



The use of grounded theory in identifying the user experience during search



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ABSTRACT

Grounded theory offers a useful method for gaining an understanding of the context of the user experience when searching on an experimental multilingual image retrieval system. Observational, cognitive and affective data were collected while users searched for images in a multilingual environment. Straussian grounded theory was used to identify the elements of the dynamic process of information searching behaviour. The stages in which the data were coded are outlined to show how users' thoughts and actions were integrated in the analysis and to present and visualise the emerging concepts as representative of the context of the user experience.

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1. Introduction

A variety of different models have been developed in the context of studying user-oriented and cognitive information retrieval research (Jarvelin & Ingwersen, 2012). These include generic models which try to model a large domain (Ingwersen & Wormell, 1988; Wilson, 1999); relevance models which focus either on user-oriented topical relevance, or a more dynamic, multidimensional and multigraded relevance (Borlund, 2003; Cosijn & Ingwersen, 2000; Saracevic, 1996; Wang & Soergel, 1998); process models exploring users' behaviour in an online, interactive setting, typically a professional or work environment (Bates, 1979; Fidel & Soergel, 1983); models which focus on cognitive structures and actors (Belkin, 1978; Belkin, Oddy, & Brooks, 1982; Ellis, 1989; Marchionini, 1995); and task-based models (Ingwersen & Jarvelin, 2005; Vakkari, 2001a, 2001b). All have the common goal of providing insights into users' information seeking behaviour, and in many cases these models complement one another (Jarvelin & Ingwersen, 2012).

As a process model, users' information seeking behaviour (ISB) has been studied both as linear and non-linear. In particular, Foster's (2004) model of ISB depicts a non-linear process with users' characteristics (such as cognition) influencing the core processes of opening, orientation, and consolidation. Furthermore emotions such as motivation, feelings of uncertainty, and confidence have been shown to affect the information seeking process (Choo & Marton, 2003; Mackenzie, 2003). While seeking for information is known to be a process which is subject to contextual influences, the process can be explored from the ground up to gain a better understanding of search behaviour. Drawing on the terminology from grounded theory (GT), a qualitative method of data

analysis, information searching may be studied as a phenomenon in which the dynamic and fluid process can be identified from user actions and their thoughts and expressions. Towards this end, the present study employs GT to analyse data collected on users' searching behaviour, with an emphasis on the coding and analysis approach adopted. The inductive approach of GT coupled with its procedural analysis enables the study of what is essentially the flow found in information searching behaviour. Specifically the approach enables:

- the analysis of users' actions and interactions, the consequences, and their thoughts and expressions while interacting with a MLIR system, as well as
- the identification of the factors which seem to influence and inform users' search behaviour.

The context of this research is multilingual information retrieval (MLIR) systems, which are intended to accept queries in a single language and through translation retrieve objects indexed in other languages (Chen & Gey, 2004; Jorna & Davies, 2001).

2. Problem statement

Searching for information is a dynamic process influenced by a variety of factors. Grounded theory has been adopted by a number of studies to shed light on the factors influencing users' searching behaviour but few such studies address the dynamic nature of information searching. Moreover, previous studies have tended to focus on describing models of information seeking in general rather than on the detailed steps users undertake to search for information. The present study adopts procedural analysis that is a sequence of stages which change over time, to provide detailed analysis of users' image searching

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behaviour in a multilingual environment. Data are broken down, coded, analysed, and reassembled to reflect the procedural nature of users' behaviour.

Thus, in this study GT is used to analyse user interaction in depth, with the collection of as much data as possible on users' actions and contextual information. The three coding steps of Straussian GT (open, axial and selective) are applied to explore users' behaviour and to identify the concepts and relationships in order to build what is termed the substantive theory. The categories and concepts which emerge and the substantive theory, are presented only as an outcome of the analysis approach—the approach itself is the main focus of the present study. In-depth discussion of the user experience when described and modelled by the influencing factors can be found in [Vassilakaki, Johnson, and Hartley \(2012\)](#).

Identifying users' information searching behaviour and search patterns and especially users' own interpretations of the system in use is essential for developing information retrieval systems that meet users' information needs. The additional element of thinking about languages and searching across languages in multilingual systems adds cognitive challenges to users and highlights the importance of knowing more about user ISB. The present research contributes in providing a way of analysing procedural data to gain better understanding of the processes in which users are involved during search. In addition, it provides another way of exploring, analysing, and modelling users' searching behaviour, and offers specific guidelines for identifying the processes discernible from the data. Finally, it contributes a valuable insight into users' thought processes and explanations during searches and thus informs the design, development, and evaluation of effective multilingual information retrieval systems.

3. Literature review

Users' information seeking behaviour has been investigated both as static and linear ([Kuhlthau, 1993](#); [Wilson, 1997](#)) and as a dynamic, interactive, and non-linear process subject to a range of influences ([Foster, 2004](#)). In these studies a variety of methods, quantitative, qualitative, and mixed-methods have been employed ([McKechnie, Baker, Greenwood, & Julien, 2002](#); [Vakkari, 2008](#)). Qualitative research encompasses a number of approaches and methodologies ([Flick, 2004](#); [González-Teruel & Abad-García, 2012](#)); GT is a wholly qualitative method of data analysis ([Urquhart, Lehmann, & Myers, 2010](#)), originating from [Glaser and Strauss \(1967\)](#). GT aims to systematically derive theories of human behaviour from empirical data. While the philosophy of GT as a research method can raise debate, it is based on the notion that the researcher can set aside theoretical ideas on the phenomenon under investigation to ensure an inductive approach is taken in identifying characteristic concepts in the data.

GT has gained momentum gradually but steadily and for some has been considered one of the main methodologies for exploring users' information seeking behaviour ([González-Teruel & Abad-García, 2012](#)). For example, GT has been used to provide a model of information seeking behaviour derived from a review of Jewish studies scholars ([Bronstein, 2007](#)); model the information behaviour of on-duty critical care nurses ([McKnight, 2007](#)); and develop an interaction value model ([Musoke, 2007](#)). [Winkelman, Leonard, and Rossos \(2005\)](#) use GT to analyse factors related to the perceived usefulness of online medical records by patients. [Xie \(2009\)](#) analysed the theoretical framework which influenced the development of health information needs. [Correia and Wilson \(2001\)](#) presented the core factors emerging from analysis as categories which influenced users' environmental scanning activity, and [Pace \(2004\)](#) explored the development of a theory to describe users' experiences on the Web.

Both Glaserian GT ([Glaser & Strauss, 1967](#)) and Straussian GT ([Strauss & Corbin, 1998](#)) have been employed in studies of information behaviour. Glaser divides the coding process into two procedures: substantive coding and theoretical coding. Substantive coding consists of

two phases, open coding and selective coding, whereas theoretical coding refers to the relating of substantive codes to each other to formulate hypothesis and theory ([Walker & Myrick, 2006](#)). In Straussian GT, there are two types of analysis for concepts and for coding in process. The difference between the two is that instead of looking for properties and their relations during the analysis of concepts, coding in process identifies and traces actions/interactions over time. This can be defined as a series of evolving sequences of actions and interactions over time and space, changing or staying the same depending on the situation or the context. The study of the actions and interactions is a study of a process because of its evolving nature and the variety of forms relating to a purpose ([Strauss & Corbin, 1998](#)). Furthermore in Straussian GT, the integration of the users' thoughts and expressions (conditions) with process (actions and interactions and consequences) leads to the emergence of research questions that explain the phenomenon studied. These questions when applied to data enable the emergence of factors and the identification of their relationships in the emerging theory ([Strauss & Corbin, 1998](#)).

Previous studies that have adopted GT to explore information seeking behaviour have adopted a static analysis of the data obtained. In particular, these studies did not treat, or model, the process of searching as a sequence of stages changing over time but more like a situation which stays the same regardless of time. Concepts or categories and subconcepts or subcategories, as well as their relationships, may be identified from a static coding, although information seeking is clearly a process—a sequence of stages which evolve over time ([Jarvelin & Ingwersen, 2012](#); [Strauss & Corbin, 1998](#)). The adoption of procedural analysis in the present study seeks to identify the concepts when coding the mental thoughts that take place in the physical process of an actual search.

4. Procedures

The [Strauss and Corbin \(1998\)](#) guidelines were adopted to analyse the data for the identification of conceptual categories and to enable procedural analysis. Specifically, three approaches to analysis were adopted: open coding to allow for the emergence of the core concepts and their properties; axial coding to allow for the identification of the process in the data and consequently users' actions and interactions, conditions, and consequences that were core to the process; and, finally, selective coding to allow for the integration of the data and discovery and refinement of the substantive theory. In all three approaches, the process of constant comparison was used in an attempt to compare not only users' actions and interactions and consequences of these actions with a view to finding similarities or differences, but also users' thoughts and explanations of these actions. Constant comparison enabled a better insight into both users' actions and most importantly users' thoughts.

4.1. The system

This study used FlickLing, a basic cross-language search front-end to the well-known web application Flickr. FlickLing was developed as part of the user's behaviour experiments in the interactive CLEF track (iClef) of CLEF, the Cross-Language Evaluation Forum ([Clough et al., 2008](#)). FlickLing consists of two modes: the monolingual and the multilingual mode ([Peinado, Lopez-Ostenero, & Gonzalo, 2009](#)). In the monolingual mode, users can search and retrieve images only in one language, that is, the search term(s) are matched only against index terms in that same language. The multilingual mode provides a translation mechanism which enables images to be retrieved regardless of the languages used in its header and tags. Users of FlickLing can choose in which of the six supported languages they want to express the query. The system automatically provides the translations in the chosen languages, retrieves the images from the collection and presents the results to the user. Furthermore each time a user runs a query either in monolingual

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