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An Illustrated Introduction to the Infosphere

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Abstract

This introduction to Luciano Floridi's philosophy of information (PI) provides a short overview of Floridi's work and its reception by the library and information studies (LIS) community, brief definitions of some important PI concepts, and illustrations of Floridi's three suggested applications of PI to library and information studies. It suggests that LIS may just be as important to PI as PI is to LIS in terms of deepening our mutual understanding of information ontologies, the dynamics of informational domains, and the variety of evolving relationships among information organisms and information objects.

Introduction

As the "library of the future" invents and reinvents itself over time, its collection also rearranges itself according to our changing notions of relevance. For instance, back in 1995, a year that saw such technologically important events as the release of DEC's AltaVista search engine, Microsoft's Windows 95 operating system, and Netscape's Navigator browser, as well as the release of such provocatively topical book titles as *Life on the Screen: Identity in the Age of the Internet* (Turkle, 1995) and *Future Libraries: Dreams, Madness, and Reality* (Crawford & Gorman, 1995), it is hardly surprising that a short piece by an academic philosopher, based on an invited talk at a distant meeting, would have gone largely unnoticed by the library and information studies (LIS) community.

In fact, this particular piece by Oxford University's Luciano Floridi, based on his remarks on "What We Do Not Know" at the fiftieth-anniversary conference in Paris commemorating the founding of UNESCO, did not appear especially striking in the context of the times and seems even less startling today:

> Not only has the Internet already enlarged our notion of illiteracy, and produced new forms of cultural isolation and discrimination, but, because it intensifies and amplifies the effects of the digital revolution, the Internet is also transforming some of our most radical conceptions and habits. Take our conception of a text, for example. The enormous

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> importance of the new model of "spineless textuality" represented by the hypertext, the virtual ubiquity of documents, the appearance of online services and electronic sources that need to be catalogued, have all changed a discipline like librarianship in the most radical way. Even the library itself may disappear, as we move from the holding and lending library, which stores knowledge physically recorded on paper, to the consulting library, which provides access to electronic information on the network; then from an object-oriented culture, which produces multiple copies of physical entities like books and CD-ROMs for each user, to a culture that appreciates the relationship between time and information, and provides services charged per period of use; and finally from the library as a building to the library as a gate node in the virtual space of the digital encyclopedia. (1995a, p. 264)

The quotation also seems quite consistent with contemporary calls within LIS that year "to shift, first thought, then discourse, then research, by initiating a questioning of assumptions and purposes" in a search for new epistemological foundations (Budd, 1995, p. 315), and to give "much thought to meaningfully translating our values into an electronic information context" (Buschman, 1995, p. 213). What *is* notable about this particular piece is that it can be said to represent the popular point of origin for the combination of Floridi's previous work in the historical foundations of epistemology (1993, 1994, 1995b), especially the importance of the "encyclopedia" in the emergence of human knowledge (1996), with his coming exploration of the impact of the internet on metaphysical speculation itself (2002c), culminating in the development of his putative "philosophy of information" (PI).

Although certainly not the first to explore the impact of information- and computing-technology advances on philosophy and vice versa (*e.g.*, Agre, 1997; Crane, 1996; Heim, 1993; Pepperell, 1995), Floridi's work (1999b) has gone beyond much of the early "computational turn" in philosophy (*e.g.*, Bynum & Moor, 1998) with his formulation of a philosophy done informationally (Greco, Paronitti, Turilli, & Floridi, 2005) and offering a formal analytic approach that can be employed metatheoretically in various domains (Floridi, 2008d). The central questions raised by Floridi's PI project continue to attract critical attention, primarily in philosophy (Adams & de Moraes, in press; Allo, 2010; Beavers, 2011; Caticha, 2014; Crnkovic & Hofkirchner, 2011; Durante, 2011; Ess, 2009) and in areas of computer science (Benini & Gobbo, 2014; Colburn & Shute, 2011; Golan, 2014; Sicart, 2009; Wolf, Grodzinsky, & Miller, 2012), but the provocative questions posed to LIS in particular (Floridi, 2004a, p. 659) still remain largely unaddressed over a decade later

As Hjørland (2014, p. 231) recently commented regarding the core concepts of LIS and the unexplored possibilities of PI, "[w]e need to go from the concrete to the abstract and back again." This

paper, therefore, will illustrate a few aspects of PI in the context of library and information studies in the twenty years since the publication of Floridi's "Internet: Which Future of Organized Knowledge, Frankenstein or Pygmalion?" (1995a) in hopes of eliciting some further response from the field.

The Philosophy of Library and Information Studies, Then and Now

The philosophy of library and information studies—whether "philosophy" is construed as focusing on first-order questions *within* information studies inquiry or on second-order questions *about* information studies inquiry, and whether LIS is broadly or narrowly construed as librarianship, library science, cataloging, documentation science, information science, archival science, bibliographic studies, book history, information management, knowledge management, informatics, data science, records management, knowledge organization, analytical bibliography, document studies, textual studies, or some or all of the above—has traditionally been a matter of interest to some and indifference to most in these so-called information professions.

As early as 1933, Butler lamented: "Unlike his colleagues in other fields of social activity the librarian is strangely uninterested in the theoretical aspects of his profession. . . . The librarian apparently stands alone in the simplicity of his pragmatism: a rationalization of each immediate technical process by itself seems to satisfy his intellectual interest" (pp. xi–xiv). Shortly afterward, Danton (1934, p. 550) wrote in *The Library Quarterly*:

> Sooner or later, however, if the purely pragmatic aspects of our professional thought are to be raised, it must be placed in its complete relations to the history of human thought. The library as a social institution is, after all, but one phase of its philosophical implications. Does the library have a *Wesen* of its own and does it have metaphysical implications? That is, is the library an institution merely or does it contain within itself the germs of a philosophical relation to epistemological progress?

Exploration of these metaphysical implications requires a considerable departure from the pragmatic, positivist approach employed in much of LIS literature, which typically focuses on evaluating the efficacy of practices intended to support user access through optimization of order and organization. Radford (1998, p. 618) neatly described this pragmatic perspective in his observation that

> A library is a place where knowledge is first classified and then kept, stored in texts of all kinds such as books, periodicals, and audiovisual materials. Such an understanding imposes a rigid structure of expectations that come to define the library experience for both librarian and library user. . . . For both positivism and the library, the dominant metaphor is that of "the search." In positivist science, the search is for underlying

> structures that comprise the truth of the natural world. In the library, the search is among the structures for a truth that will alleviate a specific "information need."

Perhaps ironically, pragmatism as a movement appears to have been much more influential in such "practical" disciplines as LIS than it has ever been within its own academic discipline of philosophy (Campbell, 2007). Perhaps even more ironically, contemporary metaphysics, which has been one of the dominant approaches within academic philosophy, has recently turned from its classic approach of modeling fundamental concepts about the world to more so-called naturalized attempts at metaphysical modeling of the fundamental nature of the world itself, often employing techniques not dissimilar from those of scientific disciplines (Paul, 2012). Thus, Danton's question about a possible "metaphysics of the library" may now elicit more focused attention to the potential answers.

There have been a number of authors within LIS over the past eight decades who have concerned themselves specifically with we might call the metaphysical implications of the library writ large, and they have done so from a strikingly wide variety of philosophical and professional vantage points.[1] Surprisingly little of this often-excellent work has received much attention from outside the LIS field, and, quite often dismayingly, little attention from inside it. Contrarily, Floridi's (2002a, 2004a) work relating to LIS has succeeded in attracting more attention from fields outside LIS than from within it, although he notes that LIS appears to be an ideal field in which to practice PI.

Floridi asserts that his PI framework offers philosophically oriented scholars, including those in LIS, a new, information-centric approach to metaphysics, with an explicit focus on metatheoretical applications to various disciplines. Still, despite the publication of his seminal *Philosophy and Computing* (1999b), as well as more recent publications like *Information* (2010a), *The Philosophy of Information* (2011b), *The Ethics of Information* (2013a), and *The Fourth Revolution* (2014b), there has been little discussion of PI and its potential for use in LIS since the two journal special issues—one of *Social Epistemology* edited by Fallis (2002), and one of *Library Trends* edited by Herold (2004)—that first introduced Floridi's work to the LIS community over a decade ago.

In particular, Floridi's (2002a, 2004a) proposal that LIS be viewed as an applied form of PI has been countered by arguments that LIS already possesses an adequate philosophical base of its own, often identified as *social epistemology* (Budd, 2002; Fallis, 2006; Zandonade, 2004). Oddly, the concept of social epistemology as it is generally understood today has little or no direct connection with the term as originated by LIS theorists Egan and Shera, even while their original impetus for the concept (that is, in the service of continuous improvement of bibliographic services to users) is still firmly embedded in ongoing library work. The next section, therefore, will discuss that debate in some detail.

Social Epistemology, Then and Now

In 1950, Jesse Shera, of the University of Chicago's Library School, reported in the pages of *American Documentation* that he and his Chicago colleague Margaret Egan had prepared and presented the U.S. report on national bibliographic problems and activities at the UNESCO Conference on the Improvement of Bibliographic Services held in Paris. This conference, he noted, was an important first step in identifying the importance of bibliographic organization to international intellectual cooperation and the problems implicit in any effective program of action toward the improvement of access to recorded knowledge (Shera, 1950). Soon afterwards, Egan and Shera's seminal article "Foundations of a Theory of Bibliography" appeared in the pages of *The Library Quarterly*, introducing their concept of *social epistemology*, which they defined as

> the study of those processes by which society as a whole seeks to achieve a perceptive or understanding relation to the total environment—physical, psychological, and intellectual. The derivation of the term is readily apparent. Epistemology is the theory or science of the methods and foundations of knowledge, especially with reference to the limits and validity of knowledge, and through it the philosopher seeks an understanding of how the individual achieves a perceptual or knowing relationship to his environment. Social epistemology merely lifts the discipline from the intellectual life of the individual to that of the society, nature, or culture. (1952, p. 132)

Much of their ensuing emphasis, therefore, was on the improvement of knowledge-organization processes, such as the design, development, and diffusion of both bibliographic records and bibliometric data. After Egan's death, Shera continued to develop the concept of social epistemology further during the next few decades through a series of essays and speeches, such as this presentation at the Foundations of Access to Knowledge conference held at Syracuse University:

> The study of social epistemology, which is in reality the study of social cognition, is the proper foundation of the science of librarianship. As a study in its own right it must synthesize and draw upon the work of many disciplines, but it must always focus upon those processes by which society achieves a state of knowing and communicates its knowledge through its constituent parts. The librarian's responsibility is the efficient and effective management of the transcript, the graphic record of all that society knows about itself and its world. It includes that which the social organism has learned, its values as well as its facts, its imagery as well as its reality; it is at once historical, contemporary, and anticipatory. (1968, pp. 24–25)

At the same time, Shera was careful not to discount the influence of technological advances, as he

wrote in “Librarians against Machines” (1967, p. 749):

> That librarians are deeply troubled by the new technology can be directly attributed to their devoting excessive attention to the techniques of their craft, and to their neglect of the fundamental questions that they should have been asking. The computer could force them, at long last and in self-defense, to examine the philosophical implications of librarianship. It could also condition them for accommodation with areas of inquiry that have not previously been thought to be related to their work.

In fact, his tenure at Case Western was also notable for his efforts in establishing the Center for Documentation and Communication Research there, the first computerized research center associated with a library school. Despite Shera’s occasionally expressed reservations about this research partnership (Wright, 1988, pp. 28–32), the center’s legacy to LIS (in particular, furthering development of the terms *recall* and *precision* in the evaluation of library information retrieval) has been widely acknowledged.

The term *social epistemology* failed to attract equal notice, with some exceptions, such as Brooks (1973), until, five years after Shera’s death in 1982, it was reinvented and popularized by sociologist Fuller (1987a, 1987b) with the establishment of the journal *Social Epistemology*, but without reference to libraries or librarianship (Zandonade, 2004). A 1992 sidebar in *American Libraries* accompanying Pierce’s (1992) plaintive query as to “Who Are Our ‘Dead Germans’?” listed Shera among library educators’ top choices for significant theorists in LIS, but without specifying social epistemology as his theoretical contribution. Five years later, Zwadlo (1997) insisted in the pages of *The Library Quarterly* that there is no need at all for any philosophy of LIS. In rebuttal, Radford and Budd (1997) maintained that there is—but, again, Shera’s social epistemology failed to make an appearance in that discussion.

Twenty years after Shera’s death, and fifty years after the publication of Egan and Shera’s seminal article, Fallis edited a 2002 special issue of *Social Epistemology* devoted to the topic of social epistemology and information science, in which several articles (Budd, 2002; Dick, 2002; Furner, 2002b) recognized Egan and Shera’s foundational role and their coining of the term *social epistemology*. Floridi’s contribution (2002a) offered a dissenting voice, arguing that social epistemology did not provide an appropriate conceptual structure for LIS. Instead, he suggested that the relationship between social epistemology and LIS is more that of sibling fields rather than of a foundational discipline and its derivative (pp. 37–38). Floridi noted that social epistemology as it is presently understood is comprised of both the sociology of knowledge (SoK), which is the descriptive and empirical study of the historical causes and conditions of what is commonly recognized as knowledge, and the epistemology of social knowledge (ESK), which is the critical and conceptual study of the social dimensions of knowledge.

Describing Shera's view of social epistemology, Floridi discerned an unresolved tension in Shera's writings between his desire to ground the library field in the epistemology of social knowledge as a sort of applied social epistemology and his desire to define the library field as the epistemology of social knowledge itself (p. 40). Floridi rejected both alternatives, pointing out that LIS takes a normative stance, as "the library is a place where educational and communication needs and values are implemented, defended, and fostered, where contents are assessed and selected for the public, and where practices like cataloging, for example, are far from being neutral, evaluation-free activities" (p. 39), but that it cannot and should not be prescriptive in its perspective in the way that both what he called "classic" ESK (the socially distributed discovery and justification of knowledge as truth) and "revolutionary" ESK (the contention that knowledge, truth, and justification are all social constructions) are (p. 40). Further, LIS's concerns are both broader (in terms of the wide range of both factual and fictional content that the library contains) and narrower (in that social epistemology deals with much outside the contents of any library, however broadly construed).

Floridi maintained that LIS's proper concern is not knowledge itself, but the information sources that make it possible, even if only indirectly (p. 41). This, in fact, is consistent with the original emphasis by Egan and Shera (1952, p. 133) on "the analysis of the production, distribution, and utilization of intellectual products in much the same fashions in which the production, distribution, and utilization of material products have long been investigated. Graphic communication provides objective evidence of the process." Egan and Shera proposed two main areas of investigation: *situational analysis*, which involves a complete analysis of the kinds of information, knowledge, and insights developed by all the contributory sciences or disciplines that are brought to bear upon each of the many focal points of human activity (p. 135); and *analysis of the information unit*, involving techniques for the accurate description of the many "thought units" that comprise the flow of information, and to the creation of a method for identifying classes of these units briefly, through the use of symbols (p. 136).

In a thoughtful examination of the matter, Furner (2004a) concludes that Egan and Shera's original concept of social epistemology is indeed quite different from previous work on the sociology of knowledge and the epistemology of knowledge that, if not inspired, informed its creation. He notes that it is also quite different from later and distinctive usages of the term *social epistemology* by Fuller (1988), Goldman (1999), and others, and is more in the tradition of Otlet's *bibliology*—another term that never gained wide circulation (Furner, 2002b, pp. 18–19). Nevertheless, much of their social epistemology legacy is still very much alive within LIS, both in *situation analysis*, better known as today's "user studies" (Miksa, 2009), and in *analysis of the information unit*, better known as "knowledge-organization studies" (Smiraglia, 2008)

Much of what Egan and Shera called the "pyramids," comprising both micro- and macro-bibliographic endeavors (1952, p. 126), and that Wilson (1968, pp. 6–19) subsequently termed the *bibliographical universe*, has now been connected thanks to shared ventures in what Wilson identified as "descriptive control" (bibliographic and metadata formats, cataloging, indexing), as well as significant advances in what he called "exploitative control" (bibliometrics and scientometrics, information retrieval, relevance research). The advent of globally networked information and communication technologies has now made it apparent that society's graphical records extend far beyond the bibliographical universe as seen from within the library. The "archival multiverse" (Gilliland & McKemmish, 2012) has boundaries far beyond published documents alone, while the "records continuum" (Upward, 2000) extends into the past, present, and future of recorded memory, and even a "hypertextual documental universe" has been suggested (Gnoli & Ridi, 2014). As the Churchlands (1983, p. 5) have observed, "[t]he conglomeration which is the human brain standardly evolves an awesomely-complex world representation in short order and on the basis of scanty input. . . . [T]he world-representation evolves, and it evolves not only during the lifetime of one human brain, but across the lifespan of collections of brains." Or, as Smiraglia (2008, p. 36) elegantly summarizes, Egan and Shera's vision of social epistemology was "a way of saying that a library arises in response to social demands that the culture of the society be collected and disseminated in a formal way."

Intriguingly, this aspect of Egan and Shera's vision connects with Floridi's (1996) own view of how

> [t]he emergence of the human *encyclopedia,* as the totality of knowledge stored and inherited by generations of human beings through the centuries, came to be governed by the humanistic prescription to the effect that knowledge is to be preserved at virtually any cost. . . . [P]ost-modern philosophy—and I use the adjective only for want of a better label—can be understood as the late philosophy which flourishes *within* the encyclopedia. . . . Knowledge is everywhere, and yet little is said upon its nature as an object, as a piece of reality, as an extended domain. Post-modern philosophy has moved too swiftly from reflecting *upon* the process of knowing—the modern concern with method—to reflecting *within* its result, leaving to information technology the task of providing the ontic medium of the domain, and to social sciences the attempt to sketch its ontological description. (p. 30; emphasis in original)

This paragraph appears surprisingly close to one from Shera's last article (1983), published posthumously, in which he observed that

> the library can be seen as three interrelated spheres: the sphere of optimum content, the operational or mechanistic sphere, and the sphere of maximum context. . . . Janus-like,

> the library looks in two directions simultaneously. It looks toward the social sciences, because it is a creature of society, evolved to meet the needs of human beings working towards the solution of certain problems. . . . But the library is also humanistic in that its characteristics, modes of access to its resources, uses, and values are humanistic. It is not and never has been, a scientific enterprise. (p. 385)

Floridi (2002a) initially described the relationship between LIS and PI in the following terms:

> (LIS) Library and Information Science as Applied Philosophy of Information is the discipline concerned with documents, their life cycles and the procedures, techniques and devices by which these are implemented, managed and regulated. LIS applies the fundamental principles and general techniques of PI to solve definite, practical problems and deal with specific, concrete phenomena. In turn, it conducts empirical research for practical service-oriented purposes (*e.g.* conservation, valorization, education, research, communication and co-operation), thus contributing to the development of basic research in PI. (p. 46)

Given these connections, Floridi's contribution to LIS discourse may be significant in a much broader sense than merely as a critique of Egan's and Shera's ideas, and can even be construed as an evolution from their initial effort "to provide a framework for the effective investigation of the whole complex problem of the intellectual processes of society" (Egan & Shera, 1952, p. 132), even as the UNESCO conference in 1995 was a successor to the one in 1950, into an exploration of what Floridi (2001a, pp. 18–19) calls the "infosphere." The next section will discuss Floridi's philosophy of information in an attempt to clarify some of those relationships.

The Philosophy of Information, Then and Now

Although not readily apparent to readers without some familiarity with the ways in which contemporary philosophy is changing (and, for accessible introductions for the nonspecialist to contemporary metaphysics, see Mumford [2012], and to contemporary ontology, see Effingham [2013]), Floridi's PI seems to fall somewhere between two recent naturalistic turns in philosophy, the first being to a naturalized metaphysics, with its privileging of scientific reasoning as a way of constraining purely metaphysical speculation (Kincaid, 2013); and the second to object-oriented ontology, with its principled refusal to privilege human experience over nonhuman things (Bryant, 2011). PI's approach, with its focus on "structural informational realism" in general and "informational objects" in particular, attempts to provide a logically structured way for human reason to transcend its origins in and focus on localized environments, and to address more universal concerns based on a wide variety of data from these localized environments. As Vakarelov (2013) has pointed out, one of the most challenging aspects

of this is the way in which Floridi uses "information" as a way to unify the epistemological and metaphysical aspects of his project rather than as the goal of either. Epistemology and metaphysics are the two faces of the PI coin, while information provides the edge.

PI uses a formal analytic methodology and specialized vocabulary intended to study empirical, scientific, and social "observables" at various levels of abstraction through the explicit application of various theoretical lenses rather than implicitly privileging or reducing any of these. Despite its resemblance to both formal computer modeling and scientific methodology, PI retains its metaphysical identity in its commitment to "open" questions that are associated with "information," very broadly construed, rather than addressing those questions that can be resolved conclusively through other means of investigation. Floridi's most specific statement in this context is that "philosophical questions are in principle open, ultimate but not absolute questions, closed under further questioning, possibly constrained by empirical and logico-mathematical resources, which require noetic resources to be answered" (2013b, p. 215). "Noetic resources," of course, are "informational" ones.

Floridi's "What Is the Philosophy of Information?" appeared in *Metaphilosophy* in 2002 and described PI as concerning itself with both the historical antecedents and contemporary manifestations of philosophy as

> critical and creative investigations [that] identify, formulate, evaluate, clarify, interpret, and explain problems that are intrinsically capable of different and possibly irreconcilable solutions, problems that are genuinely open to debate and honest disagreement, even in principle. These investigations are often entwined with empirical and logico-mathematical issues and so are scientifically constrained, but, in themselves, they are neither. They constitute a space of inquiry broadly definable as normative. It is an open space: anyone can step into it, no matter what the starting point is, and disagreement is always possible. It is also a dynamic space, for when its cultural environment changes, philosophy follows suit and evolves. (2002c, p. 134)

More specifically, he defines the philosophy of information as being

> the philosophical field concerned with (a) the critical investigation of the conceptual nature and basic principles of information, including its dynamics, utilisation, and sciences, and (b) the elaboration and application of information-theoretic and computational methodologies to philosophical problems. . . . Its task is not to develop a unified theory of information but rather an integrated family of theories that analyse, evaluate, and explain the various principles and concepts of information, their dynamics and utilisation, with special attention to systemic issues arising from different contexts of

> application and interconnections with other key concepts in philosophy, such as being, knowledge, truth, life, and meaning. (p. 137)

This programmatic statement for doing philosophy informationally was followed by his "Open Problems in the Philosophy of Information" (2004b), again appearing in *Metaphilosophy*. This paper posed eighteen open problems as being central to PI, a list which can be only briefly summarized as follows:

- Problem 1. What is information?
- Problem 2. What are the dynamics of information?
- Problem 3. Is a grand unified theory of information possible?
- Problem 4. How can data acquire their meaning?
- Problem 5. How can meaningful data acquire their truth values?
- Problem 6. Can information explain truth?
- Problem 7. Can information explain meaning?
- Problem 8. Can cognition be fully and satisfactorily analysed in terms of information processing at some level of abstraction? How is the triad of cognition, information processing, level of abstraction to be interpreted?
- Problem 9. Can natural intelligence be fully and satisfactorily analysed in terms of information processing at some level of abstraction?
- Problem 10. Can natural intelligence be fully and satisfactorily implemented nonbiologically?
- Problem 11. Can an informational approach solve the mind–body problem?
- Problem 12. How can information be audited? If information cannot be transcended but can only be checked against further information—if it is information all the way up and all the way down—what does this tell us about our knowledge of the world?
- Problem 13. Should epistemology be based on a theory of information?
- Problem 14. Is science reducible to information modelling?
- Problem 15. What is the ontological status of information?
- Problem 16. Can information be naturalized?
- Problem 17. Can nature be informationalized?
- Problem 18. Does computer ethics have a philosophical foundation?

As Herold (2003, pp. 562–563) has noted, many of these open questions appear beyond the purview of even the most expansive notion of LIS, but several of them can be considered to be essential questions in even the narrowest view. He identified these as relating to content, meaning, authorship, community,

and ethics. Accordingly, Herold edited a special issue of *Library Trends* in 2004 devoted to "the philosophy of information," introducing the issue with the statement that

> researchers in LIS have increasingly turned to the efficacy of philosophical discourse in probing the more fundamental aspects of our theories, including those involving the information concept. A foundational approach to the nature of information, however, has not been realized, either in partial or accomplished steps, nor even as an agreed, theoretical research objective. It is puzzling that while librarianship, in the most expansive sense of all LIS-related professions, past and present, at its best sustains a climate of thought, both comprehensive and nonexclusive, information itself as the subject of study has defied our abilities to generalize and synthesize effectively. (p. 373)

The issue featured several articles that provided thoughtful critiques of various aspects of Floridi's PI project in relationship to LIS concerns. In particular, articles by Cornelius (2004) on the failure of PI to account for LIS as a collection of ongoing social practices deeply grounded in information behavior by both information professionals and their communities of users, Fallis (2004) on PI's utility in assessing the accuracy of information, Frohmann (2004b) on the desirability of subsuming PI under a broader, more historically grounded philosophy of documentation, and Jacob (2004) on classifying as a critical form of information dynamics offered some specific examples and counterexamples.

Floridi (2004a) provided an afterword, expanding on his original (2002a) suggestions as to how PI might supply a better framework for LIS than does social epistemology, however defined. He proposed that a "PI approach to the foundations of LIS may be expected to work on the ontology of its (*i.e.*, LIS's) 'objects,' on a substantial theory of information dynamics, and on an ethical approach to the domain of information" (p. 659).

The issue was received by the LIS community with mixed reactions (see, for example, Benoît, 2006; Buckland, 2005; Rayward, 2004; Wells, 2004) and with little subsequent attention to PI. Furner (2010, pp. 170–171) calls Floridi "the most prolific and most widely celebrated scholar working on problems of philosophy and information," but one who is relatively infrequently cited in the LIS literature. Floridi is mentioned only once, for instance, in Osburn's (2009) monograph on important works of "library philosophy," and PI not at all. Furner (2010, pp. 171–173) listed four main attributes of PI to urge LIS researchers to increase their awareness and appreciation of Floridi's project: its broadness of scope, its embeddedness in social theory, its utility for ethical analysis, and its foundational position at the heart of contemporary philosophy. According to him, two reasons that PI has failed to attract much sustained attention from LIS may be that Floridi's books tend to focus on non-LIS-centric concerns, and that Floridi's articles tend to be published in non-LIS-centric journals.

Two additional reasons may be, first, that his writing as "conceptual engineering" (Floridi, 2011a) offers a challenging blend of interrelated metaphysical and modeling concepts and vocabulary that cannot easily be understood within the context of a single article, and, second, that little effort has been made to situate PI within the LIS context, exploring its advantages and disadvantages. Exceptions to this latter point include Saab and Riis (2011) in their overview of contemporary definitions of information, Tomic (2010) in her analysis of how PI might relate to information science, Fallis (2011) in his discussion of information and disinformation, Watson and Carlin (2012) in their critique of the neglected praxeological considerations involved in studying information, and Durante (2013) in his examination of the competing informational interests between civil rights and societal security within the global information society, as exemplified by legal cases. Thus, the next section provides an elementary "pathfinder" for PI.

A Pathfinder for the Philosophy of Information

It should be noted that PI is clearly a work in progress, subject to a variety of criticisms (Doyle, 2010; Dunn 2013), while Floridi's own prolific publications about it range from the engagingly accessible (2007) to the dauntingly technical (2008e). The following explanations, therefore, can be considered as elementary interpretations of some of the more basic concepts, using quotes from some of Floridi's works as appropriate. Any and all errors of explanation or interpretation, however, are my own.

Information Structural Realism.

Floridi (2008a) calls this a "liminal" realism, suggesting that it occupies a position midway between external realism (in which kinds, categories, and structures of the world are not a function of our conceptual schemes, either causally or ontologically) and internal realism (in which they are). Central to this neo-Kantian, intersubjective, socially constructible, dynamic, and flexible perspective is his analytic method of abstraction (the levels of abstraction [LoA] approach) for application to the study, modeling, and analysis of phenomenological and conceptual systems as instantiated by clusters or networks of *observables*,which are identified and interpreted as "typed" variables so that their relationships and behavior can be formalized.

This liminal realism also seems to offer a contact zone between philosopher John Worrall's (1989) work on "structural realism" and physicist John Wheeler's (1990) work on "it from bit." In *Minds and Machines*'s recent special issue on PI, Bynum (2014) has speculated on the possibilities of quantum informational structural realism, which might link intriguingly with what Bawden, Robinson, and Siddiqui (in press) identify as the potentialities of a "quantum turn" in information studies.

Levels of Abstraction and Gradients of Abstraction.

The LoA method is adapted from formalized modeling often used in information system design (Greco, Paronitti, Turilli, & Floridi, 2005), which in itself draws from metaphysics, particularly ontological design (Artz, 1997). A helpful discussion of the uses of abstraction in general, and of Floridi's approach in particular, can be found in Saitta and Zucker (2013).

Floridi differentiates the LoA analytic methodology from other well-known "leveling" methods of abstraction, such as the so-called LoO (levels of organization), which supports an ontological approach based on particular systemic attributes, and LoE (levels of explanation), which supports an epistemological approach based on particular nonsystemic attributes (2008d, p. 319). Both of these approaches can be embedded within the LoA approach, as it also offers the opportunity through an "interface" named the "gradients of abstraction" (GoA) to compare multiple LoAs. Floridi notes that LoA analysis always requires a theoretical lens through which the *observables* can be studied, although these theoretical lenses can be of any kind. This allows him to defend LoA analysis from criticisms that have been leveled at seemingly similarly structured conceptual schemes (pp. 321–324).

Additional discussions of the challenges posed by LoA/GoA work are offered by Gobbo and Benini (2014), who stress the potential value of category theory in developing these levels of abstraction, and by van Leeuwen (2014), who suggests that an explicit system of annotations similar to those used in programming languages would help to specify boundaries and constraints. Such proposed enhancements to the LoA/GoA approach may help to make it more readily accessible to interested scholars.

Data and Dedomena.

Floridi (2008c, p. 235) posits that a more basic, metaphysical concept of data is required than most definitions provide: neither the epistemic, which views data as facts, nor the informational, which views them as information, nor the computational, which views them as collections of binary elements, is sufficiently fundamental. He asserts that data in themselves are unknowable without some "difference" to distinguish them. Therefore, he suggests that data be viewed as "diaphoric"; in other words, that *difference* is what defines data from nondata, and that a datum is ultimately reducible to a lack of uniformity. He proposes that "data in the wild"—that is, proto-epistemic data that have no interpretation—be termed *dedomena*, and notes that they cannot be accessed or elaborated independently of some level of abstraction. Thus, dedomena are whatever lack of uniformity in the world that serve as the source of whatever we interpret as data.

Lack of interpretation or misinterpretation, of course, does not preclude future interpretation or reinterpretation. Interpreted (or misinterpreted), dedeomena can become what we term *data*. Such interpretation entails either the lack of uniformity between (the perception of) at least two physical

states, such as that of a system (for instance, between connection and disconnection within an electrical circuit), or it can be the lack of uniformity between two symbols of a code (for instance, the letters "A" and "B" in the English alphabet). Floridi (2011b, pp. 87–88) notes that the actual format, medium, and language in which data are encoded are often irrelevant and hence disregardable. His proposal of *dedomena* as proto-epistemic data provides a potentially useful way of distinguishing it from *data*, which can then be subdivided into the five commonly used categories of primary, secondary, metadata, operational, and derivative data. All such data might then be further interpreted as "informational objects."

Informational Objects.

Informational objects, or, as Floridi (2012b, p. 268) has recently dubbed them, "i-objects," are also foundational to his view of reality, or what he calls "information structural realism." He (2008a, p. 236) states that a "straightforward way of making sense of these structural objects is as *informational objects*, that is, as cohering clusters of *data*, not in the alphanumeric sense of the word, but in an equally common sense of *differences de re*, i.e., mind-independent, concrete points of lack of uniformity." These informational objects then can be viewed as *observables* at various levels of abstraction, giving different pictures of their data structure and associated behavior appropriate to each level (2008a).

Information.

Floridi's (2009, p. 13) definition of *information* is clearly a semantic one. He notes that "[i]nformation is notoriously a polymorphic phenomenon and a polysemantic concept so, as an explicandum, it can be associated with several explanations, depending on the level of abstraction adopted and the cluster of requirements and desiderata orientating a theory." A simple schematic of how information may appear to PI is as follows: any initial appearance of "structured" data can presumably be separated into either environmental data or semantic content. Semantic content can further be separated into instructional or factual content. Factual content can further be separated into untrue and true content. Untrue content can be further separated into disinformation (intentional untruth) and misinformation (unintentional untruth). True content cannot be subdivided further, and may result in knowledge (p. 15).

Ultimately, Floridi wishes to refine the *generalized definition of information* (GDI), which is normally defined as semantic content consisting of one or more data that are well-formed and meaningful (p. 16). His preferred revision is that declarative, objective, and semantic information should consist of well-formed, meaningful, and truthful data (2005, p. 367). There have been a number of critiques (Fetzer, 2004; Long, 2014; Scarantino & Piccinini, 2010), as well as defenses (Sequoiah-Grayson, 2007) of Floridi's definitions of information.

Of particular interest to LIS is Floridi's "correctness" theory of truth, which provides for those special instances in which categories of fictional, empirical, ethical, modal, dispositional, metaphorical, and other semantic content are of interest (2011b, pp. 182–208). All these can be dealt with as *information*, provided that attention is given to the levels of abstraction at which they are being analyzed. For instance, "Dr. Watson is Sherlock Holmes's best friend" is true within a level of abstraction that deals specifically with that fictional world (pp. 203–204), but not within a level that deals with historical data from the nineteenth century.

Infosphere.

Floridi's PI is perhaps most widely associated with this term, even though it was actually originated by Boulding in 1970. Boulding viewed the *infosphere* as one among the six "spheres" in his own system (which also included the sociosphere, biosphere, hydrosphere, lithosphere, and atmosphere), and suggested that each individual or group of individuals exists as a node in a network of inputs and outputs of information, symbols, and language. He claimed that

> [t]he infosphere then consists of inputs and outputs of conversation, books, television, radio, speeches, church services, classes, and lectures as well as information received from the physical world by personal observation. . . . [I]t is clearly a segment of the sociosphere in its own right, and indeed it has considerable claim to dominate the other segments. It can be argued that development of any kind is essentially a learning process and that it is primarily dependent on a network of information flows. (pp. 15–16)

Unsurprisingly, given that he was writing almost thirty years later, Floridi's reinvention of the term *infosphere* is independent of, and quite significantly different from, that of Boulding. Floridi (1999b) states that

> The computerised description and control of the physical environment, together with the digital construction of a synthetic world, are, finally, intertwined with a fourth area of application, represented by the transformation of the encyclopadeic macrocosm of data, information, ideas, knowledge, beliefs, codified experiences, memories, images, artistic interpretations, and other mental creations into a global *infosphere*. The infosphere is the whole system of services and documents, encoded in any semiotic and physical media, whose contents include any sort of data, information and knowledge . . . with no limitations either in size, typology, or logical structure. Hence it ranges from alphanumeric texts (i.e., texts, including letters, numbers, and diacritic symbols) and multimedia products to statistical data, from films and hypertexts to whole text-banks and collections of pictures, from mathematical formulae to sounds and videoclips. (p. 8)

More recently, Floridi (2009) has claimed that the infosphere is being both developed and defragmented as it continues more or less simultaneously and spontaneously to erase barriers between production and consumption of information, between databases of information, between who does and does not have effective availability and accessibility to information, between physical and global access to information, and, ultimately, between here (offline, analog, carbon-based) and there (online, digital, silicon-based). He argues that the infosphere serves as our access to foundations of the information reality that is the universe, even though he asserts that this does not entail a so-called computational universe, such as that posited by the "digital metaphysics" of Steinhart (1998), for example. PI views information as not only foundational, but fundamental in a way that Boulding's concept clearly does not. But our access to these foundations is necessarily mediated through our augmented ability to explore and observe them (Floridi, 2003).

Reontologization.

Floridi (2007) states that *reontologization* is another neologism that he created to refer to a very radical form of reengineering, one that fundamentally transforms the intrinsic nature of a particular system. The term clearly carries connotations related to the distinctive usages of *ontology* in both analytical philosophy and software engineering, and is also reminiscent of Heidegger's (1953/2010) somewhat similar creation of neologisms from familiar technical terms in *Being and Time*.

Floridi (2001b) claims that digital information and communication technologies are reontologizing the very nature of (and hence what we mean by) the infosphere as reality by making it "frictionless" through the transition from analog to digital data and the ever-increasing growth of digital space. He warns that this reontologization will have serious societal consequences, as the "digital divide" will be not only between those who do and do not have access, but also between those who can impact and those who can only be impacted by the results. His concern is the greater because of the awareness that

> it is precisely those high-technology societies, which have brought about the information revolution, [that] seem to be the least able to cope with its ethical impact. Pre- or non-industrial cultures, which have been able to maintain a non-materialistic and nonconsumistic approach to the world, are still spiritual enough to perceive in both physical and immaterial realities something intrinsically worthy of respect, simply as forms of existence. They may not be environmentally sensitive, but they can be important sources to develop an ecological approach that will make the infosphere a more civilized space for all. The environmental ethics of the infosphere must be built by considering also the needs and input of its 'outsiders.' (p. 4)

Fourth Revolution.

Floridi (2008b, 2014b) claims that we have entered a *fourth revolution* in human thinking about the universe and our place in it, although this realization is not yet widespread and certainly not universal. He posits that the first revolution was the Copernican in which we became aware that the earth was not the center of the universe; the second was the Darwinian in which we became aware that human beings were subject to the same evolutionary processes as other organisms; and the third was the Freudian in which we became aware that our cognitive processes can be both complex and opaque beyond our conscious knowledge. This fourth revolution currently in progress, according to Floridi (2012c, p. 3540), the "Turingian," is grounded on the idea that we are becoming aware that we are informationally embodied organisms or *inforgs* who are mutually connected and embedded in an informational environment, the *infosphere*, which we share with both natural and artificial agents similar to us in many respects. Although there are several potential milestones with which to date the start of this revolution, Floridi (2014b, pp. 93–94) marks it by that vital period of intellectual activity leading up to the 1950 publication of Turing's seminal paper in *Mind* on computing machinery and intelligence.

Floridi's (2001b, pp. 2–3) informational revolution also presents two gaps. The first is what he terms *vertical and ahistorical*: this divide is between *past modernity*, which focuses purely on mastery of the physical world, and *post-modernity*, which focuses on the alternative, nonnatural environments that replace or underpin it. The second gap is what he terms *horizontal and ethical*: this divide is between those who do and those who do not have digital access, which mandates the creation of a universal information ethics that would ensure a safe, equitable, and public infosphere for all.

Information Ethics.

Although *information ethics* (IE) has become a well-known term within both philosophical (*e.g.*, Moor, 1985) and professional (*e.g.*, Mason, 1986) practice since Weiner's early work on "computer ethics" (Bynum, 2008, 2010), Floridi's (2013a) development of IE is novel in that it has broadened the scope of discourse to an almost universal macro-ethics centered on information. His more expansive concerns are expressed as follows:

> In IE, the ethical discourse concerns any entity, understood informationally, that is, not only all persons, their cultivation, well-being and social interactions, not only animals, plants and their proper natural life, but also anything that exists, from paintings and books to stars and stones; anything that may or will exist, like future generations; and anything that was but is no more, like our ancestors or old civilizations. IE is impartial and universal because it brings to ultimate completion the process of enlargement of the concept of what may count as a centre of a (no matter how minimal) moral claim, which

> now includes every instance of *being* understood informationally . . . no matter whether physically implemented or not. (2006a, p. 26; emphasis in original)

IE thus suggests that there is something even more valuable than life and consciousness—namely, *being*, understood as information; and something more wrongful than pain and suffering—namely, a lack of meaningfulness that is seen as information entropy. According to IE, one should evaluate the duty of any rational being in terms of his or her contribution to the growth of the infosphere, and any process, action, or event that negatively affects the whole infosphere—not just an information object—as an increase in its level of entropy and hence an instance of evil. Without information there is no moral action, but in IE, information moves from being a necessary prerequisite for any morally responsible action to being its primary object (Floridi & Sanders, 2002).

Central to Floridi's argument for an information macro-ethics is the notion that all entities, even those that do not qualify as "information organisms" as such, may possess a minimal informational value that qualify them as "moral patients" worthy of at least some respect by other agents, notably by human beings (Floridi & Sanders, 2002). Thus, both information organisms and informational objects can be *agents* (that is, actively affecting other entities) or *patients* (that is, being actively affected by other entities) at any given time, regardless of whether either agent or patient is a living entity.

Floridi's information macro-ethics therefore requires that ethical considerations expand beyond the traditional ones that have been centered around human beings and certain living entities considered as close to human beings. While there are a number of philosophical precedents concerning moral agency among humans and nonhumans (Mitcham, 2014), this is clearly one of the most provocative aspects of Floridi's PI proposals. Critics such as Brey (2008) and Byron (2010) argue that Floridi's ethical expansion of IE beyond the current boundaries of both bio-ethics and eco-ethics has failed so far to make an acceptable case for treating all entities as having any such intrinsic value, informational or otherwise.

Information Entropy.

As noted above, Floridi's information ethics is partially predicated on mitigating the evil of what he calls "information entropy" in the infosphere. The four tenets regarding this are that entropy ought not to be caused in the infosphere (null law); entropy ought to be prevented in the infosphere; entropy ought to be removed from the infosphere; and information welfare ought to be promoted by extending (information quantity), improving (information quality), and enriching (information variety) the infosphere (Floridi, 1999a, p. 47).

Again, this has attracted criticism, notably from McKinlay (2013), who comments that Floridi's use of the term *entropy* in connection with information needs much clearer definition, as it has little in

common with the more familiar use of entropy in physics. In particular, McKinlay suggests that information entropy is not necessarily an evil, but rather an unavoidable consequence of informational activity creating desired complexity elsewhere in the infosphere. And, even in the case of the information entropy presumably caused by "bad objects" like computer viruses and spam, there are those who would advocate for a more nuanced response to their existence (Parikka & Sampson, 2009), making the issue considerably more complex than Floridi's tenets would appear to allow.

Information Organism.

Floridi's term *information organism*, or *inforg*, while both related to and reminiscent of *cyborg* (Clynes & Kline, 1960; Haraway, 1991) and *informavore* (Miller, 1983), is intended to encompass all information-processing mechanisms, ranging from those that can only process data at an elementary level (for instance, a sunflower responding to sunlight as information) to the most advanced (a network of supercomputers). While Floridi's focus is on human beings as inforgs because of their special nature as "structuring structures" that are self-conscious and self-determining (2010c, pp. 279–280), there seems to be room in his definition to include not only nonhumans like poker bots and bomb-disposal robots, but also self-organizing social structures that process information, such as corporations or nations. While Floridi's PI may possess surface similarities to other contemporary projects centered around the recognition of the importance of the nonhuman, it remains distinctive, in that PI is grounded in information rather than materialism as in the work of Harman (2005) and other object-oriented philosophers, or in networks as in the work of Latour (2005) and other actor-network sociologists, as well as in its implications for the future (Giardino, 2012).

Knowledge.

Information, whether transmitted via perception or testimony, according to Floridi (2014a), "upgrades" to knowledge only if it can be correctly "accounted for" through an active process of question and answer by the knower. This definition of *knowledge* is supported by an extensive infrastructure of his earlier work on the symbol grounding problem (Taddeo & Floridi, 2005), action-based semantics (Taddeo & Floridi, 2007), definitions of semantic information (Floridi, 2005, 2010b), the logic of "being informed" (Floridi, 2006b), epistemic relevance (Floridi, 2008e), and a network theory of account (Floridi, 2012a). Floridi (2014a) concludes that the philosophical "problem of justification" (that is, defining "justified, true belief" by a knower) can be addressed more pragmatically by viewing knowers as reality's active, problem-solving designers rather than its passive observers:

> We are cognitive amphibians: as embodied and embedded physical agents, we live in, and interact with the world in itself, Kant's *noumena*. We eat and drink, handle and build, avoid and crash into *noumena*. But as informational organisms, we experience and

> inhabit the world as a semantic reality both afforded and constrained by the world in itself. Our ontology is entirely semantic, so we know the world when we are informed about it and are able to account for such information. For a knower is "the man who knows how to ask and answer questions" (Plato, *Cratylus*), giving an account, that is, about the information that he holds. (p. 93)

Although this account of knowledge as "upgraded" information of shared perceptions and testimonies within a social network of "cognitive amphibians" over time is clearly still a subject of much philosophical debate (Allo, 2014; Harnad, 2011; Piazza, 2010; Primiero, 2013), it also serves to connect the philosophy of information to some of the most central concepts and concerns of LIS. The next section will now turn to some of PI's possible applications within library and information studies.

The Infosphere of Information Studies

As noted above, Floridi (2004a, p. 659) suggests that a PI approach to the foundations of LIS may be expected to work on the ontology of its (that is, LIS's) "objects," on a substantial theory of information dynamics, and on an ethical approach to the domain of information. This section will address how PI might relate to other LIS works in progress in each of these areas.

The Ontology of LIS Objects

Despite an increasing interest in ontological development within the field, most ontic models in LIS are not intended for general use, as they tend to reflect a single concrete area of researcher interest. The one well-known model in LIS that does arguably resemble an abstract ontology of generic information "objects" is the so-called DIKW (data-information-knowledge-wisdom) Pyramid or Hierarchy, variously attributed to Adler, Ackoff, Zeleny, and others (Rowley, 2007). However, Frické (2009) has deftly exposed its definitional deficiencies, logical inconsistencies, and faulty dependencies, pointing to its outmoded reliance upon a systems worldview based on operationalism and instrumentalism and stating that it should be abandoned as a model.

As Floridi (2004a, p. 662) notes, "LIS deals with contents understood as meaningful data [and] connected with the activity of stewardship of a semantic environment." But in order to be considered as a foundational philosophy for LIS, PI must offer a useful way of looking at a perennial "open problem" in LIS: what should be construed as the "objects" of information studies when there are so many possibilities from the disparate domains from which all these are drawn? Since the primary concerns of LIS include both the stewardship of collections of LIS objects and, critically, the responsibility for the accuracy and accessibility of their representations as well, this will be an increasingly complex issue in the "reontologized" world that PI presupposes.

Although Floridi has proposed that LIS's data consist of documents and their life cycles, that itself is

an open question, as "documents," even within the more traditional LIS contexts, are largely undefined. (See Buckland, 1991, 1997; Frohmann, 2009; Hjørland, 2002a; and Lund 2009, 2010 for discussions of the nature of documents.) Buckland has observed, following Briet (1951/2006), that "the document," rather than being viewed solely as texts or as variations in textual format, should be more accurately viewed as any "thing" that can be interpreted as some kind of evidence, whether textual or otherwise. Documents can take physical or virtual form, or both, at different times. "Evidence" also is problematic, as library examples of even clearly textual documents include an extensive variety of both evidentiary (Furner, 2004b) and nonevidentiary (Hanley, 2004) instances that can only begin to indicate the range of potential interpretations, both factual and fictional, over the millennia. The Cuneiform Digital Library Initiative, for instance, has facilitated interpretations of accounting practices in ancient Mesopotamia (Monaco, 2005), while the Neo-Assyrian Text Corpus Project has done the same for investigations into the mythological roots of the First Dynasty of Uruk there (Woods, 2012).

Another critically important informational object closely related to questions of evidence is the *record*, which has also been undergoing substantial and substantive reconsiderations in both archival and records-management studies (Yeo, 2007, 2008, 2012b). Questions problematizing the definition and description of records (Conway, in press; Duff & Harris, 2002; MacNeil, 2005; Millar, 2002; Yakel, 2003), the construction of their identity (Rowat, 1993; Trace, 2002; Yeo, 2010), their contextual aspects (McKemmish & Piggott, 2013; Nesmith, 2006), their temporal aspects (K. Anderson, 2013; Brothman, 2006; Cumming, 2010; Meehan, 2006, 2009; Upward, 1996, 2009), and their custodial communities (Bastian, 2002; Caswell, 2013; Christen, 2012; Huvila, 2008) have become endemic within the archival field, leading Upward and colleagues (2013, p. 40) to lament that "we cannot reliably say what a record as a thing is as our conceptual understanding of it blurs into data, documents, information, the archive, and the plurality of archives. . . . Our new information spaces with their vibrant diversity are paradoxically producing a collapse of collective memory." In their examination of the archival literature and the concept of *collective memory*, however, Jacobsen and colleagues (2013) note that the archival field has been more insulated from other disciplines engaging in memory studies and the encompassing environment of collective-memory work in the world at large than archivists themselves may realize. Thus, all this may portend less a collapse than a convergence in which these critical questions about evidence, significance, and temporality will become far more widely appraised both inside and outside LIS (Cook, 2011, 2013).

In addition to documents and records, there are other potentially viable candidates for roles as LIS objects. For instance, Ekbia (2009) has advanced a processual and relational theory of digital artifacts as *quasi-objects* in which he draws together actor-network theory, documentation theory, and object-

oriented philosophy—a proposed advance on traditional document studies. Also, Budd (2013b) has recently published a quantum theory approach to information studies that addresses the problematic of perceiving information with the aim of finding meaning in the micro-structures of small linguistic elements rather than the macro-level of texts, which could dramatically both increase and impact LIS research endeavors.

Miksa (1998) has examined and dismissed the notion that library classifications such as Dewey's have historically had anything more than a tenuous connection with direct classification efforts in the sciences or knowledge in general. Representation of objects, such as books, in LIS has traditionally worked from an indirect or "second-hand knowledge" (Wilson, 1983) perspective: for instance, the *aspect classification* of bibliographic description, which loosely resembles a compilation of categories based on the informal ontologies of various phenomena as viewed from within disciplines; and the *occurrence representation* of records management, which loosely resembles an account-driven data-file structure within organizations rather than through the creation of more abstract and formal ontologies. However, there has been growing concern that such representation must inevitably fail to accurately reflect the wide range of relevant worldviews on actual content and should be completely rethought (Feinberg, 2007; Mai, 2010, 2011; Szostak, 2013).

Nevertheless, representation of content remains absolutely essential to LIS despite these challenges. Certain efforts appear to be successfully maneuvering through these thorny thickets of complexity. For instance, Smiraglia's seminal publications (2001, 2002, 2005) on "works" include the phenomenon of instantiation in the bibliographic representation of knowledge about works, which are increasingly likely to have multiple manifestations in space (a series of filmed performances, for instance) and/or time (several editions of a book, for instance) that constitute sets of representations of a work. All these, then, form a *content genealogy* important to identifying information objects of any kind. In addition, Furner (2002a) has observed that works are entangled in extensive networks of document relatedness, such as associated metadata frameworks or citation networks, which may be considered as LIS objects in their own right as well, while Day (2008b) has made an equally far-ranging exploration of the entanglements of works of art. Beyond these classic approaches, yet another emerging knowledge-representation initiative is the León Manifesto, which proposes treating each "knowledge item" itself as the basic unit for classification rather than employing the disciplinary approach of traditional cataloging, but which would also allow for more global-level descriptors (Gnoli, 2010).

Further, there is the question of information objects, whatever they may be, as part of sets or collections or as sets or collections in themselves (Wickett, Renear, & Furner, 2011). Moreover, even the question of "what is a collection" in LIS is far from resolved, although a number of researchers have

addressed it (Currall, Moss, & Stuart, 2005, 2006; Lee, 2000; Manoff, 2006, 2010; Martens, 2011; Yeo, 2012a, 2012b).

All of this points to a key advantage for PI as a framework for LIS: that despite an understandable concentration on and commitment to veridical truth in defining *information*, which Floridi shares with the many other philosophers since Bertrand Russell who have faced the so-called problems of reference (see Pepp [2012] for a useful contemporary introduction to these), Floridi's informational framework for semantic content can make provision for fiction (that is, the rich imaginary that provides the majority of our cultural heritage) as well as fact when employed at the appropriate level(s) of abstraction, without resorting to relativism.

There are certainly sufficient precedents in the philosophical literature to warrant the further exploration of fictional semantic content (*e.g.*, Lewis, 1978; Thomasson, 1999; Voltolini, 2006; Walton, 1990) in LIS, in addition to that of factual semantic content, especially as the "fictions" involved can also be said to be somewhat similar to those routinely employed in mathematical and scientific modeling (Contessa, 2010; Frigg, 2010).

Floridi (2004a, p. 662) writes that "[t]he semanticization of data is a modeling process at some level of abstraction [LoA]. . . . According to the [LoA] methodology, any access to data (and hence any access to whatever aspect of the world is under scrutiny) is mediated by an ontological commitment to a level of abstraction that can be roughly understood as an interface." He goes on to assert: "We neither discover nor invent the world; we design it. So we understand it derivatively, only insofar as we understand its models. The world as we experience it every day is the outcome of our modeling its data with a degree of intra-LoAs coherence as great as one may wish. This is neither a realist nor an antirealist but a *constructionist* view of information" (p. 663; emphasis in original).

For LIS, whether called documents, records, or works, all such evidence or documentary reality is, in reality, somehow constructed by human beings directly through creation and elaboration or more indirectly through observation and explanation. Although the interpretations may be lost, as is the case with the Voynich manuscript and the Tartaria tablets, or yet to be completed, as with the cladistics of viruses and the Langlands conjectures in mathematics, or are fully shared only within a certain group, as with string theorists and song-line speakers, all these still remain part of the library. The library encompasses much more than reified technical knowledge, although our current, taken-for-granted emphasis on science, and particularly "information science," tends to obscure this fact. Floridi's (2009, p. 15) own schematic of information may well need to be redrawn to incorporate some of these major contributions from LIS's enduring stewardship of the full social transcript into the overall PI project itself.

This vast residual category in PI's general metaphysical framework for exploring the meanings and interpretations of information objects reveals enormous scope for LIS investigations in support of what Floridi (2002a, p. 46) himself views, in MacLeish's words (1972, p. 361), as "the library's implicit assertion of the immanence of meaning." Whether or not Floridi's *fourth revolution* occurs as he suggests, LIS will continue to include *The Analects of Confucius*, *The Epic of Gilgamesh*, and *The Tale of Genji*, as well as base-ten arithmetic, the periodic table, and the solar calendar. Thus, the ontological concerns of LIS are likely to have important implications for PI as well.

Information Dynamics

Floridi's (2002c) recommended second foundational focus of attention for LIS is "a substantial theory of information dynamics." He describes *information dynamics* for PI in general as

> (i) *the constitution and modelling of information environments*, including their systemic properties, forms of interaction, internal developments, and so on; (ii) *information life cycles*, that is, the series of various stages in form and functional activity through which information can pass, from its initial occurrence to its final utilisation and possible disappearance; and (iii) *computation* both in the Turing-machine sense of *algorithmic processing* and in the wider sense of *information processing*. . . . PI privileges 'information' over 'computation' as the pivotal topic of the new field because it analyses the latter as presupposing the former. (p. 138)

Among the most substantial and substantive theories relevant to LIS-related information environments developed over the past two decades is Hjørland's seminal work on domain analysis (Hjørland & Albrechtsen, 1995), which Tomic (2010) has suggested provides a useful complementary approach to Floridi's PI, with connections that could be further explored. While Tomic detailed some specific philosophical avenues of connection, this section will focus on a more general discussion of the two.

Domain analysis as defined by Hjørland (2002b) offers a philosophical foundation, as well as a practical toolkit of recommended techniques (2002a). Hjørland's (2010) socio-cognitive approach posits that studying specific discourse communities, such as a scientific specialty, professional field, or other interacting group of participants who share a common area of expertise, is the optimal way to understand the creation, dissemination, and utilization of knowledge, as the shared concepts, vocabularies, activities, and communication processes of such groups of subject experts will eventually result in the research findings and other recommendations described in the various publications that will be acquired and accessed through libraries, also providing the foundation for the development of subject headings, keywords, and other bibliographic infrastructures, thus forming the basis of society's

knowledge as a whole. This inherent privileging of the cognitive aspects over the social in Hjørland's approach to discourse communities has been seen as problematic (Fry, 2006), but it also helps to maintain a clear focus on epistemic considerations.

Domain analysis does allow for individual variations both within and between such groups, recognizing that the growth of knowledge is both a competitive and cooperative concern among the group members, and that their cognitive and social backgrounds, styles, and interactions all play key roles (Hjørland & Hartel, 2003). While Hjørland's (2000b) domain-analytic project is grounded in both the philosophy of science and the sociology of science, it also draws from both the information-retrieval and knowledge-organization aspects of LIS. Unlike many other research specialty studies, which have tended to focus primarily on the specialists themselves, their processes, and/or their research products (Velden & Lagoze, 2013), domain analysis is particularly suited for the study of how various domains interface with LIS. For instance, it has been used to: chart changes in interdisciplinary journal choices within the computational sciences over a fifty-year time frame (Tanaka, 2010); to compare the curricula for "relevance work" in archival, reference, and competitive intelligence education at ALA-accredited library schools (Martens & Van Fleet, 2012); and to analyze factors impacting the sharing of research data within five subdomains of earth systems sciences (Weber, Baker, Thomer, Chao, & Palmer, 2012).

As Tennis (2012) has pointed out, domain analysis can be practiced in several ways: as a descriptive analysis for basic research; as an instrumental analysis for practical applications; and as a contextual analysis for a deeper understanding of the domain itself, its possible changes over time, and how it is being analyzed. PI appears as though it could be especially helpful in this third, more reflexive mode of domain analysis. A domain analytic approach informed by PI might use the LoA/GoA approach to view domains at various levels of abstraction, using different theories, and focusing on different observables to provide a more coherent picture of those parts of the infosphere of special interest to LIS over time.

While there has been criticism directed at LoA in PI because "it trades upon decontextualized uses and recontextualizes 'information' for the practical purposes of formal analysis" (Watson & Carlin, 2012, p. 327), PI clearly does not prescribe or proscribe the methods of investigation, as seen above, but may provide a structure and syntax to facilitate considered comparisons at various levels.

In summary, PI is not intended to provide a replacement for scientific methods of investigation. It can serve as more of an meta-analytic overlay on all existing research practices, providing a metaphysical commentary on what is being researched, and why. In the current LIS research environment, which largely focuses on methodological rigor and practical applications, this can be seen as both unrealistic and unnecessary, but there is clearly a place for such deeper "philosophical" perspectives on our own domain. Whether LIS is willing to undertake such an effort certainly remains

an open question as well.

Information Ethics

As noted above, Floridi's information macro-ethics (IE) is largely predicated on our developing sense of stewardship of the infosphere. His proposal that information objects should have moral rights because they also embody information is probably the most controversial and celebrated part of his PI project, as it goes far beyond Weiner's foundational work pertaining to "the human use of human beings" (Bynum, 2008). One obvious application of this thesis for LIS is the destruction of archives, books, and libraries, referred to as "archivicide," "bibliocide," and "libricide" respectively. Although other authors have discussed historical cases and causes in exhaustive detail (Báez, 2008; Fishburn, 2008; Knuth, 2003, 2006; Owens, 2012; Polastron, 2007), there has been little discussion of any possible moral rights of the documents themselves, either individually or collectively, apart from those of their creators or possessors. Such a discussion is almost inevitable in the context of Floridi's fourth revolution.

The fourth revolution, both creating and being created by the infosphere, involves subjective, radical change even beyond the two gaps to which Floridi (2001b) refers: the vertical, ahistorical gap between modernity and post-modernity, and the horizontal and ethical gap between access and nonaccess. A third gap exists, one that is orthogonal and unpredictable: the sudden, subjective realization that one is oneself embedded in the infosphere is likely to be empowering, unsettling, or both, depending on the individual's own information-seeking and information-processing proclivities, and is not contingent simply on the availability of access to these alternative environments.

The human rights of displaced refugees, for instance, can easily be foreclosed within the "virtualized" mapping system of protected territories imposed by international agencies in which the actual persons may not "count" for more than their digital surrogates (Franke, 2009). Similarly, global digital surveillance of suspect individuals have become proactive rather than reactive, and is rapidly reaching a state in which it is being considered predictive of their real-world actions (Amoore, 2009). Current revelations of the massive level of "dataveillance" of individuals, groups, organizations, and even nation-states within the infosphere (Newkirk, 2013; Wood, 2009) may further serve to accelerate this realization of the reontologization of reality for others. For those already deeply concerned about the commodification of information in contemporary capitalist society (*e.g.*, Enright, 2011), this can hardly be reassuring. For the employees of organizations such as Google X, however, the fourth revolution is already here and presumably profitable (Stone, 2013).

Floridi's fourth revolution might easily be added to the list of examples in typologies of the so-called information society devised by sociologists, such as Feather (2013) and Webster (2002), to organize the

variety of empirical efforts at categorizing information "products" that followed Machlup's pioneering effort (1962). An information society that is subjectively defined by its members in the way that Floridi suggests would then fall squarely into the subjective, radical change quadrant of Fuchs's (2013, p. 415) typology of information society theories. The information "products" in such a radically reontologized information society would include both information objects and information organisms, and the boundaries would appear much more permeable. Even as the Turing test has devolved over time into a simple way for machines to distinguish human beings from other machines through the use of CAPTCHAs and as Amazon's Mechanical Turk computer program harnesses collective efforts by human beings for micro-tasks unsuitable for computers, for instance, there is increasing space for more metaphysical considerations of these boundaries.

It is useful to keep in mind that PI is grounded in a metaphysical approach, and that conceptual analysis in metaphysics, although both connected and committed to our common-sense thinking and scientific reasoning about reality (Jackson, 1998), works in a manner that is somewhat different from both. For instance, Nagel's (1974) classic exploration of the open question of the phenomenon of what it would be like to be a bat differs in approach from the scientific approach of exploring bat biology (Kunz & Parsons, 2009), the social scientific approach of examining our lay perceptions about bats (Knight, 2008), or the technological approach of extending our efforts to conserve bats (Boyles, Cryan, McCracken, & Kunz, 2011).

Similarly, PI offers LIS the unique opportunity to consider the open question of the document or the record from the point of view of the document or record itself. As Day (2011) has noted in his "Death of the User," the current understanding in LIS of the manifold relationships among human beings and information objects is in serious need of revision. Although it is extraordinarily difficult to guess what it might be to "be" other nonhuman entities with various informational properties, especially due to our innate tendency to anthropomorphize other entities, it is perhaps not beyond our powers to imagine what documents we ourselves are now or may become in the future. Such an exercise in empathy might be the beginnings of an "informational macro-ethics" turn, which could then be extended beyond our selves.

Viewing Turing himself as a representative figure of the very early stages of the fourth revolution may help illustrate this issue. The story of Turing's suicide (Hodges, 2012) indicates that the classification of one's "record" within particular sectors of a society's graphical records can have profound personal consequences far different from any other manifestations of one's work and survive long after one's physical death, whether that death is of an individual, such as Turing, or a group, such as the authors of the clandestine Shabbat Oneg archives in the Warsaw Ghetto (Kassow, 2011).

A better-known example is Anne Frank, arguably the most important single voice of the Holocaust

(Kluger, 2008, p. x). And yet Frank would most likely be as unknown as the other 1.5 million child victims listed in the Yad Vashem records had her diary had not survived as a document, the publication of which has allowed generations after her death to not only know of her, but to feel that they know her (Spector & Jones, 2007). It is also apparent that her document has been appropriated across cultures over time in multiple ways that she herself might well find unrecognizable (Wilson, 2013).

Young people leaving their own digital traces today, whether as postings on Facebook or elsewhere in the infosphere, may similarly form part of the historical record without realizing that they too are in the process of "becoming" a document. The creation and destruction of documents, therefore, whether through accidental or deliberate means, becomes a matter for more serious contemplation than it has received to date in most of LIS, where there is a tendency to focus on matters of retention and de-selection on a purely mundane basis of increased efficiencies in storage and/or retrieval. Only very recently has the "afterlife" of digital documents attracted broader research attention (Bollmer, 2013).

Another celebrated example can be found in research on medical records. It is perhaps not widely appreciated that medical records have been more or less tightly connected with librarianship for well over a century (Henry, 2011), although usually differentiated and sometimes marginalized as "medical records librarianship." This relationship developed as hospitals became increasingly institutionalized and instrumental in the rationalization of what were originally separate records formally and informally kept for various purposes by physicians, nurses, pharmacists, surgeons, and the hospital itself (Craig, 1989, 1990).

The evolution and aggregation of these different records over time into today's electronic medical record has reemphasized its importance in information studies (Siegler, 2010). Medical records have multiple purposes, both administrative and medical, and these have converged over time to the extent that Berg and Bowker (1997) can refer to "the multiple bodies of the medical record," and claim that these records do not merely represent the patients' bodies, but materially rewrite them, incorporating them into both the body politic and into bodies of knowledge.

The commonly used term *patient* in medical discussions is, of course, quite distinct from how it is used in ethical discussions, but Floridi's "On the Intrinsic Value of Information Objects and the Infosphere" (2002b) provides an instructive connection between them through viewing a human being ("Mary") as a patient at different levels of abstraction in the medical-record context. While Mary obviously has rights as a living patient in the hospital, including both legal and moral rights, the extent to which she also becomes a patient in the medical-records context exemplifies the utility that PI could bring to these discussions.

Floridi notes that Mary has certain, presumably inalienable rights as both a living patient and moral

"patient" (that is, a patient as the subject of agency by another, such as doctors and nurses in the hospital) that do not depend on the normal functioning of a human being. For instance, an unconscious, comatose, or brain-dead Mary (p. 294) still enjoys these rights as a patient. Floridi states that even after death, her body "still enjoys a degree of intrinsic moral worth because of its nature as an information object [in this case, pertaining to Mary's unique identity] and as such it can exercise a corresponding claim to moral respect" (p. 296).

He also claims that the moral worth of an informational object such as Mary has become does not end here:

> This is not a good reason to conclude that, if Mary is reduced to an information object . . . [such as] an entry in a database, then this information object is devoid of any moral value and can be rightly vandalised, exploited, degraded, or carelessly manipulated irrespectively of any moral concern and constraint . . . an entity *x* can be respected at different LoA, including the level at which *x* is only an information object. (2002b, p. 296.)

Although Mary is a fictional example, Henrietta Lacks (or "HeLa," as her cell line subsequently became known as an important informational object in cancer research) is not (Acker, in press; Skoot, 2010), and Floridi's argument here may explain why her case (W. Anderson, 2013) resonates so deeply with us. According to Floridi (2002b), PI's information macro-ethics will allow us

> [t]o be able to expand 'the everwidening circle of ecological consciousness' . . . and to appreciate what *a* has in common with *p* when *p* is an information object, [thus] *a* should try to transcend *a*'s own particular nature, recognise *a*'s own minimal status as an information object as well, and then extend the respect—which *a* would expect any other agent to pay to *a* as an information object—to any other information object that may be the patient of *a*'s actions. All this requires a change in ethical sensibility. If over-simplified, the perspective can easily be made absurd or ridiculous. Of course, IE does not argue that destroying an old copy of a database is a moral crime in itself. This is just too silly. IE argues that destroying a unique database can be morally evaluated at different levels of abstraction, and that most macroethics work at the low level represented by anthropocentric or biocentric interests, and are perfectly justified in doing so, but that there is also a higher, more minimalist level at which all entities share a lowest common denominator, their nature as information objects, and that this level too can contribute to our ethical understanding. (p. 302)

Were we to accept Floridi's view of information ethics as encompassing informational objects,

especially those whose "content genealogy" shows clear connections with human lineages, it would deepen the LIS discourse substantially, from the present practical focus on maintaining privacy, maximizing efficiency, and fulfilling legal requirements to viewing these documents as informational objects worthy of respect in their own right. Other examples particularly worth considering as informational patients in this regard might be fetal images (Raucher, 2009), photographs of unclaimed modern human remains (Kimmerle, Falsetti, & Ross, 2010) or cremains (Maisel, 2007), and biobanks and other genetic databases (Cordell, 2011). They raise important questions as to when and whether informational objects like these begin to acquire moral worth in Floridi's sense sufficient to make their survival beyond the present transcend other more pragmatic considerations. Other "embodied" records, such as the photographs found at so-called trauma sites like Tuol Sleng in Cambodia (Violi, 2012), offer compelling examples. Certainly, burned archives and looted libraries also could be considered trauma sites and their contents equally worthy of respect and preservation. A similar logic might apply to other documents like art and other informational objects of cultural heritage (Sax, 1999) or natural heritage (Carmichael, Hubert, Reeves, & Schanche, 1994), as well as elsewhere in the infosphere.

According to Floridi (2002b), PI attempts to draw

> our attention to problems that will become increasingly important the more dephysicalised and digitalised our environment becomes. In a society that calls itself 'the information society' it is vital to develop an ethical theory that has the conceptual resources to take into account the status of information objects. IE is an 'architectural' ethics, an ethics addressed not only to the users but also to the creators and designers of the infosphere. (p. 302)

This IE element of the fourth revolution would mean not only a continuation of the current trend to more collective stewardship of the global cultural heritage, but perhaps might lead to a more thoughtful reexamination of documents of all descriptions as providing useful "observables" for this endeavor. Floridi has left this question open to LIS investigation. When and if the philosophy of library and information studies extends so far beyond the concerns of the local collection, it may become no longer acceptable to remain indifferent to the documented presence of agnotology (Proctor, 2008), anti-epistemology (Galison, 2004), or apathy (Andersen, 2005) elsewhere in the infosphere and consequently make Floridi's concerns even more meaningful to us.

Conclusion

This introductory essay has attempted to provide an accessible guide to some of the many apparent possibilities and potential problems for LIS in Floridi's philosophy of information. These seem to suggest that LIS may just be as important to PI as PI is to LIS in terms of deepening our mutual

understanding of information ontologies, the dynamics of informational domains, and the variety of evolving relationships among information organisms and information objects.

The reader is urged to consult Floridi's own works, particularly his books (1999b, 2010a, 2011b, 2013a, 2014b), for a much deeper understanding of his ideas, which have been only cursorily discussed here, and to consider whether PI can indeed offer new energies and synergies to the LIS research enterprise, as well as what might be considered a poetic for LIS practice:

> In the informational fabric that we call Being, there are some special nodes. . . . [T]hese nodes are informational structures like all other nodes, encapsulated packets of differences, relations and processes, which contribute to the value and richness of the whole. Their special nature lies not in what they are—in their physics and biochemistry, to use a different level of abstraction—but in what they can do, for they are *structuring structures*, the ultimate defence against entropy/evil. They are the *loci* where the flow of information reaches its maturity and becomes self-conscious, capable of self-determination and able to decouple itself from the rest of the fabric and reflecting on its own nature and status, thus shifting from a Darwinian, physical evolution to a Lamarckian, mental development (we have developed incommensurably faster than our bodies). Such nodes, you and I included, have an unclear destiny. They might hope that their moral struggle against entropy is actually a small episode in a divine plan. If so, this can only be reason for rejoicing. Or they might fear that such a struggle is unfortunately only a titanic effort in an unrewarding and lonely universe, a thin red line against the vandalism of time, whose failure can be delayed and mitigated, but not avoided. If so, this should still be reason for some modest rejoicing, for they will have helped reality to die a more graceful death. Such nodes are the stewards of Being. They may do whatever they like, as long as they are careful. (Floridi, 2010c, pp. 279–280)

This, as we may think, seems entirely consistent with a "metaphysics of the library."

Note

1. Notable contributions to this discussion include: Artandi, 1973; Bade, 2013; Bates, 2005; Benediktsson, 1989; Benoît, 2002; Bivens-Tatum, 2006; Brier, 1996; Brothman, 2001, 2002; Budd, 2001, 2011, 2013a, 2013b; Buschman, 2003, 2006; Butler, 1952; Capurro, 2009; Cook, 1984; Cornelius, 1996, 2014; Day, 1996, 2005, 2008a; Dick, 1999, 2002, 2013; Dow, 1977; Eastwood, 2002; Fallis, 2008; Fox, 1983; Frohmann 2004a; Furner, 2014; Hansson, 2005; Harris, 1986; Hjørland, 1997, 1998, 2000a, 2004, 2005; Hoel, 1992; Hofkirchner, 2014; Jones, 2005, 2008; Ketelaar, 2001, 2002, 2012;

Kolitsch, 1945; Lingard, 2013; Lloyd, 2007; Lor, 2014; Madden, 2014; Mai, 2013; Manoff, 2001, 2004; Mukherjee, 1966; Natoli, 1982; Neill, 1992; Nesmith, 2002; Nitecki, 1979, 1985; O'Toole, 1993; Olson, 1997; Radford, 1992, 1998; Rawski, 1973; Rudd, 1983; Shera, 1973; Smiraglia & Van den Heuvel, 2013; Sundin & Johannisson, 2005; Talja, Tuominen, & Savolainen, 2005; Thornley, 2012; Trosow, 2001; Warner, 2008; Wilson, 1983; Wright, 1978; Zins, 2007.

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