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CULTURAL DIMENSIONS OF DIGITAL LIBRARY DEVELOPMENT, PART I: THEORY AND METHODOLOGICAL FRAMEWORK FOR A COMPARATIVE STUDY OF THE CULTURES OF INNOVATION IN FIVE EUROPEAN NATIONAL LIBRARIES[1]

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This study examines the influence of culture on digital libraries of the first wave. The local cultures of innovation of five European national libraries (Biblioteca nacional de Portugal, Bibliothèque nationale de France, Die Deutsche Bibliothek, the National Library of Scotland, and the British Library) are reconstructed in case histories from interviews with policy makers and developers of institutional digital libraries. The theories of culture and organizational rationality, social-choice systems, and strategies of organizational behavior helped articulate the framework for analysis. The study provides a historical foundation for understanding the processes of innovation in the earliest digital projects and digital libraries that resulted in an initial mass of digitized heritage material. Theory, methodology, institutional histories, and a summary of findings are presented here. Part II will present the

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foundational narratives of development—reconstructing the histories of digital initiatives in five European national libraries and their cultures of development.

> Without a collective memory, we are nothing, and can achieve nothing. It defines our identity and we use it continuously for education, work and leisure. . . . The Internet is the most powerful new tool we have had for storing and sharing information since the Gutenberg press, so let's use it to make the material in Europe's libraries and archives accessible to all. (Viviene Reding, Information Society and Media Commissioner, September 2005 [1])

Introduction

Since the European Commission adopted the initiative "i2010—a European Information Society for Growth and Employment" proposed by Viviene Reding,[3] making the resources in Europe's libraries and archives available on the Internet has become central to negotiating the new European identity [1]. The European Digital Library, a Web portal that provides consolidated digital access to material from individual libraries [2, p. 28], has been the technological manifestation of the idea of global access to local collections. While the pronouncements on the past and future of European digital heritage space work through the vision of universal access to European collective memory, the European "heritage space" is defined administratively. Thus, despite the rhetoric of collective culture, the framework of the European Union is superimposed on the local institutional context. Diversity, as a core European cultural policy today, is based on heritage substrates of constituent nations, which in turn places increased focus on national collections and local foundation collections [3, p. 72].

The processes that gave rise to the critical mass of digitized heritage material created in the first wave of digital library development from 1998 have not been researched from the point of view of the local cultures of innovation. This article fills that gap by presenting an account of the beginnings of digital library development in five European national libraries between 1998 and 2002. During that time, libraries were defining the relationship between this new medium and their existing collections and were completing large-scale digitization projects. This period can be seen as a defining moment in the adoption of the Internet in its first decade and its institutionalization. Because the Internet as a medium is "uniquely capable of integrating modes of communication and forms of content" [4,

3. The initiative was adopted on June 1, 2005 (see IP/05/643).

p. 307], studying media effects of the Internet through the lens of emergent digital libraries in national libraries had two purposes: first, to reveal the nature of the transformation and emergence of unique cultural objects coproduced in the contiguities of print and digital environments as libraries struggle to maintain authoritative representations of cultural heritage; second, to demonstrate how innovation is shaped by society, organizations, and professional norms.

This research, which focuses on the modalities of digital library development in Europe, is the latest in a series of studies focusing on the history of digital libraries, starting with the analysis of new forms of content and media continuity during the initial digital library boom from 1998 to 2002 [5, 6] and the analysis of the National Digital Library Program (1995–2000) at the Library of Congress [7, 8]. The national library contexts reflect distinct institutional traditions and local cultures; their cultures of innovation, it is argued, are shaped by continuities of organizational cultures.

The main thesis of this article is that a cultural analysis can provide insights on why models of development are unique and particular. The article identifies variables that can be used to make statements about cultural norms in a particular society and to analyze strategic choices (how the strategic issues are identified and prioritized in a particular context). These variables point to cultural variability and thus can be used to compare and contrast strategies across contexts (cultural participation), as a descriptive tool kit to consider how the environment is interpreted and how the emerging issues are validated [9, p. 151] in a particular national context (cultural diversity). In short, this is a study of cultural participation and cultural diversity through the lens of emergent digital libraries.

Medium- and short-term time frames in the history of digital library development open distinct historical time lines.[4] In a medium-range time line, digital library development can be seen in continuity with the transformative process launched some thirty years ago with the formation of the OCLC (Online Computer Library Center; originally the Ohio College Library Center) in 1967, which institutionalized a vision of an active and interactive library (Wayne K. Smith, quoted in [7, 8]), which in turn may be seen in light of the vision of access to the interconnected content of the world's libraries, as articulated in the vision of hypermedia systems and intellectual machines in the theoretical thought of information science pioneers like Paul Otlet, Suzanne Briet, and Watson Davis [10]. With the onset of digital library development in the mid-1990s to full-fledged development within a decade, there seems to be the fulfillment of a technological (and technocratic) vision of a democratized model of in-

4. The medium- and short-term time frames refer to historical periods of thirty to 100 years and five to ten years, respectively.

formation storage with ubiquitous access to multimedia collections. Pronouncements on the past and future of the European digital heritage space mirror similar teleological and technocratic visions of universal access to European collective memory.

In a short-term time line, the infrastructure for digital library development in the European context points to the periodization that identifies the first generation of digital library development, from 1998 to 2002. This coincides with a DELOS initiative funded by the European Commission's Information Society Technologies Fifth Framework Programme (IST-FP5). This initiative aimed to provide an impetus for activities contributing to the development of a "user-friendly information society," multimedia content and tools, and essential technologies and infrastructures.[5] The second generation of digital libraries roughly coincides with the Sixth Framework Programme for Research and Technological Development (FP6) running from 2002 to 2006 (effectively starting on January 1, 2004). The focus of FP6 is to coordinate research activities of European teams working in digital library–related areas, with the objective of developing the next generation of digital library technologies.[6] In her overview of European digital library activities of the past decade (1995–2005), Jia Liu concludes that their focus has been on cultural heritage and that they reveal a high awareness for special collections and rare books, have often involved cooperative efforts, and have demonstrated a shift from project to information infrastructure at a European library level [11, pp. 465–67]. Lorcan Dempsey [12, p. 2] defines the first decade of digital library development (1996–2006) as one driven and heavily influenced by several funding programs and initiatives within the European Union that are comparable to the Digital Library Initiatives of the National Science Foundation in the United States and to the Electronic Libraries Programme (eLib) of the Joint Information Systems Committee (JISC) in the United Kingdom. The past decade, according to Dempsey, is one that defined thinking about digital libraries in terms of "grand challenges" and "grand responses" [12, p. 2]. While it is safe to assume that the majority of European national libraries do have some digitization program in place today, in 2002 only fifteen of forty-three national libraries had some sort of electronic resource or digital library with online public access.[7] A search of the European national library portal

5. European Commission, "Fifth Framework Programme of the European Community for Research, Technological Development and Demonstration Activities (1998–2002)," Europa, http://europa.eu.int/comm/research/fp5.html.
6. DELOS Network of Excellence on Digital Libraries, 2005, http://www.delos.info.
7. Gabriel site searches were conducted by Sarah Oelker on May 22, 2002. Among the forty-three national libraries for which there was a record available in Gabriel, six had no Web presence, twenty-two had a Web site only, and fifteen had some form of interactive electronic resource (such as an online-access searchable catalog of its collections, digital con-

Gabriel (and its successor, the European Library)[8] at two time points—in May 2002 and June 2007—provides a basis for a very broad comparison of the scope of digital library development within that five-year period. In 2007, of the forty-seven national libraries represented in the European Library, more than half had a partly or fully functional digital library. At the time of writing this article, the formalized developments are further articulated through a common European digital cultural heritage space and information society.[9]

The launch of the i2010 initiative for a European Digital Library is part of the most recent wave of digital library innovation. This development is a multidimensional process, with an innovation component embedded into discourse around cultural heritage and the roles and jurisdictions of cultural collecting institutions, including national libraries in relation to (increasingly digital) heritage [14] in addition to digital continuities for print and paper. The DigiCULT thematic issue (December 2004) *The Future Digital Heritage Space: An Expedition Report* [15] describes the state of digital library development in Europe in terms of priorities that emphasized practical aspects of conserving cultural treasures and scientific information, the outcomes of which were reported at the meeting held in Salzburg (June 21–22, 2006).[10] Digitization of cultural heritage is a key activity,

tent, or resource representation). They ranged from digital collections to fully developed digital libraries (e.g., Gallica at the Bibliothèque nationale de France or Denmark's ELEKTRA Collections). This finding does not account for digital library development and digitization activities that were under way in the national libraries but not yet publicly available on the Web.

8. Accessed on May 22, 2002, at http://www.bl.uk/gabriel/en/countries.html. Since June 25, 2007, the link has been redirected to the European Library site (http://www.theeuropeanlibrary.org/portal/index.html), which shows a slightly different configuration of forty-seven European national libraries and twenty-four searchable collections.

9. The DigiCULT report (January 2002) *Technological Landscapes for Tomorrow's Cultural Economy: Unlocking the Value of Cultural Heritage* [13], issued by the directorate-general of the European Commission's Information Society, presents the digitization policy requirements for national and regional governments and the cultural institutions (the memory institutions). What is notable for cultural analysis is the association of cultural heritage with the notion of cultural economy. In the aftermath of the first wave, the emphasis on circulating economic and not only political meanings around cultural heritage has informed some of the entrepreneurial thinking about the digital future for Scotland in the European context (see Part II for further discussion).

10. The conference was titled "An Expedition to European Digital Cultural Heritage: Collecting, Connecting—and Conserving? International Conference on the Digitisation of Cultural Heritage." Its goals are summed up briefly in a call for papers: "The conference thus builds on the efforts of the European Union to make the diversity of the European cultural heritage accessible to all citizens and to preserve it for future generations. It aims at contributing to the implementation of the Dynamic Action Plan for the EU coordination of digitisation activities, and at fostering discussion on the i2010 initiative for a European Digital Library" (Pete Johnston, e-mail to JISC Interoperability mailing list,

according to the European Commission's proposal for a recommendation on digital preservation in 2006 [1]. Programs to make digital libraries a reality throughout Europe include the funded projects of FP6 (2005), the Seventh Framework Programme (FP7; 2007), and the eContentplus Programme (2005–8).[11] The words of Information Society and Media Commissioner Reding used as an opening for this article reflect a vision for managing national identities at the European level through digital library development.

From European Commission initiatives IST-FP5 (1998–2002), FP6 (2002–6), and FP7 (2007), programs presented in *The Future Digital Heritage Space: An Expedition Report* [15], and the eContentplus Programme (2005–8) to a distributed European Digital Library of the i2010 program, the time line of digital library development in Europe has shifted from innovation to institutional maturation. The launching of the i2010 initiative for a European Digital Library has brought new emphasis to the questions arising from the digitization and transformation of historical heritage into digital content. The national and depository libraries will remain institutional bases for coordinated cultural practice at the European level.

Problem Statement: Innovation as the Problem of Culture

The culturalist perspective assumes that organizational variability can be attributed to cultural differences [16], as one way in which one may problematize variability. This can be reformulated as the question of whether the particularities of the emerging models of digital library development are attributable to culture as a special dimension, in addition to organizational contingency or institutional imposition. The culturalist approach focuses on the semantics of development and interpretation by social actors (humans involved in the process) rather than on structural constraints in a deterministic fashion. Further, this question can be embedded in broader discussions about innovation diffusion, such as whether technology itself is an agent of social change or whether technology is shaped by social and cultural contingencies.

February 3, 2006, http://www.jiscmail.ac.uk/cgi-bin/webadmin?A2=ind0602&L=Interoperability&T=0&F=&S=&P=180).

11. For example, FP6 made 36 million euros available for various research programs on advanced access to cultural heritage and digital preservation; FP7 aims to increase research on digitization, digital preservation, and access to cultural content through "centres of competence" in digitization and preservation. Similarly, between 2005 and 2008, the eContentplus program will contribute 60 million euros toward interoperability of national digital collections, facilitating multilingual access and the use of cultural material [1].

Research Questions

The following questions guided the research presented in this article:

- Is culture involved in innovation diffusion and institutionalization?
- How are digital libraries built at the national and international levels?
- How does culture affect organizational variability in the area of digital library development?

The study of institutional change connected to technological innovation and library development was accomplished through interviews with seven policy makers and digital library developers from five national European libraries: Biblioteca nacional de Portugal, Bibliothèque nationale de France, Die Deutsche Bibliothek, the National Library of Scotland, and the British Library. The accounts they provided about the beginning of the digital initiatives in their institutions provided material for the reconstruction of institutional discussions of development. The interviews were conducted at the point of institutionalization of the digital libraries in these institutions. Research sites were selected according to typologies common in cross-national studies of organizations, to ensure that research sites are representative of the variability of national cultures and models of development. The rationale for selection of these particular sites is discussed in the section "The Research Design."

The main thesis of this research project is that understanding technological innovation in libraries nationally and internationally depends on how the environment (structure) is shaping decision making for innovation. Using a theoretical framework presented in earlier studies [6–8], structure is considered at three levels: society (external to the organization), professional norms (external and internal), and organizational pressures for efficiency and control (internal to the organization and external in terms of pressure from governmental offices). How one interprets the interaction between structural levels, technological innovation, and organizational variability depends on how technological innovation is viewed in the first place. Three existing models that guide the research on technology innovation in organizations [17] need to be considered here. Ranging from technological determinism to social constructivism, they include (1) the technological-imperative model, (2) the strategic choice model, and (3) the structural change model. These three models present the technology environment as internal (strategic choice model), external (technological-imperative), or mixed external-internal (structural change model).

Perspectives on Technological Innovation in Organizations

1. *External.*—In the technological-imperative model (technological determinism framework), technology is viewed as an autonomous and

external force beyond human control that structurally changes organization (i.e., an external agency with deterministic impact on organizations). Integral to this view is that technology is discontinuous and revolutionary [18].

2. *Internal.*—The social constructivism framework emphasizes the human aspect in shaping technology. Technology is viewed not as an external object but as an intentional product of human actions, design, and appropriation [17]; it thus can be studied from the point of view of social constructivism [18]. This approach does not emphasize as primary the physical realities of the technology (its material and structural aspects).[12] Instead, the social constructionist perspective focuses on how shared interpretations of the meaning of a certain technology arise and how they affect the development of and interaction with that technology. These perspectives focus on understanding the continuous time dimensions of technological change [19]. A social constructivist approach to the study of large technical systems, such as recent digital innovation in libraries, is therefore by necessity historical—that is, retrospective and longitudinal in the language of social science. A recent application of the social constructivist approach in the information science field to study the development of a large technical system, the National Digital Library Program at the Library of Congress, provided insights into how the meaning of technology is created and sustained by different groups [7, 8]. Social constructivism as a metatheoretical orientation can integrate the social imposition model at work through external pressures for efficiency (such as those by governmental offices that shape interactions) because it allows seeing such pressures in the context of a variety of external/internal loci of control and the socially relevant groups shaping innovation. The social constructivist model extends beyond the normativity and determinism of the social imposition framework.
3. *Mixed external-internal.*—The "technology as a trigger for structural change" model views technology as an external and objective force that affects organizations but is also shaped by organizational contingencies, therefore making it dependent on environment [17] in a mechanistic sense.

While the strategic choice model (2) focuses on the phenomenological perspectives of social actors (the human dimension of technology), the structural change model (3) views technology as embedded in different

12. The sociotechnical perspective focuses on how technology is physically constructed through the choices and decisions of human actors and how the sociotechnical fit results in better performance [17].

organizations and shaped in the context of historical processes and organizational contingencies.[13] This model conceives of its adoption as structured and mediated through inertial historical processes that express the culture and community engaged in replication and dissemination of culture and its token manifestations [20, p. xii]. Thus, the contingencies of external and internal loci of control that shape technology can be mapped to the structural aspects identified earlier: the society, professional norms, and organizational pressures for efficiency. The cultural dimension, operating through these structural levels, is expressed through the philosophies of digital library development that emerged in the interviews.

Innovation Cultures: Relevant Theories

The study of variability of digital library development in national libraries hinges on the definition of culture. The systems of meaning around innovation (the cultures of innovation) reflect different levels of institutional control that shape innovation activities and provide rationalization for these activities, as another take on the culture problem in the context of how organizations manage technological change. Relevant theories of cultural variability and theories of organizational rationality were used as a framework for the analysis of the cultural variability of digital library development. Together, these two frameworks enabled a comparative approach in recreating dominant discourses of development and interpreting each case in relation to rationality frames provided by societal, professional, and organizational context. The two aspects of this theoretical context are discussed next.

The Culture Dimension: Cultural Variability and National Culture

The culture dimension is a contingency that involves national, organizational, and professional culture, as well as heterogeneous influences from the heterogeneous cultural tool kit, which may integrate other cultural influences (such as popular culture forms or internal protocols of innovating teams). The culture formula representing these different influences looks like this:

Culture = National Culture + Organizational Culture + Professional Culture + Heterogeneous Tool Kit Culture, or

$$C = NC + OC + PC + TC.$$

A range of cultural influences from a tool kit of interacting cultural

13. In this view, technology is a social object that is defined by the context of its use while its physical form remains fixed over time [17] and across different organizations.

systems and nonnational subcultures, such as organizational and professional culture-following processes, will motivate the culture formula. Therefore, cultural analysis needs to take into account the compound and heterogeneous nature of culture. The section that follows will examine the culture concepts influential in the studies of organizations, including a latent-variable view of culture, social-choice systems, and epistemic cultures of knowledge work environments.

Latent-variable view of culture.—The latent-variable view of culture produced influential thematic categorizations in management research [21–24]. Although this framework has been superseded by the view of "representations of culture as toolkit or repertoire (a collection of stuff that is heterogeneous in content and function)" [25, p. 267), it still inspires empirical work in the management field. The latent-variable view of culture allows for typifications of behavior and inferences to groups, and it works with assumptions of worldviews and collectivities.[14] National libraries are institutional contexts within which norms for collectivities are articulated by the state and tradition, organizations shaped by external forces of governments, and official representations of culture.[15]

Simcha Ronen and Oded Shenkar [26; quoted in 9, p. 152] have shown that two sets of cultural assumptions in particular are relevant to explain and understand the formulation of strategies and organizational behavior. They are assumptions about "external adaptation" (relationship with the environment) and assumptions about norms of "internal integration" (relationships among people). A more detailed schema of two basic cultural assumptions and constitutive dimensions from the management literature follows.

External Adaptation (relationship with the environment):

- Uncertainty and ambiguity: avoided versus tolerated
- Control over the environment: manage it versus adapt to it
- Activity: proactivity versus reactivity; doing (task orientation) versus being (propensity for fatalism)
- Truth and reality: empirical evidence (reliance on hard facts, tangi-

14. The latent-variable view of culture originates from the Durkheimian notion of "organic solidarity" of coherent national societies and cohesive subnational groupings.
15. As one of the reviewers of this article noted, latent-variable culture calls for a Gramscian critique of state worship and for hegemonistic tactics of dominant worldviews engaged in the production of culture, knowledge, and the nation in the context of digital library development. This may be a productive direction for further study of digital heritage in national memory institutions, as opposed to grassroots initiatives and interventionist roles of organic intellectuals. At this point, I entertain this idea in relation to a broader context of how digital heritage initiatives of the broadest scope have provided access to the competing ideas of heritage, locality, and vernacular cultures.

bility) versus philosophical orientation (theoretical logic); inductive versus deductive
- Time: past-, present-, or future-focused (determines tradition orientation); linear versus cyclic; limited versus unending
- Change: positive (seen as progressive) versus threatening (seen as disruptive)

Internal Integration (relationships among people):
- Hierarchy: power and status are emphasized (or de-emphasized)
- Individual versus group: individualism versus collectivism
- Social versus task orientation

These variables can be used to make statements about cultural norms in a particular society and to analyze strategic choices (how strategic issues are identified and prioritized in a particular context). They can point to cultural variability and can thus be used to compare and contrast these strategies across contexts. They provide a descriptive tool kit to understand how the environment is interpreted and how emerging issues are validated [9, p. 151] in a particular national context. Defining variables that make it possible to compare efforts of digital library development in national libraries were developed from the elaboration of these two variables and their dimensions.

The two basic approaches to managing the environment (external adaptation) are controlling or adapting [9, p. 154], and they can be used to understand technology innovation in relation to uncertainty (reduction/tolerance), control (high/low), and activity (proactive/reactive). The nature of relationships among people within an organization (which influences internal integration) will define who is involved in strategy formulation in a particular organization [9, p. 154] and the nature of structuring the relationships in the organization (through hierarchy, peer relationships, and task orientation vs. social orientation). These environmental adaptive strategies can be matched to a full-fledged typology developed by Geert Hofstede that has inspired cross-national research [23] despite many justified criticisms of such an approach.

The "national culture" problem.—Researchers of culture recognize that nations are multicultural and cultures are multinational [9, p. 152]. They also note that national culture research is fraught with fallacious assumptions and inaccurate empirical descriptions when generalizations are used [27]. Moreover, they rely on the premise that culture can be defined as a system of shared assumptions that developed over time to solve problems of environmental adaptation and internal integration [28, 29]. This definition reduces the culture dimension to the concerns of environmental adaptation and individual strategic action (internal integration). Further,

TABLE 1
HOFSTEDE'S CULTURAL INDICES MATCHED TO VARIABLES OF ENVIRONMENT (EXTERNAL ADAPTATION) AND RELATIONSHIPS (INTERNAL INTEGRATION)

Hofstede's Cultural Index	Abbreviation	External Adaptation (Environment)	Internal Integration (Relationships)
Power distance (dependencies)	PDI		Emphasis on hierarchy
Uncertainty avoidance (propensity for change)	UAI	Control	
Individualism vs. collectivism (relationship to tradition)	IDV		Peer relationships
Masculinity (career success) vs. femininity (quality of life)	MAS		Task orientation vs. social orientation
Long-term orientation	LTO	Activity Truth and reality Time Change	

the idea of national culture depends on the idea that these styles of environmental adaptation are to some degree universal (i.e., the assumption is made that they can be generalized) and can be localized within territorially defined units (i.e., confined to the territory of states). In this section, the "national culture" problem will be examined critically.

Meta-analysis of the management literature [26] has shown that country clusters report similar values and beliefs and that those similarities in cultures among nations are rooted in history, geography, language, and religion [9, p. 152]. Accordingly, culture, which is understood as a system of shared assumptions in cohesive social units (organized within nation-states as one such social form), influences how realities are constructed and affects the process of responding to the environment.

Geert Hofstede's cultural indices.—Also known as the Cultural Work Value Scale, Hofstede's cultural indices include relative values for the characteristics of culture. These dimensions can be matched to environment and relationship dimensions presented in the theoretical section, in the context of the latent-variable view of culture based on Ronen and Shenkar's schema [26, quoted in 9, p. 152] (also known as Ronen and Shenkar Country Clusters). Table 1 is a mapping of Hofstede's indices for national cultures to the variables of environment from management literature.

Hofstede identified cultural dimensions for work cultures on the basis of a large-scale study of IBM employees conducted in 1967–73 [21] and produced cultural indices for national cultures (cultural work values) of fifty-three countries [30, p. 1]. Hofstede's typology is partly usable for a

qualitative analysis of culture, even though it has also attracted considerable and justifiable criticism because Hofstede [22] makes predictive statements about the preferences for social forms and behaviors of national cultures related to these dimensions. For example, power distance (PDI) is defined as "the extent to which the less powerful members of institutions and organizations within a country expect and accept that power is distributed unequally" [22, p. 28]. From here he extrapolates to social relations and infers that cultures with high power distance emphasize hierarchies and dependencies. Great Britain and Germany score alike on the dimensions of power distance and masculinity while differing on the individualism score, and they have the largest difference in the uncertainty avoidance dimension, which, according to Hofstede, explains the greater tolerance of the unpredictable shown by the British [22, p. 110].

Uncertainty avoidance (UAI), the "extent to which the members of a culture feel threatened by uncertain or unknown situations . . . with a need for written and unwritten rules" [22, p. 113], addresses predictability. This may imply that in lower uncertainty avoidance countries "top managers may occupy themselves more with strategic problems and less with daily operations" [22, p. 122]. Hofstede writes that "strategic problems are by definition unstructured and demand a greater tolerance for ambiguity than operational problems," and this may influence how innovation is handled.

Weak uncertainty avoidance countries, therefore, could be more likely "to stimulate basic innovations as they maintain a greater tolerance toward deviant ideas," while at the same time "they seem to be at a disadvantage in developing these basic innovations towards full-scale implementation, as such implementation usually demands a considerable sense of detail and punctuality . . . more likely to be found in strong uncertainty avoidance countries" [22, pp. 122–23]. This dimension may explain the differences in the propensity for knowledge creation (innovation) versus production of operational products (implementation).

Thinking in legal terms is more natural in strong uncertainty avoidance countries [22, p. 127], as is the propensity for conservatism and the stronger need for "law and order" [22, p. 128]. Therefore, cultural differences in this dimension will be related to attitudes about rules and the relationship of citizens toward institutions, attitudes on regionalism and internationalism, belief in common sense, tendency toward relativism and empiricism in weak uncertainty avoidance countries, belief in experts and specialization, and belief in grand theories in strong uncertainty avoidance countries [22, p. 134]. Uncertainty avoidance is related to the propensity for and ease of change and the degree to which cultures establish rules, procedures, and rituals to manage individual choice.

The power distance dimension could be connected to several aspects

of digital library development, such as how client relations (libraries and users) are perceived in society, in preferences for decentralized (or centralized) organization in the institution itself, and expectations about the role of learning institutions (which could be seen as organizing learning or providing blueprints to be followed). Similarly, the innovation process may be shaped differently if one considers power distance and uncertainty avoidance dimensions to analyze the discourse of developers and development.

"In the collectivist society there is a stress on adaptation to the skills and virtues necessary to be an acceptable group member," Hofstede writes. "This leads to a premium on the products of tradition" in collectivist societies [22, p. 63]. The individualist society emphasizes continuous learning and expects that schools provide skills for continuous learning [22, p. 63]. Personal action and responsibility and loose ties between individuals in strongly individualist societies are contrasted to those in which the group (or in-group) is the major source of one's identity [22, p. 50].

Variables can be conflated, as in the case of France, which is a society with medium power distance and strong individualism, where hierarchies and dependencies are in contradiction with individualism. According to Hofstede, this is resolved through a bureaucratic system with impersonal rules and centralization [22, p. 55]. Therefore, the dimensions are translated into a principle of organizing through stratified individualism (an elaborate system of ranks not determined by the group but by tradition) [22, p. 56].[16] Hofstede claims that these dimensions can determine preferred configurations and coordination mechanisms in key parts of an organization [22, p. 152].

This deterministic system and the predictive values of national cultures have limited application to the cultural analysis of technology adoption and produce a flat and deductive view of culture (uncritical latent-variable view of culture). Despite the limited usefulness of his universalist approach to culture in the field of anthropology, Hofstede's framework continues to have wide application in management studies and sociology. His detractors have questioned the "plausibility of systematically causal national cultures" [27]. Brendan McSweeney rejects systematization that involves the national dimension of culture altogether, considering it to be reductionist and neglecting variability within a particular national culture, but also because this type of cultural analysis marginalizes richer conceptions of culture (as exemplified by Clifford Geertz's "thick description" [32]).

16. Hofstede's masculinity vs. femininity dimension and long-term orientation could not be applied here. Adler [31] has suggested that the career success vs. quality of life dimension is related to the centrality of work or social connectedness instead of masculinity/femininity dimensions because they may be confused with gender.

Although it is problematic to identify culture through a single national variable only, it is equally radical to reject the reality of national cultures altogether. This may be particularly problematic for research into national libraries because their mission as heritage institutions is defined in terms of the rhetoric of national culture. The basic tenets of Benedict Anderson's "imagined communities" [33], the engagement of the state in producing identities through artifacts of culture and print that Oz Frankel calls "print statism" [34], and Immanuel Wallerstein's world-system analysis [35] acknowledge reality in the cultural practices associated with national culture. This article follows the tradition of analysis in which national culture can be seen as rhetorical reality and a signification system that privileges particular discourses of culture in the context of institutions of the state. In this analysis, the national culture dimension is considered as one of the resources in the cultural repertoire that shapes digital library innovation [25, p. 267].

Social-choice systems.—Jim March and other researchers have consistently shown that social-choice systems [36, p. 69] operate through means of action that include far more than national culture [37]. They advocate a view of culture as tool kit. The approach taken in this article to studying technology adoption in the context of national libraries (digital library development) uses a combined model of strategic choice (the human aspect of strategic choice in shaping technology) and technology as the trigger for structural change (in which technology is an external and objective force that influences organizations but is shaped by organizational contingencies). The social-choice system approach to studying culture does not attempt to separate influences that may be difficult to distinguish. These influences include organizational structure, technology, level of economic development, products, market and industry characteristics, and institutional arrangements [9, p. 150]. These influences cannot be studied without an acknowledgment of the sociocultural history within which they occur; therefore, the national culture context needs to be considered as well.

Epistemic cultures.—In her study of knowledge-producing communities, Karen Knorr Cetina [38] developed a typology of epistemic cultures (i.e., knowledge cultures) on the basis of the strategies they use to organize the social environment and the process of argumentation. She contrasts object-oriented management and management by content. This distinction allows for comparison of cultural styles in the context of innovation.

Object-oriented mechanisms are found in the organizational framework of a laboratory, in which the "experiments [as] temporal, object-oriented mechanisms are substituted for social authority mechanisms of manage-

ment (for example, the unfolding strategy)" [38, pp. 242–43]. The cultural style identified as preferring inductive and empirical rather than deductive and theoretical reasoning corresponds to an object-oriented management culture that typifies the epistemic cultures of the laboratory and disciplines that rely on empirical argument. The experiments that constitute object worlds in expert settings of science are similar to the practice of innovation and experimentation with technology in the context of digital library innovation in libraries and in professional cultures (of librarians) that engage in this production. An analogy of a digital laboratory explains digital library development as a process that engages mechanisms of knowledge-producing communities. Focus on the empirical context of innovation that stems from practice corresponds to object-centered management—"management that maintains the proximity with objects and lets itself be structured by them" [38, p. 243]. This is paralleled by the distribution of social authority and distributed cognition (emphasizing the social nature of knowledge encoded in the objects in the environment). Communities of practice, such as the professional community of librarianship, can function as a management mechanism through discourses that coordinate work. It is by the means of discourse that "work becomes coordinated and self-organization is made possible" [38, pp. 242–43].

By contrast, management by content is a feature of organizational contexts "in which coordination [is] achieved through procedures of the sort that the unfolding procedure illustrates" [38, p. 243]. In other words, such an approach relies on strategy and established procedures that are self-justifying. It may appear that such management stifles innovation and favors the replication of existing processes. This style prefers authority to coordinate the work of knowledge production.

Theories of Organizational Rationality: Innovation and Institutional Constraints

Paul DiMaggio and Walter Powell [39] suggest a framework for studying innovation and organization in a broader social context while explaining change in the local environment. They identify three different mechanisms that define how organizations behave with regard to innovation and institutionalization:

- *Coercive isomorphism* is coercive authority imposed by "other organizations upon which they are dependent and by cultural expectations in the society within which organizations function" [39, p. 150].
- *Mimetic processes* arise from symbolic uncertainty in the environment and the organizational response to that uncertainty. To solve problems, those involved engage in resolution seeking (problemistic search) that may have a ritual aspect, such as when companies adopt

innovations to enhance legitimacy and to demonstrate that they are improving efficiency [39, p. 151].
- *Normative pressures* are exerted by the requirements of professionalization and the cognitive authority of the organizational field [39, p. 152].

All three mechanisms of transformation (sometimes referred to as isomorphism) can interact with the cultural dimensions of identity and social norms. The different levels identified by DiMaggio and Powell present loci of control through which libraries, library professionals, and society interact in the process of innovation set in motion by a "digital library" initiative. For example, coercive isomorphism can be seen at work when innovation (a digital library project) is set in motion through state legislation, or in explanations and rationalization in response to the need of innovation to manage national heritage. In this case, it is seen as a social (and cultural) imperative.

The emergence of the World Wide Web in 1994 enabled experimentation and technological innovation to create new services and products that increase institutional efficiency. The desire for efficiency has high legitimacy in the field of librarianship, and when underlying the emergence of the digital library systems, it reflects mimetic isomorphism. Normative pressures are exerted through the cognitive authority in the organizational field of librarianship that promotes digitization as a technologically progressive activity. The adoption of technology to further institutional goals has propelled institutional change and change in the field of librarianship. As an emerging field of activity, digital library development is "characterized by a high degree of uncertainty" [39, p. 156], especially when innovation processes encounter resistance or when they attempt to conform to the legitimate (established) practices. This interaction can provide a valuable insight into the process of social change and the different levels that are engaged in shaping that change in a particular culture of innovation.

The Culture Formula Revisited

As shown in this section, the culture dimension includes a range of cultural influences and nonnational subcultures, such as organizational and professional culture, corresponding to the strategic choice systems or the tool kit of interacting cultural systems. The premise is that the culture dimension is contingent on environmental adaptation and internal integration. Organizational rationality theories contributed to identifying the levels of analysis related to society, profession, and organization that are shaping the cultures of innovation.

The culture dimension can be explored in the empirical context of digital library development, to analyze the perceptions and beliefs of those

who represent the national library institution (the participants in this study). In the national library context, the cultural frames of reference include national culture and the broader environment (society at large), the organizational cultures of each of the national library institutions, and the occupational cultures in the values of the participants in the study. Therefore, the accounts of the study participants—which are reported in Part II of this article—and the summary of findings presented at the end of this article reflect their understanding of that process and delineate the cultural frame within which they interpret the environment, identify strategic priorities, and validate issues from these overlapping environments. National particularities and the historical uniqueness of national libraries offer only one perspective. The other one is the uniformity of national libraries set by the international professional context (institutionalized in the International Federation of Library Associations) and defined by their fundamental role in shaping cultural memory.

The problem of variability can be seen as relevant to these multiple and contradictory needs. Assuming that variability among the organizations can be attributed to variability of cultural dimensions and that cultural characteristics for each of the cases presented in this article can be defined in terms of relationships with the environment (external adaptation) or relationships among people (internal integration), this article adopts social-choice and latent-variable views of culture and a view that national cultural authority is inherent in the institutional context of the national libraries and that the discourse of the participants of this study also reflects such views. At the same time, this study provides a descriptive account in which culture is related not only to national but also to other cultural dimensions. The dimensions of culture from management literature help to outline the cultural repertoire in the descriptive accounts. Discourses are related to power and to the theoretical context of organizational rationality identified in the "Theories of Organizational Rationality: Innovation and Institutional Constraints" section.

Therefore, the formula of cultural variability for the discourses of development will look like this (where CD is the cultural dimension for each of the five national libraries):

$$\mathrm{CD}_{1-5}(\mathrm{NC}_{1-5} + \mathrm{OC}_{1-5} + \mathrm{PC}_{1-5} + \mathrm{TC}_{1-5})$$
$$= \mathrm{CD}_1, \mathrm{CD}_2, \mathrm{CD}_3, \mathrm{CD}_4, \mathrm{CD}_5.$$

The resultant cultural dimension (CD) is compounded from the national, the organizational, and the professional cultures (and elements of a heterogeneous cultural tool kit), and they will vary. That variability does not imply national typologies or generalizable traits but historical case

studies. The purpose of the analysis in Part II is to present the stories of development as cultures of innovation in national libraries during the first wave of digital library development. Providing insight into individual cultures of development aims to initiate and strengthen scholarship on the history of innovation in libraries and outlines a constructivist framework for the theory in digital library development and a historical foundation for studying the early days of digital library development.

The Context: Chronologies of Digital Library Development in European National Libraries

Historical study of the cultures of innovation is an interpretive enterprise and needs to be distinguished from factual and institutional histories because the reconstruction of culture implies that the distinction between the referential and the evaluative is maintained. A complete historical view combines perceptions of those who were integral to the development and an archive consisting of technical reports and gray literature, compendia of cultural policies and trends for each of the European countries—including the national definitions of culture for comparative assessment [40]—contemporary surveys of activities [41], national library Web sites, and a recent report on current digital preservation practice in European national libraries by Ingeborg Verheul [42]. The interpretation builds on factual histories of development, models of practice, and a baseline chronology of events and landmarks. A brief account of the chronologies of digital library beginnings in the national libraries follows.

Biblioteca nacional de Portugal (NLP)

Two collaborative initiatives are crucial for understanding the history of the digital library initiative, or Biblioteca Nacional Digital (BND), at the NLP.[17] The first one involves a cooperative agreement of a consortium of national libraries in Europe to investigate using CD-ROMs as a means of distributing and using national bibliographic data in 1990 [43]. The second one coincides with the beginnings of the collaborative project Bibliotheca Universalis, a G-7 initiative. The NLP joined the partnership of eleven na-

17. The BND Web site dates from February 5, 2002 (retrieved from the Internet Archive at http://web.archive.org/web/20020205093953/http://bnd.bn.pt/index.html). That must be the time when an independent site was created. The link to the digital library (Biblioteca Digital) dates from August 18, 2000; until May 11, 2000, it was shown in the directory of the library Web site (http://web.archive.org/web/20000511192235/www.bn.pt/org/bib_dig/index.html). Earlier versions of the library Web site contained links to exhibitions, which led to the digital library page.

tional libraries soon after its initiation in 1995. The objective of Bibliotheca Universalis was "to provide access to the world cultural heritage digitized by libraries" [44].

Bibliothèque nationale de France (BNF)

The beginning of the digital initiative at the BNF coincides with the creation of the Gallica experimental server in 1997.[18] Gallica became synonymous with the digital library initiative at the BNF. At that time, it primarily included nineteenth-century material ("Images et textes du XIXe francophone") and was based primarily on digitized print and paper formats. The Classical Gallica service contained a reference and document delivery component, with the Gallica 2000 version of the system being the most significant version of the system since its inception [41].

Die Deutsche Bibliothek (DB)

The German Digital Libraries Project was launched in 1998, with funding for two phases to be completed in 2004. The focus of the development was to work on electronic resources and access and to develop "prototypes to be implemented in the German national information infrastructure" [41]. A focus on structural aspects, network, and infrastructure primarily directed to research and scholarly communication distinguishes this project from other ones that have a popular appeal.

The National Library of Scotland (NLS)

At the time of the interviews, digital information initiatives in Scotland were well established. The Centre for Digital Library Research group at the University of Strathclyde was founded in 1999 and encompassed a number of cooperative initiatives, including practical projects such as the Glasgow Digital Library and GAELS (Glasgow Allied Electronically with Strathclyde) pilot project. The digitization of early Scottish printed books (the Chepman and Myllar prints were printed in Edinburgh around 1508) and a digitization project on the photography of John Thompson were the main initiatives at the NLS. The NLS "created one of the largest online bibliographical databases in a European library" [41].

The British Library (BL)

The BL digitization initiatives from the mid-1990s acquired visibility and prominence in the emerging international infrastructure of cultural her-

18. Gallica has appeared in the Internet Archive since February 13, 1998 (retrieved at http://web.archive.org/web/19980213022257/http://gallica.bnf.fr; currently not available for public access through the Internet Archive by request of the site owner).

itage digitization projects at the time of the interviews.[19] These projects were the result of collaboration with institutions and scholarly communities in Great Britain and abroad. Significant digitization projects that reached some stage of completion in 2002 included the Electronic Beowulf project (1993), the International Dunhuang Project (1997), and two projects with Keio University—the Gutenberg Bible project (2000) and Caxton's Chaucer (2002).[20] In addition to digitization of the library's collections, the BL's Digital Library Programme included the acquisition of published digital materials and the legal deposit of digital materials published in the United Kingdom [41]. Its official beginning was in July 1997.[21] The House of Commons Culture, Media and Sport Committee produced a report that has influenced the directions toward international and universal preservation orientation for the BL digitization efforts in 2000, as noted by BL Chief Executive Lynne Brindley [45].

The initial development of digital initiatives at the BL started with the library's digitization bids for heritage material of national significance organized around two themes: (1) "a national sense of place" (with focus on the location and appearance of places within the United Kingdom) and (2) "moving here" (content based on immigration to England). The digitization policy had several components: to build a critical mass of digital materials, to give this material coherence, and to enable "re-purposing" of materials for multiple uses. An agreement was reached with IBM to provide a platform for the long-term acquisition and preservation of collection materials in digital form and for the preservation of its own historical collections [45]. "E-strategy" is another initiative of that time, aimed at making accessible "the world's intellectual, scientific and cultural heritage" preserved in the library's collections [45]. The descriptions of national library digital initiatives vary in length and scope because of the lack of documentation circulated in the form of public documents that address digital development in national libraries and accessibility of sources.

19. The first documented version of the BL Web site (Portico), dating from June 25, 1997, can be retrieved from the Internet Archive; it has a link to the BL Digital Library Programme.
20. The years listed in parentheses mark the initiation of each project, as listed on the BL Web site.
21. The document accompanying the official launching of the initiative (BL reference IS/0302/96) is found at http://web.archive.org/web/19970625030250/www.bl.uk/ric/notice.html, which defines the program as "Computer and Related Services/Digital Product Development and Marketing." It states, "The British Library is currently planning a project to support the establishment of new or enhanced products and services, estimated to commence in summer 1998, and based on digitised information under its Digital Library Programme. The services required will support the Library's users within its own reading rooms in the UK and the worldwide information market. Value is not known at this stage but it is likely to be a multi-million pound project."

Research Procedure and Methodological Assumptions

Identifying and comparing the philosophies of digital library development relies on several key assumptions about national libraries as the institutional setting for innovation—namely, that national libraries are

- Territorially defined units of political and cultural power that exert cultural authority, define their institutional practices, and reflect identity concerns coinciding with the territory of states
- Institutional contexts whose primary role is to manage token manifestations of culture, which are perceived as legitimate and canonical cultural representations of a localized culture
- Communities of practice that are engaged in replication and dissemination of national culture and its token manifestations
- Occupational contexts sharing a common occupational culture across national boundaries

National libraries are therefore complex cultural entities and primary institutional contexts for the organization of social and national memory. The relevant theorists of social memory [46–49], of history as cultural invention [50–52], and of the theoretical frameworks originating in studies of the sociology of culture are implicit in considering the circulation of knowledge and national libraries. Theories of cultural production and institutionalization [20, 25, 53–55], organizational isomorphism [39], and the impact of national culture on organizational strategy formulation [9] are also integrated in this framework. Digital histories that shape national tradition in the context of an emerging transnational global culture are implicitly related to the study of globalization and modernity [56–58].

The assumptions about national libraries presented earlier shaped the research procedure in terms of how research sites and study participants were recruited. The variability due to the culture dimension is part of that strategy. As discussed in the theoretical framework in the previous section, an attempt is made to avoid deduction from culture universals and reductive notions of immutable and particularistic national culture. Technology innovation is viewed as structured social action by which national libraries approach cultural strategy formulation. It is also seen as a trigger for structural change, as seen by the interviewees, with the intent to present the official views (performative narratives).

The recruitment of individuals who would describe the process from such a viewpoint is integral to the method. The assumption underlying the uses of storytelling and episodic interviewing is that the authority of the teller and what was told are situated in the figure of the narrator as "poetry maker" [59, 60]. Narration mediates experience and recollection by means of rhetorical and constrained discourse. What narratives refer

to are not psychological events but socially constructed experiences. They are realist because they are shaped by firm epistemological standards of institutional discourses of development from which they originate. Therefore, the narratives are neither subjective nor objective but "poetic" (rhetorical) in the sense that they are organized as discourses of their respective cultural contexts (shaped by environment/relationship constraints). Such narratives entail intentionality (what John Budd calls "cognitive imperative" [61]). Therefore, they cannot be considered transparent empiricist reconstructions of the history of digital library development; at the same time they can provide the basis for *a* history, which does not claim the status of objective knowledge. The phenomenological enterprise is implicit in such an approach. In that sense, this study is comparable to a phenomenological study of digital library innovation at the Library of Congress [7, 8].

The storytelling approach implies that story and history are bivalent and that the stories cannot be used to make referential claims [59, pp. 303–4]. This qualitative approach[22] implies a two-tiered model of the narrative as *histoire/discours* (referential/evaluative) [59, p. 302]. The interviews conducted for this study provide the basis for insights about the nature of cultural work involved in the construction of digital libraries and the innovative use of technology in the national library setting. Interview-based methodology fits with the classic approaches to diffusion of innovations research. (An alternative approach would be to use evidence of culture embodied in cultural artifacts and material facts—such as Web sites and local choice of technologies—taking a view that national culture is static and universal.)

Research Process Summary

The main research objective was to understand how digital libraries are built at the national and international levels. Through understanding of such development in five European national libraries, the study seeks to identify the cultural dimension of development, describe organizational variability at the point of emergence (institutionalization), and study the effects of the Internet in the national library context in the first decade of its adoption. Based on this objective, the specific research questions posed in the study are as follows:

- How is the cultural dimension involved in innovation diffusion and institutionalization? (RQ1)

22. The authority of the archive is founded on similar processes of selection, by which institutional contexts are documented at the nodes that represent some form of historical agency.

- How are digital libraries built at the national and international levels? (RQ2)
- How can culture be used to explain the variability of digital library development in national libraries? (RQ3)

The research process was conducted at two levels: (1) qualitative analysis of narratives of development and (2) modeling—identifying the distinctive processes in each institution. These two stages are combined in the analysis section in Part II. A summary at the end of this article aggregates findings from the analysis.

Stage 1: Qualitative Analysis
Analysis of innovation diffusion and institutionalization as seen by the study participants (RQ1, RQ2) will be accomplished through the following objectives:

- Objective 1: Describe the participants' self-perception (roles, involvement with the digital library project, and career paths) and implicit/explicit indicators of identity concerns related to their roles.
- Objective 2: Identify the cultural dimensions of the process of development in each of the institutions.
- Objective 3: Identify the contextual contingencies (the organizational field, institutional processes, and client relations with society at large and related institutions) and describe how they are involved in shaping digital repositories of cultural texts and identity concerns.
- Objective 4: Identify strategies by which identity concerns are managed through the building of digital repositories of cultural texts and strategies by which national libraries (as territorially defined units of political and cultural power) are challenging or reinforcing the process of hybridization of culture and of extraterritorialization.

Stage 2: Modeling and Theory Building
The modeling of culture in relation to organizational variability (RQ3) will be accomplished through the following objectives:

- Identify elements of organizational, professional, and national cultures related to digital library development.
- Identify the philosophies of development for each of the national libraries and interpret them in relation to existing cultural categorizations.
- Compare the philosophies of development and identify the limitations of cross-cultural comparison.

The secondary research objectives derived from the main objective stated

at the beginning of this section are shown in table 2. The table shows each of the objectives in relation to analytical contexts, the data collection instrument, and structure. The structure of the innovation process in relation to the internal and external environment is considered as a variable shaping the process of technological transformation.

Narrative accounts are obtained through interviews with the policy makers from five national libraries (interview questions are reproduced in the appendix to Part II). The interviewed individuals see themselves as assuming certain roles in shaping the development of the digital library system, and their narratives are performative. As members of social groups shaping innovative technology, they control the discourse about such innovation. Their narratives thus reflect reasoning through constraints and the cultural dimension as follows:

- How they presented their institutional roles and self-perceptions
- How they identified formative events and project landmarks
- How they perceived the organizational field, institutional processes (project and departmental), client relations of related institutions, and society at large
- How they presented strategies for managing identity concerns in the national and international context (localization/globalization)

The cultural dimension of institutional change emerges through the perspectives of the study participants—in how they defined their environment and in how they built cultural interpretations in narrative accounts of that process.

The Research Design

The research sites.—The research sites included five European national libraries: Biblioteca nacional de Portugal (NLP), Bibliothèque nationale de France (BNF), Die Deutsche Bibliothek (DB), the National Library of Scotland (NLS), and the British Library (BL). The research sites were selected to be representative of national cultures, following the typologies common in cross-national studies of organizations and cultural work values [21, 62, 63] and studies that identified country clusters that report similar values and beliefs [26; quoted in 9]. This ensured that the research sites represent the variability of national cultures, as exemplary cases to study different models of development.

The selected sites included the national libraries of Portugal, France, Germany, Scotland, and England. The social norms related to social hierarchies (PDI dimension), predilection for change (UAI dimension), level of individualism (IDV) versus collectivism, and career-achievement orientation (MAS) provided dimensions along which country clusters are sorted in the literature. The values for the dimensions of national culture

TABLE 2
Research Objectives and Interview Questions in Relation to a Theoretical Framework

Research Objective	Dimension	Interview Questions	Structure (Loci of Control/ Reasoning Constraints)	Culture Dimension(s)
1. DESCRIBE the participants' self-perception of their roles, their involvement with the digital library project, and their career paths and explicit/implicit indicators of identity concerns related to their roles	Participants	Q1, Q2	Normative pressures (profession), mimetic processes (organization)	Relationships (PDI, IDV), environment (UAI)
2. IDENTIFY cultural dimensions of the process of development in each of the institutions (descriptions of formative events and project landmarks, barriers, negotiation, and conflict resolution)	Processes	Q3–Q5	Mimetic processes (organization)	Relationships (PDI, IDV), environment (UAI)
3. IDENTIFY the contextual contingencies (the organizational field, institutional processes, and client relations with society at large and related institutions)	Context	Q5, Q10, Q14	Coercive isomorphism (society), mimetic processes (organization), normative pressures (profession)	Relationships (IDV)
4. IDENTIFY strategies by which identity concerns are managed through the building of digital repositories of cultural texts and strategies by which national libraries are challenging or reinforcing the hybridization of culture and of extraterritorialization	Identity	Q5, Q7, Q11–Q14	Coercive isomorphism (society)	Environment (UAI), relationships (IDV, MAS)

Note.—This analysis selectively uses responses to questions related to the collections and the uses (users) of the digital collections (notably Q6, Q8, and Q9). All questions (Q1–Q14) are reproduced in the appendix of Part II of this article. Structure refers to social context—that is, an environment in which the loci of control shape reasoning in the social choice model. Thus, they are referred to as reasoning constraints. As regulative processes, they originate in the external environment and refer to norms of behavior and moral codes in the communities of practice, as well as to the effects of power blocs in the institutional context [39, pp. 147–60]. Together, they regulate strategy formulation in the organization [9]. Relevant culture dimensions for each of the objectives include environmental adaptation and internal integration; they are matched to Hofstede's cultural indices (in parentheses) as shown in table 1.

TABLE 3
SCORES FOR CULTURAL WORK VALUES OF NATIONAL CULTURES ($N = 7$)

Cultural Work Value	Scotland*	Portugal	Germany	France	England*	United States
PDI	48 (35)	63	35	68	52 (35)	40
UAI	49 (35)	104	65	86	47 (35)	46
IDV	51 (89)	27	67	71	47 (89)	91
MAS	51 (66)	31	66	43	53 (66)	62
LTO	NA (25)	NA	31	NA	NA (25)	29

NOTE.—Values for dimensions of national cultures are from the work by Hofstede [22, pp. 26, 53, 84, 113, 166], as shown in table 1. The United Kingdom was considered a region. The United States is included for comparison. These values represent scores obtained for fifty-three countries and regions (fifty countries and three regions), as reported in the work by Hofstede [22]. The correspondence of score values to rankings of high (H), medium (M), and low (L) are shown as follows. In the PDI dimension [22, p. 26], the range of score values is 11–104 (L to H) for fifty-three countries and regions; therefore, 11–57 = L, 58–63 = M, and 64–104 = H. In the UAI dimension [22, p. 113], the range of score values is 8–112 for fifty-three countries and regions; therefore, 8–59 = L, 64–70 = M, and 75–112 = H. In the IDV dimension [22, p. 53], the range of score values is 6–91 for fifty-three countries and regions; therefore, 6–32 = L, 35–41 = M, and 46–91 = H. In the MAS dimension [22, p. 84], the range of score values is 5–95 for fifty-three countries and regions; therefore, 5–45 = L, 46–52 = M, and 53–95 = H. In the LTO dimension [22, p. 166], the range of score values is 0–118 for twenty-three countries and regions (including the United Kingdom, the United States, and Germany but not France or Portugal); therefore, for the countries in this study, 25–31 = L. NA = not available.

* Values for Scotland and England are from the work by Victor Savicki [63] (decimals are rounded up). As he argued, they differ in MAS dimension. The values in parentheses are for score values from the work by Hofstede [22, pp. 26, 53, 84, 113, 166].

for each of the national libraries are presented in table 3, and their relative rankings are in table 4.

As shown in table 3, Scotland is ranked lower in power distance (PDI) and higher in individualism (IDV) than England. Table 4 shows that in the power distance dimension it is also comparable to England, as well as to the United States and Germany, and is more significantly different from France and Portugal. France and Portugal score highest in the power distance dimension (hierarchical). The United States scores highest in the

TABLE 4
SCORE RANKINGS FOR CULTURAL WORK VALUES OF NATIONAL CULTURES ($N = 7$)

Cultural Work Value	Scotland*	Portugal	Germany	France	England*	United States
PDI	36 L (42/44 L)	24/25 M	42/44 L	15/16 H	34/35 L (42/44 L)	38 L
UAI	39/40 L (47/48 L)	2 H	29 M	10/15 H	42 L (47/48 L)	43 L
IDV	20 H (3 H)	33/35 L	15 H	10/11 H	22 H (3 H)	1 H
MAS	25 M (9/10 H)	45 L	9/10 H	35/36 L	23 H (9/10 H)	15 H
LTO	NA (18 L)	NA	14 L	NA	NA (18 L)	17 L

NOTE.—Cultural work values are abbreviated as shown in table 1. Rankings are for fifty-three countries for all dimensions except LTO, for which twenty-three countries are ranked so far (based on the work by Hofstede [22, pp. 26, 53, 84, 113, 166]). Therefore, the number represents the position in the representative rank list (1–53 or 1–23). Each of the dimensions is classified as high (H), medium (M), or low (L). For fifty-three country rankings, score ranking 1–23 = H, 24–30 = M, and 31–53 = L. NA = not available.

* Values for Scotland and England are from the work by Savicki [63]. The numbers and classifications in parentheses for Scotland and England are score rankings according to the work by Hofstede [22, pp. 26, 53, 84, 113, 166].

TABLE 5
RANKINGS FOR CULTURAL WORK VALUES

Cultural Work Value and Rank	Countries
PDI (social distance; hierarchical to egalitarian):	
H	France
M	Portugal
L	England, Scotland, United States, Germany, United Kingdom
UAI (uncertainty avoidance; resistance to change):	
H	Portugal, France
M	Germany
L	Scotland, England, United States, United Kingdom
IDV (individual responsibility):	
H	France, Germany, Scotland, England, United States, United Kingdom
L	Portugal
MAS (values of career in relation to values of quality of life):	
H	Germany, United States, United Kingdom
M	England, Scotland
L	France, Portugal
LTO (long-term orientation):	
L	Germany, United States, United Kingdom

NOTE.—Cultural work values are abbreviated as shown in table 1. H = high, M = medium, and L = low.

individualism dimension, and Portugal scores highest for uncertainty avoidance (UAI). All studied countries rank low in long-term orientation (LTO).

Table 5 uses rankings presented in tables 3 and 4 to identify modalities for cross-cultural comparison (differences/similarities). In all three representations, values for the United States and the United Kingdom are included for comparison. According to the rankings, France and Portugal are close in all but the individualism dimension (France ranks high). France is also highest in the power distance dimension. In other dimensions, Portugal ranks highest in the uncertainty avoidance dimension, while the United Kingdom ranks lowest. The United States ranks highest in the individualism dimension, while Portugal is lowest in that dimension. The United Kingdom and Germany are the highest in the career success dimension (MAS), while Portugal is the lowest.

On the basis of these rankings, it would appear that these research sites are comparable on some dimensions and can be contrasted on others. Nevertheless, as emphasized earlier, these dimensions were not operationalized unilaterally or matched with specific practices of digital library development. Nor were they used as a priori explanations for the philosophies

of development or causality. A better understanding of their connection to practice will emerge in the process of qualitative interpretation in the analysis section in Part II.

National libraries can be matched on two aspects: (1) comparable goals related to the use of digital library technology[23] at this early stage of development and (2) the function of a national library. Although the libraries are comparable in terms of their overall mission as national heritage institutions and have shared professional norms, their organizational histories and roles as national heritage institutions are unique. The historical and contextual particularities result in distinct cultures of innovation.

The research participants.—The study participants were administrators or leaders of digital library initiatives in their institutions. They were identified through a snowball sampling procedure at the annual meeting of the Consortium of European Research Libraries (in Lyon, 2001), to tap into the social network of librarians from national libraries. Through chain referral within that network, the relevant individuals were identified and contacted in advance; others were recruited at the 2002 International Federation of Library Associations (IFLA) annual meeting. The interviews with the participants were conducted during the IFLA meeting and at the BL (August 18–23, 2002).

Seven of those interviews were with individuals directly involved with digital initiatives in the national libraries. Four of these participants were female; three were male. Most were age 30–50 years; minorities were not represented in this group. Two of the participants mentioned having advanced degrees, and all but one had formal training in librarianship. For all but one of the participants, their nationalities matched that of their host institutions. Therefore, they were integrated in the cultures of their organizations and in the occupational culture of librarianship. At the time of the interview, two were in top administrative positions in their institutions. They had comparable proximity to digital library development in terms of involvement through policy-related activities, such as administrative roles through which they needed to determine the course for the development of institutional digital initiatives or digital project management.

Three of the study participants are primary policy makers (P1, P3, P4). Some had dual functions through their involvement with project management (P2, P6, P9) as well, whereas others were primarily focused on project management (P5, P7, P8). These roles will influence how these individuals perceive and describe development. For example, primary policy makers

23. Innovative strategies will aim toward isomorphism (standardization) across institutional contexts (through standardization efforts).

(P1, P3, P4) and individuals with dual function (P2, P6, P9) are more likely to involve all levels of culture (NC, OC, PC) in their narratives, while project managers (P5, P7) may be more concerned with operational context (OC, PC).

The interviewees' responses are aggregated in the analysis. Because of the importance of individual statements and comparison, quotes from the interviews are coded (P1–P9). Interviewees P8 and P9 were integral to national digital library development in the case of Scotland, although they were not affiliated with the NLS.[24] The rationale for this decision to include participants not affiliated with the NLS is methodological and results from snowball sampling as the recruitment method.[25]

Multiple schemes for the categorization of digital project staff can be used to compare these individuals according to their own statements about their roles in digital library projects that are not revealed through their official titles, as shown in table 6. Three categorizations were used in an earlier study of the digital library development program at the Library of Congress [7, 8], with emphasis on activity- and domain-related roles and the classification related to knowledge life cycle.[26] In terms of knowledge life cycle, one can distinguish roles related to policy, project management, and utilization. Multiple categorizations were used because digital library

24. Both P8 and P9 were men, were trained as librarians, and were 30–50 years of age.
25. The decision to include the additional interviews is tied to the recruitment of study participants, by use of snowball sampling, at the IFLA meeting held in Glasgow (2002). My attempts to limit the interviews to relevant NLS staff were met with skepticism and concern that national digital initiatives in Scotland told from the institutional point of view of the national library would be incomplete because, they felt, I would not get a full picture or insights into the most cutting-edge developments, and because digital initiatives in Scotland are interrelated because of the small size of its professional community. I felt that including additional informants would be in the spirit of the snowball sampling method, which places importance on insider recommendation. The importance placed on the collaborative process led me to use all four interviews in the analysis, although the NLS case is built around the perspectives of the participants from the national library. The data from two additional interviews were used to contextualize the activities at the NLS within a broader context of the professional culture and national information policy in Scotland. One explanation that I could offer to counter the skepticism of limiting my informants to those who gave accounts of digital library development at the NLS, rather than taking a broader view of national activities of which the NLS is only one integrated part, is that collaborative and personal connections were so very important. That explanation fits within the subsequent interpretation and analysis in Part II. The enthusiasm with which I was led to include multiple perspectives and led to significant informants may have been crucial in the constructions of meaning about how the emerging digital libraries were perceived by this professional community, but also about how that innovation circulated in an open system. Social network analysis could provide a useful perspective.
26. Definitions of categories based on domains and activity have been reproduced elsewhere [7, pp. 407ff. nn. 14–15].

projects were at an early stage and the organizational place of digital programs and innovator roles varied; consequently, the job titles were not always descriptive of what the respondents' actual roles were in relation to digital library development.

Most of the study participants defined their roles in digital library development in terms of management and evaluation. They often combine two or three roles. In terms of work domains, they deal primarily with content (and culture). From the knowledge life cycle point of view, the roles of the participants ranged from involvement with policy to project management (production, organization, preservation) and utilization (usability). The study participants belong to the following three cultures relevant for the interpretation of their accounts of digital library development: occupational, organizational, and national cultures. Because they belong to the same type of institutional context, they could be matched on the basis of occupational and organizational cultures. It may be argued that the respondents do share some aspects of organizational culture. Therefore, their response differences can be attributed to a combination of organizational and national cultures, unless they explicitly refer to an individual aspect of their national library.

Data collection.—The data collection was a combination of document analysis and semistructured interviews. The documentary evidence included internally produced technical reports and published reports in the professional literature, which aided in establishing a brief baseline chronology presented in the earlier section.

Interviews provided an insight into the organizational process from an experiential point of view. They convey the perspective of the participants, their understanding of technology innovation, and the histories of the digital library development in their institutions. As already argued, their observations are not entirely subjective but are constrained by their roles as administrators or leaders of digital library development in their institutions. The semistructured interviews were organized around fourteen open-ended questions. The questions touched on participants' involvement with the digital library development, the history of the initiatives in each institution, awareness that participants had of collection development policies and of the novel uses of collections, and specific projects. These questions form the basis for the data analysis and findings presented. Because of the semistructured interview format, the informants free-associated and compounded issues from several different questions.

The description of the project and the questions were available to the participants before the interview—they were mailed to four of the participants prior to the interview, and the researcher introduced the study at the time of on-site recruitment to three participants. One of the partici-

TABLE 6
PARTICIPANT ROLES AND INVOLVEMENT WITH THE DIGITAL LIBRARY PROGRAM ($N = 9$)

Participant Code and Job Description	Background Employment and Training	Years Involved with DLP at the National Library	Activity-Related Role	Domain-Related Role	Knowledge Life Cycle–Related Role
P1, NLP deputy director	Librarian; at NLP 1978–2002 (in present position since 1992)	7 (since 1996–97)	NA	Other (management)	Policy
P2, BNF head of Digital Library Department	Physics and chemistry; librarian; electronic publishing company manager; science librarian: evaluation of automation and technologies for the library (since 1984); at BNF 1999–2002	3 (since 1992)	Infrastructure	Content, other (management)	Project management
P3, DB director general	Biologist; librarian; collection development, acquisitions, cataloging, administration; administrator at DB in 1998	3.5	NA	Other (administration)	Policy
P4, NLS head of Rare Books and Manuscripts Division in the Department of Special Collections	Librarian; at NLS 1977–2002: collection development, acquisitions, cataloging, administration, digitization steering group member (in present position since 1998–99)	4–5 (since 1995–96)	NA	Other (administration)	Policy (evaluation)
P5, NLS deputy head of Map Library	Geographer; map librarian (since 1991); at NLS 1994–2002: cataloging, digital developments concerning maps	4–5 (since 1995–96)	Curatorial, educational services	Content, culture	Project management, utilization

P6, BL assistant director (DLP)	Librarian; online searcher (industry); at BL 1979–2002: networks, digital storage experimentation, digitization, administration of funding for digital projects, e-strategy organizing team	8 (since 1994)	Educational services, core	Content, other (management)	Policy, project management
P7 (additional interview), BL digital preservation coordinator	Degrees in conservation of cultural materials and computer science; paper conservator and digital preservation since 1996; at BL 2000–2002: evaluation of digital preservation system requirements	1.5	Core, infrastructure	Technology, other (evaluation), content	Project management
P8 (additional interview), SLIC/CDLR technical advisor*	Cataloger (Scottish Cooperative Cataloging Program since 1976); database programming since 1980; at CDLR 2000–2002	NA	Infrastructure	Technology, services?	Policy (evaluation)?
P9 (additional interview), SCRAN publishing contractor†	English teacher; Scottish Council for Educational Technology (development of all information technology systems and educational materials, 1986–96?); at SCRAN 1996–2002	NA	Core, educational services	Other (management), content	Policy

NOTE.—DLP = digital library program; NLP = Biblioteca nacional de Portugal; BNF = Bibliothèque nationale de France; DB = Die Deutsche Bibliothek; NLS = National Library of Scotland; BL = British Library; NA = not applicable. Several coding schemes are used for the informants' roles. They are based on the existing schemes used in identifying the digital library staff. These categories identify different types of staff in terms of the organizational setting (the library), domains of activity, and knowledge life cycle (for further explanation of the roles, see [7, pp. 407ff. nn. 14–15]).

* The abbreviations are for Scottish Library and Information Council (SLIC; http://www.slainte.org.uk/Slic/slicindex.htm) and its project that the participant was working on at that time, the Centre for Digital Library Research (CDLR), University of Strathclyde (http://cdlr.strath.ac.uk).

† The Scottish Cultural Resource Access Network (SCRAN; http://www.scran.ac.uk) was started in 1996.

pants referred to notes he prepared prior to the interview. The actual interviews lasted from sixty to ninety minutes and were taped. (The interview guide is reproduced in the appendix in Part II.)

The data analysis allowed certain topics to emerge. Based on the grounded theory approach [64], the analysis entailed selective coding that helped themes to emerge in addition, independent from the interview questions. Data reduction and interpretation aimed to help identify the cultural dimensions in the reasoning of the participants.

The interview process.—The participants introduced themselves in terms of their background and position in the institution (Q1) and described their involvement with the digital library initiatives at the national library (Q2). These two questions tapped into cultural identities through which these individuals interpreted their organizational role and professional identity and career path as linked to digital initiatives in their institutions. These cultural frames revealed how they perceived the normative pressures of the profession, organizational processes, and the cultural authority of their home institutions. They reflected on the history of digital initiatives (Q3), identifying key stages and barriers (Q4). The participants were prompted to identify the uniqueness of the process in their institution (Q5, Q14). This made it possible to identify localization strategies. Thus, they identified the elements in the broader social environment that shape innovation.

The participants were also asked to assess how heritage concerns are reflected in collection development and how this process is shaped by the transition from print to digital formats (Q6). The culture dimensions of usability of the digital libraries were addressed next by eliciting their views on cultural programming, the uses of collections nationally (local) and transnationally (global), and the barriers to cross-cultural usability as identified by their users (Q7) and by asking them to identify the new uses of the collections (Q8), existing strategies to ensure usability (Q9), and how the individual national library approach differs from approaches in comparable institutions (Q14). The participants' perception of the context of development was conveyed through their identification of social groups and the negotiations involved in shaping new technology (Q10). (The responses to Q6–Q10 were selectively used in the analysis.)

In the task of comparing two projects that the informants were most familiar with (Q11), they reflected on model resolutions of crises (Q13). The critical incident approach was used to identify crisis points in the history of the projects and of the negotiation processes (Q12). The intention was to capture how the participants assessed the social and cultural norms surrounding the development of specific digital library projects.

The connections between the research objectives and the research questions (RQ1–RQ3) to the interview questions (Q1–Q14) are shown in table 2.

Summary of Findings

What was learned from the policy makers and digital library developers about innovation related to digital library development is how meanings emerge around innovation and how they are related to organizational transformation. Since the analysis and data, including diagrams, are presented in the accompanying article, Part II, only summary observations are included here.

Development Time Lines

The reconstructed time line for each of the national libraries consists of landmark events, tracing the beginnings of digital library programs to the early to mid-1990s (except for the BNF, which started in the late 1980s). That institutional histories are unique was not surprising; what is interesting is to compare an overall approach to telling the histories and the frameworks for digital development.

For example, infrastructural concerns are prominent in the case of DB history, which is process rather than object oriented: the emphasis is on the development of a network; on collaborative contingencies; and on the national information policy as a regulative context of agreements, standards, integration of bibliographic resources, and long-term projection to the virtual German-language digital library. The beginnings of the NLP time line are associated with international initiatives (e.g., the European consortium for the exchange of bibliographic data on CD-ROM, Bibliotheca Universalis). Nevertheless, local interpretation of heritage in that broader environment (the Memory of Portugal as the public face of the national digital library) is prominent within that context. The prominence of the public campaign and the circulation of the digital library prototype on CD-ROM with the newspaper reinforce a populist educational framework for the national digital library and its intention to be a heritage library for Portugal in the broader European context.

The BNF time line for digital library development runs in parallel to the move to the new building. The starting point at the diagram is "the idea of digitization," which is the launching point for the technological developments and for an evolving idea of the encyclopedic library of French culture and, later on, a shift in the overall knowledge structure (from a comprehensive encyclopedic to a selective-thematic encyclopedic

library). This time line itself may be seen as based on some stable notion of French culture, an extension of the national library functions and organization.

The NLS history is organized around technological and institutional landmark events, a major delineation being between the experimental (problem solving) and the systematic program of development (the establishment of the NLS Digital Program) from 2001.

The BL time line was the most difficult to interpret from the interviews. It was organized by funding and discrete programs and initiatives and through project completion time lines, as the concrete outcome of funded initiatives. The completion of several monumental projects at the BL formalizes the transition from an experimental to restructuring phase (e-strategy). The cultures of development identified are further summarized and compared by focusing on the meanings that were given to the experience of development.

The Philosophies of Development

The taglines for each of the case studies attempted to capture their philosophies of development—"The Memory of Portugal," "The Encyclopedic Library," "The Virtual German Library," "The Nimble North," and "The World's Knowledge" and the BL brand. For the most part the taglines were adapted from the interviews, to engage the informants' discourse. The notion of imperative [20] is central to cultural analysis of technology innovation, showing that when national libraries are faced with technological imperatives, their cultural authority in shaping these imperatives focuses on collections as an object of heritage and institutional mission articulated in terms of transmission of heritage across media environments. This ensures that the technological becomes intertwined with an existing cultural imperative, which in turn is used to accelerate innovation. For all of the cases analyzed in this study, their actualizations (built digital libraries) vary, and so does the way in which innovation is controlled through imperatives.

The Memory of Portugal is a cultural and technological object and the official program within which digital library innovation is articulated at the NLP. This "object" serves as a semantic placeholder and a sociotechnical entity to accelerate and legitimate the adoption of digital technology not only in the national library but in the society at large. In this case, the "heritage imperative" has established control of the content and the participation of institutions and society in the service of maintaining tradition [20, p. 149].

A variation on the centralized networks of heritage (as national heritage, which is prominent in the discourses around the NLP, BNF, and NLS) is extended to pan-German, transnational, and multicultural European her-

itage in the case of the DB, with its vision of the future digital library development based on scaling of the seamless technologies of access. Thus, the argument is built around structure and process. Integration of content around an idea of unified culture is not the main focus. This harks back to the typology of epistemic cultures developed by Cetina [38] and the contrast of object-oriented with content-oriented epistemic cultures. These cultures define how innovation is interpreted and work is organized in terms of distribution of social and cognitive authority. In the cases examined here, the social authority mechanisms are pronounced in the context of the NLP and the BNF because they similarly operate through a centralized process—by means of a blueprint of development in which the cultural imperative is dominant in driving adoption, justifications, and legitimacy of digital library innovation (content-oriented epistemic cultures). In the case of the DB and other matrix-type organizations, it is to be expected that object-oriented approaches in these contexts will also be decentralized (NLS, BL).

Reasoning constraints in all of the narratives rely on vernacular constructions of heritage and meanings around digital library development. As commonsense knowledge, vernacular constructions can translate to heritage management and meanings attached to cultural specialties (as voluntary, ideological, and programmatic courses of action).

Thus, the case histories provide a snapshot into the significant period and the unique environments of the first wave of digital library development in Europe, in the period from the mid-1990s until 2002. The descriptions and analyses of the five cases and the accompanying narratives of development presented in Part II belong to that wider context and infrastructural framework discussed in policy documents and surveys [1, 11, 40, 42, 44, 65]. The five libraries in this study were selected as representative of the experimental phase of that development because of their distinct histories and institutional cultures. This type of study does not aim to generalize the cultural particularities from individual histories of innovation, which would be as absurd as making generalizations about the individual histories of national libraries. What it does provide is how in each case the strands of interacting cultures (national, professional, organizational) interact and how their comparison and recurring patterns can lead to distinct models of development and typologies. The typologies are contingent on the interpretive process in the descriptive case studies in Part II. The interpretive process is repeatable, and the findings of this study can be extended to analyze other contexts of development comparatively.

A *Discours* of Digital Library Development (the Constructivist Approach to Innovation)

This article focuses on a formative period in the history of innovation in national libraries, as the first generation of digital resources was becoming formalized in digital libraries between 1998 and 2002. The variability of foundational innovation activities in the context of five European national libraries was a starting point to study the emerging models in relation to cultural and organizational context, producing constructivist histories and time lines of development and descriptions of unique institutional models of development. In addition to historical particulars of national digital libraries, this study also points to structural explanations of organizational rationality and identifies systems of meaning that organize activities of innovation. In the institutional context of national libraries, the history of institutions and their associated practices, which are themselves part of a larger environment in which national libraries operate, presented an ideal environment for applying the culturalist approach. This strategy sought to understand the variability of cultures of innovation and how they may be articulated by institutional contexts and inheritance (the institutional identities and cultural authority of national libraries). It was not surprising to find distinct cultural imperatives in each of the studied institutions.

This research started from a critique of cultural and technological determinism and of explanations of national cultures that match approaches to technology innovation and explanations of the shaping of cultural heritage in the digital realm. Nevertheless, the analyses of narratives of innovation, when seen in terms of a complex formula of culture presented at the outset (in which organizational, professional, and national cultures interact), have shown that the perceptions of innovation in the *discours* shaped by innovators, and the activities of building and constructing the digital libraries representative of national heritage, are institutionally articulated. Digital library development as the activity and how it is carried out, associated with other activities, and combined into activity systems, as well as the meanings it is given, are internally consistent. This brings us back to the familiar assumptions of activity theory as a form of social rationality that organizes how individuals perceive and interact with the environment in ways in which they construct tools for communication. Digital library innovation in national libraries is one such activity carried out socially by individuals in an organizational context, using that context (national, professional) to mediate the transformative processes of new media environments in relation to old media. National libraries thus become tools for the exteriorization of heritage and technological manifestations in the form of digital(ized) collections that communicate that her-

itage in ongoing social interactions. The stories of innovation presented in Part II give insights into a *discours* of heritage, modes and technologies of its inscription, and institutions that shape social action.

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