Genre as Interface Metaphor: Exploiting Form and Function in Digital Environments

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Abstract

We hypothesized that the attributes of a document's genre determine a document's ability to be identified uniquely. Consequently, recognizing the genre will facilitate effective user-document interaction. In this pilot study, we exposed fifteen participants to a set of paper and digital documents, each converted into two surrogates: one based on form, in which the text was masked leaving only the structure, and another on function, which reduced the document to its semantic content. Our findings indicate that the form attributes of a genre play a significant role in the identification of corresponding documents, and suggest that genre can potentially serve as an interface metaphor.

1. Introduction

Documents provide visual cues that enable users to conceptualize their form: in particular, the layout of a document contains distinctive features which alert the users to the type of content the document will likely contain. A user, even before reading the content, may recognize a document, for example, as a newspaper through the appearance of columns and headlines; an annual report features numerous tables, and a dictionary contains an alphabetic sequence of tabs. These features evolved as an efficient means of representing the semantic contents of particular types of information. As such, they trigger a user's recognition of socially-familiar discourses – in essence a user's mental model – to such a degree that if the words labelling the form were omitted, the documents' functions would remain perceptible and interpretable.

A user's effective use of the digital documents depends on an ability to recognize the formal cues which distinguish among document types. When paper documents evolve to digital form, however, those cues intrinsic to paper may not be transferred or even be transferable. Hence, users may be unable to infer the contents from the formal features, requiring additional effort to make sense of the document, adding to the person's cognitive load and potentially leading to misunderstanding and misinterpretation. Additionally, new genre are arising because of the new medium [7].

In this study, we hypothesize that a document is an instance of a class of genre, and that each genre has a parsimonious set of attributes that distinguishes one genre from another. We suggest that a document can be represented as a set of distinct facets or layers (see Figure 1 at the end of the paper):

- document *function*: the semantic content of the document as represented by the meaning of the words in the text,
- document *form*: the visual appearance of the document, its structure, as manifested by its specific formatting and layout, and,
- document *interface*: the means by which the document is accessed and used, and the portal through which it is examined. In the paper world, this layer is represented by a variety of tactile and physical characteristics such as the size of an item, the texture of the paper and so on; in the digital world, by a common user interface.

We suggest that the identification of a document's purpose occurs through recognition of two sets of cues received from a document's form and function; correct identification occurs when these cues are consistent with those defined by its class of genre. As a consequence, genre can serve as an organizing metaphor to facilitate a user's recognition of and subsequent interaction with a digital document. The purpose of this pilot study was to investigate this concept by examining the visible cues present in paper and digital documents to assess the potential use of genre as an organizing metaphor in user-document interactions.

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2. Background

2.1. How people use documents

Researchers have known for some time that reading is a far more complex process than simply moving the eyes across the page; it involves an active interpretation of both meaning and form. Historians, for example, exhibit a high sensitivity to document form [5]. Wittrock concludes that readers "construct" the meaning of what they read by creating "images and verbal transformations"of the text [22] in much the same way as users who interact with digital systems [16]. As in digital systems, when users interact with documents, three possible outcomes may occur:

- The user's interpretation matches the intentions of the creator
- The user constructs a satisfactory interpretation that differs from the creator, or
- The user fails to construct any interpretation [6]

In constructing these interpretations, users employ signalling devices as they read or scan a text. Signalling devices do not add new content to the text, but emphasize inherent aspects of its existing structure or content [12]. Hypothetically, these devices also enable a user to distinguish one type of document from another. Thus, if these signalling devices are unrelated to, or at odds with the user's expectations of a particular text type, they make additional cognitive demands on the part of the user to understand the intent of the document and to interpret its contents. Signalling devices may be interpreted as elements of both Form and Function.

2.2. Genre

Genre, with its roots in art and literature, has found a new relevance in digital documents. Rhetoricians and literary theorists have traditionally attempted to classify communicative documents into categories according to shared innate features of form, topic or purpose. Genre theory – the study of how texts are classified into kinds and types – directs attention to the texts themselves and to the users of those texts. On the one hand, it explores the ways in which the semantic content of the text is shaped and determined by its generic nature and traditions, which dictate the structure, as well as the length, format, and use of language. On the other hand, genre theory explores users' interactions with texts. Beghtol, drawing on the theories of Van Dijk [25], argues that readers bring a framework of expectations to a document: a framework which they mentally insert into the text "as an aid to immediate text comprehension and to eventual storage in and retrieval of the text from a reader's semantic memory" [1]. As discussed earlier, this is not unlike how readers construct meaning from text.

2.3. Interface metaphors

In the evolution from print to the electronic medium, the interface metaphor was adopted to make systems easier to learn and use, by establishing user expectations and encouraging predictions about how the system behaves. System designers use a metaphor at the point of interaction to teach the user how to manipulate the interface. The user "loads" the metaphor into the working memory [4], and the similarity between the structure of the metaphoric image and the structure of the interface enables the user to exploit prior knowledge to understand the system and work with it [3].

Interface metaphors familiarize users with an information store or with a set of tasks. One technique used to develop metaphors borrows from precursor tools and artifacts [14]; new systems are often built on the functionality of older systems. Thus, the original system suggests an organizing metaphor since it represents a well-known structure. Other metaphors are drawn from wider areas of familiarity: the house metaphor for fiction [18], the library metaphor for multimedia information [21], and the electronic city for community information [20].

Not all metaphors are successful; Jones and Dumais [10] warn that "the intuitions of systems designers are not always in accord with the needs or abilities of users." Toms and Kinnucan [20], for instance, discovered that the electronic city metaphor was inadequate as a Freenet interface, because the users treated the metaphor as an analogy, and attempted to make a one-to-one mapping between the concept and the interface. For interface metaphors to be useful, they need to be aligned with users' mental models of the system [13]; furthermore, they often focus too closely on the system model, and fail to match "the type of conceptual information being communicated" [9]. If, however, we design interface metaphors that are rooted in users' understanding of the type of information being presented, these metaphors may remain, to some degree, as fundamental structuring principles of the document. We are suggesting that document genre, as manifested particularly in the visual layout, can provide just such an organizing metaphor for the users of digital documents.

2.4. Genre as interface metaphor

New media capabilities are creating new genres and transforming old ones. Crowston and Williams [7] provide an extensive list of information types that commonly appear on the World Wide Web: types that are represented by documents which are linked by "similar substance and form and taken in response to recurrent situations" [23]. Similarly, O'Neill [17] created a tentative taxonomy of text

types that appear on the Web: a taxonomy based primarily on document purpose, including non-fiction, fiction/entertainment, reference/index, institutional and personal. These studies do not explore the convergence of digital genre and interface design: namely, the potential of genre as an interface metaphor.

The genre of a document typically communicates itself to the user through a series of visual cues: devices which enable the user to recognize the text's form and purpose, and, like an interface metaphor, to "load" the appropriate framework of expectations into working memory. These devised may be features of format and layout, such as the use of columns, or of a particular typeface; they could also include devices which indicate authenticity or currency: watermarks, copyright symbols or version numbers. They could also include features designed to facilitate a particular kind of use: the presence of indices, illustrations, headers and footers, page numbers or tabs. In essence, they communicate to the user something about the document and thus may function somewhat like an interface metaphor in the user-document interaction.

To test the use of genre as an organizing metaphor, we conducted a repeated-measures within-subject experiment. We exposed a group of academically-oriented people to two sets of documents in which the document's form and function were isolated in both paper and digital environments. The questions guiding our study were:

1. Can genre as represented by its form be used as an organizing metaphor?
   a) Can users identify document when only the document's form is presented?
   b) Can users more efficiently identify a document when only the form is presented?
2. What is the most parsimonious characteristic that uniquely identifies a document?
3. Are the characteristics that are present in paper documents transferrable to digital documents?

3. Method

3.1. Participants

Fifteen participants (six female and nine male) participated in the experiment. About 50% were under thirty years of age. All have at least a Bachelor's degree and just over 50% also have completed graduate work. All were university students, administrative staff, librarians or faculty. They were an experienced computer user group and were active Web surfers. Sixty percent have been using a computer for more than six years. Nearly 90% have been surfing the Web for more than a year; seventy-five percent surf the Web at least once a day or more frequently. Hence the participant group was representative of the academic community and well versed in Web usage.

3.2. Materials

The types of documents in the test collection were determined by the results of a small survey of academics. Prior to the start of the experiment, thirteen university students and academics in Canada replied to a survey about the types of documents they used most frequently in the past six months. Results of the survey are listed in the first column of Table 1.

Representative documents of each of these types were selected for the test collection of twelve documents as illustrated in Table 1. Half came from traditional paper sources and half from those created for distribution via the Web. Each document was converted into two surrogates based on these elements:

a) Form:
This version exhibited all of the physical characteristics of the original document, but the text was masked. Each alphabetical character was represented by an "x" (upper or lower depending on the original text) and each digit by a "9" as illustrated by the samples in Appendices I and II. Thus the structure remained intact, but all semantic meaning was removed from the document.

b) Function:
In this case, a document was reduced to its semantic content. The document was represented as one single paragraph of information presented in regular text (i.e., 12 pt Times Roman). None of its physical structure was retained (see examples in Appendices III and IV).

3.3. Variables

The following variables were tested:

a) Type of document: Journal Article, Course Reading List, Departmental Memo, Dictionary, Minutes from Meetings and Course Calendar.

b) Genre element: Form versus Function versions of a document.

c) Medium: Paper versus Digital document.

These variables were measured by the number of different documents that could be identified correctly by participants and by the amount of time taken to identify correctly the type of document. In addition, but not quantitatively measured, the distinguishing characteristics that uniquely identified a document type and the most discriminating characteristic as perceived by participants were analysed.

3.4. Tasks

Each participant examined eight print documents and eight digital documents; four presented 'Form' and four

presented 'Function' in each type of medium. While examining each document, participants were asked the following questions:
a) What type of document is this?
b) What characteristics lead you to believe that the document is [user response to first question]?
c) What is the most discriminating characteristic that lead you to believe that the document is [user response to first question]?

3.5. Procedure

To control order effects, the types of documents and their assignment to participants were randomized in the following ways:
• the form and function of the same document type were not examined in sequence,
• the order of presentation of each participant's set of documents was randomized,
• half the participants viewed the digital form set first followed by the paper form set and vice versa,
• each person viewed four different document types in the first set and four in the second set. In the second set, two new types that had not been viewed in the first set were introduced.

At the start of the experiment, each participant was told:

> We will be showing you a set of documents that have been altered. These documents could be different types of documents such as annual reports, research proposals, and course assignments. We will show you the documents, first a set of print documents and then a set in digital form [or vice versa], and ask you some questions. The documents in print may or may not be the same as those in digital form and may or may not even be valid documents.

In each case one of the researchers worked with the participant while the second transcribed responses to the questions and kept track of the time. Each document was shown to participants in the order initially devised and each of the three questions were asked in sequence per document. The digital documents were viewed using Netscape on a Toshiba laptop with a 12-inch screen. Participants were instructed to use only the back button and the scroll bar.

4. Results

The numerical data was analysed using descriptive statistics and repeated-measures analysis-of-variance. Responses to questions two and three were transcribed and categorized by the researchers.

4.1. Genre recognition by response and time

The numerical data was analysed using two dependent measures: a) number of document types correctly identified, and, b) amount of time taken to identify the document type. We analysed these measures by type of media (Paper or Digital), genre facet (Form or Function) and more distinctively, by the specific type of document, e.g., Journal Article, Dictionary, etc.

4.1.1. Number of documents correctly identified

In the course of the session, participants examined sixteen documents, 8 in the Paper set and 8 in Digital set. Half of each set were represented by the Form version and half by the Function version. Overall, participants on average correctly identified ten (63%) of the documents that they had examined; about half of these were from the Digital set and about half from the Paper set ($F(1,14)=.01$, *n.s.*). Of these ten, approximately 5.7 were represented by the Function version and about 4.5 by the Form version ($F(1,14)=5.90$, $p=.029$). There was no interaction of genre facet and medium ($F(1,14)=1.85$, *n.s.*). Thus, participants identified significantly more documents represented by the document's Function than by its Form, but were unaffected by the type of presentation, Paper or Digital. Table 2 summarizes the results.

4.1.2. Amount of time taken to identify a document

Participants were timed from the point at which a document was visible to the point at which they verbally named the type of document. In some cases, participants corrected an initial response. In those cases, the time used in this analysis is the amount of time taken to provide the final definitive response. In cases of inability to identify a document, no time was recorded.

On average, participants took 19.7 seconds to identify a document, 17 seconds to identify a Paper document and 22.4 seconds to identify a Digital document ($F(1,12)=2.89$, *n.s.*). Although the differences were not significant, the ability to scan a full regular printed page versus the much smaller space on the monitor may have contributed to the subtle time differences. Participants took less time to identify a document by its Form (18.6 sec), than by its Function (20.6 seconds), but not significantly less ($F(1,12)=1.63$, *n.s.*). Like the number of items identified correctly, there was no interaction of the genre facet and medium ($F(1,12)=2.59$, *n.s.*). Thus, participants took a little less time to identify the Paper documents than the Digital and to identify documents represented by the Form rather than the Function, but these differences were not

statistically significant.

4.1.3. Comparison of document types

Each participant examined six different types of document within a session. Table 4 shows how many participants correctly identified each type of document. Not all participants could identify each type ($F(5,70)=5.55$, $p<.001$) based on its Form or its Function, but this was not consistent from document type to document type. As illustrated in the table and confirmed by Bonferroni pair-wise comparisons, the Meeting Minutes and Course Calendar proved to be the most inconsistent.

4.2. Genre recognition summary

Not surprisingly, there were no significant differences by type of media. Overall participants correctly identified the same number of Paper documents as Digital documents and took similar amounts of time doing so regardless of the document's genre facet. This suggests that the cues represented in the Paper document were transferred and transferrable to the digital world.

Interestingly, participants were able to identify significantly more documents represented by the document's Function than by its Form. The semantic cues present in the documents naturally lent themselves to recognition. Time taken to recognition and correct identification was non-significant. But, those who identified the document by its function did, on average, take slightly less time.

What can we conclude from this data? Clearly the structural cues represented by a document's Form are recognizable as determined by the large number of documents that were correctly identified from a document's form version only. Inconclusive, but suggested by the data is that participants may have taken slightly less time to recognize a document based on Form than on Function.

4.3. Discriminating characteristics of genre and genre types

After the participants had identified the type of document, they indicated the most discriminating feature or features of the document type and explained briefly how they reached that decision. In general, participants reached similar conclusions about these features as summarized in Tables 5 and 6, with little variation by type of media. But there were differences from participant to participant at the detail level, which prevents the specification of a unique parsimonious set of attributes per genre.

4.3.1. Form (see Table 5)

When examining the documents in which the content had been removed, leaving only the Form, the participants noted a variety of formatting features in each case. Some identified the paper journal article through the headers, and others through the columns or the illustration box; some identified the course reading list through the indentation, while others noted the presence of letters, numbers and punctuation in an order which suggested the citation of a journal article.

Not surprisingly, the participants tended to interpret the formatting features of the document in light of characteristics which they associated with that particular format. An underlined or italicized section in the reading lists, for instance, would be identified as a title; characters in brackets would be labeled as journal issue numbers, and the numbers following the colon as page numbers. Participants quickly identified the format of dates, and discussed them as such; similarly, they identified the "signature line" in the memo.

In general, participants were the most successful at choosing the correct document type when there was a close identification between the genre and a specific feature, such as the "To/From/Subject/Date" headers of the memo. In some cases, the choice of the most discriminating feature was unanimous; virtually everyone, for instance, chose the "To/From" header as the most discriminating feature of the memo. However, a unanimous choice of feature did not guarantee a successful identification. The greatest failures occurred in cases where a specific feature of Form was closely identified with more than one genre. Many participants were attracted to the headers in both the paper and digital sets of minutes. Only two, however, identified the documents as minutes of a meeting; others interpreted the headers as the preliminary information on a résumé, as the opening of an article, or as the beginning of a course syllabus. Similarly, the electronic version of a scholarly article featured the names, addresses and e-mail contacts of its two authors, which some participants interpreted as the "To" and "From" addresses on a formal letter. Formatting conventions for some genre sometimes vary widely, and those participants who were familiar with the particular conventions used in the samples had the greatest success in identifying the documents through Form.

But the participants' responses suggested that they were doing more than simply matching specific formatting features with remembered features of different genres. To begin with, the participants repeatedly responded not just to individual formatting features, but to the ways in which these features were combined in the documents. The dictionary, for instance, was repeatedly defined as a repetitive sequence based on contrast between bolded and non-bolded elements. The features of bibliographic citations

in the course reading lists gained their meaning from their proximity with each other: one participant identified the electronic reading list as "individual sections of entries with the appearance of bibliographic entries." The digital calendar, too, was meaningful to participants through the combination of a "clear heading followed by description," and by the presence of numbers within the bolded sections.

Indeed, many participants discussed the overall appearance of the text; in addition to the specific features, they clearly drew on their sense of the dominant structure of the information. One participant discussed the article as "the whole package"; another identified the dictionary from its "structure of chunks," while another discussed the course calendar as "little blocks of text." One participant noticed the unequal lengths of the paragraphs in the print article, and interpreted them as a sign that a continuous argument was being presented throughout the document, instead of a series of dictionary entries or definitions. Genre recognition through Form arose, not just from identifying familiar formatting features but from gaining a bird's-eye view of the text, and recognizing patterns in their appearance.

4.3.2. Function (see Table 6)

When asked to identify the genre of documents in which the formatting had been removed, the participants tended to respond through one or a combination of three primary techniques. Some simply began to read the document in sequence until they encountered key words which identified the document for them; the cues they relied on, therefore, tended to occur within the first two or three lines of the text. Such cues included the name of the institution and the words, "To," "From," "Subject" and "Date" in the memos, the "See" reference of the dictionary, the words, "Staff Meeting" and "Present" in the minutes, and the term, "Course offerings" in the first lines of the course calendar.

Other participants scanned the entire document to get a gist of the content; in such cases, the participants provided overall summaries of the contents, or identified key words that occurred throughout the passage. One participant identified the journal article by saying that it "talked about research"; another noted the persistent use of the past tense in the meeting minutes, while another noted the scattering of course numbers through the course calendar. Frequently, the participants scanned the entire text for signs of repetitive patterns. The dictionary was identified by the recurrence of word and definition; similarly, the course reading list was described in terms of a regular sequence of bibliographic citations.

Significantly, the participants appeared to be scanning for more than semantic content. Just as the participants used content expectations in interpreting the Form, they used Format expectations when interpreting the Function. Some participants found visual cues, even in the unformatted texts: the frequency of numbers in the course calendar, of parentheses in the reading list, and the "bright red link" in the electronic journal article. Indeed, in some cases, a heightened awareness of format hindered participants from recognizing the document type through the semantic content. One participant grumbled that the unformatted reading list was a "hodgepodge, jumbled together;" another described it as "a whole bunch of citations crammed together." Some participants mistook the block of text to represent an abstract or an e-mail message, particularly in the case of the memo, with its "To" and "From" references. Some felt hesitant about their content-based decisions for formatting reasons: "I want to say these are minutes," said one participant, "but it's too short." Therefore, while the participants all relied on some form of semantic cue to identify the document types, many expressed a response to the text as a visual totality.

5. Discussion and Conclusions

Overall, participants correctly identified significantly more documents when examining a document's Function – its semantic content – than when examining only the document's Form. This was not unexpected as the document's Function provided a host of self-evident semantic clues alerting the participant to the general purpose of the document. When only the document's structure was exposed, participants had to match their sensory response with the corresponding representation stored in long-term memory. In doing so, participants isolated features of the document such as the indented lines and bolded versus non-bolded text, and used them as signaling devices (to adopt Lorch's term [12]) in an attempt to make a match. When viewing familiar, well-used documents such as journal articles and memos, the participants made a clear match with the document's intentions and purpose. When viewing less familiar documents, or those admitting a wider range of formats, such as meeting minutes, the participants either constructed an interpretation that differed from the document's purpose or failed to construct any purpose at all.

The difference in the amount of time taken to identify a document by Form or by Function was not significant: a finding which is highly suggestive. Recognition by Form is not a process that occurs later than recognition by Function; indeed, participants actually spent slightly less time correctly identifying a document by its Form. To identify a document by its Function required reading, comprehending, interpreting and synthesizing the text, while identifying via the Form version required a quick scan and interpretation of a few visual cues: in other words, in roughly the same time it takes to find semantic cues, the participants also "loaded" a set of expectations based on an interpretation of the few

visual cues present. In essence, the form has metaphoric connotations to the user. We can conclude that the visual cues present in a document act in tandem with the semantic content to influence the user during the crucial seconds of initial exposure. A misinterpretation of the Form cues could delay or subvert accurate recognition.

But how does document Form affect the user in those first few seconds? Clearly, this question requires further study, but the results of this pilot study have given us some crucial leads. Whether looking at a document with only Form and no content or vice versa, the user appears to perform an initial "scan" of the document as a visual totality, indicating that users develop a sense of the document as a visual whole – an identifiable 'base level.' Brown [2] and Lakoff [11] suggest that the act of categorization begins psychologically at a basic level, and only later moves up and down the hierarchy to form less intuitive categorizations. Lakoff describes this level as the one at which "things are perceived holistically, as a single gestalt" [11]. Thus, if we correctly hypothesize that genre forms the basis of document recognition and, ultimately, digital text design, then we must discern the instances and conditions in which the characteristics of genre serve as a "basic level" of recognition.

Our study has given us valuable indications of the impact of context within discourse communities on the interpretation of genre. From pattern matching research, we know that context limits the number of choices or "establishes expectations concerning incoming patterns"[8]. By providing "socially recognizable markings [that] invoke a shared background" [24], genre can play an important role in maintaining stable communication within discourse communities. All participants in this study were from a specialized community: all were university students, staff, librarians, or faculty examining documents typical of an academic environment. Yet in some cases, despite the familiarity of the document, participants confused one document type with another. The course calendar, for example, was thought of as an abstracting service because the bolded pattern of numbers and letters, used to list the course name and number, could also be interpreted as the numbering scheme typically used to number abstracts within those services. Although we did not test within context, students appeared to be untroubled by the distinction; only librarians and faculty well-versed in both types of documents seemed confused. Thus despite the fact that context was controlled, participants were clearly viewing the documents from their personal space, a much narrower environment than that initially envisaged. Possibly individual work context may be more significant than discourse community.

What did we learn? Like Meyer [15], who suggests that organization of text indicates the type of genre, and signals to the user how to think about the content, we believe that document structure has a similar role. Clearly from this study, document structure can be used as a means of identifying documents. Evident also is the fact that those same cues that make a document immediately identifiable in the paper world are readily transferrable to the digital world. Potentially, structure may communicate document intent faster than semantic content, but a larger study is needed to confirm this. Thus, document structure may be suggestive of a document's content and, like the metaphors that facilitate software use, may provide notion of what the user is interacting with. Unclear in this study is the interaction of Form and Function in that interpretation.

Clearly evident from participants' responses and behavior was the concept of taxonomic families of documents based on document structure. Participants, for example, often recognized indented lines in short chunky paragraphs as a series of bibliographic citations; some, however, identified the document as a bibliography, while others moved up a hierarchical level to imagine the documents that *contain* bibliographies such as reading lists or a list of end-notes at the end of an article. In this case, the movement up the hierarchy did not involve a misinterpretation; at other times, it did. The structure of the course calendar clearly indicated the presence of itemized headings with descriptions; some, however, perceived this structure as part of a course calendar, while others interpreted it as an abstracting service. Hence, we need to group digital documents into hierarchies, and identify the nature of such hierarchical relationships. We must adapt concepts from categorization/classification research that define these relationships: are they partitive, suggestive of a part/whole relation, or genetic, suggestive of a parent/child relation? Equally important, we need to define, within these hierarchies, the most likely base level of categorization: the level at which the visual effect of the text is the strongest, and in which the function and form attributes of the genre are likely to be most clearly represented within each document instance. Designing digital documents on the basis of genre will require a much more sophisticated taxonomy of digital genres than the lists provided by O'Neill [17], and by Crowston and Williams [7].

The results of this pilot study provided much needed empirical evidence attesting to the value of a document's structure in document recognition and thus, the role of genre in interface design. It is a proof of concept and a starting point. Additional studies which replicate this pilot study and seek to identify the elusive parsimonious set of attributes are currently being planned. Overall our findings will impact the development of electronic document management systems, by facilitating the creation of standard document type definitions that define types of genre. Like Smoliar and Baker [20], we believe that identifying digital genre will

facilitate the authoring, reading and the classification of digital documents. Additionally, the identification of basic elements of a genre, and the incorporation of those elements into a textual structure, ultimately will increase the precision with which digital documents can be accessed and browsed..

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References

[1] Beghtol, C., "Bibliographic Classification Theory and Text Linguistics: Aboutness Analysis, Intertextuality and the Cognitive Act of Classifying Documents", *Journal of Documentation.*, Aslib, London, 1986, pp. 84-113.

[2] Brown, R., *Social Psychology*, Free Press, New York, 1965.

[3] Carroll, J. M., R. L. Mack, and W. A. Kellogg, "Interface Metaphors and User Interface Design," *Handbook of Human-Computer Interaction*, ed. M. Helander, North-Holland, Amsterdam, 1988, pp. 67-85.

[4] Carroll, J. M., and J. C. Thomas, "Metaphor and the Cognitive Representation of Computing Systems," *IEEE Transactions on Systems, Man and Cybernetics*, Institute of Electrical and Electronics Engineers, New York, 1982, pp. 107-16.

[5] Case, D.O., "Conceptual Organization and Retrieval of Text by Historians: The Role of Memory and Metaphor," *Journal of the American Society for Information Science*, American Society for Information Science, 1991, pp. 657-668.

[6] Colley, A.M., "Text Comprehension," *Cognitive Approaches to Reading*, ed. J.R. Beech and A.M. Colley, Wiley Publishers, Chichester, 1987, pp. 113-138.

[7] Crowston, K. and M. Williams, M., "Reproduced and Emergent Genres of Communication on the World-Wide-Web," *Proceedings of the Thirtieth Annual Hawaii International Conference on Systems Sciences*, vol. 6, 1997, pp. 30-39.

[8] Ellis, H. C. and R.R. Hunt, *Fundamentals of Cognitive Psychology*. 5th ed. Brown, Madison, WI, 1993.

[9] Jamar, P., "Mental Models for Computer Users", *Proceedings of the 1986 IEEE International Conference on Systems, Man and Cybernetics*, Institute of Electrical and Electronics Engineers, New York, 1986, pp. 761-765.

[10] Jones, W. P. and S.T. Dumais., "The Spatial Metaphor for User Interfaces: Experimental Tests of Reference by Location versus Name", *ACM Transactions on Office Information Systems*, ACM Press, New York, 1986, pp. 42-63.

[11] Lakoff, G., *Women, Fire and Dangerous Things: What Categories Reveal About the Mind*, University of Chicago Press, Chicago, 1987.

[12] Lorch, R. F, "Text-signaling Devices and their Effects on Reading and Memory Processes", *Educational Psychology Review* Plenum Press, New York, 1989, pp. 209-234.

[13] MacMillan, J., D.J. Getty, B.C. Tatum and G. Ropp, "Visual Metaphors and Mental Models in Display Design: A Method for Comparing Intangibles", *Proceedings of the Human Factors and Ergonomics Society*, vol. 1, Human Factors Society, Santa Monica, 1997, pp. 284-288.

[14] Madsen, K.H., "A Guide to Metaphorical Design", *Communications of the ACM*, ACM Press, New York, 1994, pp. 57-62.

[15] Meyer, B.L.F., "Text dimensions and cognitive processing" eds. *Learning and Comprehension of Text*, ed. H. Mandl, N.L. Stein & T. Trabasso, Lawrence Erlbaum, Hillsdale, NJ, 1984, pp. 3-47.

[16] Norman, D.A., "Cognitive engineering", *User Centered System Design: New Perspectives on Human Computer Interaction*, ed., D.A. Norman & S.W. Draper, Hillsdale, NJ, Erlbaum Associates.

[17] O'Neill, E. T.,. "Characteristics of Web Accessible Information., Presented at the *63rd IFLA General Conference*, August 31-September 1997 (Available from: http://www-nlc-bnc-ca/ifla/IV/ifla63/63onee.htm)

[18] Pejtersen, A. M. and F. Nielsen, "Iconic Interface for Interactive Fiction Retrieval in Libraries Based on a Cognitive Task Analysis", *Human Aspects in Computing: Design and Use of Interactive Systems and Work with Terminals*, ed. H.J. Bullinger, Elsevier, Amsterdam, 1991, pp. 753-762.

[19] Smoliar, S.W. and J.D. Baker, "Text Types in Hypermedia," *Proceedings of the Hawaii International Conference on System Sciences (HICSS '97)*, Special Track on Genres in Digital Documents, Maui, HA (January 7-10)Vol VI, IEEE Computer Society Press, Los Alamitos, 1997, pp.

[20] Toms, Elaine G. and M. T. Kinnucan, "The Effectiveness of the Electronic City Metaphor Used to Organize the Menus of Free-Nets," *Journal of the American Society for Information Science*, American Society for Information Science, 1996, pp. 919-931.

[21] Väänänen, K., "Multi-Media Environments: Supporting Authors and Users with Real-World Metaphors", *CHI'87 Short papers, Conference on Human Factors in Computing Systems* ACM, New York, 1993, p. 263.

[22] Wittrock, M.C., "Reading Comprehension", *Neuropsychological and Cognitive Processes in Reading*, ed. F.J. Pirozzolo and M.C. Wittrock, Academic Press, Toronto, 1981.

[23] Yates, J. and W.J. Orlikowski,. "Genres of Organizational Communications: a Structurational Approach to Studying Communications and Media." *Academy of Management Review*, Academy of Management, Amherst, MA, 1992, pp. 299-362.

[24] Yates, S. and T. Sumner, "Digital Genres and the New Burden of Fixity," *Proceedings of the Hawaii International Conference on System Sciences (HICSS '97)*, Special Track on Genres in Digital Documents, Maui, HA (January 7-10)Vol VI, IEEE Computer Society Press, Los Alamitos, 1997, pp. 3-12.

[25] Van Dijk, T.A. *Macrostructures: An Interdisciplinary Study of Global Structures in Discourse, Interaction, and Cognition*, Lawrence Erlbaum, Hillsdale, N. J., 1980.

Table 1. Types of documents included in the test set

Document Type	Paper		Digital	
	Form	Function	Form	Function
Journal article	√	√	√	√
Dictionary	√	√	√	√
Course reading list	√	√	√	√
Memo	√	√	√	√
Meeting minutes	√	√	√	√
Course calendar	√	√	√	√

Table 2. Average number of documents identified, identified incorrectly or not identifiable

Response	Average Number of Documents			
	Paper		*Digital*	
	Form	Function	Form	Function
Correctly identified	2.5 (n=14)	2.7 (n=14)	2.1 (n=14)	3.1 (n=14)
Incorrectly identified	1.2 (n=12)	1.0 (n=8)	1.3 (n=11)	.7 (n=7)
Unable to be identified	.3 (n=2)	.33 (n=3)	.5 (n=6)	.3 (n=1)

Table 3. Average number of seconds taken to identify correctly or identify incorrectly the type of document

Response	Average Amount of Time (seconds)			
	Paper		*Digital*	
	Form	**Function**	**Form**	**Function**
Correctly identified	11.4 (n=14)	19.4 (n=14)	25.3 (n=14)	23.8 (n=14)
Incorrectly identified	16.5 (n=12)	17.6 (n=8)	24.4 (n=11)	65.4 (n=7)
Unable to identify	na	na	na	na

Table 4. Recognition of individual genre

Document Type	Number Identified Document	Types Document Was Confused With	Number Identified Document	Types Document Was Confused With
	Form		**Function**	
Journal Article	12	Index News	11	Abstract Report Textbook
Dictionary	14	Course Reading List Directory Index Play	13	Creative Writing
Memo	16	Journal Article	15	Journal Article Abstract E-mail Message
Meeting Minutes	2	Journal Article Memo Résumé Course Outline	15	Abstract Service Agendas
Course Reading List	18		17	Directory
Course Calendar	7	Course Reading List Abstract Service	15	Abstract Course Outline

Table 5. Characteristics of a Document based on 'Form'

	PAPER	DIGITAL
ARTICLE	Combined titles and columns Captions **Bolded header layout, suggestive of author and title** Presence of illustration Paragraphs of uneven length Columns 3-digit page number Numbers which could represent references	Layout information at top suggesting : title, subtitle, opening salutation, date, **authors, addresses** "@" symbol suggests an e-mail address, which suggests an academic affiliation Format suggests address blocks Links Footnotes in text
DICTIONARY	Bolded headings Italicized sections Text broken into "chunks" **Contrast between bolded and non-bolded elements** Indentation Columns Numbers suggesting page numbers	**Bolded elements followed by dash and non-bolded elements** Presence of numerous elements
MEMO	**Headers suggestive of "To/From/Subject/Date"** Header suggestive of letterhead Signature line Footer suggestive of company/business information	**Header suggestive of "To/From/Subject/Date"** Line at bottom suggesting a "copied-to" abbreviation
MINUTES	**Heading structure**, suggestive of: a list of items, an opening salutation, prefatory information on a resume Numbered list of items Heading that suggests a date	**Heading structure** suggestive of: date, preliminary information, name and title at top, list of faculty Uniform organization of information
COURSE READING LIST	**Form of entries suggests bibliographic citations** Indentation Elements which suggest a name, title, page numbers Parentheses: suggestive of a journal Headings suggestive of title	**Form of entries suggests bibliographic citations** Underlining Bolded items suggestive of topic subdivisions Indentation
CALENDAR	**Contrast between bolded and non-bolded sections** Numbers and columns Numbers suggestive of dates or volumes	Division of text into sections **Contrast between bolded and non-bolded sections** Presence of numbers in bolded sections

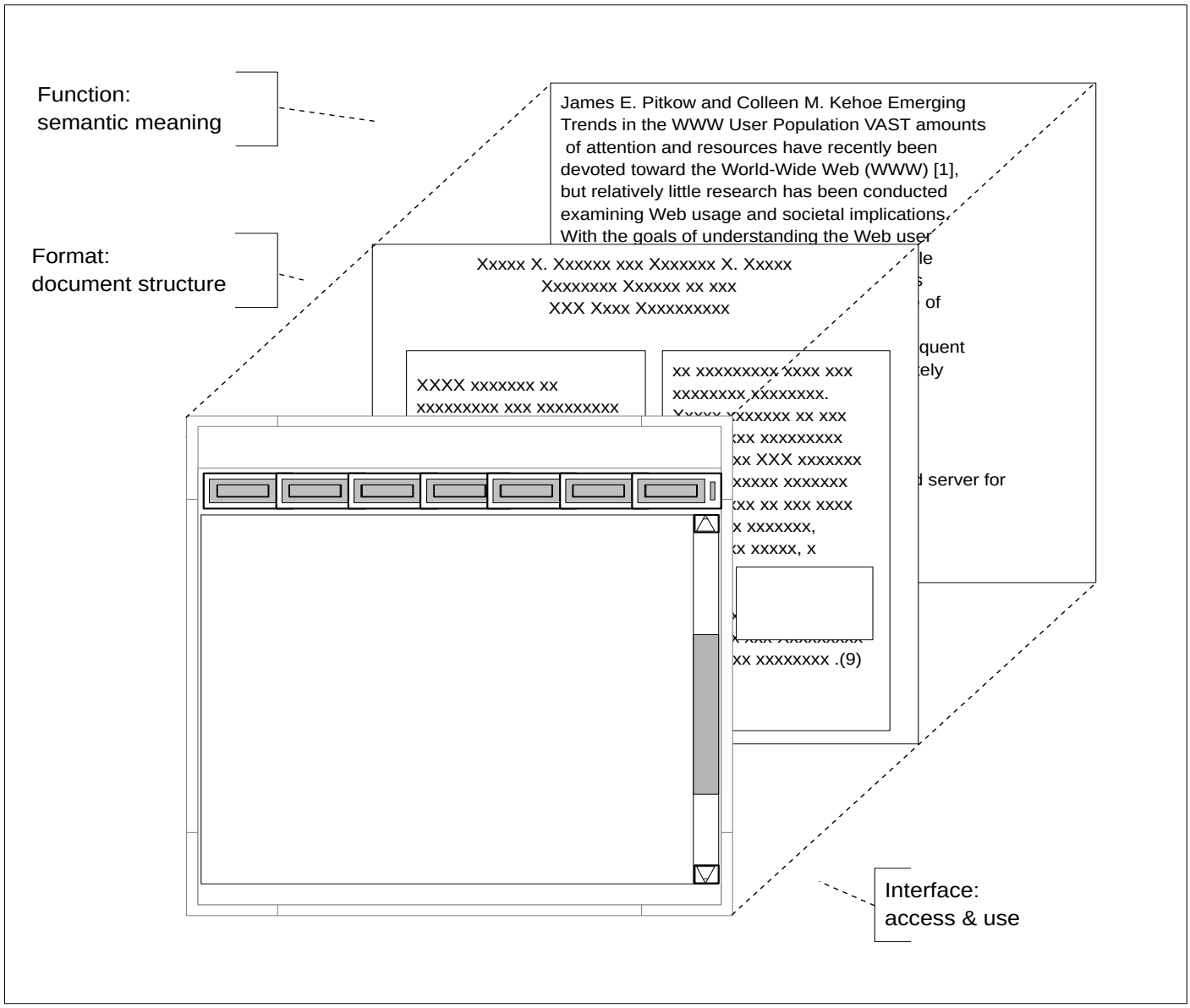
Note: *bolded text signifies the feature which was most frequently chosen as the most discriminating.*

Table 6. Characteristics of Document Based on 'Function'

	PAPER	DIGITAL
ARTICLE	**Presence of author and title on first line** Research discourse Key words: "survey," "response rate," "emerging trends," research" Image box Presence of footnotes or endnotes	Key words in first line: journal title, article title Presence of abstract Presence of links **Keywords throughout document: "abstract"**
DICTIONARY	**Presence throughout text of words and definitions** "See" references References to "things" List of words and variant phrases	**Entry term at beginning, followed by description**
MEMO	**Occurrence of "to/from/subject/date" in first 2 lines** Occurrence of institution name in first line Occurrence of mail/fax number at the bottom Format, or "shape" of text	**Occurrence of "to/from" information in first few lines** Occurrence of organization name in first few lines Occurrence of personal pronouns throughout the text Signoff phrase Context suggests results of a meeting or interview
MINUTES	**Occurrence of specific words: "staff meeting," "present"** Presence of numbered items in numerical order Use of future tense and past tense Use of short sentences	Sequence of elements at the beginning **Occurrence of words in first few lines: name of council, dates, names of those present, "meeting"** Use of the past tense Passage within text which relates events
COURSE READING LIST	Presence throughout text of quotation marks and parentheses Separate entries that are organized in a similar fashion **Presence throughout text of titles, sources, dates, page numbers** Multiple topics	Occurrence of words in opening lines: "Education 140," "reading list," "Topic I" Occurrence throughout text of course titles and due dates **Bibliographic nature of information**
CALENDAR	**Description throughout text of courses and their contents** Occurrence of phrases in first line: "New course numbers came into effect"	Occurrence of words in first line: "Course offerings" Occurrence throughout text of course numbers: "502, 503, 504," etc. **Occurrence of key words throughout the text: "course description," "electives."** Text clearly describes a list of courses, rather than one single course

Note: bolded text signifies the feature which was most frequently chosen as the most discriminating.

Figure 1. Anatomy of a digital document



Appendix I. Sample of print document 9 (Course Reading List)

XXXXXX XX XXXXXXX XXX XXXXXXXXXXX XXXXXXXX
XXXXXXXXX XXXXXXXXXX

XXXX 9999: XXXXXXXXXX XXXXXXXXXXX XXXXXXXXX
Xxxxxx Xxxxxxxx xxx Xxxxx Xxxxxxxx
Xxxxxx 9999

Xxxxxxxxxxx xx Xxxxxxxxxx Xxxxxxxxx Xxxxxxxxxx

Xxxxx, X.X. xxx X.X. Xxxx. "Xxxxxxxx Xxxxxxxxxxx xx Xxxxxxxxxx Xxxxxxxx Xxxxxx Xxxxxxxxxx xxxx Xxxxxxxx Xxxxxx." *Xxxxxxxxx Xxxxxx* 99 (Xxxx 9999): 999-999.

Xxxxxxx, Xxxxxx X. "Xxxxxxxxx Xxxxxx xx Xxxxxxxxxx Xxxxxxxxxxxx." *Xxxxxxxx Xxxxxxx Xxxxxxx* 99 (Xxxxxxx 9999): 999-999.

Xxxxxxxx, Xxxxxxx xxx Xxxxx X. Xxxx. "Xxxxxxxxxx Xxxxxxxxxxxx xx xx Xxxxxx Xxxxxxxxx: X Xxxxxxxxxxx Xxxxx." *Xxxxxxxxxx Xxxxxxxxxx xxx Xxxxxxxxx* 9 (9999): 999-999.

Xxxxxx, Xxxxxx X. "Xxxxxxxxxx, Xxxxxxxxxxxxxx xxx Xxxxxxx xx Xxxxxxxxxx Xxxxxxxxxxxx Xxxx Xxxxxxxxxxxx xxxx xxx Xxxxxxx Xxxxxxx Xxxxxxxxxx." *Xxxxxxx Xxxxxx* 9 (Xxxx 9999): 99-99.

Xxxxxx, Xxxxxxx X. xxx Xxxxx Xxxxx Xxxxxx. "Xxxxxxxxxx Xxxxxxxxxxxx xx Xxxxxxx Xxxxxxxxx: X Xxxxxxxxxxx Xxxxx xx Xxxxxxxx Xxxxxxxxxx." *Xxxxxxxxxx Xxxxxxxxxxx Xxxxxx* 99 (9999): 999-999.

Xxxxxx, Xxxxx X. "Xxxxxxxxxx Xxxxxxxxx xxx Xxxxxxxxxx xx Xxxxxxxx Xxxxxxxxx." *Xxxxxxxxx Xxxxxxxxxxx Xxxxxx* 99 (9999): 999-999.

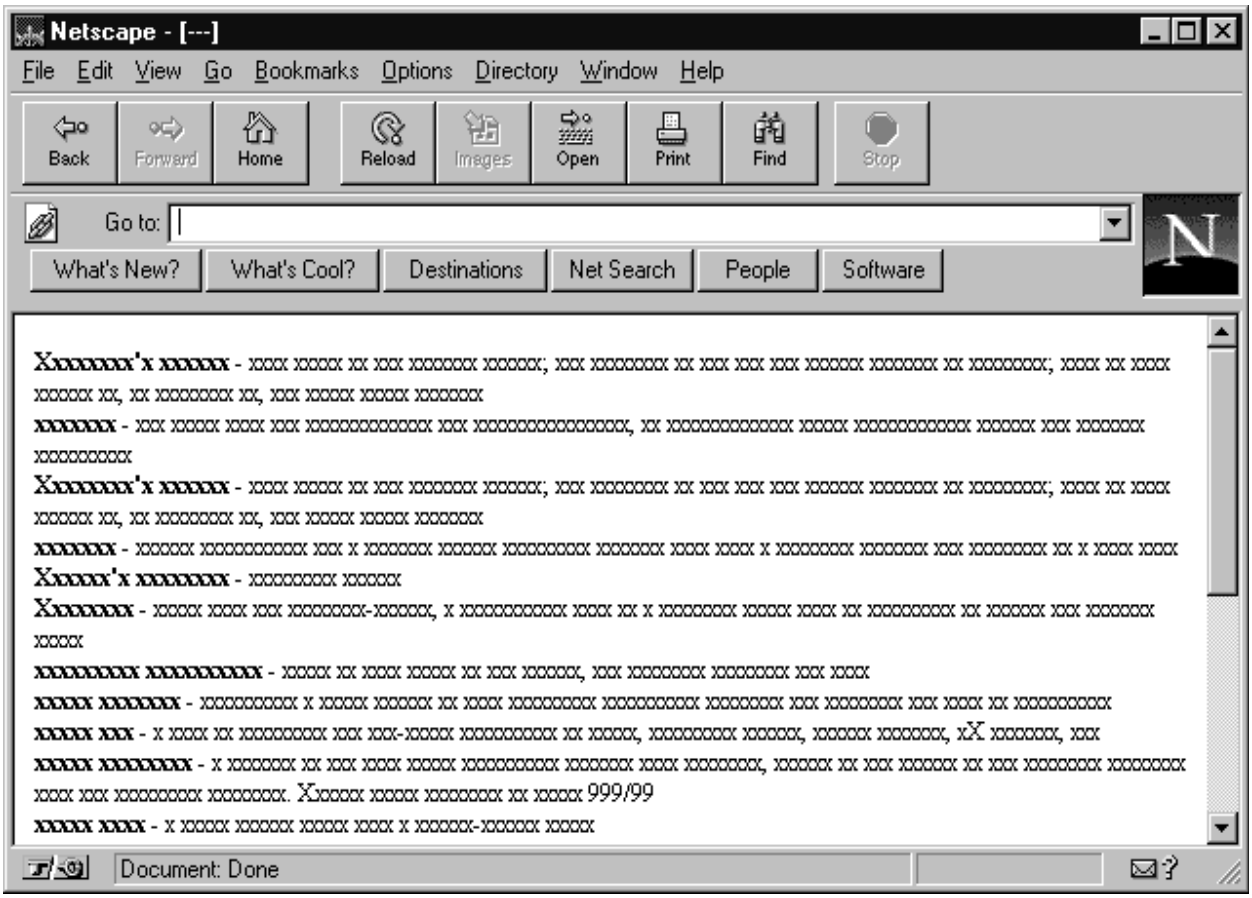
Xxxxxxxxxx, X.X. xxx X.X. Xxxxxx. "Xxx Xxxxxxxxxx Xxxxxxx Xxxxxxxxxx: Xxx Xxxxx Xxxxx xxx xx xxx Xxxxxx." *Xxxxxxx Xxxxxxxxx* (Xxxxxx 9999): 99-99.

Xxxxxx, Xxxxx xxx Xxxxxxx X. XxXxxxx. *Xxxxxx Xxxxxx xx Xxxxxxxxxx Xxxxxxxxxx: Xxxxxx, Xxxxxx xxx Xxxxxxxxxx.* Xxxxxxx, X.X.: Xxxxx Xxxxxxxxxx Xxxxxxxxxx, 9999.

Xxxxx, Xxxxxxx X., Xxxxx Xxxxxx, xxx Xxxxx X. Xxxx. "Xxxxxxxxxx xx Xxxxxxxxxx Xxxxxxxxx Xxxxxxxxx Xxxxxxxxx Xxxxxx." *Xxxxxxxxx Xxxxxxxxxx Xxxxxxxxx* 9 (9999): 999-999.

Xxxx, Xxxx. "Xxxxxxxxxx Xxxxxx Xxxxxxx xxx Xxxxxxxxx xxx Xxxxxxxxx Xxxxxxxxxx Xxxxxxxxxx."
Xxxxxxxxx Xxxxxx 99 (Xxxx 9999): 999-999.

Appendix II. Sample of electronic document 3 (Dictionary)



Appendix III. Sample of print document 12 (Course Calendar)

Note: New course numbers came into effect for the 1995-96 academic session. Old course numbers appear in italics in parentheses. Core Courses LIS1210H(1510/1518): Information and its Social Contexts An introduction to the economic, political and sociological dimensions of an information-rich environment, including the historical development of information studies, knowledge production, issues of control versus free flow of information (such as intellectual freedom, intellectual property rights, and public policy), the social organization and distribution of knowledge, and ethical and legal aspects of information services. (Staff) LIS1220H: Representing, Organizing and Storing Information Within the context of user needs, the nature of information and its organization in various media, including databases, catalogues, inventory control system, finding aids, full-text systems and databanks. Principles and applications of standards and codes for representing, storing and exchanging information. Provision of access keys and normalization of data through authority control. (Staff) LIS1230H(1540/1548): Management of Information Organizations An introduction to information organizations and the role of effective administration in the provision of information services through selected theories, principles, and techniques of administrative science, library and information science, information systems and archives. Familiarizes the student with the realities of participation in the management of information organizations. (Staff) LIS1240H(1550): Research Methods
The nature of research in the information professions; focuses on developing an understanding of the appropriate research methodologies for the investigation of both practical and theoretical problems. Develops as well the faculty of critical analysis which permits a reasoned, accurate assessment of published research. (An acceptable course in Statistics is a pre- or co-requisite) (Staff) Required Courses LIS Stream LIS1310H(1520/2203): Information Resources and Services An introduction to the relationship between users and recordable information. Origin, evaluation, and use of general information sources in print and electronic form; principles of information service; acquisition, collection and exploitation of information resources in local and national institutions. (Staff) LIS1311H(1565): Introduction to Information Technology
An introduction to the conceptual knowledge of information technology and the usage skills necessary for all information professionals. The concepts include the structure of a computer system, major types of software, principles of program composition and structuring, and telecommunications basics. Skills to be developed will include use of several common
personal computer programs for data analysis and retrieval and introductory computer programming. (Staff) LIS1320H(1530): Introduction to Bibliographic Control Principles and methods of describing, analyzing and organizing information and materials for storage and retrieval. Within the context of user needs, examines bibliographic access through codes, standards, tools and technologies. (Staff) Archives LIS1311H(1565): Introduction to Information Technology An introduction to the conceptual knowledge of information technology and the usage skills necessary for all information professionals. The concepts include the structure of a computer system, major types of software, principles of program composition and structuring, and telecommunications basics. Skills to be developed will include use of several common personal computer programs for data analysis and retrieval and introductory computer programming. (Staff)

Appendix IV. Sample of electronic document 2 (Journal Article)