by Design*.

⁶⁶ Some post-positivist and postmodern approaches are found in: deLeon, Peter. "Democracy and the Policy Sciences: Aspirations and Operations." *Policy Studies Journal*, 22:2, 1994, pp. 200-212; Danziger, Marie. "Policy Analysis Postmodernized: Some Political and Pedagogical Ramifications." *Policy Studies Journal*, 23:3, 1994, pp. 435-450; deLeon, Peter. "Models of Policy Discourse: Insights versus Prediction." *Policy Studies Journal*, 26:1, pp. 147-161; and Fisher, Frank. "Beyond Empiricism: Policy Inquiry in Postpositivist Perspective," *Policy Sciences Journal*, 26:1, 1998, pp. 129-146.

Some recent approaches to rethinking the policy process focus on the beginning of the policy process construct, emphasizing the need for focusing on problem definition in an attempt to better explain ways in which issues find a place on the public agenda. Rochefort and Cobb liken problem definition to political discourse that functions at once “to explain, to describe, to recommend, and, above all, to persuade.”⁶⁷ Stone focuses on politics in the policy process and the nature of causal relationships in a politically constituted policy process,⁶⁸ while Kingdon focuses on agenda-setting,⁶⁹ and Birkland credits “focusing events” for calling attention to policy problems.⁷⁰ Despite the usefulness of these insights, none specifically addresses the fundamental question of issue transformation.

Given the burst of creativity in the policy sciences, the newcomer to policy endeavors is often intimidated by the sheer variety and diversity of perspectives and finds herself in the position of having to find a categorization or meta-construct to order the bewildering array of theoretical approaches. Addressing that challenge, Sabatier⁷¹ sorts the seven most frequently used policy approaches into three categories. One of these categories focuses on two approaches to policy change over time: punctuated equilibrium theory and the advocacy coalition framework.

Punctuated equilibrium theory focuses on explaining large-scale departures from the overall tendency toward stability and incrementalism in political processes. Encompassing both stability and change in policy processes, punctuated equilibrium focuses on issue definition and agenda setting, with less emphasis on activities later in the policy life cycle. Issues are typically processed within policy subsystems, and in a parallel fashion. But when issues take on high visibility, they are dealt with by macro-political institutions such as Congress, bodies that deal with high-profile issues serially,

⁶⁷ Rochefort, David A., and Roger W. Cobb, eds. *The Politics of Problem Definition: Shaping the Policy Agenda*. Lawrence, KS: University Press of Kansas, 1994, p.15.

⁶⁸ Stone, Deborah. *Policy Paradox: The Art of Political Decision-Making*. New York: W.W. Norton & Company, 1997.

⁶⁹ Kingdon, John. *Agendas, Alternatives, and Public Policies*. Boston: Little, Brown & Co., 1984.

⁷⁰ Birkland, Thomas A. *After Disaster: Agenda Setting, Public Policy, and Focusing Events*. Washington, DC: Georgetown University Press, 1997.

⁷¹ Sabatier, *Theories of the Policy Process*.

or at most, a few at a time. This phenomenon of serial attention helps explain the bursts of change in policy activities.⁷²

The advocacy coalition framework (ACF), on the other hand, views public policies in the same manner as “belief systems, i.e., as sets of value priorities and causal assumptions about how to realize them.”⁷³ Such a perspective allows one to assess the entire policy process, including policy change, by utilizing a time perspective that requires a decade or more, according to its authors. Policy change is understood by examining the policy subsystem, which is populated by “those actors from a variety of public and private organizations who are actively concerned with a policy problem or issue, . . . and who regularly seek to influence public policy in that domain.”⁷⁴ And while the ACF does not address issue transformation per se, the framework it provides for examining policy change creates a useful construct to use in searching for issue transformation. This point is addressed more fully in the chapter that follows.

Kronenberg,⁷⁵ however, specifically addresses issue transformation, situating it within the broader context of improving public policy by understanding the transformational aspects of policy processes. He has turned toward what he calls “The New Sciences of Transformation” (NST) – chaos, complexity, and autopoiesis – in order to better understand “the transformational aspects of these processes.” The traditional policy process construct, such as that outlined by Dunn, he asserts, requires both metaphorical and structural modifications in order to accommodate and explicate the complexity and dynamics of policy activities. These modifications are required to move beyond the traditional static and simplistically linear process approach to better understand the dynamic, non-linear and complex policy environment. Kronenberg’s structural remedy is the addition of another phase – an “issue transformation” phase –

⁷² True, James L., Bryan D. Jones, and Frank R. Baumgartner. “Punctuated Equilibrium Theory: Explaining Stability and Change in American Policymaking.” In Sabatier, Paul A., ed. *Theories of the Policy Process*. Boulder, CO: Westview Press, 1999, pp. 97-115.

⁷³ Sabatier, Paul. “An Advocacy Coalition Framework,” p. 131.

⁷⁴ *Ibid.*, p. 119.

⁷⁵ Kronenberg, P.K. “Chaos and Re-thinking the Public Policy Process,” in Albert, A. ed. *Chaos and Society*. Amsterdam: IOS Press, 1995, pp. 253-265.

at the end of the traditional policy assessment phase in order to reconnect the traditional end of the policy process to its beginning. Thus, issue transformation “bridges” previously disconnected islands of policy attention into a more coherent but dynamic policy stream that can span considerable periods of time. But beside the addition of an issue transformation phase, he suggests that metaphorical adjustments are also needed to provide a more appropriate cognitive focus.

Metaphors are powerful linguistic devices that focus attention, summon up mental images, and then embed cognitive constructs within the imagery. Meaningful metaphors help us make sense of our world.⁷⁶ Kronenberg asserts that the machine metaphor typically used to describe policy processes, with its linear and mechanistic assumptions, is incompatible with the ill-defined, dynamic, and complex attributes of issue transformation. By changing our metaphorical context to a cloud metaphor, especially for the initial and concluding phases of the policy process, one is better able to encompass the dynamics and complexity of policy processes as they are understood by participants. “The cloud acquires its greatest utility when we recognize how hard it is to define the boundary of a social network. Like a cloud, we can see it off in the distance, but as we approach it, it becomes less and less distinct.”⁷⁷

Clouds, he notes, have a number of features that can enhance our understanding of policy processes. Boundaries of clouds, as noted above, are as difficult to define with precision as are the boundaries of policy subsystems; as one approaches either a cloud or a policy subsystem the definitiveness so evident at a distance becomes blurred as its edge diffuses into its surrounding environment. Clouds also mirror the changeable and unpredictable nature of policy subsystems; they evoke descriptive differences that are interpretive rather than factual; and they can be generally – but only generally – characterized or patterned as to type. Policy subsystems exist within and are related to their surrounding environment in much the

⁷⁶ See Behn, Robert D. “Management and the Neutrino: The Search for Meaningful Metaphors.” *Public Administration Review*, 52:5 (Sept/Oct 1992), p. 409. Metaphors also play significant roles in the work of Gareth Morgan. See Morgan, Gareth. *Imagin-i-zation: New Mindsets for Seeing, Organizing, and Managing*. Thousand Oaks, CA: Sage Publications, 1997, pp. 276-280.

⁷⁷ Kronenberg, “Chaos and Re-thinking the Public Policy Process,” p. 259.

same way that clouds are related to temperature, wind direction, wind speed, and relative humidity. And clouds, like policy subsystems, have outputs and outcomes that may trigger additional environmental adjustments.⁷⁸ These features of clouds as a metaphor for policy subsystems are fully compatible with the advocacy coalition framework, as discussed in the next chapter's research approach.

The initial and concluding phases of policy activities are difficult to define with precision, involved as they are with change, redefinition, and values-driven tension. It is especially in these areas, Kronenberg notes, that the cloud provides a more appropriate metaphor for policy activities, and that issue transformation more accurately describes the nature of policy activities in this special environment linking the end of the policy process with its beginning. This perspective provides a useful mental model for viewing and examining issue transformation and its relation to policy change across the history of information resources management as a policy subsystem.

2.3 Public Administration: The Disciplinary Home

A retrospective look at American administrative practice reveals the confluence of two fundamental and uniquely American concepts. On a political level, an individual's rights to exercise political freedoms of expression, assembly, and participation in the political process are constitutionally guaranteed. At the same time, one's economic interests through the acquiring, holding, and disposing of property are also constitutionally guaranteed. Because of citizens' rights to participate in civic life and to control property, government is required to provide a great deal of information to its citizens. Protecting individual and corporate economic interests in property while simultaneously guaranteeing the individual's rights within a political system built upon a

⁷⁸ Ibid., pp. 259-260. Kronenberg notes that other phases of the traditional process also suffer from limitations of the machine metaphor (specifically the policy formulation and policy adoption phases); here an organic metaphor incorporating notions of growth and interaction with the environment could provide significant improvement in explanatory power for these phases.

foundation of checks and balances mandates an information intensive Federal enterprise.⁷⁹

The separation of powers, checks and balances, the Bill of Rights with its due process clause, not to mention the federal administrative structure, necessitate a tremendous amount of paperwork. Checks and balances, along with the separation of powers, frequently require the executive branch, Congress, and the courts to simultaneously engage in similar information activities in the process of developing independent positions on the same issues. The Bill of Rights and its due process clause, designed to protect the rights of the individual and property, cause a considerable amount of paperwork in the attempt to ensure privacy and confidentiality.⁸⁰

It is not surprising, therefore, that dealing with the information generated for and by governance has been a subject of nearly continuous concern to policy-makers. Special committees, boards, and legislative initiatives have been used as vehicles for dealing with information management challenges since at least 1813, striving to deal with the expanding reach of government, its economic and efficient operation, and the inevitable volume of information.⁸¹ Between 1887 and 1974, no less than eight separate commissions addressed "paperwork management" as part of their management reviews,⁸² revisiting the Federal government's paperwork problem on an average of once every eleven years! It is not surprising then to find that the remedies recommended were predominantly oriented toward the management philosophy and information technology in vogue at the time, and that most of the reform palliatives

⁷⁹ Morss, Elliott R., and Robert F. Rich. *Government Information Management: A Counter-Report of the Commission on Federal Paperwork*. Boulder, CO: Westview Press, 1980.

⁸⁰ Ibid., p. 1. Attributing the root causes of the "paperwork burden" to the Founding Fathers is not a commonly heard point of view, perhaps because "paperwork" is usually viewed as a contemporary problem, and because of a desire to politically affix blame. This view, nevertheless, contains an argument that is difficult to discount.

⁸¹ Relyea, Harold C. "Historical Development of Federal Information Policy." In McClure, Charles R., Peter Herson, and Harold C. Relyea, eds., *United States Government Information Policies: Views and Perspectives*. Norwood, NJ: Ablex Publishing Corporation, 1989, p. 27. He notes that in 1813, routine printing and distribution of House and Senate journals was authorized. That same year, depository libraries for congressional literature were authorized.

⁸² Commission on Federal Paperwork. *Information Resources Management*, pp. 19-20.

lacked a theoretical basis. Until the second half of the 20th Century, these remedies had at best a tenuous connection to public administration thinking or practice.

Prior to 1975, most Federal information policy activities were associated with major administrative reform initiatives. In these initiatives, reform legislation directly influenced or created *de facto* information policy. Reforms addressing government documents and their management, for example, can be found in the early history of the United States, in the Brownlow Commission's activities,⁸³ and culminating with the Federal Reports Act of 1942.⁸⁴ Document production and handling technologies and concepts were developed and refined during this period. Handwritten documents were replaced by typewritten ones; filing systems, forms, carbon paper, dictating machines, and vertical filing cabinets were developed to generate, handle, and store information.

Records management (and its attendant activity "forms clearance") arrived as a formal administrative activity with the passage of the Federal Reports Act of 1942, signaling the reformers' concern with the physical manifestations of information. Two Hoover Commissions sought to reform government management practices and policies;⁸⁵ and legislative insistence prompted agency-level records management systems and added records to the management repertoire.⁸⁶ Records and document management systems were justified in terms of providing a permanent record, an auditable trail of official actions, and a legally sufficient record of government activities.⁸⁷ Despite the increased focus on records management, these information-intensive

⁸³ Chandler, Ralph Clark, ed. *A Centennial History of the Administrative State*. New York: Free Press, 1987, p. 22.

⁸⁴ 5 U.S.C. 139c. The Federal Reports Act of 1942 (5 U.S.C. 139c) prohibits any agency from conducting or sponsoring the collection of information upon identical items from 10 or more persons without the prior approval of the Director of the Bureau of the Budget.

⁸⁵ The First Hoover Commission on Organization of the Executive Branch of the Government was established July 7, 1947 (61 Stat. 246). It studied and investigated the organization and methods of operation of the Executive branch of the Federal Government, and recommended organization changes to promote economy, efficiency, and improved service. The Second Hoover Commission, established July 10, 1953 (67 Stat. 142), focused on policy issues avoided by the First Hoover Commission. Paperwork and records management was one of thirteen functional areas studied.

⁸⁶ Federal Records Act of 1950.

⁸⁷ 44 U.S.C. Chapter 31, Sections 3101 and 3102.

activities were reflected in public administration practice and literature as components of a broader, general management reform theme.⁸⁸

Then the computer burst upon the scene. By the mid-to-late 1960's, computers were rapidly becoming integral to major federal programs, state governments, and large urban governments. Because of computers' costs, associated concerns such as information, information technology, and attendant issues became items of policy attention on Capitol Hill. However, as a discipline, public administration was slow to acknowledge the ongoing computerization of public agencies at all levels. Administrative processes for computer acquisitions stemming from the Brooks Act of 1965 were far less interesting to researchers than federalism or the Nixon administration's block grants. Refereed literature covering the initial development and infusion of information systems into public agencies is scarce, especially during the latter part of the 1960's and the 1970's. And much of the discussion of IRM implementation and its policy implications, rather than appearing in public administration literature, surfaced in journals related to the information and library sciences, reflecting that discipline's concerns, policy orientation, and system of values. One significant work, an edited volume addressing the work of the Commission on Federal Paperwork was created by some of the researchers involved in studying information and technology-related issues.⁸⁹

Through the work of a few visionary researchers, an awareness of computers in public organizations slowly found its way into public administration research, educational programs, and literature.⁹⁰ In 1986 ASPA produced a special edition of the

⁸⁸ Chandler notes that management reform in practice and in the literature dates back to at least 1910, with a focus on "classical management, specifically those emphasizing line and staff relationships, functionalism, and the old principles of administration, all to the ends of economy and efficiency." Chandler, *A Centennial History of the Administrative State*, p. 15.

⁸⁹ Horton, Forest W., and Donald A. Marchand, eds. *Information Management in Public Administration: An Introduction and Resource Guide to Government in the Information Age*. Arlington, VA: Information Resources Press, 1982.

⁹⁰ See for example, Kraemer, Kenneth L. "The Evolution of Information Systems for Urban Administration," *Public Administration Review*, 29(4), 1969, pp. 389-402. Kraemer, along with John Leslie King, William H. Dutton, James H. Danziger, Rob Kling, James L. Perry, and Alana Northrop (to name just a few of Kraemer's prominent collaborators) has created a highly enviable publishing record (Kraemer began to publish in 1969) focusing on information systems in public agencies.

Public Administration Review containing 15 articles on various aspects of computing in public organizations.⁹¹ Two of these articles focused on the need for information systems education in public administration, public affairs, and public management programs. The focus of these authors' concerns, however, was weighted heavily in favor of technology: learning about technology, its capabilities, and its use in governance. Information and information technology were rarely viewed as *policy concerns* within public administration.

Implementing the IRM legislation, following the passage of the Paperwork Reduction Act (PRA) of 1980, did receive some scholarly attention. In 1986 the National Academy of Public Administration sponsored a study of the implementation and effectiveness of the PRA.⁹² The interest in implementation may have been due as much to clashing ideologies as to its intrinsic importance, especially given the reluctance of the first Reagan administration to implementing a Carter administration initiative that they believed only added to the bureaucratic problem posed by government in Washington.

During the decade of the 1990s, however, policy and management issues related to the increasing penetration of information systems into public agencies began to receive attention in public administration circles. Journals such as the *Social Science Computer Review* and the *Government Information Quarterly* provided coverage of computing in both disciplinary and agency settings. Garson contributed to what he calls "the relatively small but growing body of empirical research on just what information technology is doing to our society, our organizations, and even to us as individuals."⁹³ Light examined 50 years of reform movement trends,⁹⁴ and more recently, Heeks' edited volume examined the international "reinventing government" movement and concluded that this also is a different way of presenting reform. "Reinventing government in the information age therefore means addressing a long-standing reform

⁹¹ *Public Administration Review*, November 1986, Vol. 46, Special Issue.

⁹² Caudle, *Federal Information Resources Management: Bridging Vision and Action*.

⁹³ Garson, *Computer Technology and Social Issues*, p. i.

⁹⁴ Light, Paul C. *The Tides of Reform: Making Government Work, 1945-1995*. New Haven, CT: Yale University Press, 1997.

agenda with a greater emphasis on information and on the use of information technology.”⁹⁵

Increasingly, topics addressing information, information technology, and records in relation to policy have been the subjects of dissertation research within public administration. Three recent dissertations from Virginia Tech’s Center for Public Administration and Policy have addressed managing information technology,⁹⁶ electronic records,⁹⁷ and implementation of Federal Chief Information Officer legislation,⁹⁸ demonstrating a growing interest in the intersections of public administration and policy with information- and information-technology related concerns.

New perspectives and cognitive models, needed to deal with the increasing penetration of information and information technology into traditional public administration, provide intellectual inspiration and can cause us to view the familiar from new and fresh points of view. One such perspective is provided by Goodsell’s⁹⁹ study of political authority as reflected in the architecture of civic spaces, insights that are especially relevant when thinking about designing and constructing a virtual reality model of policy and public administration activities.

2.4 Information Resources Management: The Practice

In the late 1950's and early 1960's a handful of curious scholars, business executives, and government leaders were beginning to appreciate the importance of information to both public and private organizations. Their research and observations suggested that information and the means to manipulate it were becoming increasingly pervasive and important to organizational action. While scholars were focused on

⁹⁵ Heeks, Richard, ed. *Reinventing Government in the Information Age: International Practice in IT-enabled Public Sector Reform*. London: Routledge, 1999, p. 1.

⁹⁶ Holden, Stephen H. *Managing Information Technology in the Federal Government: New Policies for an Information Age* (Ph.D. diss. Virginia Polytechnic Institute and State University, 1994).

⁹⁷ Rawlings-Milton, Mary. *Electronic Records & the Law: Causing the Federal Records Program to Implode* (Ph.D. diss. Virginia Polytechnic Institute and State University, 2000).

⁹⁸ Bernard, Scott A. *Evaluating Clinger-Cohen Act Compliance in Federal Agency Chief Information Officer Positions* (Ph.D. diss. Virginia Polytechnic Institute and State University, 2000).

⁹⁹ Goodsell, Charles T. *The Social Meaning of Civic Space: Studying Political Authority Through Architecture*. Lawrence, KS: University Press of Kansas, 1988.

questions dealing with the nature, use, usefulness, economic context, and value of information, a number of issues dealing with information as a tool of governance began to emerge. The increased role of computing and communicating digital information in public organizations was raising fundamental governance issues related to privacy of information, information technology acquisition, information and management reforms, security of information, paperwork burden, and the information and records of government actions. (The genesis of each of these issues is discussed in more detail in Chapter 4.)

The notion of an information economy was first introduced by economist Fritz Machlup in his seminal work, *The Production and Distribution of Knowledge in the United States*.¹⁰⁰ Published in 1962, he argued that “an economy can be separated into two domains. The first is involved in the transformation of matter and energy from one form to another. The second is involved in transforming information from one pattern into another.”¹⁰¹ His macroeconomic analysis of information in the U.S. economy provided the first quantitative assessment of the information age: using 1958 as the base year for his analysis, Machlup showed that knowledge industries then contributed 29% of the GNP and employed 31% of the non-farm workforce.

At the Wharton School, Adrian McDonough was seeking to understand the complex relationships among communications, computers, and management systems. His 1963 book, *Information Economics and Management Systems*, postulated the notion of “information economics,” a focus that led him to examining the value premises of information within the firm. “The essence of information,” he noted, “is the property of value – the use of information to further well-being. Information processing in the past has suffered because it was assumed that it was similar to the processing of a physical product. Information is and must always be conceptual in nature. It has no physical

¹⁰⁰ Machlup, Fritz. *The Production and Distribution of Knowledge in the United States*. Princeton, NJ: Princeton University Press, 1962.

¹⁰¹ Porat, Marc Uri. *The Information Economy: Definition and Measurement*. Washington, D.C., Office of Telecommunications, U.S. Department of Commerce, May 1977, p. 2. Special Publication 72-12(1). Note that here Porat speaks about the contribution of Machlup to defining our notions of an information economy, and of information as an economic resource.

embodiment. The separation of the concept of information from the physical mediums carrying information has been a major breakthrough."¹⁰²

McDonough's research linked the notions of knowledge, information, and data to management activities and to organizations, making consideration of information a necessary element of management reform. "Thus information, problem solving, and decision making are sequentially related, and a study of one must necessarily overlay the other. . . . Information pervades all aspects of a business."¹⁰³ Credited with advancing the notion of "*treating information as a resource*" in business and government, McDonough's ideas found fertile ground more than a decade later, profoundly influencing the members of the Commission on Federal Paperwork. It was through this intellectual connection that the term "information resources management" was coined.

In 1975, the Commission on Federal Paperwork began examining the problem of excessive paperwork resulting from government activity. The commission found that the practice of regarding information as a "free good" by many government officials was an important cause of excessive paperwork. They estimated the annual federal paperwork cost to the business community at \$25-30 billion (in the 1975-1977 time period). After two years of study the commission recommended numerous ways to improve the management of information within the federal government, providing a conceptual foundation for legislative action.¹⁰⁴

In the two years following the commission's conclusion, a number of paperwork reduction initiatives were introduced, including three Senate bills in 1979.¹⁰⁵ Each of these narrowly drawn bills would create additional oversight of and restrictions on the paperwork initiatives of agencies. None passed, and it was not until 1980 that a legislative initiative broad enough to encompass a critical intersection of issues and

¹⁰² McDonough, Adrian M. *Information Economics and Management Systems*. New York: McGraw Hill Book Company, Inc., 1963, p. 14.

¹⁰³ McDonough, *Information Economics*, p. 28.

¹⁰⁴ Commission on Federal Paperwork, *Information Resources Management*.

¹⁰⁵ S. 119, the Business Reporting Reform Act of 1979; S. 1141, The Paperwork and Red-Tape Reduction Act of 1979; and S. 391, the Federal Administrative Improvements in Reports Act.

interests was introduced. When passed in 1980 by unanimous voice vote, the Paperwork Reduction Act of 1980 encompassed the issues of acquisition, computers, and records, as well as the political streams of government reform, paperwork burden reduction (especially for small business interests), and control over information technology. IRM's political benefactors displayed their common interests in passing the Paperwork Reduction Act: proponents of a decrease in the paperwork burden, especially on small business, a faction lead by Representative Frank Horton (R-NY); those backing general government reform, especially to promote efficiency, a group led by Senator Lawton Chiles (D-FL); and those seeking to institute centralized management control over automatic data processing acquisitions in the federal government, a faction led by Representative Jack Brooks (D-TX).¹⁰⁶ On December 11, 1980, lame-duck President Jimmy Carter, a longstanding advocate of administrative reform, signed the Paperwork Reduction Act creating an "information resources management" function in each Federal agency. In the terms of the advocacy coalition framework, information resources management was now a "nascent" policy sub-system, a subsystem "in the process of forming."¹⁰⁷

2.5 Virtual Reality: Technology for Visual Representation

"Virtual reality is the ultimate representation, with the aim of simulating reality in such a way that our perceptions of the *virtual* environment replace the perception of our *real* environment. The development of perspective in the fifteenth century was indeed the first milestone in the path which leads to the simulation of three-dimensional forms through two-dimensional media."¹⁰⁸ While some might find the use of virtual reality (VR) in policy research a bit incongruous, one could suggest that this is no different than the first use of a Chi-Square test, a Pearson's *r*, or a t-distribution in policy research. Virtual

¹⁰⁶ Caudle, *Federal Information Resources Management: Bridging Vision and Action*.

¹⁰⁷ Sabatier, *Theories of the Policy Process*, p.135.

¹⁰⁸ Bertol, Daniela. *Designing Digital Space: An Architect's Guide to Virtual Reality*. New York: John Wiley & Sons, Inc., 1997.

reality is a tool, as is statistics, with which to represent a complex reality – in this case a digital and visual representation of issue transformation in policy activities.

Arriving in full-hype early in the 1990's, virtual reality enthusiasts peddled their technological innovation as the ultimate in interactive simulation or virtual experience. Rheingold, in his popular book *Virtual Reality*,¹⁰⁹ provided the first lay introduction, characterizing the technology, personalities, and promise of VR. Part simulation, part representation, and part interaction, virtual reality provides an environment that not only is “totally visual, but the user can also be involved interactively with the outcome or progress of the simulation. Virtual reality creates ‘worlds’ in which the user can visit, interact with objects, change things, and experiment in general with the environment. This element of interactivity becomes the key defining feature of a virtual reality experience.”¹¹⁰ The early to mid 1990's produced numerous books and articles on virtual reality and its promise. Much of the writing was devoted to the technology and the wishful thinking of the technology's advocates. A few volumes, such as Pimental and Teixeira's *Virtual Reality: Through the New Looking Glass*,¹¹¹ provided a balanced perspective for viewing the technology, for understanding the challenges of creating a virtual world, and for understanding some likely applications of VR's capabilities – without all the usual technoeuphoria.

“Virtual reality,” Pimentel says, “is all about illusion. It's about computer graphics in the theater of the mind. It's about the use of high technology to convince yourself that you're in another reality, experiencing some event that doesn't physically exist in the world in front of you. Virtual reality is also a new media [sic] for getting your hands on information, getting inside information, and representing ideas in ways not previously possible. . . . Virtual reality is where the computer disappears . . . [it] retreats behind the scenes and becomes invisible, leaving you free to concentrate on tasks, ideas, problems, and communications.”¹¹²

¹⁰⁹ Rheingold, Howard. *Virtual Reality*. New York: Summit Books, 1991.

¹¹⁰ Knode, Steve. *A Manager's Guide to Virtual Reality*. Unpublished manuscript, IRM College 1999.

¹¹¹ Pimental, Ken, and Kevin Teixeira. *Virtual Reality: Through the New Looking Glass*, 2nd. San Francisco: McGraw-Hill, 1995.

¹¹² *Ibid.*, p. 7.

Given that virtual reality is all about representation and representing information within a computer in ways so that the computer becomes invisible, the challenge then becomes one of crafting the representation of information. Brenda Laurel, one of the foremost thinkers about human-computer interface design, and author of the provocative *Computers as Theatre*, asserts that a graphic designer's role in a computer representation is like the role of the theatrical scene designer. "Both create representations of objects and environments that provide a context for action. . . . Both theatrical design and graphical interface design are aimed at creating representations of *worlds that are like reality only different*. But a scene design is not a whole play – for that we also need representations of character and action. . . . In a theatrical view of human-computer activity, the stage is a virtual world. The technical magic that supports the representation, as in the theatre, is behind the scenes. Whether the magic is created by hardware, software, or wetware is of no consequence; the only value is in what it produces on the 'stage.' In other words, *the representation is all there is.*"¹¹³

Literature providing insight into creating virtual representations, although available, is of limited utility and follows one of two tracks. Stuart, author of a comprehensive work on designing virtual environments, presents the rational software engineering point of view.¹¹⁴ Its reductionistic and linear orientation presumes a rational-comprehensive view of the entire enterprise, akin to the policy sciences functionalist "linear policy stages" model from which analysts are trying to escape. The other track provides "how to" and "here's what we did" vignettes about VR world creation. While individually interesting, one must peruse, extract, and distill useful lessons from a considerable body of experiential and anecdotal information. Partially filling this void is a relatively new field of study, information visualization, focusing on visually displaying complex information without fealty to hardware or software configurations.

¹¹³ Laurel, Brenda. *Computers as Theatre*. New York: Addison-Wesley Publishing Co., Inc., 1993, pp. 9-17.

¹¹⁴ Stuart, Rory. *The Design of Virtual Environments*. New York: McGraw-Hill, 1996.

2.6 Visualization: The Toolset

“Until recently, the term *visualization* meant *constructing a visual image in the mind* (Shorter Oxford English dictionary). But now it has come to mean something more like *a graphical representation of data or concepts*. Thus, from being an internal construct of the mind, a visualization has become an external artifact supporting decision making.”¹¹⁵ The second, newer meaning is the primary meaning used in this research; however, the visualization approaches used can also cause the phenomenon of the first definition to occur. This overview of visualization literature focuses on three broad groupings: the artistic, the academic, and the pragmatic.

In one of his early works, political scientist and statistician Edward Tufte commented on the difficulty of representing statistical information.¹¹⁶ In several of his subsequent projects, he remedied that difficulty by highlighting the visual display of data,¹¹⁷ nouns,¹¹⁸ and verbs¹¹⁹ in his artistic quality books. In each of these three volumes he focused on presenting exemplars of visual information, retaining fidelity to the original phenomena, yet providing a visual and informational experience unavailable through other means. Although Tufte eschewed computer visualizations until quite recently, I asked him if he thought virtual reality had a future in visualizing complex phenomena. Admitting that it might be possible, he noted that the primary challenge (as of 1996) was trying to represent high resolution information in a low resolution medium. While resolution remains a challenge, each successive generation of computing and display devices lessens the barriers to true visual fidelity. As an icon in the “visualization as informative art” category, Tufte provides visualization benchmarks.

¹¹⁵ Ware, Colin. *Information Visualization: Perception for Design*. San Diego: Academic Press, 2000, p. 1.

¹¹⁶ Tufte, Edward R. *Data Analysis for Politics and Policy*. Englewood Cliffs, NJ: Prentice-Hall, 1974.

¹¹⁷ Tufte, *The Visual Display of Quantitative Information*.

¹¹⁸ Tufte, Edward R. *Envisioning Information: Narratives of Space and Time*. Cheshire, CT: Graphics Press, 1990.

¹¹⁹ Tufte, Edward R. *Visual Explanations: Images and Quantities, Evidence and Narrative*. Cheshire, CT: Graphics Press, 1997.

The artistic literature also includes the work of Richard Saul Wurman,¹²⁰ and information designer Clement Mok.¹²¹

Academic literature on visualization tends to cluster into two camps. One group begins with the information and examines approaches to visualizing information. The other group approaches visualization from the cognitive side, focusing on the mechanisms available for crafting an understandable message. Fortunately, two recent works, one from each of the camps identified above, summarize and extend the available research and insights. Spence's *Information Visualization*¹²² provides an overview of approaches to information representation and coverage of all the recent data viewing technologies. It should be of interest to anyone wishing to visualize quantifiable social science data. Ware's *Information Visualization: Perception for Design*¹²³ represents the perception-cognition approach to information visualization. The greatest value derived from this book is the understanding gained into the contexts and approaches for designing effective visualizations. Two other academics, Shepard and Goodsell, provide useful insights into visualization phenomena, Shepard by investigating the psychology of visual illusions,¹²⁴ and Goodsell by interpreting political phenomena visualized in the architecture of public spaces.¹²⁵

The last category is a potpourri of pragmatic visualization literature, dedicated to effective communication in general and to conveying specific messages in particular. Wildbur and Burke's *Information Graphics*¹²⁶ provides visually rich examples of wayfinding; techniques for maintaining spatial orientation in large, complex physical and information spaces. Harris's extensive reference work, *Information Graphics*,¹²⁷

¹²⁰ See *Information Architects*, 1994, *Understanding USA*, 1999, and his *Access* series of city guides.

¹²¹ Mok, Clement. *Designing Business: Multiple Media, Multiple Disciplines*. San Jose: Adobe Press, 1996.

¹²² Spence, Robert. *Information Visualization*. New York: ACM Press, 2001.

¹²³ Ware, *Information Visualization: Perception for Design*.

¹²⁴ Shepard, Roger N. *Mind Sights: Original Visual Illusions, Ambiguities, and Other Anomalies, with a Commentary on the Play of Mind in Perception and Art*. New York: W.H. Freeman and Co., 1990.

¹²⁵ Goodsell, *The Social Meaning of Civic Space*.

¹²⁶ Wildbur, Peter, and Michael Burke. *Information Graphics: Innovative Solutions in Contemporary Design*. London: Thames and Hudson, Ltd., 1998.

¹²⁷ Harris, Robert L. *Information Graphics: A Comprehensive Illustrated Reference*. Atlanta: Management Graphics, 1996.

provides approximately 4,000 illustrations of charts, maps, graphs, tables, and diagrams for analyzing, managing, and communicating virtually any kind of interval, ordinal, or relational data. Meyer's *Designing Infographics*¹²⁸ builds on the *USA Today* school of newspaper graphics to provide a journalistic introduction to persuasive and effective informational graphics. And last, but certainly not least, is Horn's *Visual Language*.¹²⁹ This volume is an ambitious approach to constructing a visual language that integrates words, images, and shapes into a visual language capable of communicating across cultural and geographic boundaries. Together these disparate titles provide a cafeteria of approaches and techniques for organizing, integrating, and visually displaying complex and conceptual information in a virtual reality world.

2.7 Summary

This chapter has provided a brief introduction to the fields and sources of literature represented in this study. The policy sciences provide the foundation for this effort by contributing the research question and the advocacy coalition framework used to investigate issue transformation. Set in the institutions and governance processes of the U.S. Federal government, this effort draws on public administration's theory-practice orientation for insights into information resources management as the substantive policy area and research target. Virtual reality and information visualization, the other contributing fields, provide technology and techniques with which to visually communicate the structure, the process, and results of this investigation to a broader and non-traditional audience.

¹²⁸ Meyer, Eric K. *Designing Infographics: Theory, Creative Techniques, & Practical Solutions*. Indianapolis: Hayden Books, 1997.

¹²⁹ Horn, Robert E. *Visual Language: Global Communication for the 21st Century*. Bainbridge Island, WA: MacroVU Inc., 1998.