

Deferred Action: Information seeking in the National electronic Library of Infection (DA-NeLI)

Nandish Patel
Brunel Business School
Brunel University
London, UK
Nandish.Patel@brunel.ac.uk

Patty Kostkova
City ehealth Research Centre (CeRC)
City University
London, UK
patty@soi.city.ac.uk

ABSTRACT

Recently, we have witnessed an overwhelming amount of information to be available in digital libraries and, in particular, on the Internet, however, the design of search engines and site-specific navigation interfaces lacks the human knowledge searching perspective. Typically, the technical design does not pay attention to human search strategies. Without better understanding and evaluating how humans search for knowledge, most electronic information on Internet is never retrieved, or is retrieved in a misunderstanding or misinterpreting way. This is of particular concern in the development of live critical applications, such as medical digital libraries. Understanding how healthcare professionals search for knowledge in the National electronic Library of Infection (NeLI) www.neli.org.uk and improving the search and navigation design of this national project applying deferred system design principles is the main aim of this research project.

Categories and Subject Descriptors

General Terms

Digital Libraries, Information Seeking, Deferred Action, Deferred system Design

Keywords

Deferred Action, Deferred system Design, NeLH, NeLI, Infectious Diseases, Healthcare Digital Libraries

1. INTRODUCTION

Digital libraries are designed on the basis of rationally derived objectified algorithms that are thought to reflect how individuals rationally and methodically search or seek computerized information. The 'rational actor' has primacy in such models of information seeking but their implementation is constrained, not only by available technology, but the very presumption of rational information seeking strategies among digital library (digital library) users. Information seeking models for digital library design traditionally rely on this type of rational model, termed here planned action. The planned action model is resulting in missed opportunity in the National electronic Library of Infection (NeLI) to simplify and enhance the quality of information retrieval in NeLI [1].

NeLI (www.neli.org.uk) is a Specialist Library of the National electronic Library of Health (NeLH) www.nelh.nhs.uk, a government-funded project [2] providing a single-entry portal to the best available medical evidence for UK professionals. The NeLI Specialist Library provides information on treatment, prevention, investigation, and management of infectious diseases. It consists of quality-appraised documents by professionals participating in the development of NeLI. The library was run in a pilot version from early 2000 until November 2003 when it was officially launched at the Federation of Infection Societies conference in Cardiff, UK. NeLI currently serves as a primary Web-based Internet resource for thousands of professionals curing infectious diseases in the UK and abroad.

Initial evaluation of users reveals that the actual information seeking behaviour differs among users significantly. This initial web log analysis [3] reveals that browsing seems to be more popular than searching and the limited flexibility, not supporting personal customisation, is causing a barrier to quicker uptake of the library's information content. It is essential to evaluate the system in terms of finding out how different types of users seek information, whether they are satisfied with the given results, the way information is presented, and how their personal preferences and needs could be met in a flexible and easy-to-use manner. In

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addition, the web log evaluation for the period from January 2002 till June 2003 revealed that the number of users is increasing and they tend to stay longer on the library [3]. However, there were problems with the search keyword-based pull-down interface preventing users from finding the information they were seeking. Other issues were identified that could significantly improve the user satisfaction with the library.

Patel's work on the Deferred Theory [4, 5] provides a synthesis of the rational actor model, usually implemented as planned action in systems such as NeLI, with natural human activity and emergence in social contexts where humans act. This work has been implemented in a banking system and is used for systems analysis by local government project managers. The designers of NeLI want to explore its relevance. They believe that because it explains how planned action can be combined with emergence, through the concept of **deferred action**, it may be able to provide a better model of actual information seeking behaviours. The proposed collaborative research thus brings together research into NeLI digital library and Deferred Systems capable of reflecting actual human conditions under which systems are used. It will extend existing government funded research into NeLI digital library by applying and extending research into Deferred Systems.

This research project brings together the well-defined Deferred Theory, incorporating Deferred System's Design, Deferred Design Decisions and Deferred Action, investigated and propounded by the applicant, which is underestimated in practice, and tests it on NeLI, designed and managed by the co-applicant. NeLI's information seeking support and search tools are designed on the basis of one-size-fits-all model of planned action, assuming the rational actor model, that require the users (health care professionals) to behave in predetermined ways when seeking information.

In this paper, we will look at the principles of deferred design, then we will introduce the information seeking strategies currently available on NeLI and focus on applying deferred actions on the NeLI digital library through collaboration with the professional healthcare community.

2. DEFERRED DESIGN PRINCIPLES

The aim is to investigate, understand, and develop knowledge of deferred action that is theoretically sound and practically relevant for the enhanced design of the NeLI system. The research will develop knowledge of human information seeking behaviour that combines deferred action, which is rich context-sensitive information need, and planned action, which is predetermined and fixed search algorithms based on established techniques.

Through social science target group surveys and detailed search behaviour evaluation, underpinned by the Deferred Theory and iterative development, we aim to improve significantly information seeking in NeLI to satisfy human expectations.

Through this cross-disciplinary research, bridging overlapping but separately-studied areas such as human and computer information seeking, digital library design, e-learning, Deferred System's Design and Web technology applied to the government's highly-strategic healthcare objective, we aim to better understand the underlying principles of digital libraries, information seeking, human-computer interaction, and the impact on our system design decision making.

The focus of the study is on *human* action or human information seeking and purpose rather than computation. The planned action model of information seeking currently implemented in NeLI is rigid. Trials and user surveys have demonstrated various shortcomings with the existing design. Consequently, the NeLI research team has raised questions on the appropriate way of modelling information seeking in NeLI:

How can natural or social human information seeking behaviour, termed deferred action, be understood, synthesised and reflected by formal search design in a digital library, termed planned action?

Modelling information seeking as deferred action is postulated as an alternative ontology of human action that accounts for emergent information seeking behaviours within planned action. The deferred action model differs from the planned action model, because it provides an account of *natural* or social human activity within required formalism such as the NeLI system.

3. INFORMATION SEEKING IN NeLI

NeLI provides several ways of information seeking that we are currently evaluation in order to determine how these meet the user needs and to re-implement the information seeking strategies to better assist all user groups in finding the best answer to their clinical and no-clinical questions.

The key currently available strategies for accessing the quality-assured evidence on NeLI are structured search and browsing, in addition to using NeLI as an access point for another web site, such as Useful Web Sites, Journals Online etc.

The top NeLI navigation page is illustrated on Figure 1.

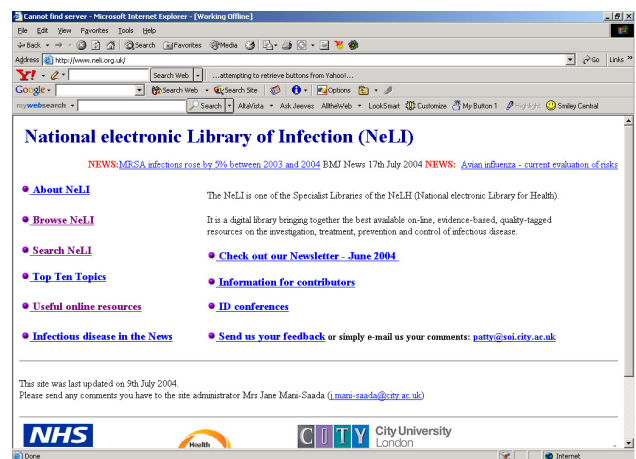


Figure 1. NeLI Navigation Page

A weblog analysis of the period of January 2002 to June 2003 demonstrates that users tend to prefer browsing to structured searching. This is illustrated on Figure 2.

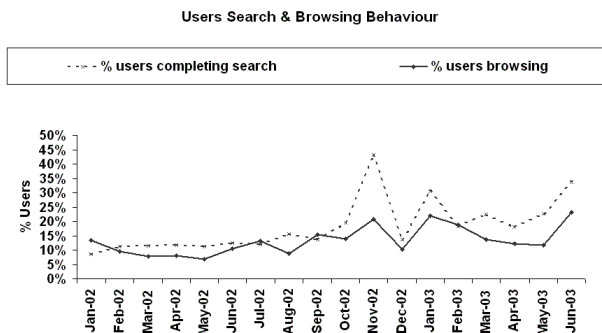


Figure 2. Comparison of use of structured search and browse

Further investigation the user information seeking behavior by applied methods in Deferred System Design and identifying the Deferred actions in order to improve the tools is the key aim of this project.

4. DEFERRED ACTIONS IN NeLI

Librarianship requires the professional management and administration of literary and other resources and services. Research into digital library system design and information seeking is dominated by planned action, but it has the scope, through the digital medium, to break the physical bounds of librarianship. The NeLI aims to develop electronic library systems to support evidence-based practice and to inform the public on health issues, and enable them to develop an informed opinion of personal medical diagnosis and prognosis.

The NeLI provides the prime means for enacting governmental intention and purpose to provide the professionals the best available evidence when and where they need it. City University was commissioned to develop the NeLI Specialist Library of NeLI. The critical challenge for cross-disciplinary researchers is to develop knowledge of how to combine organisation and systems effectively to enable the fulfillment of such human intention and purpose.

Planned action alone is not sufficient to design the type of interpreted library systems required by NeLI is to serve context-sensitive needs. Planned action is formulaic and depends on predefined information seeking strategies. Vickers [6] questions the primacy of the 'god of rationality' in systems and problem-solving, arguing that other cognitive styles are equally, if not more, important in systems analysis. Understanding formed through distinctions between form and context and figure and ground are critical for understanding and determining how to act. Accounts of purposeful action need to explain such apparent ambiguity surrounding human action. Polanyi's often-quoted adage: "We know more than we can tell" best describes such apparently ambiguous action. Effective digital library system design needs to be able to combine such apparently ambiguous behaviour with planned action, the latter to meet the constraints of system design, and the former to enable natural human activity.

Interpreted information seeking situations pose problems for planned action models. Interpreted means situations in which humans exercise judgment. Generally, situations like surgical diagnosis and executive decisions, emergencies, crises, war, combat, all require information seeking that is interpreted and unique. Where change is an additional factor, planned information seeking becomes more problematic for specific needs arising from such change. These situations are characteristic of deferred action – the space between human action based on plans and deferring planned action because it lacks relevance or cannot be enacted because of lack of requisite information or knowledge.

It is proposed that these situations are better described as deferred action. The ontology of deferred action differs from that of planned action. Deferred action is fuzzy, uncertain, tacit, and it is dependent on the user and her/her interpreted situation. For example, surgeons' diagnosis and treatment draws on learnt knowledge but it is highly dependent on the particular patient being treated and the circumstances of the treatment. An individual's search for information on medically diagnosed illness depends on personal feelings and emotions. Information sought on infectious diseases is dependent on the particular patient and their circumstances.

These are situations where digital library information provision such as in NeLI is designed as planned action but is not sufficient. The action of surgeons, consultants, emergency workers, and individuals diagnosed with illness, whilst informed by previous knowledge and planned information seeking strategies, depend on implicit knowledge, context, and situation. Knowledge of what particular action to take emerges in context rather than being predetermined through detached cognitive and logical analysis. Knowledge of the context itself, required action, and even goals, all emerge in such situations. Formalistic system design based on planned action alone is unable to cope in such situations.

An alternate deferred action model of information seeking, based on the Deferred-Specified IT/IS Matrix shown in Figure 3, will be developed for NeLI. The model will reflect the three dimensions of the Matrix: plans, emergence, and deferment. The Matrix is interpreted as follows: Formalism or planned action is necessary for organised activity and is an aid to defining purpose and means, for example through plans. Plans typify the basis of systems design and result in planned action (top dimension). Human action though is difficult to limit to a plan because of emergent factors (left dimension) arising from rich context-sensitive needs, so appropriate responses to emergence is required in the form of Deferred Design Decisions (the right dimension).

The correlated dimensions result in the four types of systems depicted in the Matrix. The dimensions relate effectively natural human activity with the necessity of formalistic systems required to achieve goals. The top right quadrant of Deferred System's Design is the focus of the present study. (The other types of systems are not within the scope of the proposed research). This research innovatively seeks to develop knowledge of formalistic digital library system design for the NHS through a synthesis of these dimensions as reflected in Deferred System's Design. It seeks to account for information seeking behaviour as deferred action and explain why formalistic digital library systems need to account for the emergent aspects of information seeking. It will

deploy the Deferred Design Decisions principle to enable appropriate responses to emergent factors in information seeking.

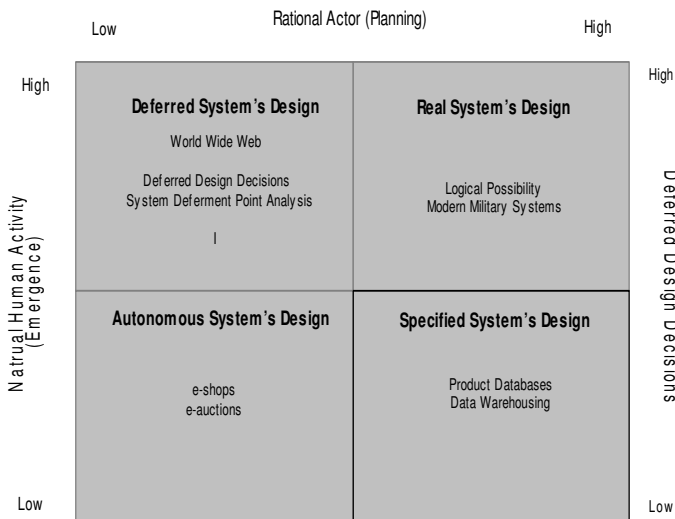


Figure 3: The Deferred-Specified IT/IS Matrix

(Source: The Logic of Deferring the Design Process, In Patel N V (2003) Adaptive Evolutionary Information Systems, Idea Group, Hershey)

The research seeks to understand NeLI characterisation as a deferred system (top left quadrant) and develop appropriate information seeking tools. The research will investigate information seeking in terms of human intent, uncertainty, tentativeness, and changing information needs, termed here 'emergence' or natural human activity. To understand deferred action the correlated dimensions resulting in the Deferred Systems' Design type will be investigated to develop a model of information seeking behaviour in NeLI. Deferred system type is the result of planned action, emergence, and Deferred Design Decisions, the conditions assumed to prevail for people searching for information in NeLI.

The synthesis provided by the Matrix, interdisciplinary study, and the participative research method (see next section), form the innovative perspective of the proposed research. The Matrix is a unique synthesis of the Aristotelian rational tradition (reflected in the planning dimension) and modern humanistic thinking on organisation and system (reflected in the emergence dimension). It seeks to develop an interdisciplinary model of digital library systems and foster the development of systems knowledge that is both systemically coherent and individually and organisationally relevant.

5. METHODS FOR INVESTIGATING USER BEHAVIOUR

As the professional community around infection is not too large (thousand of professionals) we need to be realistic about the size of our population sample. As the purpose of this research is qualitative rather than quantitative we do not intend to engage enough users to get statistically significant sample rather, we aim to involved representatives from all medical professions around infection (GPs, clinicians, communicable disease control nurses, environment health officers, consultants in communicable disease control, etc). NeLI Advisory Board has got representatives from all major societies in the UK and we will closely collaborate with them on the identification of the suitable diverse population for this project.

- Min 10 professional users and medical students using NeLI in workshops and interviews (selected in collaboration with NeLI Advisory Board)
- Min 50 online (exit, pre and post questionnaires) filled by NeLI users (self-selected)
- web logs will be available throughout the project from NeLI web server (currently, NeLI servers registers over 12 000 hits per month)
- Datasets A, B, and C will be collected recording the CA (Conversation Analysis) between the researcher and NeLI designers, between NeLI designers and users identified with the NeLI Advisory Board and between NeLI system and users.

A number of assumptions underpin the field research. Foremost is the assumption that people will deviate from the planned action design, to some extent this assumption is validated by the initial weblog analysis cited in the section on background earlier. Peoples' personal context in which they seek information is assumed to be emergent. They will have an idea of what they want but it could change. It is assumed that information seeking in NeLI is purposeful and specific and is done within time constraints and other limited resources. These assumptions are important because information seeking strategies need to be simple and easy to execute. These assumptions and NeLI design based on the collected data analysis results will be verified with the subjects through the iterative design and development of the NeLI system and the participative research methodology.

The subjects will be determined in conjunction with the NeLI system administrator. They will range form novice digital library users to experienced users to provide cross sectional data. A preliminary interview questionnaire will be semi-structured and will be designed and tested on local (university) digital library users and accordingly revised for the actual interviews. The interview questions for CA (Conversation Analysis) will seek rich descriptions of people's intention, purpose, and system usage. The interview conversations will be captured on audio-tape and researcher's notes. Conversations between users and the NeLI system designers will also be recorded on audio-tape.

The 'conversation' between users and NeLI will be video recorded. The recording will capture all aspects of the users interaction with NeLI. The analysed video recording will be supported with further interview questions to determine the

subject's 'thinking patterns' observed during particular information searches.

The captured conversations will be analysed using the CA technique. Both the audio and video can be replayed to conduct detailed and deeper analysis, and the audio recording will be transcribed. Construing the NeLI system as an actor's voice will make a transcription of the video recording possible too. As no standard analysis notation exists for CA the notation developed will reflect the constructivist postulates of multiple realities, based on Jefferson's technique [9]. The notation will be trailed on the initial pilot questionnaire data collected from university digital library users and adjusted accordingly for the actual data.

The findings will be analysed for 'pattern theories' [7] consistent with constructivist data analysis. It is expected that the data will reveal emergent factors that determine information seeking behaviours. Patterns of such data will be sought that inform systemic deferment points. The data analysis will build on previous similar work [8].

6. CONCLUSION

These expected research outcomes reflect the synthesis of planned action with characteristics of humans and organised human activity based on humanistic thinking. It is expected that this knowledge will be a significant contribution to formalism for system design capable of reflecting human context and purpose.

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