

## Implementing New Knowledge Environments: Year 1 Research Foundations

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**Abstract.** In this paper, we present details of the first year work of the INKE (Implementing New Knowledge Environments) research group, a large international, interdisciplinary research team studying reading and texts, both digital and printed. The INKE team is comprised of researchers and stakeholders at the forefronts of fields relating to textual studies, user experience, interface design, and information management. We aim to contribute to the development of new digital information and knowledge environments that build on past textual practices. We discuss our research questions, methods, aims and research objectives, the rationale behind our work and its expected significance – specifically as it pertains to our first year goals of laying a research foundation for this endeavour.

We thank the Social Sciences and Humanities Research Council of Canada (SSHRC) for funding a research cluster grant, which has made our research network possible, and the generous co-sponsorship of our institutions and research partners. The research discussed in this paper is carried out by Ray Siemens, Richard Cunningham, Alan Galey, Stan Ruecker, and Claire Warwick, with Lynne Siemens, and the INKE research group.

**Keywords:** Text, Interface, Prototype, Reading, Book, Design, Human Factors, Theory

This paper presents an overview of the first year, foundational work of the INKE (Implementing New Knowledge Environments) research group, a large international, interdisciplinary research team, including 35 individuals from 20 different institutions. We have come together to study different elements of reading and texts, both digital and printed.

The INKE team is comprised of researchers and stakeholders at the forefronts of fields relating to textual studies, user experience, interface design, and information management. We aim to contribute to the development of new digital information/knowledge environments that build on past textual practices. We have already articulated a foundation for identifying the characteristics of digital interfaces

that respond to the expectations and needs of a broad constituency of professional, personal, and lay readers.

Ultimately, our work provides functional reading interface prototypes that have the potential to transform the way we engage with the digital materials that comprise our personal and professional reading. To do this, our *Textual Studies* (TS) research responds to the need for further understanding what components of existing textual artifacts are essential to represent in new digital objects and reading devices. Our *User Experience* (UX) research identifies characteristics of user engagement with print and digital environments; our *Interface Design* (ID) research focuses on extending continuous reading and scholarship involving digital environments through interface; and, through iterative processes involving all research groups, our *Information Management* (IM) research builds prototypical digital reading interfaces that promote active reading patterns and draw on dynamically integrated collections of supporting materials. In addition to these four areas of research, a fifth area of our consideration focuses on understanding, creating, and evaluating research structures that will allow academic and non-academic (including industry partner) members of our research team to work together in ways that meet the needs of the research and development cycles of the entire INKE group.

Over the course of our seven year initiative, we aim to combine the traditional strengths of print with the advantages of the computer to produce integrated digital reading environments that take full advantage of the technical possibilities of the electronic medium. We seek to:

- document the features of previous textual forms as the context for implementing new knowledge environments;
- advance our understanding of how reading texts and using information is affected by digital, multimedia delivery;
- conceptualize new knowledge environments, and develop tools to produce accessible, flexible information architecture;
- extend user control and/or affordances;
- implement new visual metaphors and integrate social networking functionality;
- create dynamic interface prototypes for new knowledge environments.

The prototypes represent a complex of foundational textual forms, comprising most professional and personal reading environments: the *scholarly edition*, such as those of the Folger Shakespeare Library publication series, the Internet Shakespeare Editions (ISE), and the Bibliothèque du Nouveau Monde (PUM), among others; the *academic monograph*, such as *Du papyrus à l'hypertexte* (Vandendorpe); *poetry and creative fiction*, as represented in the Electronic Literature Organization (ELO) collections; and the *scholarly journal and essay collection*, such as those of the Public Knowledge Project (PKP) and the Blackwell *Companion to Digital Humanities* (ed. Schreibman, Siemens, and Unsworth). These prototypes encompass a wide range of further text types: a digitized work (originally created in print); a born-digital work (created entirely in digital media, with no print source); a work with complex interpretive apparatus; an interactive work; a highly encoded work; works in different

file formats; a Web-based document; work(s) in different genres; work(s) in French and English; and a dynamic document.

A fuller overview of the research team goals and year 1 plans is available in Siemens, et al. (forthcoming).

In the context of our larger research goals, first year concerns are foundational for us, in which we attempt to more fully lay the theoretical, methodological, conceptual and infrastructural groundwork necessary for building prototypes in the subsequent phases of our research. A symposium will be held in year 1 (INKE 2009, [tinyurl.co/inke2009](http://tinyurl.co/inke2009)) at the same time as all groups update their current reviews of existing literature. Facilitating our foundational endeavour, TS evaluates the economic, cultural, and technological history of textual production and reception; ID adapts existing software, such as social network analysis tools, to develop a visualization application that enables us to study the interrelations between research papers published by different disciplines; IM explores the current state of technology for building collections and databases for digital documents; and UX begins studies to derive requirements for prototype development. All of these activities provide a baseline survey of key areas relating to user interaction with digital artifacts. A more detailed discussion of mandates and activities follows.

#### **Textual Studies (TS): Documenting Architectures of the Book**

To understand how digital textuality will affect practices associated with the engagement of materials in new media, TS documents the features of past textual forms and practices to provide the vocabulary and theoretical framework for implementing new knowledge environments. The emerging field of Digital Textual Scholarship conceives of its materials in broad terms that encompass artifacts like scrolls, newspapers, transcriptions of oral folktales, photographs, small-press periodicals, poems and plays in manuscript, electronic literature, video games, multiple versions of films, and unpublished archival materials. TS brings several approaches to bear upon all manner of human artifacts, digital and analog. These include *book history's* interest in books as primary mediators of human relationships (Johns), and in the book as "the text" on a human scale; *bibliography's* focus on print material as physical, machine-produced vehicles of abstract texts (Greetham); and *literary theory's* sensitivity to the complexities of form, content, and materiality in all linguistic mediation (McGann). Digital textual scholarship also involves an anthropological understanding of texts as "the universal human work of weaving or fabricating with words" (Barber), as well as a psychological understanding of texts as artifacts embedded in cognitive networks of attention and memory (Galey).

The TS team's primary contribution to INKE will be to document the essential features of historical textual forms and their associated human practices, which will provide the essential vocabulary and theoretical framework for the other teams' re-conceptualizing of the book. For INKE's prototyping cycles to be grounded in the histories and imaginable futures of human reading practices, the project as a whole will need a knowledge base that bridges between book history and information architecture. As a necessary complement to INKE's core activity of *prototyping*, we

will need an ongoing *modeling* process that informs INKE's work at the levels of theory, history, and code.

As their primary activity in year 1, TS will establish a textual features knowledge-base which we have tentatively titled *Architectures of the Book* (or *ArchBook*), which provides a history of textual production. This online resource will not only be the most comprehensive online reference for the history of the book, but will also promote research on the future of the book through its focus on the information architecture of texts. In essence, *ArchBook* will combine

- the accessibility and ubiquity of Wikipedia (but without the possibility of public modification)
- the rigor, depth, and editorial oversight of a scholarly reference
- the scope and strategic coverage of an essential introduction to textual scholarship, but equally inclusive of digital textuality and multimedia
- the visual richness of digital resources like the British Library's *Treasures in Full* ([www.bl.uk/treasures/](http://www.bl.uk/treasures/)), and McMaster U's *Peace and War in the 20th Century* ([pw20c.mcmaster.ca](http://pw20c.mcmaster.ca)).

It will act as a resource for all members of our team and, further, will be available to all those working in areas touched on by *ArchBook*.

### **User Experience (UX): User Requirements Gathering**

UX studies the complex processes involved in engaging with materials in print and digital environments, deriving requirements for, and subsequently testing, prototypes developed by the research team. UX conducts studies with individuals engaging with humanities artifacts in a variety of contexts and for various purposes. These artifacts may include different types of content, including alphabetic language, icons, sound or images; they may be straightforward or complex in structure, and may contain marginalia or annotations, as each of these variables may modify cognitive and affective response, as demonstrated by empirical user studies in digital environments (Unz). Humanists read in many different ways, adopting different physical stances and mental attitudes dependent on the formal properties of the text and the object of the reading enterprise (e.g., whether it is for pleasure or study; Grafton). They also appear to be affected by feelings about physical environments (Rimmer, et al). Any study of individuals engaging with such materials should therefore take into account the complexity of the enterprise and employ multiple methodologies.

In addition to updating the working knowledge-base, with recent work on theories and models of reading, reading phenomenology, reader studies from the perspective of cognitive science, HCI user studies, and use-in-context studies (humanities based) in the context of coordinated historical, design, and user experience perspectives on user needs, UX will develop and implement a preliminary survey instrument for use in user requirement studies. The survey will see coverage, and subsequent analysis, from groups including those in attendance at the Digital Humanities Summer Institute (June 2009; [www.dhsi.org](http://www.dhsi.org)), those among select groups of humanities and social sciences researchers (faculty and undergraduate, graduate, and postgraduate students), adult readers of literary fiction and online information sources, and secondary school students. At UCL, studies will be ethnographic in nature, following a use-in-context approach, and will examine broadly how humanities scholars approach research (what

resources they use, etc). At UBC, user requirement studies will focus on use of particular genres of information specific to the INKE project (e.g., scholarly editions, journals and monographs, e-literature), devices, and humanities research tools.

### **Interface Design (ID): Modeling ‘Chaining’ in Professional Reading Practice**

Given the emerging possibilities offered by new media, it still remains to understand and develop methods and models to: (1) extend reader control of digital texts; (2) develop and test prototypes that address issues raised by the printed page metaphor, and give readers and researchers better control of their activities by revisiting the notion of page boundaries, devising experimental visual tools related to the scrollbar, designing advanced means of bookmarking and annotating, implementing new digital metaphors that may derive, for instance, from sculpture or visualization rather than from the codex book, and exploring possibilities for parallel displays and related tools; (3) create tools that merge reading culture with prototypes of social software; and (4) design prototypes that rethink and re-present genres of print material as well as examine some of the emerging born-digital genres. Theoretical models for representing digital textual material are in their early stages and do not fully accommodate the visual and logical dimensions of texts; moreover, they do not take into account that the process of reading involves understanding not only the logical structure of content, as the Text Encoding Initiative (TEI) structure emphasizes, but also that the integration of visual information provided by typography and the disposition and layout of text and may help reading and visual memory, as one’s ability to retrieve information depends in large part on spatial cues consistent from one act of reading to another. Given the emerging possibilities offered by new media, it remains vital to develop methods and models that rethink conventions of print material and examine emerging born-digital genres such as e-literature, and consider how reading culture is affected by the rise of ‘social’ computing environments.

ID researchers work within this research context to develop prototypical interfaces that allow readers to work with digital artifacts. They follow a research life cycle that begins by building on insights from UX and TS and founded on design workflow that includes direct user participation, with users consulted at every stage in the process and focusing on initial development of interface sketches and small prototypes that will converge into a larger working environment.

ID’s focus for year 1 is on studying the interrelations between research papers published by different disciplines, largely through the act of ‘chaining’ citation structures on existing bodies of work, and on designing an application that appropriately tracks and models this behaviour. Called the “Paper Drill,” the origin of this concept is in UX team research into the reading practices of academics who follow citations as part of their professional reading. The functional goal of this prototypical tool is to allow a user to choose a representative paper in a field they don’t know very well, have the system find the citations in that paper, then collect those papers, find subsequent citations in them, and so on down to the third level, finally producing a report that lists the most commonly cited papers in the set, and thus providing a snapshot oversight of the field(s) embraced by the paper and the dominant work and researchers within that field as represented in formal publication record.

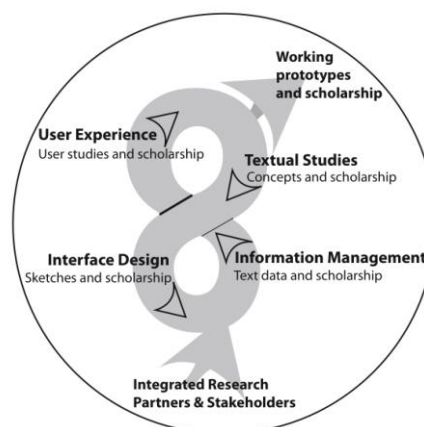
### **Information Management (IM): Developing Test-bed Corpora, Data-stores, and Analytical Facilitators**

A key problem posed by the electronic medium is that of facilitating ways that allow readers of digital materials to store, retrieve, share, annotate, and navigate information more efficiently than in the past. Traditional approaches dominate even the most current search resources, but are proving insufficient for several key reasons, namely that digital information is unstable, its volume is increasing rapidly, and there is a profusion of data formats. Key strategies for addressing these issues do exist: the chief research challenge for archives or large corpora of texts is to provide means of organization and access to a radically expanding and heterogeneously formatted body of materials. The chief research challenge for individual artifacts is to provide contextual information for producers and consumers of dynamic reading environments. Our research is a combination of the best of several knowledge management strategies, which consist of the speed and power of the search engine; deep textual-analysis methods used by the scholarly community; consistently encoded corpora in specific knowledge domains; and detailed user-recorded results provided by the social networking technologies.

Moving towards the goal of providing ways to organize and access the expanding and diversely formatted body of digital material in ways that best serve the needs of users, IM's goal is to develop the informational underpinnings for four prototypical digital reading environments. IM's year 1 goals are toward investigating and test-bed implementing corpus technologies necessary to build primary and secondary corpora pertinent to our reading environments, in English and French, through our research partnerships and stakeholder networks. This begins with a literature / technology review that surveys the current state of *corpus* building (including establishment, facilitation, and [semi]automatic generation), *stores* (including building collections, databases for digital documents, and knowledge management systems), *analytical facilitators*, and *API* issues; it culminates in the development of test-beds combining corpora (primary and secondary materials) in stores and analytical facilitators in the team's test-bed areas of the scholarly edition, the academic monograph, poetry and creative fiction, the scholarly journal, and essay collection.

### **Team Administration and Research Management**

As with INKE work across all years, year 1 activities involve focused, integrated, and coordinated activity among all researchers and stakeholding research partners, manifest in outcomes pertaining to (1) the disciplinary areas that our program of research serves, (2) the interdisciplinary fusion achieved by the work of the team as a whole, and (3) the application of our work in stakeholder



areas represented by the production enterprises of our partners. To ensure this, more than other academic research teams we have had to focus explicitly on understanding, creating, and evaluating research structures that will allow academic and non-academic (including industry partner) members of our research team to work together in ways that meet the needs of the research and development cycles of the entire INKE group. We have put into place an integrated and detailed research plan and a documented internal governance and reporting structure that together outline how we, the full research team, works together toward its common goals and ensures that we have the tools to do so.

Subsequent years will have iterative prototyping as their focus. Years 2-5 each feature an annual cycle of work that varies according to the material comprising our focus. Each year's activities are organized around different types of print and electronic media that are our focus (and are derived from our research partners): corpora (yr. 2); scholarly editions (yr. 3); journals and monographs (yr. 4); and electronic literature (yr. 5). In each cycle, UX (for user or reader requirements) and TS (for relevant textual production and reception) undertake research toward the construction of initial prototypes with IM and ID. These prototypes are tested by UX, the results being essential to the prototypes' revision and perfection by the research team. Results are cumulative, with the gains of each annual cycle being reaped by the subsequent one.

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