Information science knowledge in research, research communication and research communication research: Cases from the Prior project.

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Abstract

This paper explores how information science knowledge (theory) can be put to work systematically in interdisciplinary research settings. Taking as a starting point the observation that only a few studies in research communication explicitly integrate information science knowledge, the paper presents a heuristic of how information science domain knowledge can be accessed in developing research websites. The paper proposes a combined analytic and synthetic approach. The analysis component includes the identification of information systems, the assignment of an information system type to them (for instance “bibliography”) and accessing the information science knowledge associated with this type. This specific, problem-oriented knowledge grounds the analysis of the corresponding information systems, guides interventions and is reintroduced when reexamining system modifications and reevaluating the original type. The synthesis part reestablishes the interdependence of partial systems in a functional whole. Both the analytic and synthetic aspects of research sites’ development are illustrated by the author’s own work in the project “The Primacy of Tense: A. N. Prior Now and Then”, in which researchers in the time logic of the New Zealand philosopher and logician Arthur Norman Prior work together with information scientists affiliated with the Royal School of Library and Information Science, University of Copenhagen.

Introduction

How can information science theory inform research communication and the development of systems for research communication in particular? This question arose from my engagement in a research project with which I am presently affiliated. In the funded, Denmark-based research project “The Primacy of Tense: A. N. Prior Now and Then” (Prior project group, 2017) researchers in the time logic of the New Zealand philosopher and logician Arthur Norman Prior work together with information scientists affiliated with the Royal School of Library and Information Science, University of Copenhagen. To the main tasks of the information science group in which I am participating, belong the development of the Danish Prior websites associated with the project to enhance communication and collaboration between Prior researchers on the project and worldwide, and to make Prior’s unpublished manuscripts accessible in transcribed and digitized form. In 2017 the focus is on reworking and modernizing the Danish Prior websites, accelerating the output of transcribed manuscripts from the Prior Virtual Lab and making them more accessible on the Internet. In this paper, I will frequently draw on examples from my practical work in the project in order to illustrate the main points I want to make.[1]

Information Science in Research Communication

Systems for research communication on the Internet are quite common in modern academic infrastructures and include research portals (Becker, Knackstedt, Lis, Stein, & Steinhorst, 2012), digital platforms for scientific collaboration ("collaboratories", cf. Finholt, 2002; Olson et al., 2008) and, more recently, “cyber-infrastructures” in e-science (Borgman, 2007; Elsayed, Madey, & Brezany, 2011). All these types of systems are well-researched interdisciplinary objects and are approached by researchers typically guided by very diverse kinds of research interests and theoretical backgrounds. Examples can be drawn from research into wikis (Kimmerle, Cress, & Moskaliuk, 2012; Notari & Honegger, 2012), where socio-constructivist learning theory and the concept of coevolution from Luhmann’s system theory are combined in order to shed light on learning and knowledge building in online communities (Kimmerle et al., 2012; Notari & Honegger, 2012), or the modeling of research teams as complex systems interacting on different levels in a complexity theory background (Vasileiadou, 2012).

While some of these studies draw on specialized, sometimes fragmented theoretical frameworks, others prefer more unified, “disciplined” approaches to research communication and collaboration. The latter involve whole, coherent “packages” of knowledge, accrued by a discipline in the course of its history. Illustrations for this strategy are the use of a system of interconnected psychological concepts and theories such as “impersonality” or “being one’s self” in a psychological analysis of web blogging (Gurak & Antonijevic, 2012; see, more general, Wallace, 2001) or the discussion of a “cyber-ethnography”, which redefines sociological inquiry and traditional ethnographic methodology (field work, participant observation, text-as-data) in the new online environments (Robinson & Schulz, 2012).

Among these “disciplined” research efforts in research communication research, examples of information science theory that explicitly ground research collaboration and research into it are not easy to find. It is true, on the one hand, that much work in this field appeals to the ubiquitous role and importance of information, information behavior and other related informational concepts in researchers’ learning, collaboration and research practices;[2] on the other hand, and in contrast to the numerous references to informational concepts in research communication, scholars only occasionally address information science knowledge directly.[3] This suggests a discrepancy between the widespread acceptance of information science concepts' relevance in research communication and the disciplinary knowledge from this field that is actually used and set in action. This paper wants to fill this gap and present some methodological and theoretical insights which can be useful in researching and practically developing scholarly collaboration from an information science perspective.

Relating Information Science to Other Research

Online research communication and collaboration (and their scientific study) are relatively recent phenomena which are strongly connected with the rise of the networked personal computer and the World Wide Web (Tredinnick, 2007). Seen from a more science-sociological perspective, it is thus not surprising that pronounced applied-practical and technological perspectives on research communication and collaboration characterize this field of research. Typical practical endeavors include research into taxonomies and types of research collaboration infrastructures (Bos et al., 2008), lists of success criteria for online collaboration (Olson et al., 2008), design of evaluation procedures for collaboration projects (Ramage, 2010) and issues related, for example, to coping with interdisciplinary digital communication and collaboration (Cummings & Kiesler, 2008). The technological strand identifies grid computing, big science, data mining and dataspace (BGA) (Elsayed et al., 2011; Finholt, 2002), coding, standards and markup techniques (Eggert, 2009; Flanders, 2012), digital collaboration tools (Zaugg, West, Tateishi, & Randall, 2011) and more as factors which crucially determine modern digital research environments.

Though it is sometimes somewhat unclear how the results of these various strands of research connect with each other and what their consequences for a broader and more general picture of digital research communication and collaboration might be, we are facing a promising and exciting, real interdisciplinary field of inquiry. Investigations in this area of research communication help us to better understand how researchers interact with technology, with other researchers (and the public) and with information—often all at the same time. My own proposals here concern the work in an interdisciplinary project setting, in which the integration of information science knowledge into the development of digital research communication and collaboration systems plays a crucial role.

In order to get a more concrete idea of how information science (knowledge) links up with other research in a project environment, in our case the "logical/philosophical part" of the Prior project, I want to model this connection by relating an abstract dimension of cognitive information science knowledge to a complex dimension of research activity types in a certain domain, here the field of logic and philosophy. The relationship between these two dimensions is of the semantic type "transfer", where information science characterizes the academic "donor", and the research domain the academic "recipient".

The target domain from logic and philosophy comprises three interrelated types. Most basically, "research" stands for time-logical, discipline-based, scientific knowledge building on the individual, cognitive level; as this knowledge is directed to the primary research objects of the domain (logical entities, philosophical arguments, etc.), it is of the first order. The second type, "research communication", refers to the communicative activities of time logicians and philosophers related to first-order knowledge building, and also to practical research tasks such as project work, coordination and joint knowledge exchange in publishing, meetings, at conferences and in discussions. Thirdly, "research communication research" is knowledge building of second-order entities with respect to the patterns of time-logical research communication and first-order knowledge building (research) and does therefore not directly refer to domain knowledge, i.e., the time-logical and philosophical domain.

By relating information science knowledge as donor with the recipient's three research-related subdomains' research, research communication and research communication research, we arrive at three distinct modes concerning how information science knowledge can be brought into play in an interdisciplinary project environment of the type discussed. The following table illustrates this.

TABLE 1. Three modes how information science knowledge is part of interdisciplinary research in project settings.

	Research (first-order knowledge building)	**Research communication (activities)**	**Research communication research (second-order knowledge building)**
Information science (knowledge system)	(Mode 1: Interdisciplinarity)	Mode 2: Information science-informed research system development	Mode 3: Information science research into mode 2 (knowledge of binding in information science concepts into research communication tools)

Mode 1 means interdisciplinary contacts in which information theory concepts such as 'information', 'knowledge', etc. are integrated into time-logical and philosophical research. Interdisciplinarity is today a research discipline in its own right (Frodeman, Klein, & Mitcham, 2010; Klein, 2010; Krohn, 2010) which has already provided fruitful concepts and a theoretical background for the analysis of information science's interdisciplinary relationships with other disciplines (for a study exploring the interdisciplinary relationships between information science and linguistics see Engerer, 2016). I will not touch further on interdisciplinarity in knowledge systems.

Mode 2 demarcates the intersection of information science theory and practical research communication tools relevant for time logicians and philosophers involved in the project. As a result, mode 2 is information science-informed system development in order to facilitate research communication activities. Mode 3 involves the building of second-order knowledge and refers to methodological principles concerning how concepts from information science systematically can inform the development of research communication tools for the domain target group (mode 2). This second order knowledge does not belong to the time-logical or philosophical domain, but is information science 'meta' knowledge designating knowledge concerning how information science knowledge is applied in a specific research domain.

This paper covers aspects both of mode 2 and 3 by discussing in the following section the systematics of accessing information science knowledge in the process of developing digital communication tools (websites) (mode 3) and demonstrating in the subsequent section the implementation of these transfer principles in the practical development work in the Prior project (mode 2).

Information Scientific Knowledge in Research Websites Analysis (Analytic Mode 3)

What happens when information science knowledge is drawn upon in a systematic way in the development of digital research resources? This is the basic question underlying mode 3, introducing information science 'meta' research into the domain research of time logic and philosophy, and thus generating knowledge about how to use information science concepts in developing research communication tools.

To address this problem of 'second-order knowledge' (in contrast to first-order knowledge from the time-logical and philosophical domain), it must be clarified what the proper objects for information scientific analysis and scientifically grounded information interventions should be. The task is, quite generally, to move from functionally unspecified, barely formal organization units (Internet domains, websites, etc.) to functionally specified information systems which can be regarded as the appropriate objects of study from an information science point of view. Are these information systems once identified, they can be assigned to distinct information system types; the latter are then interpreted as pointers to the disciplinary knowledge accrued for each type by information science research.

The information science knowledge areas associated with each information system subtype are identified, collected and organized in a way so that the analysis of the information system in question can be guided by the relevant disciplinary knowledge. As a consequence, interventions, functionality improvements and other development initiatives are undertaken in a controlled manner and based on information science analysis. Simultaneously, these modifications are starting points for new, subsequent cycles. Questions like these motivate new rounds: did the interventions lead to a substantial or insignificant modification of the original information system type or did they even lead to a new type? If a reconsideration of the information system subtype is in place, which new disciplinary knowledge on this emergent system is available? This enquiry leads to a new description of the newly developing information systems and, eventually, to new interventions.

In the following, I will make this informal description of the integration process more explicit through a general characterization of the components involved and the dynamics between them. The first part of the dynamics, the path from websites to knowledge over information systems and knowledge types, and back to information systems again, is illustrated as follows.

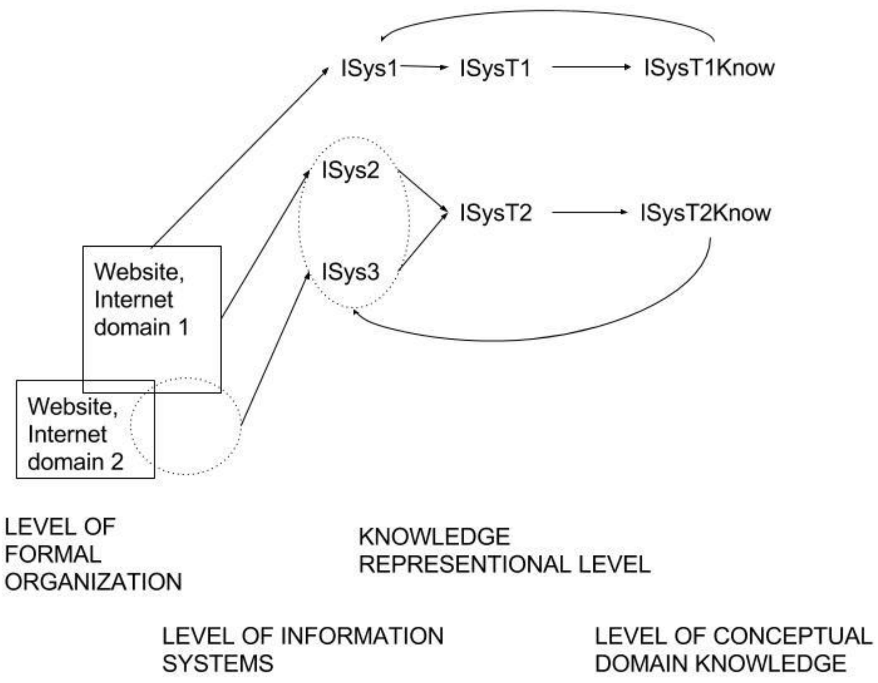

FIG 1. From websites to information systems (ISys) to types of information systems (ISysT) to type-specific knowledge (ISysTKnow) and back.

Starting from the left, the illustration suggests that the relationships between formal website units/Internet domains and information systems (abbreviated ISys) are not necessarily one-to-one; one information system (in our example ISys3) can formally be distributed over two web domains (indicated by the dotted circle on the left, overlapping with two websites), and, perhaps trivially, one website can contain more than one information system, as is the case with Internet domain 1, embedding ISys1 and 2. More generally speaking, the relationships between websites and information systems connect the level of digital, formal organization with the level of information systems, marking the transition from an informationally neutral, functionally unspecified domain of communication to a functionally specified—in our case the informational—domain.

Similarly, a non-unique relationship can be observed between the level of information systems and the knowledge representation level on which the types of information systems are specified (abbreviated as ISysT). One information system can be related to one type only (here, connecting ISys1 with ISysT1 only), or, as illustrated in Fig. 1, there is the possibility of two information systems, ISys2 and ISys3, both instantiations of one and the same information system type (here, for demonstration, ISysT2). Through the transition from the level of information systems to the knowledge representation level, types of information systems are specified, which indicates a further step towards domain specialization. This specialization consists of domain-specific characterizations of formerly unspecified information systems by mapping unclassified informational units ISys onto a scientific, terminological and hierarchical, nomenclature/classificatory system of domain terms ISysT. This recognition of the disciplinary terminology of a knowledge system, not unlike a thesaural system, is the key to the knowledge itself.

Moving on to the level of conceptual domain knowledge (more commonly labeled as “expert knowledge” or “expertise”), links between information system types and partial knowledge systems (with domain concepts at the lowest level) are established. Relationships between knowledge type terms and the knowledge system itself are not unambiguous either (though not indicated in the illustration above). One information system type can in practice correspond to more than one knowledge system or concept; this is for example the case when two rivalling theories or explanations are offered for the same phenomenon/information system. Similarly, two different information system types can relate to the same kind of knowledge system or concept.

In theories of knowledge organization these latter relationships are interpreted as ambiguous relationships between descriptor terms in a thesaural system (here, terminological labels for information system types) and their “meaning”, “definition’, “referent”, “semantics”, etc. (here, knowledge as a system of interrelated concepts linked to these terms). In traditional information organization, ambiguities like the ones mentioned are regarded as mismatches and undesired drawbacks in information retrieval and indexing (Svenonius, 2000). In our very different context we might simply talk about a challenge for the information professional in identifying the most appropriate knowledge best corresponding to the information system type under inquiry and, more pragmatically, in choosing the knowledge which is most useful in the context of the subsequent analysis of the information system.

Once the relevant type-specific information science knowledge ISysTKnow is identified, it can be projected into the realm of information systems where it grounds analysis and, eventually, prompts interventions. Knowledge of type 1 (ISysT1Know) is applied to information systems of type 1 (here only ISys1) and knowledge of type 2 (ISysT2Know) is applied to information systems of type 2 (ISys2 and 3). In our illustration, these two transfers of partial information science knowledge onto information systems are indicated by arrows “backwards”.

The type-guided analysis is executed on three information systems ISys1, 2, and 3 and applied to the background of two information science knowledge systems (ISysT1Know and ISysT2Know). These analyses lead in our example to three interventions (system modifications, implementations, tests, etc.)—IV1, 2, and 3, marked with red in the illustration below. These three interventions result in three modified systems, here represented as ISys1’, ISys2’, and ISys3’:

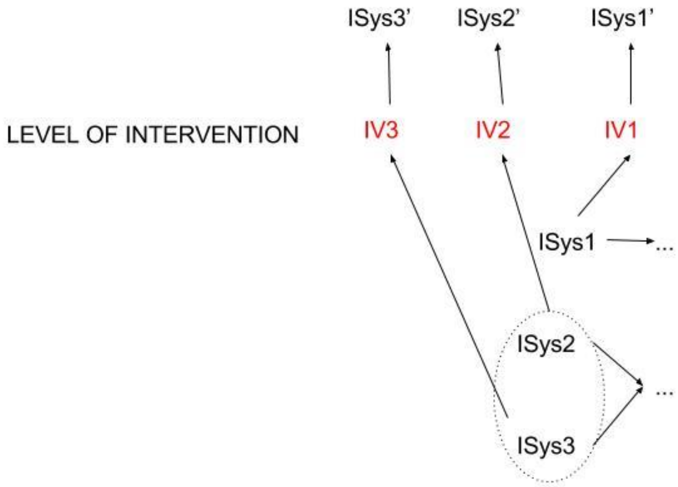

FIG. 2. Three development interventions IV1–3 on three information systems ISys1–3 resulting in three modified systems ISys1', ISys2', and ISys3'.

Whether a modification of an information system on the level of evaluation was successful or not, can, among other criteria, be ascertained by reexamining the intervened information systems with regard to their original, preinterventional types or in terms of the typed knowledge system which originally had motivated the intervention. With regard to the former, the researcher asks whether the intervened system still is of the original type or whether a new type has to be considered; in relation to the latter evaluation strategy, a question like "Is the typed information science knowledge still adequate for the modified information system?" could be posed. Typically, the spiral will continue, moving from modified types and associated modified knowledge to new analyses with changed implications for intervention; this results in a new set of modified information systems and so on and so forth.

Application: Information Systems in the Prior Internet Resources (Analytic Mode 2)

The Prior Internet Resources (PIR) comprise the Internet resources on Arthur Prior associated with our project. The term "PIR" includes both formal digital elements such as websites, knowledge organizing units such as bibliographies and other information systems, which I present in further detail below. The overall structure of PIR is made up of three main content components. "Foundations of Temporal Logic—The WWW-site for Prior-studies" (Hasle & Øhrstrøm, 2016), shortly "Priorstudies", is the main entrance for scholars interested in Arthur Prior's work and life. The related "Virtual Lab for Prior Studies" (Albretsen, 2016), hereafter abbreviated as "PVL" (Prior Virtual Lab), is the virtual platform for researchers transcribing Prior's handwritten documents. Finally, we have the so-called "Nachlass", a full text archive of transcribed and published Prior manuscripts. These three distinct content areas, Prior Studies, PVL and the Nachlass, are distributed over three Internet domains.

Step 1: From websites to information systems

As indicated in the preceding section, the first step in an information science approach to research websites is to identify the information systems ISys contained in (or distributed over) them. Though the term "information system", having its roots in the world of management and business (Burton Swanson, 2009), as default seems to refer to IT-based support for organizations to accomplish specific tasks (comp. Wallace, 2015), definitions and conceptions of information systems vary significantly between technology, social, sociotechnical and process views, as has been shown in a thorough review of information systems' definitions (Boell & Cecez-Kecmanovic, 2015).

The perhaps broadest, but for our purposes still meaningful, characterization of an information system stems from Wikipedia, a definition which is cited widely in textbooks (for example, Bourgeois, 2014) and on conference websites (in the Wikipedia article itself no references are given). According to this definition "[a]n information system […] is an organized system for the collection, organization, storage and communication of information. More specifically, it is the study of complementary networks that people and organizations use to collect, filter, process, create and distribute data." (Wikipedia, 21 April 2017, https://en.wikipedia.org/wiki/Information_system, link marking and bold type removed).

This broad and encompassing definition of information systems is practical and allows in a first step to roughly identify six information systems embedded in PIR. We have glossed each information system in PIR with the specific information-related action, taken from the definition above:

1. "Foundations of Temporal Logic—The WWW-site for Prior-studies": … communication of information …
2. Works written by Prior, primary literature: … collection, organization of information …
3. Works written on Prior, secondary literature: same as 2.
4. "Nachlass" (full text): … organized system for the collection, organization, storage and communication of information …
5. "Nachlass" in the archive boxes: … organization of information …
6. Prior Virtual Lab: … complementary networks that people and organizations use to collect, filter, process, create and distribute data …

It has to be emphasized that the Wikipedia characterization by no means accounts for an operational approach to identifying information systems. Clearly, there is much heuristic preunderstanding involved in the identifications above. However, if these six objects can be mapped onto significant information systems types and by this be linked to information science knowledge which in a meaningful and instructive way can be used to understand these systems better, this should in a way confirm the plausibility of our initial decisions.

Step 2: From information systems to information science subtypes to information science knowledge

In information science, information systems are of several distinct types—ISysT, most prominently documentary languages implemented in knowledge organization systems (KOS) such as classification systems, thesauri and ontologies (Hjørland, 2013; Hjørland, 2003; Stock & Stock, 2013, sect. L); information services such as bibliographies, retrievable databases and text repositories; and, last but not least, research portals and collaborative academic platforms in general. In order to identify the information science knowledge ISysTKnow relevant for the six PIR-embedded information systems, these systems have to be mapped on more specific types of ISysT such as the ones mentioned. The goal of this exercise is to systematically access relevant and useful scientific disciplinary knowledge, which improves our understanding of PIR and can be a professional starting point for developing and improving the present PIR.

PIR, defined as the virtual space delimited by the three abovementioned content areas and Internet domains (Priorstudies, PVL, and Nachlass), contains, after a first inspection, six information systems, ISys1–6, of five distinct types, ISysT1–5. All information systems types, ISysT, are well-known and acknowledged in the information science research tradition, and disciplinary knowledge, ISysTKnow, in relation to these types is readily accessible:

- ISys1: “Foundations of Temporal Logic—The WWW-site for Prior-studies” (part of the Priorstudies Internet domain)
  - ISysT1: research portal
  - ISysT1Know (exemplary knowledge sources: Becker et al., 2012; Elsayed et al., 2011)
- ISys2: “Of Prior”, works written by Prior, primary literature (part of the Priorstudies Internet domain)
  - ISysT2: bibliographical database
  - ISysT2Know (exemplary knowledge sources: Chowdhury, 2010, p. 17; Hider, 2012)
- ISys3: “On Prior”, works written on Prior, secondary literature (part of the Priorstudies Internet domain)
  - ISysT2: bibliographical database
  - ISysT2Know (exemplary knowledge sources: Chowdhury, 2010, p. 17; Hider, 2012)
- ISys4: “Nachlass” in its narrow meaning (Nachlass Internet domain)
  - ISysT3: full-text database, text repository
  - ISysT3Know (Blair & Kimbrough, 2002a; Borgman, 2007; Eggert, 2009; Lin, Fan, & Zhang, 2009; Littlejohn, 2005)
- ISys5: “Nachlass” in the archive boxes (part of the Priorstudies Internet domain)
  - ISysT4: taxonomic entry to archival metadata
  - ISysT4Know (exemplary knowledge sources: Batley, 2005; Bawden & Robinson, 2012; Broughton, 2006; Millar, 2017; Thomas, Fowler, & Johnson, 2017)
- ISys6: Prior Virtual Lab (Prior Virtual Lab Internet domain)
  - ISysT5: collaboratory, research platform
  - ISysT5Know (exemplary knowledge sources: Becker et al., 2012; Bos et al., 2008; Elsayed et al., 2011; Finholt, 2002)

Again, it has to be emphasized that there is much heuristic preunderstanding involved about which types of knowledge systems exist in the information science domain, which attributes and functions they typically have and how these traits and types can be recognized in a variety of instantiations of digital information systems. Similar things can be said about the assignment of information science theory to the corresponding types. Clearly, individual professional background, professional experience and theoretical inclinations play a crucial role with respect to which theories and works an information scientist draws upon when he/she describes a specific type of information system. One strategy to counteract these biases is to be as explicit as possible about one's decisions and to be open to discussion and critique.

The digital information structure of PIR so far, at the present stage of the project phase, includes four theoretical levels: level of formal organization (three internet domains), information systems (six partial systems), knowledge representation level (five information science subtypes) and the level of conceptual domain knowledge (five partial knowledge domains, corresponding to five information science subtypes). At the moment, work on the level of intervention is going on; some preliminary results of this work in progress are presented in Engerer & Albretsen (in prep.). The illustration below sketches the general structure of PIR with its summer 2017 status:

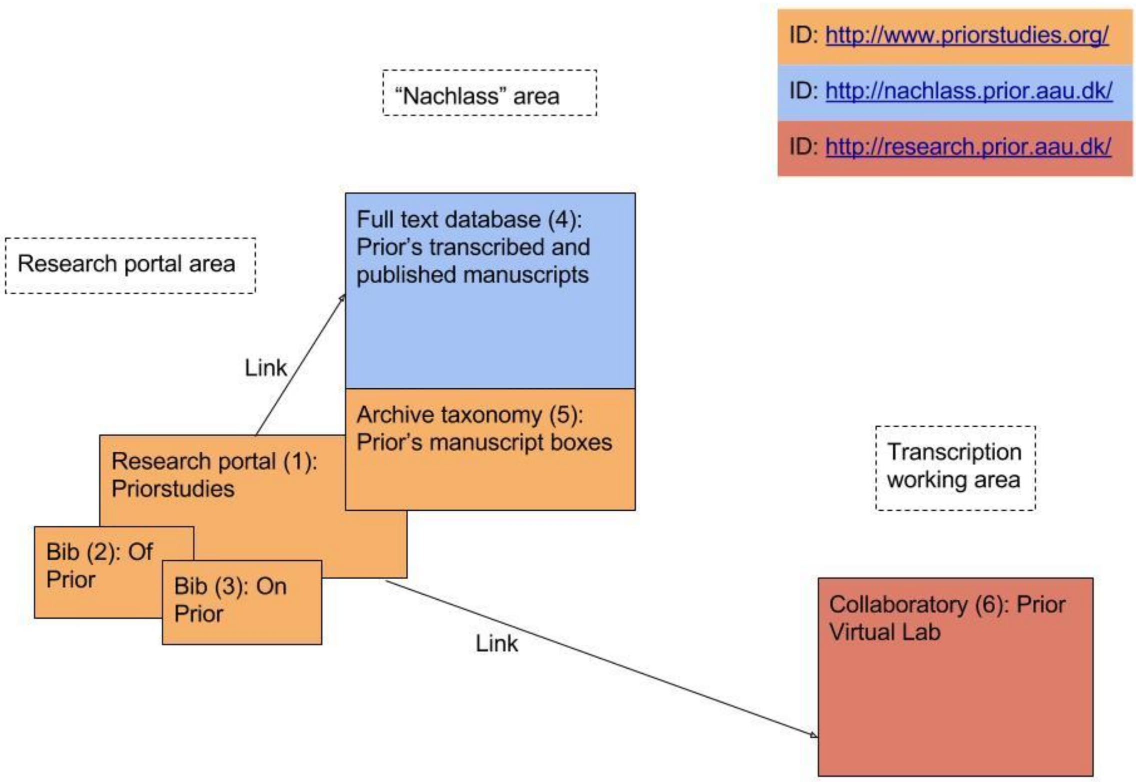

FIG. 3. General structure of PIR (summer 2017): six information systems representing five distinct types, implemented on three internet domains functioning in three areas.

Synthesis: Connecting Information Systems Again—The "Transcriber Loop"

In this final section I want to illustrate the importance of a "holistic" view on system components—here information systems—in an information science-informed approach to research communication systems. While the forgoing steps illustrated so far have been based on an isolating, analytical view of information systems, the fact that such systems are always part of a larger system has not been acknowledged so far. This is the synthesis aspect of digital information systems, which recognizes the functional interconnectivity of information systems in one research domain.

For the PIR, in their current form, a substantial functional connection between three information systems can be observed. For the Prior Virtual Lab (a collaboratory, information system 6) to work, and in order to transcribe, digitize and make electronically accessible (findable, searchable, sharable, etc.) as many unpublished manuscripts of Prior as possible on the Internet, the dynamics between the archive taxonomy (information system 5, Prior's archive boxes), the Prior Virtual Lab and the Nachlass full-text database (information system 4, Prior's transcribed and published manuscripts) is crucial. In this configuration, the box taxonomy from the Nachlass section (5) is of particular relevance, as it functions for Prior scholars as their only possible point of departure in order to identify relevant topics in the original handwritten material and to match these topics with their own research questions and research interests.

It is important to note that researchers at that point of their inquiry do not have the opportunity to verify the documents' relevance by consulting the original through browsing an electronic copy, here a photography (Blair & Kimbrough, 2002b); it is solely the documents' metadata, their descriptions and representations, which must be taken at face value as constituting reliable surrogates for the original document by the researcher. A preliminary match of interest is certainly a major motivation for scholars to engage in signing up for the Prior Virtual Lab, requesting the copy and then determining whether the text is worthwhile transcribing. In other words, if Prior scholars cannot in a trustworthy way ascertain whether the archive boxes contain relevant documents with regard to their research questions, it is highly unlikely that they will proceed and register for the Prior Virtual Lab.

The box taxonomy must therefore be viewed as the transcription project's hub, where the researcher kicks off a document circle which takes its starting point from identifying an appropriate document for transcription; should this be successfully completed, the document runs through transcription and returns finally to the Nachlass as a full-text searchable electronic document and database record. I illustrate this dynamic between information systems under one system umbrella with the following drawing, in which the pathways of researchers and manuscripts/documents between the three information systems are schematically sketched.

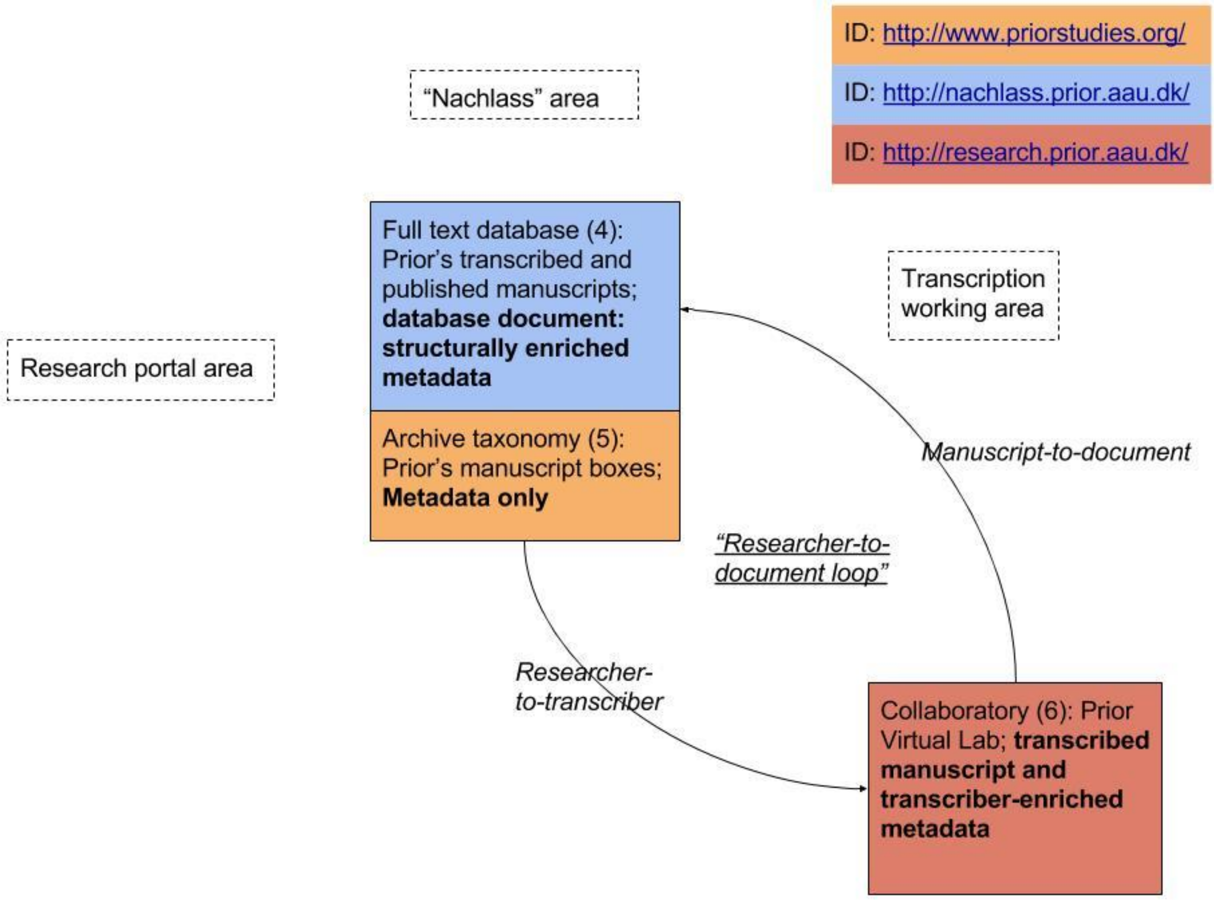

FIG. 4. The researcher-to-document loop connecting three information systems in PIR.

As suggested in the illustration, the researcher changes into the role of a transcriber by moving from the archive taxonomy to the Prior Virtual Lab. In this transition the formal manuscript metadata remain attached to the manuscripts throughout the subsequent phases of information processing. In the initial phase of the manuscript circle, the "manuscript-born" index fields, which have been derived from specialist archiver's descriptions, are closest to the original documents. This makes them extraordinarily valuable access points (Hjørland, 1998; Lancaster, 2003, p. 6) for advanced specialist searches. As the researcher progresses to the Prior Virtual Lab, taking on the role of a transcriber, he/she does not only carry out the transcription, but also enriches the manuscript metadata from the archive with information from his/her expert knowledge and textual/contextual knowledge arising from his/her deep intellectual involvement in the manuscript contents at the time of transcribing. This is one important aspect of the manuscript-to-document process, indicated by the arrow from the Prior Virtual Lab to the Nachlass full-text database.

The sequential aggregation of metadata, as it can be observed here here, is a typical case of "enrichment via information-added values", whereby texts are further formally described and indexed for content (Stock & Stock, 2013, p. 69), resulting in fully-fledged surrogates, sometimes called "documentary units" (Stock & Stock, 2013, p. 69). The last step of this manuscript-to-document process is the formal adaptation of documentary units to a database environment, an organized collection of surrogates which can be searched, retrieved and explored. This makes them to what often is called a "record". From this information science perspective, the manuscript-to-document arrow signifies a text's (manuscript's) change of status from a more or less unstructured and informal piece of text to a standardized record in a formal, machine-readable and searchable database collection in the full-text Nachlass. Processes like these only get visible (and can be understood) when a holistic view on interacting research communication systems supplements analysis.

Conclusion

This paper was an attempt to shed light and make explicit how we draw in a systematic way on information science knowledge in interdisciplinary projects. The starting hypothesis was that, although the importance of informational concepts is generally acknowledged in research communication research, cases in which explicit information science knowledge is brought in in the development of research communication tools are relatively rare. In order to follow up this claim and set my own proposals and analysis of the Prior Internet Resources into a context, I distinguished three modes of involving information science knowledge into the project setting of another domain, here the time-logical and philosophical domain: the spheres of systemic interdisciplinarity, research tool development and information science research into the methodology of research tool development.

I proposed a general scheme in which information systems are linked to information science types, which themselves are associated with significant knowledge areas in information science. These areas are then a background for analysis and the eventual development of interventions, which again, in a second loop, can be evaluated. This dynamic was illustrated by our concrete development work in the Prior project, in which the analysis led to six information systems allocated over five types with associated knowledge areas from information science. I complemented this analytical approach with a holistic view of information systems, where the interaction and mutual dependency of subsystems step into the foreground. The value of this supplementary perspective has been demonstrated by the so-called “researcher-to-document loop”, in which the manuscript’s path through three information systems from the box taxonomy, over the Prior Virtual Lab and finally into the Nachlass repository was followed from the information science perspective. This gave rise to functionally and motivationally relevant insights which can be of value for further improvements.

It is my hope that this paper can provide inspiration and professional self-consciousness to information scientists in order for them to use their educational background in a reflective and effective manner. I also hope that I can demonstrate to project managers in research collaboration that information science knowledge and information specialists, who are enacting this knowledge, are worth having on research projects. Last but not least, I endeavored to show that website analysis, in terms of information systems, is theoretically not a trivial and one-dimensional process, but involves the complex interplay of various levels such as the formal organization of websites, functionally specialized communicative items such as information systems, principles of knowledge representation, the conceptual domain of knowledge, and the level of practical change and interventions.

My plan is to expand the threefold typology of research, research communication and research communication research to a second information science dimension, namely the individualized bearer/knower of information science knowledge—the information specialist enacting this knowledge in interdisciplinary project settings. This will result in a quite different account of the interplay of information science and project research settings, where the abstract scientific knowledge system is transferred to a professional competency of practically working information scientists in interdisciplinary settings.

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Blair, D. C., & Kimbrough, S. O. (2002a). Exemplary documents: A foundation for information retrieval design. *Information Processing & Management, 38*(3), 363-379.

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Footnotes

[1] In particular, I will concentrate on one 2017 focus area, namely the development of the information systems embedded in the present Prior website presentation, including Priorstudies http://www.priorstudies.org/, Prior Virtual Lab http://research.prior.aau.dk/ and “Nachlass” http://nachlass.prior.aau.dk/. Issues related to the other main working focus, the indexing and representation of Prior’s handwritten letters and manuscripts, will be touched on in a paper in preparation (Engerer, in prep.). The project group has reported on some of the information science issues of the project elsewhere (Engerer, Roued-Cunliffe, Albretsen, & Hasle, 2017) and more visions for the development of the digital Prior resources along information science lines are in preparation (Engerer & Albretsen, in prep.).

[2] References to informational concepts in collaborative research include statements such as the following: information needs to be made accessible and provided with a multitude of access points in collaboration platforms (Borgman, 2007, p. 2; Elsayed et al., 2011, p. 270); a content and a markup aspect in digital information and websites must be conceptually separated (Eggert, 2009, p. 75); information must be acknowledged as a shared, accessed and created commodity in knowledge collaboration (Kimmerle et al., 2012); research collaboration involves not only the need to link people on research platforms, but also to link researchers with information such as, for example, digital libraries (Finholt, 2002, p. 79); tacit and presupposed, not only explicit and textual information in digital communication is important (Finholt, 2002, p. 96); information overload is a major negative factor in collaboration situations (Cummings & Kiesler, 2008, p. 113); there is a conceptual gain in distinguishing between “information” and “knowledge” when studying research communication (information is easier to mediate than knowledge) (Bos et al., 2008, p. 54);

information functions as the third basic resource type besides tools and knowledge in classifying collaboration systems (Bos et al., 2008, p. 68); the importance of information is highlighted by Borgman's notion of an "information infrastructure" for future scientists (Borgman, 2007, p. 3); the information/data dichotomy is crucial in understanding modern research collaboration (Borgman, 2007, ch. 3).

[3] Cf. Hockey who emphasizes the positive role of "information specialists" (a kind of practically working information scientist) collaborating with researchers in digital humanities projects, but does not directly refer to information science sources (Hockey, 2012, p. 87). An exception is Christine Borgman, who is working intensively on exploring how information science concepts can be utilized in order to understand digital research communication and collaboration, "Scholarship in the digital age", as she called this area in one of her recent books (Borgman, 2007).