

**USER NEEDS AND INDEXING PRACTICES IN  
A DIGITAL NEWSPAPER PHOTOGRAPH ARCHIVE**

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## ABSTRACT

The production and transfer methods of digital images have evolved rapidly and the digital image material in various organizations is growing fast. New information retrieval (IR) solutions are needed to provide access to images. The requirements of the data type, user needs and work tasks and processes need to be studied. Much research focuses on the development of image indexing methods and algorithms. However, the research on user needs seems to come behind the rapid technical development. For images, considerably few user studies exist, on which to found the system design.

This work presents a field study on the needs and searching behaviour of journalists and indexing performed by archivists in a digital newspaper photograph archive. Observations and interviews were used to collect data on journalists' illustration tasks, photograph needs and selection criteria applied and on indexing practiced by the archivists including photograph attributes indexed and the specificity of indexing. In addition, a sample of requests given to archivists and a sample of photograph captions produced in photograph production process were collected and analysed.

The results obtained on user needs were contrasted with observed indexing practices and problem areas in the end-user access to photographs were identified. The analysis revealed that the users coped reasonably well when searching photographs of named persons or current news events, which needs were also prevailing in the data. Photographs of object types, named places or themes were also needed but considered difficult to find. Browsing was the key searching strategy applied by the users. The access problems faced by the users are discussed and potential solutions by developing the indexing and the user interface are proposed.

# Part I Introduction

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## 1. Introduction

The production, compression and transfer methods of digital images have evolved rapidly in recent years, and the digital material in various organizations has been growing fast. New information retrieval and interface solutions are needed to provide better access to images and support image users in different work tasks. Most important, digital image collections are often accessed directly by end-users. Fast growing digital collections and direct end-user access present challenges for image archives. The requirements of data type, user needs and work tasks and processes need to be studied.

Digital evolution has raised growing interest in indexing and retrieval methods of images. Traditional image archives are based on manually assigned textual descriptions and traditional text-retrieval methods. Currently, much research concentrates on content-based image retrieval methods (CBIR). CBIR aims to automate the indexing of images based on their visual appearance, e.g. color, shape and texture. A variety of methods and algorithms have been developed. Unfortunately, the user-centered research in this area is far behind the technical development. How these techniques can be utilized by users in real image search situations is rather unexplored area (Rasmussen 1997).

Relatively little is still known about the requirements which image users address to image archives. However, the design of successful retrieval methods, functions and interface features should be based on the analysis of user's needs and work processes and situations (e.g., Pejtersen and Rasmussen 1997). These needs are likely to differ from one user-group to another (Fidel 1997).

The purpose of the study reported here was to enlighten the little studied area of the needs, searching and use of journalistic images. Several user studies on image retrieval have been published to date. However, many of these studies are based on requests passed to intermediaries of searches in the archives (Armitage and Enser 1997, Enser 1993, Karhula 1991, Ørnager 1995 and 1996). This is natural, since operational digital archives offering direct access to end-users are a relatively new phenomenon. Thus, studies on image needs, searching and selection behavior of end-users in direct access digital image retrieval systems and in real work task situations are still few.

Similarly, little is known about image indexing as a practice. Various image attributes and levels of meaning for indexing have been discussed in theoretical and empirical studies (e.g., Shatford 1986, Jorgensen 1995). Exhaustive indexing is not possible in most image archives (Shatford 1986). Therefore, the image attributes for indexing has to be selected on the basis of user requirements, collection characteristics and resources available.

The study was conducted in a major Finnish newspaper where digital technology had changed the storage and retrieval of photographs and affected also to the work tasks and processes in the newspaper. The photograph archive received every day large volumes of digital photographs from various sources. Journalists, graphic designers and other editorial staff were expected to exploit digital collections directly from their desktop computers and usually they conducted their own searches. The focus of image archivists' work was shifting from intermediated searches to the selection and indexing of photographs for the archive.

Task-based approach was adopted in the study (for a review on task-based approach in information searching research see Vakkari 2003). By observing the underlying work processes and situations of photograph searching it is possible to find the core of needs and requirements independent from the archive system used.

The work consists of two parts. The first Part serves as an introduction and a summary to the study presented in the second Part. The study of the second Part is presented in two articles, which were published in 1998 and 2000. Some studies published later but relevant to the present study are included in the first Part. Thus, the results are discussed also in the light of more recent studies.

Part I is organized as follows. Section two reviews the related literature and introduces research problems: It considers conceptual indexing of images, gives a short introduction to content-based image indexing, discusses image indexing practices and reviews related research to user needs. Section three summarizes the study presented in the two articles in Part II. The research questions are presented in Section 3.1, methods and data described shortly in Section 3.2 and results presented in Sections 3.3, 3.4 and 3.5. Conclusions are drawn and discussed in the final Section 4.

The study of the second Part is presented in following articles:

1. Markkula M and Sormunen E (1998) Searching for photos - Journalists' practices in pictorial IR. In Eakins J, Harper D, Jose J (eds.) *Electronic Workshops in Computing – Challenge of Image Retrieval*. Newcastle, UK, February 1998, 1–13.
2. Markkula M and Sormunen E (2000) End-User searching challenges indexing practices in the digital photograph archive. *Information Retrieval* 1(4): 259-285.

The first article focuses on journalists' photograph needs, searching and selection behaviour as part of journalistic work tasks and processes. In the second article, the results on indexing practices applied in a newspaper photograph archive are presented and contrasted with the needs and requirements of journalists. Problem areas in end-user access are considered and suggestions to improve end-user access to photographs are made.

## **2 Related literature**

### **2.1 *Concept-based indexing***

In traditional image archives, access is based on manually assigned descriptions (index terms, cataloguing data, and captions) and on standard text retrieval systems. Display and browsing support for thumbnail images is the major enhancement in the access functions in the digital photograph archives. (Cawkell 1993, Enser 1995.)

The indexing and searching of images differs from that of text documents. In text collections reasonable performance can be achieved by automatic methods when the whole document or document parts are indexed and searchable. In image archives, the most common approach is intellectual indexing performed by indexers.

In the indexing process, the indexer analyses the document and decides which are the important concepts in respect to the document content and/or the user needs and translates the concepts in the indexing language (Lancaster 1991). The consistency of image indexing has been quite low. People perceive, interpret and describe the image content differently and even one indexer interprets the same image differently at different times (Markey 1984, Seloff 1990).

Many theoretical considerations for image indexing have been proposed. The practical implementation of a theoretical model is a framework or template developed for indexing. The template is expected to direct the indexer's focus while investigating the image and increase the consistency of indexing. For instance, Brown and Hilderley (1996), Karhula (1991), Markey (1986), Ørnager (1997) and Shatford (1986) have proposed different sets of attributes and levels of meaning to consider in image indexing. However, the applicability of such frameworks has seldom been verified with empirical tests.

According to Karhula (1991), the content and the context of an image may be difficult to separate from each other. Image content description may include aspects that are considered cataloguing in the context of text documents. Shatford Layne (1994) suggests four main classes of image attributes: (1) image content, (2) biographical attributes including, for example, photographer, shooting time and place, (3) image type and (4) context.

The work of the art historian Erwin Panofsky (1970) has had a major impact on the theoretical developments in image content indexing. Panofsky's theory of three levels of meaning was first adapted by Markey (1986) and then by Shatford (1986), who introduced a faceted classification of image attributes (Table 1). Shatford suggests four facets: Objects (Who), Activities and Events

(What), Place (Where) and Time and Space (When). Within these facets, an image may be interpreted to represent both concrete and objective entities (ofness, e.g. objects, places, actions) and abstract and subjective entities (aboutness, e.g. feelings, concepts manifested or symbolised by objects). Moreover, she stated that an image is simultaneously specific and generic. For example, the image of the Brooklyn Bridge is at the same time an image of a specific bridge, i.e. Brooklyn Bridge and an image of a bridge.

<b>FACETS</b>	<b>Specific Of</b>	<b>Generic Of</b>	<b>About</b>
WHO? animate and inanimate; concrete objects and beings	Individually named persons, animals, things	Kinds of persons, animals, things	Mythical beings (Generic/Specific) Abstractions manifested or symbolized by objects or beings
WHAT? are the objects and beings doing? (actions, events, emotions)	Individually named events	Actions, conditions	Emotions Abstractions manifested by actions, events
WHERE? locale, site, place; geographic cosmographic architectural	Individually named geographic location	Kind of place; geographic or architectural	Places symbolized (Generic/Specific) Abstractions manifested by locale
WHEN? time; linear or cyclical	Linear time; dates or periods	Cyclical time; seasons time of the day	Emotions or abstractions symbolized by or manifested by time

*Table 1. Faceted classification of image attributes for analysis by Shatford (1986)*

Karhula (1991) studied indexing of journalistic photographs. She suggests, based on her study on photograph requests in a newspaper archive and theories of photography, the following indexing model.

1. Content attributes which include the meaningful elements in the photograph and meanings they create together. These are (1) concrete objects in the photograph, (2) time (linear or cyclic), (3) place (architectural, geographical and spatial), (4) organisations, (5) themes including action, events, abstract and expressional aspects
2. Context attributes produced when the photograph is connected to texts and other images. These are, for example, article type, use and size.
3. Attributes connected to the presentation of the photograph and created in the production process. These are source, provider, news event, photograph type and shooting distance.

According to Karhula, abstract theme, concrete objects, time, news context and the photographer are the most important aspects of newspaper photographs to describe.

From text documents, indexes can be produced automatically. Also many photographs are accompanied with texts which may be used for access. Documentary captions are usually written for news photographs at an early stage of its life cycle by photographers or photograph agencies. Later, the photograph may be published in a newspaper to illustrate a news story and a new caption is written for it by a journalist or layout designer. The article to which the photograph is assigned does not necessarily tell about the same topic than the photograph, since the purpose of the photograph might be to create associations to the reader. Further, one photograph may be used several times to illustrate different stories and thus gathers many meanings (Karhula 1991). According to Kiimalainen (1994) the photograph and the caption do not always correspond to each other since the text and image journalists often work independently. The relationship between the photograph and the text is often created in the lay-out stage. In the worst case, the caption is an awkward transition between the text and the image.

Doubts have been expressed about the suitability of captions for query matching. Captions are of varying quality, often short and present only one interpretation of the image subject (e.g. Enser 1995, Price & al. 1992). Despite these doubts, captions are widely utilized in image retrieval. Natural language tends to increase the topicality and specificity of indexing and thus the specificity of retrieval (Aitchison & Gilchrist 1987). Neither the quality of captions nor the retrieval performance of natural language querying on captions has been studied extensively in large, general type image collections.

To conclude, the richness of image elements has been shown in many studies on image interpretation and content classification (Brown and Hilderley 1996, Burford et al. 2003, Eakins and Graham 1999, Jørgensen 1995, 1996 and 1998, Markey 1986, Panofsky 1970, Shatford 1986, Shatford-Layne 1994 and Turner 1994). Concept-based indexing evidently neglects some of the richness of an image. First, very exhaustive indexing is difficult in practice because of limited resources. Second, some of the visual information may be difficult to express with words. Third, users' search criteria may be very specific, subjective or abstract. Therefore, it may be more effective to let the user browse through a group of images than index in detail (Shatford Layne 1994).

In image databases, the user works directly with the document. Thus, the relevance assessment should be quicker than in text databases (Crehange et al. 1989). If the user can quickly browse and select the relevant images from the unrelevant, the need for very exhaustive indexing is diminished (Enser 1995, Shatford Layne 1994). In the end, the efficiency of browsing depends on the size of the database and the discrimination power of the indexing language (Enser 1995).



Digital image collection holders face two important questions concerning image indexing: (1) which aspects of the frameworks for the image attributes are important for users of a particular collection and should be considered in indexing, and (2) how the levels of indexing exhaustivity and specificity (for term definitions, see Soergel 1994) are selected in practice under given constraints (time, personnel).

## **2.2 Content-based indexing**

Probably the largest body of research in the area of image retrieval concerns content-based image retrieval (CBIR). Content-based image indexing aims to automatic identification and abstraction of the visual content of an image (for reviews, see e.g. Eakins 2002, Enser 1995, Rasmussen 1997). A common model is that images of the collection are described with a set of feature vectors. Typical features used are color, shape, texture and spatial layout. The query is made by an example image (e.g. photograph, drawing, sketch). The user may specify which feature parameters are important or default settings are used in matching. The algorithm compares the feature vector of the query image to the feature vectors of collection images. The retrieved images are ranked according to some calculated similarity order by applying best-match techniques (e.g., Gong 1998, Gudivada and Raghavan 1997, Gupta and Jain 1997).

In the light of user studies, the CBIR algorithms do not seem very useful for general-purpose photograph collections. Despite the vast research on these technologies, current content-based retrieval can successfully perform only with the primitive features of images, such as color and texture. Even the recognition of objects in generic contexts is a challenging task for algorithms due to the various possible representations of such objects. Thus, there seems to be a mismatch between the capabilities of the technology and user needs. The users tend to specify their needs at semantic or abstract levels (Eakins 2002). Further, users define their needs very often using contextual criteria that cannot be derived directly from the photographs but rather from the assigned textual descriptions (e.g., Armitage and Enser 1997, Enser 1995 and Keister 1994).

The research on the semantic-level CBIR is of growing interest. Many researchers are concentrating on, for example, combining relevance feedback to CBIR to advance semantic-level retrieval (Eakins 2002).

However, even primitive-level CBIR might benefit users of image collections, for example, by grouping visually similar images together. This approach was suggested by Sormunen et al. (1999) and Markkula et al. (2001) who introduced an evaluation method and a test-collection for CBIR algorithms. The performance testing was based on photograph similarity perceived by end-users in

the context of realistic illustration tasks. (For information on the evaluation framework and building of the test-collection see Sormunen et al. 1999). A case evaluation of two CBIR algorithms was performed. The results of the case evaluation showed that there was a clear correlation between the end-users' similarity assessments of photographs and the functioning of feature parameters of the tested algorithms.

Evaluation of image retrieval techniques including CBIR is carried out in ImageCLEF<sup>1</sup>, a cross-language image retrieval track which is run as part of the Cross Language Evaluation Forum (CLEF). ImageCLEF offers various image retrieval tasks for evaluation including also user-centered evaluation tasks.

### **2.3 *Image Indexing practices***

To date, image indexing practices have been almost ignored in image retrieval research. Ørnager (1995) interviewed and observed archivists in 15 Danish manually operated newspaper archives. Ørnager's study showed that archivists conducted detailed indexing of a photograph only if they thought it was necessary for finding it later. Archivists utilized associated texts for indexing if these were available. Captions written by photograph agencies were an important source of information for indexing the context of a photograph.

The archivists stated that they commonly used specific names in indexing. All said that they indexed themes. Indexing of atmosphere or feelings expressed in a photograph was also found to be important although only one half of archivists confirmed that they actually indexed these attributes.

### **2.4 *User studies***

Several field studies on user requirements have been reported. Many of them have explored requests received by archivists in manually operated archives. Enser (1993) analysed 3000 requests received by a commercial Hulton Deutsch Collection from advertising agencies, magazines and newspapers. In Enser's typology, requests were divided into two main categories: (1) unique requests of specific entities, events, locations and (2) non-unique requests expressed with generic concepts. Most requests fell into the unique category (69%). This was the case particularly among the requests from newspaper and magazine publishers (70%). Requests were often refined with time, location, event or technical criteria.

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<sup>1</sup> <http://www.ImageCLEF>.

Keister (1994) analysed requests received by the Archive of the National Library of Medicine. The requests fell into two groups: (1) Visual requests in which the user constructed the image by defining what should be seen in it (e.g. a warm picture of nurse, mother, baby) and (2) topical requests with unspecified visual requirements (e.g. cholera in France in the 19th century). She found that one third to one half of the requests were of the first type. According to Keister, the visual requester is not so interested on the topic of the image but construes a mental image of an imagined or a reminisced image, which she tries to describe in the request.

Armitage and Enser (1997) conducted a facet analysis of the concepts in the requests instead of grouping them as a whole. They examined almost 2000 requests applying Shatford Layne's classification in the analysis. The seven image collections from which requests were collected embraced still and moving images and various domains. Results from this study support the earlier findings in that the specifics were most often needed: highest number of concepts fell into the facets of individually named concrete objects and places. Terms referring to object and event types were also common. Kinds of places and specific time definitions like dates and time periods also occurred while cyclic time expressions and all the concept incidences in 'about' level facets were few.

Ørnager (1995) interviewed archivists and observed journalists formulating their requests to clarify the needs of newspaper journalists. One half of requests were simple, concerning persons, and another half dealt with themes. Ten per cent of requests were defined as complex requiring an in-depth interview. The journalists often gave the archivist the article which they needed to illustrate. Sometimes the journalists also presented drawings or photographs, if they wished something similar. Some of the journalists did not specify in any way their need but gave the article and let the archivist suggest photographs. Based on the requests, Ørnager made a following typology of the user types.

1. Users, who search for a certain photograph. They give a very detailed request because they have some photograph in mind.
2. Users, who wish to select the photograph themselves without archivist "getting involved". Therefore, they give broad and general requests.
3. Story tellers describe the story to the archivist and are willing to receive her suggestions.
4. The fourth type gives the story to the archivist and wishes that she selects the photograph.
5. Space filler is interested only on the size of the image.

Jørgensen and Jørgensen (2005) analyzed image search logs from a commercial image provider. They studied image queries, user query modification strategies, browsing and downloading of results. The collection users were professionals acting, for example, in advertising, marketing and graphic design. In their data, specific / unique term searches were less frequent than in earlier studies. A large number of query modifications were found in the analysis. User's search tactics seemed to be rather experimental. Browsing was heavily used. The authors point out that the searchers attempted relatively sophisticated search strategies but were unable to apply these methods correctly.

Westman and Oittinen (2006) analyzed requests to the archive and search logs of queries in a Finnish newspaper photograph archive. They found that specific needs for named entities were dominating both in requests and queries but that also object types were common. The largest single request type was for named persons.

They also observed and interviewed end-users (journalists and intermediaries) on their image retrieval behavior. They found that journalistic image needs were often fuzzy and difficult to fully explicate. Browsing was the main search strategy. Simple queries were used as a starting point for browsing and criteria for images were specified during the search process. Selection criteria employed was found situational and the utility of an image in the given task was stressed. Contextual factors, such as page lay-out, formed a selection frame.

In the experimental study by Batley (1988) searchers were offered tools for three different searching strategies: (1) random browsing, (2) specific browsing, where a user first selects an area of interest and then continues by browsing and (3) searching with descriptors from an indexing language. The study established that the use of browsing increased as the specificity of a given task decreased. Descriptors were used most in searching for images of specific topics. For general needs all strategies were applied equally frequently. Abstract (e.g. love) and subjective (e.g. beautiful image) search topics mostly led to random browsing.

Hung (2005a, 2005b) investigated search moves and tactics as well as relevance criteria related to three different journalistic image retrieval tasks (specific, general and subjective) constructed and given to test persons. Also Hung found that the subjects made more search moves when searching photographs for general and subjective needs than for specific needs. Browsing was a key move used by all five searchers and more important when general and subjective photographs were searched than in specific tasks. The task type affected also the relevance criteria employed by test persons: textual information and personal feelings were more important in selecting photographs for

general and subjective tasks whereas photographs searched for specific task were assessed more often on the basis of outward characteristics of objects in the photograph.

To summarize, the user-studies have shown the variety in users' search criteria and provided the basis for identifying the attributes of images that should be considered in indexing. The results are obviously quite difficult to generalize. Differences in the nature of collections studied, between user groups and in the ways images are used are likely to lead to different search criteria (see Fidel 1997).

However, on the basis of these studies, it seems that images of named entities (persons, other concrete objects) and events as well as types of entities are typical expressed user needs. In journalistic context, specific needs for images of named persons seem to dominate (Armitage and Enser 1997, Enser 1993, Westman and Oittinen 2006). Keister (1994) showed in her study that the user needs may be focused as well to the context than the content of the image. A particular image may be relevant to both types of needs.

Several papers have stressed the importance of browsing as a search strategy in image collections (Batley 1988, Besser 1990, Crehange et al. 1989, Hung 2005a, Shatford Layne 1994, Westman and Oittinen 2006). The possibility to browse and compare images supports iterative search process (Crehange et al. 1989). If browsing is a more essential access method in image retrieval than in text retrieval, it should have some consequences also for the applied indexing methods. The challenge is how indexing is developed to support browsing.

### **3 Summary of the study**

#### **3.1 *Research objective***

The purpose of the study was to investigate (1) image indexing practices and (2) image needs, searching and selection behavior of end-users in a direct access, digital newspaper photograph archive. Moreover, by contrasting the indexing practices adopted in the archive with the needs and requirements expressed by the end-users we wanted to identify possible problems and find solutions to improve end-user access in photograph archives.

Several user studies on image retrieval have been published to date. Many of these studies have analyzed requests passed to intermediaries (e.g., Armitage and Enser 1997, Enser 1993, Karhula 1991, Ørnager 1995, 1996). However, the request is an expression of the image need which is influenced by the user's expectations on the collection and retrieval system (Taylor 1968). Further,

a request is a static expression of the need but the nature of image searching seems to be iterative and dynamic (e.g., Hung 2005a, Westman and Oittinen 2006).

Also search logs of image archives have been analyzed in many studies (for example, Goodrum and Spink 2001, Jørgensen and Jørgensen 2005, Westman and Oittinen 2006). Although transaction logs give a good insight to the image querying behavior of users, they do not allow in-depth interpretations on the underlying image needs and tasks of the users (see Taylor 1968).

Only few studies have explored searching behavior and selection of images in direct access image retrieval systems (e.g., Batley 1988, Hung 2005a, Hung 2005b, Westman & Oittinen 2006) and only Westman and Oittinen (2006) explored image searching and selection connected to real work task situations.

Thus, image needs, searching and selection behavior of end-users in direct access digital image retrieval systems and in real work task situations is still quite an unexplored area of research. Also, little is known on image indexing as a practice even though different sets of attributes and levels of meaning to consider in image indexing have been proposed (e.g., Brown and Hilderley 1996, Karhula 1991, Markey 1986, Ørnager 1997 and Shatford 1986).

Much research is currently focused on CBIR, which, however, has been deemed too primitive at the present stage of development to benefit users of image collections. How these techniques can be utilized by users in real image search situations is a rather unexplored area. More studies on user requirements are needed to guide the design of CBIR as well as other image retrieval methods, functions and interface features.

The research questions of the study were:

1. What are the indexing practices adopted in a digital newspaper photograph archive?
  - 1.1. Characteristics of the indexing task?
  - 1.2. Sources of data exploited in indexing?
  - 1.3. Photograph attributes indexed?
  - 1.4. Specificity of indexing?
  - 1.5. Rules and principles followed in indexing?
2. What are the needs and requirements of end-users of the digital newspaper photograph archive?
  - 2.1. Characteristics of illustration tasks in the newsroom?
  - 2.2. Search topics expressed?
  - 2.3. Searching behavior adopted?
  - 2.4. Selection criteria applied?

## **3.2        *Methods***

The data was collected in Aamulehti archive and news room in summer 1996 and spring 1997. Theme interviews, group discussions and observations were used in data gathering. In addition, a collection of 108 requests received by the archivists and a sample of 60 incoming photographs and associated descriptions were gathered and analysed. The different methods were used to provide complementary data on the research topic and thus improve the validity of the research as suggested by Fidel (1993).

Recorded observation data and interviews were transcribed. Inductive content analysis (see Schamber 2000) was used for analysing the illustration processes of journalists. The analysis of observed search topics and requests was based on earlier research on classification of image content attributes (Shatford 1986) and requests (Armitage and Enser 1997, Enser 1993, and Keister 1994).

The image attributes indexed by archivists and in the captions were analysed using the faceted classification provided by Shatford (1986) as a starting point. A detailed description of the methodology is presented in the articles in Part II.

## **3.3        *Results on user needs***

### **3.3.1        *Illustration tasks***

The study showed that photograph searching in newspaper was tightly integrated into article writing, editing and layout design. In the data, photographs were searched for illustration. In the daily routines and tight schedules, the journalists often made acceptable photograph selections rather than used much time to find the best possible photograph.

The photograph searching and selection behaviour depended on the work task at hand. The effort put into searching was connected to the expected role of the photograph in the newspaper. The journalists were usually open for many illustration options and had various ideas in mind when beginning the search. This shows that various kinds of photographs may illustrate one article. This is partly due to the many possibilities to interpret a photograph, partly because the photograph does not always need to stress the main point of the article. It may also create associations.

### **3.3.2        *Illustration processes***

The photograph searching observed was often iterative: photographs for different ideas were retrieved, browsed and assessed. The journalists usually selected a couple of candidate photographs

during the search process. The final selection was often made among the candidate photographs later when the article was completed and the page lay-out outlined. At this point the final requirements for the photograph were quite clear. The final selection was often made by another person than the one who selected the candidate photographs. Model of the illustration process is presented in Figure 1.

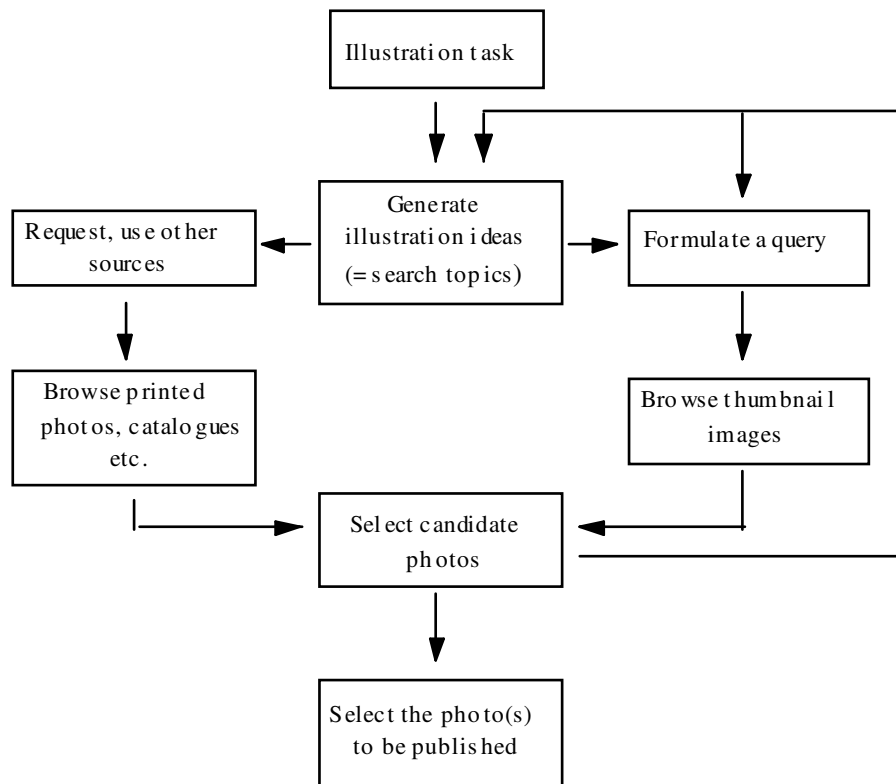


Figure 1. A model of the illustration process

### 3.3.3 Search topics in requests and in end-user searching

The search topics in requests (in total 108) and in observed search processes (in total 27 topics) were divided in four main categories according to their main focus: (1) concrete entities (people, other objects, buildings, places) in photographs (2) background information (news event to which the photograph is related), abstract themes and (4) a known photograph. The analysis showed that almost 70 % of search topics were of concrete entities. The second common group (about 15%) concerned the background (or context) information relating to the photograph. Mostly these dealt with daily news events. Abstract themes (e.g. “symbolic photographs of medicine”, “child care”) represented about 10 % of topics. A specific, known photograph was searched for in few cases.



A more detailed analysis (Figure 2) shows that most search topics were specific concerning named persons, buildings, places (e.g. Rauma old town), news events and TV programs or movies. Most of these were of persons. Interestingly, abstract themes and news events were much more common topics in observed search processes (18% and 22%) than in request (7% and 3%). On the other hand, object types represented by common nouns (e.g. “cow in a pasture”) were lacking from the observed searches while they counted 20% of requests.

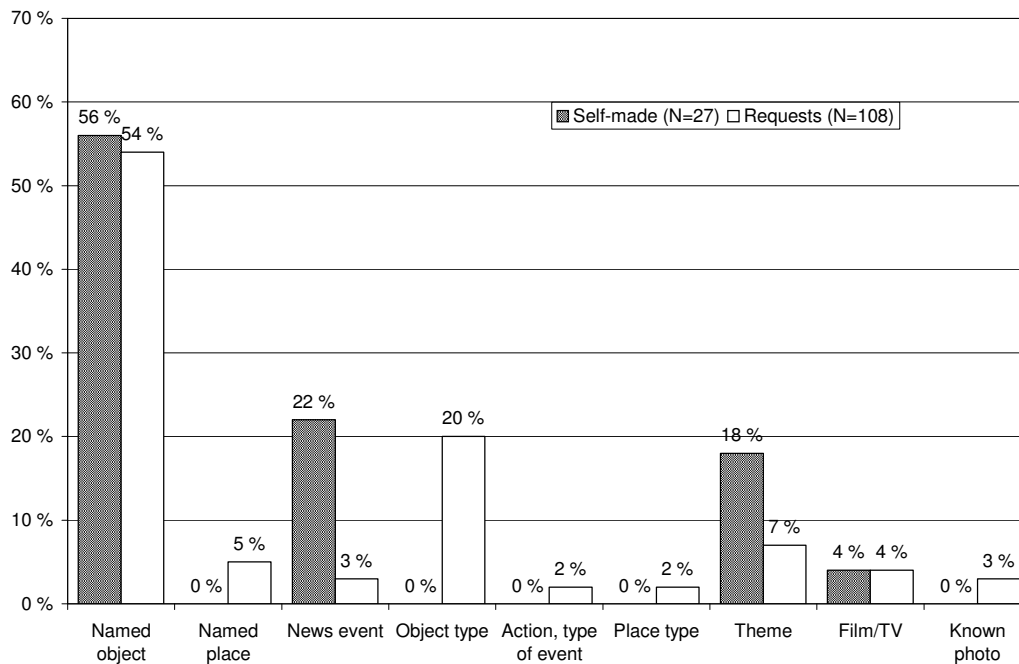


Figure 2. The distribution of search topics according to their main focus.

These results suggest that specific needs dominate in newspaper photograph archive. Photographs of named persons, places etc. were considered easy to find by the journalists interviewed. Photographs of current news events were also easily found by the journalists themselves in the relatively small repository of daily photographs in the archive.

In the interviews, searches concerning abstract themes got much attention from the journalists. Searching photographs for themes was considered challenging. However, they were more common in observed illustration processes than in requests given to archivists. This may be explained by the journalists' claims, that it is easier to search for these kinds of photographs themselves than try to explain the idea to archivist. For these needs various kinds of photographs may be accepted for illustration. Interpretative criteria e.g. emotions awakened by the photograph may be important in relevance assessments which may be seen difficult to describe to archivists.

More than half of the requests were refined with some criteria. The most commonly mentioned criteria were color photographs, shooting time, shooting distance, attributes of objects (e.g., “an extremely big fish”) and the use context.

### **3.3.4 Searching behavior**

The observations indicate that different searching behaviour related to different search topic types. Searches for specific needs, e.g. photographs of persons and news events, were quite straightforward. Only one or two querying and browsing sessions were usually needed. Queries were found easy to conduct since they could be based on proper names of persons and places. However, heavy browsing was sometimes needed because photographs of, for example, some persons were numerous in the archive.

More general needs for photographs of entity types (objects, places), event types and abstract themes often lead to longer search processes, multiple queries and heavy browsing. Each querying and browsing session was an attempt to find photographs on the topic using a particular viewpoint or strategy. The journalists tested different queries in trial-and-error basis. Candidate photographs were selected from each session. Paper copies were often printed to allow comparison. The final selection could occur much later and was sometimes done by another person than the one who selected the candidate photographs.

Single-world –queries were prevailing. The journalists did not waste much time in formulating queries. This often led to large result sets. Journalists preferred proper names as query terms and used these also when looking for photographs for general needs. Finding search keys especially for abstract concepts was seen quite difficult according to the journalists interviewed.

Journalists preferred browsing which they found easier than formulating refined queries. Browsing also gave insight what kind of photographs existed in the archive on the topic. Most journalists accepted up to 100 photographs for browsing before narrowing the search in some way. Shooting year and photograph source were the most typical criteria to exclude photographs from the result set.

### **3.3.5 Selection criteria**

The analysis of selection criteria applied by the journalists indicates their dynamic and situational nature (see Schamber et al. 1990). *Topicality* was the first criterion applied and usually judged by reading the caption of the photograph. Topicality refers here to the background of the photograph:

what is really happening in it, where, and to what event the photograph is connected to. In newspaper photographs, this information is essential and often impossible to judge from the photograph itself.

After topicality, *contextual* criteria such as publishing information, shooting date and origin were often used criteria. The *visual* criteria applied were very situational and connected to the individual illustration tasks. The article's message, type, style and page and section lay out affected to criteria used in selections.

Often the criteria seemed to be difficult to concretize when the journalists tried to explain their selections. They used very abstract wordings, e.g. '*this photograph provokes thoughts*' or explained what they saw in the photograph '*there are people fleeing*'. This kind of criteria is connected to the message the journalist wishes to deliver with the photograph. Therefore, they often relate to the emotions the photograph provokes. Expressions like '*dramatic*', '*surprising*' and '*funny*' were justifications used for the selections.

In the last selection phase, the criteria related to the layout design. The photographs already selected for the page and the newspaper section affected to other selections. The aim was to design the lay out dynamic and balanced. This requires, for example, that visually different kinds of photographs are selected to the page. Thus, photographs of action are balanced with portraits, horizontal photographs with vertical etc. The aesthetic criteria, e.g. color and composition, were mentioned important at this point.

### **3.4        *Results on image indexing practices***

#### **3.4.1        *Image indexing task and sources of data for indexing***

The archivists selected and indexed photographs for the archive from the stock of digital photographs coming daily from photograph agencies and newspaper photographers. In addition, all published photographs were indexed and archived. Photograph selection and indexing was done online using an indexing interface of the integrated photograph indexing and retrieval system. The selection was based on the archivists' knowledge of user needs and existing collection. In addition, visually attractive and "good" photographs were preferred.

A couple of minutes were used in indexing each photograph. Incoming photographs were already supplied with technical and source information and a caption. Captions described the photograph content and news context with varying exhaustivity.

The archivists studied and exploited following sources in the selection and indexing process: (1) captions, (2) articles, when the photograph was published, and (3) the photograph. The captions of international photograph agencies were in English. This was a challenge for the archivist's language competence. Archivists added index terms and translated keywords from captions into Finnish. The photograph itself was studied to identify details and more subjective attributes worth indexing. These are usually disregarded in captions.

The content descriptions made by in-house photographers were often very short and insufficient for indexing purposes. This made the indexing process laborious, when the archivists had to contact the photographer or journalist for additional information.

### **3.4.2 Image attributes indexed and specificity of indexing**

The analysis of indexing was based on the classification of image attributes by Shatford (1986). The analysis showed that all the facets presented in the framework were used by indexers sometimes. However, only the attributes and levels of meaning found important in the context of the individual photograph were indexed. The indexers concentrated on concrete aspects and more interpretative attributes were indexed only occasionally. They paid attention both to the photograph content and to the news context.

The analysis of *captions* showed that they described the content of the photograph (when, where, who, what) and the news context quite comprehensively. However, mainly specific terms were used in captions, e.g. names of objects, places and events. The archivists added index terms of common nouns for object, event and place types as well as index terms referring to abstract themes. These were seldom available in captions. The archivists indexed details if found important. Attributes of objects were also indexed sometimes. Actions taking place were often described in captions but by archivists only when perceived as an essential aspect of the photograph.

Problems were faced in indexing place and time attributes. Shooting time and location were always indexed in a standard way. However, the archivists found difficult to decide when of- and about-levels of place and time should be indexed. The of-level means indexing of a place (country, city) and time (season of year) as a theme of the photograph. The about-level refers to place and time symbolized by the photograph, for example, young lovers symbolizing spring. The index form offered a field for indexing these levels for countries, but it was seldom used by archivists. Also types of places were indexed seldom and mostly in context of sceneries and landscapes. Similarly, seasons or time of day were indexed only when seen as a main topic of the photograph.

The overall theme of the photograph was considered important to index by the archivists. Online thesaurus was used if appropriate terms could be found, otherwise the archivists used keywords. The thesaurus was found lacking many topic areas and the archivists claimed that it was more suitable for indexing photograph's news context than the content.

### **3.4.3 Indexing policy and consistency of indexing**

The indexing interface provided the framework for indexing. The framework included several fields for different data including, for example, free description and thesaurus terms. The options offered by the interface were only partly used by the archivists. To fully exploit the field structure, keywords should have been rewritten into different fields. Limited time resources for indexing made this option unattractive.

The indexing policy seemed not to be very well formulated. The archivists often felt uncertainty in their indexing. According to the archivists, the basic rule was to be objective and concentrate on the concrete content of the photograph. However, the archivists stated that in actual indexing situation it is difficult to draw the line between concrete and abstract or objective and subjective. The difficulties the archivists had in interpreting weather for example, a country is represented in a photograph, reflect these problems.

The indexing seemed to be quite inconsistent. Indexers had different styles and the output varied from descriptive and detailed full sentence descriptions to few key words assigned to main attributes. The photographs in the collection represented various subject domains. Photographs representing familiar subject areas or with detailed captions offering much information were easier to index and thus were indexed in more detail. The consequence was that photographs with poor captions were often indexed poorly also by archivists.

Also thesaurus terms were applied inconsistently. The thesaurus was deemed rather unsuitable for indexing photographs. It was originally designed for newspaper articles and therefore more adequate for indexing the news context than the photograph content. Some modifications were made by archivists but the lacking resources prevailed more profound work with it.

## **3.5 *Contrasting the results of indexing practices and user needs***

The analysis of search topics showed that needs for photographs of named objects and particularly of persons were dominating in the studied archive. These needs were well met in photograph indexing. The proper names were frequently described, and already in captions.

Also photographs of news events were commonly needed and easily found by journalists since they could be searched by using names of persons, places and organizations from the small photograph repository of the current day. The news context of the photograph was also treated well in indexing.

The problems encountered by the users were connected to

- (1) topical needs for photographs of types of objects (animals, buildings...) and themes
- (2) large and unfocused result sets

### **3.5.1 Topical needs**

The journalists seemed to trust in the help of archivists when searching for photographs of object types since these topics were common in requests but lacking from the observed search processes. The journalists interviewed also stated that they had problems in finding search terms retrieving anything relevant or anything focused enough to browse for these needs.

The archivists observed used common nouns in indexing objects even though the captions were specific in their description. However, the journalists seemed to have difficulties in finding synonymous, broader or narrower search keys for their queries.

On the contrary, abstract themes were common topic type in self-made searches but rare in requests. In these kinds of needs various kinds of photographs may be accepted for illustration. Interpretative criteria, e.g. emotions provoked by the photograph may be very important in relevance assessments. Thus, the needs may be seen difficult to describe to intermediaries of searches. The journalists rather searched photographs of themes themselves.

The greater share of themes in self-made searches may also be a consequence of the dynamic nature of photograph searching. When the journalists formulate their needs concerning themes to the archivists the need may be worked out more and become more concrete. Thus, end-user searching allows the journalists to be more explorative in their searching.

However, the journalists stated that they had constantly problems in searching for photographs of themes. One explanation for the problems is that the indexing of themes was partly based on the thesaurus. The journalists did not utilize the on-line thesaurus, which was accessible only through the "advanced search form". The use of this search form was deemed too complex by the journalists. In addition, according to the archivists, the thesaurus was used more in indexing the news context than the photograph content.

These problems with searches concerning object types and themes indicate that there is a gap between the index terms used and the query terms discovered by the journalists. In all, the newspaper photograph collection and indexing seem to be rather news event oriented.

### **3.5.2 Unfocused result sets**

Large and unfocused result sets were commonly faced when searching for (1) named geographic locations represented in the photograph to illustrate an article about that location (2) photographs of some season or time of day, (3) photographs of persons.

A quite common problem according to interviews was encountered when the journalists searched photographs of some named geographic location. The simple queries retrieved all photographs shot in the location, also indoor photographs. A proper name of a country or city in photograph's description can represent various photograph attributes: (1) shooting location, (2) location represented in the photograph (3) location symbolized by it and (4) a location connected to the news event (e.g. the scene of a forthcoming football final).

Similar problems related to time attributes (photographs shot in winter vs. photographs representing winter) and to named persons (portrait of a person vs. person in a minor role vs. person relating to the news event but not represented in the photograph). In these cases, the simple queries of end-users and free text searching often retrieved huge sets of thumbnail images. No means to organize the result set or further focus the search was available.

These problems related to the fact that the journalists did not exploit the database field structure. The field structure was accessible only in the advanced search form. This form was found too complex by the journalists and thus disregarded. In addition, the field structure for separating different attributes was only partly and inconsistently exploited in indexing.

## **4 Conclusions**

The study investigated the relatively little explored area of photograph indexing and searching in a digital direct access newspaper photograph archive. The indexers were observed while indexing photographs and the end-users were observed while searching and selecting photographs in real work task situations. The results on user needs were contrasted with observed indexing practices and problem areas in end-user access could be identified.

#### **4.1 *Image indexing in newspaper archive***

Only few minutes were available for indexing each photograph. Very exhaustive indexing was therefore impossible. Besides photographs, the archivists exploited captions and published articles as sources of information in indexing. These findings confirm the results on indexing practices reported by Ørnager (1996) and may be typical in newspaper photograph archives which process large amounts of photographs each day.

The analysis of captions produced in photograph agencies showed that they were suitable for query matching for common needs in the archive. The captions were usually of good quality in describing specific objects, persons, events and the news context of photographs. However, the captions written by in-house photographers were often poor missing vital information and therefore giving an insufficient starting point for indexers.

The indexing was found rather inconsistent supporting Markey's observations (1984). Clear indexing policy was missing in the archive but the principle was to index the concrete and objective attributes in the photograph. In real indexing situations it seemed difficult to make the difference between the objective and more subjective photograph attributes. The archivists were aware of some shortcomings of the archive but within given resources were unable to solve them.

#### **4.2 *Journalistic image needs***

The study showed that photographs of persons and other named entities dominate in journalists' needs. Also needs for photographs of current news events are common. These results are in line with Armitage and Enser (1997), Enser (1993) and Ørnager (1995) in that specific needs dominate in newspaper photograph archives. Specific needs were found dominating also in the more recent study by Westman and Oittinen (2006).

The results support Keister (1994) in that some of the needs are focused on the photograph context rather than on its content. In fact, the observations on photograph selection behavior of journalists indicate that the news context is essential in assessing the relevance of newspaper photographs.

The results indicate that the specific needs dominating in the archive were quite well met in the indexing of photographs. The problem areas were found in searching for photographs for more general needs of objects types and abstract themes. For general needs, the journalists claimed that they could not find proper search keys to retrieve anything or to retrieve anything focused enough for browsing. However, the archivists indexed object types and abstract themes. This implies a vocabulary gap between the indexers and searchers.



Object types and abstract themes were indexed using a thesaurus when terms could be found there, otherwise the archivists used keywords. The thesaurus was seen more suitable in indexing news events than the photograph contents. News event oriented controlled vocabulary and inconsistent keyword indexing may cause problems in the context of general needs. On the other hand, the end-users typically had little training in using the system. They had difficulties in discovering synonymous, broader or narrower terms for their queries. Various simple queries were tested in trial-and-error basis. A big problem was, that they did not utilise the online thesaurus, which was available only in the advanced search form which they deemed to complex.

Interestingly, the results indicate that the dominance of specific needs may partly be a consequence of the problems the users had in formulating successful queries for more general needs. The observations showed that the end-users tended to approach their general needs by “translating” them into specific instances of the topics.

The common specific needs were quite well met already in captions, which were rather good in describing specific persons, objects, places and news events. Therefore, the conceptual indexing performed by archivists could focus more on solving problems associated to topical queries, that is, in indexing themes and objects types.

### **4.3 *Dynamic and situational image selection criteria***

In the study, the whole illustration process from developing the illustration idea up to the selection of photograph was observed. This made it possible to collect data about the criteria applied in relevance assessments at different stages of the search process. The results showed that selection criteria strongly depended on the work task at hand. For example, type of article and section of the newspaper influenced to the criteria applied. The criteria changed and got more focused during the work process when the article’s content, size, location and the page lay out on the newspaper issue became clearer. Similar image selection behavior and criteria were observed later by Westman and Oittinen (2006). These results provide evidence on the dynamic and situational nature of end-user’s image selection criteria.

The first criterion applied in the beginning of the illustration process was topicality, which was judged by reading the captions (see also Westman and Oittinen 2006). The final selection was often taking place much later when the page lay out was designed. The final selection was based on the visual criteria only. Many criteria used by the journalists appeared difficult to explicate. Such criteria related to the emotions provoked by the photograph and its atmosphere.

#### **4.4. Browsing**

Browsing was discovered an important search strategy of end-users. Parallel results on the searching behavior of end-users have been more recently reported by Westman and Oittinen (2006) and Hung (2005a), also in journalistic image retrieval context. The present study revealed that, (1) the journalists wished to browse in order to see options of images before selections. (2) In the daily routines of illustrating articles, they did not want to use much time in formulating refined queries. They found browsing easier way to find suitable photographs. (3) Browsing supported development of illustration ideas and gave insight to the photographs on the topic. (4) Browsing offered a possibility to apply criteria which were difficult to express in queries. Thus, browsing can compensate indexing in situations where search criteria are situational (particularly in searching for themes) and thus difficult to predict in indexing and when the criteria is difficult to verbalize.

These findings suggest that more attention should be paid on how browsing could be supported when indexing and retrieval methods for photographs are designed. The users in this study made simple queries, which sometimes retrieved very large sets of photographs, sometimes nothing relevant to start with. Similar querying behavior and problems encountered by users have been more recently reported by Jørgensen and Jørgensen (2005) and Westman and Oittinen (2006). For example, Jørgensen and Jørgensen note that the users of their study seemed to be trying various strategies to reduce the resulting large image sets, however, mostly unsuccessfully.

These results suggest that currently the users seem to have relatively little means to control their searching. Particularly tools to assist efficient browsing would be useful. For example, some of the features present in the current interface (and making the interface too complex) might be left to the browsing stage where they could help in organizing the result set. Also selection criteria found typical in this study (e.g., photograph direction and shooting distance) could be made exploitable in the browsing stage.

Conceptual indexing could solve some of the problems connected to browsing. The journalists found their needs on abstract themes difficult to express but could give examples of possible areas of interest. In such needs browsing is an appropriate strategy. If indexing would be based on broad topic categories, it could offer good starting points for browsing when users face topical needs (see O'Connor 1993). Topic categories would create smaller and more focused sub-collections for querying and browsing.

Concerning CBIR, the study showed again that the search topics of journalists were on higher abstraction level than the current content-based methods are working with. Further, some needs

focused on the photograph context, not on its contents and thus are out of the area of CBIR. In the light of these results as well as earlier user studies, the CBIR algorithms do not seem very useful for general-purpose photograph databases. However, possible applications of such algorithms could be in the browsing stage, where the CBIR could organize the retrieved thumbnail images according to visual criteria (see Sormunen et al. 1999 and Markkula et al. 2001). Thus, users could browse, for example, photographs resembling visually one already found or look for visually different photographs in different groups. For example, automatic classification of scenes (indoors, beach) or sorting out close-ups of persons might benefit the end-users of this study. How useful these organizations would be are left for future studies and developments in CBIR.

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## Part II Articles

1. Markkula M and Sormunen E (1998) Searching for photos - Journalists' practices in pictorial IR. In Eakins J, Harper D, Jose J (eds.) *Electronic Workshops in Computing – Challenge of Image Retrieval*. Newcastle, UK, February 1998, 1–13.
2. Markkula M and Sormunen E (2000) End-User searching challenges indexing practices in the digital photograph archive. *Information Retrieval* 1(4): 259-285.

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# Searching for Photos - Journalists' Practices in Pictorial IR

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## Abstract

This paper reports the results of a field study on journalists' practices in requesting, searching for and selecting photos in the course of their daily work. The study addresses different types of search topics common in journalistic illustration tasks, journalists' searching behaviour and the criteria they apply in selecting photos. Data were collected by observing journalists in their work and interviewing them. A sample of requests received by the archive was also analysed. The results indicate that specific needs dominate the use of newspaper photo archives. Photos of objects, themes, or abstract topics expressed in general terms were also needed, but finding them and formulating queries in these cases especially was considered problematic. The results suggest that browsing is an essential strategy in accessing digital photo archives. Journalists tend to browse but the present archive systems support browsing poorly. The paper concludes with suggestions for the improvement of end-user access to photo archives. The possible applications of current feature-based indexing and retrieval methods in the newspaper photo archive are discussed in the light of the results.

## 1 Introduction

Photojournalistic work is changing with the new applications of digital technology in newsrooms [14]. Photo retrieval, manipulation and lay-out design can be done at personal workstations in the networked environment. The main tasks of photo archivists are to select and index photos for the archive, while searching has shifted almost totally to end users. Journalists, graphic designers and other editorial staff are expected to exploit digital photo collections directly. [See 25.]

This paper deals with end-user behaviour in searching a digital newspaper photo archive. Digital photo archives are a new phenomenon as operational systems and a fairly untouched area of research. Hence, the picture of end-users in searching, selecting and using photos is hazy.

On the one hand, the past research on image retrieval has concentrated on outlining a theoretical framework for conceptual indexing of images performed by humans [9-10, 15, 22-23]. On the other hand, some studies have categorised and analysed search requests received by the mediators [4-5, 11, 18-20]. Only a few papers have focused on searching behaviour [e.g. 1]. Probably the largest body of research deals with the development of automatic feature-based indexing and retrieval methods for image databases [for reviews, see for example 2-3].

Only a few user-oriented studies have been reported to date and typically they are based on analysing photo requests received by a particular manually operated archive. Various typologies have been applied in categorising image requests. Keister [11] classified requests received by the archive of the National Library of Medicine into two groups: 1) *visual* requests, in which the user constructs the image by defining what should be seen in it and 2) *topical* requests with non-specific visual requirements. She found that one third to one half of the requests were of the first type.

Enser [4] categorised almost 3000 requests received by the Hulton Deutsch Collection, which is a general commercial image collection including several distinct sub-collections. In Enser's typology, requests fell into two main categories: 1) *unique*, containing requests for specific entities, events, locations and 2) *non-unique*, containing requests formulated in terms of generic concepts. Most requests fell into the unique category (69%) and this was particularly the case among the requests from newspaper and magazine publishers (70%). Requests in both groups were refined with specifications concerning time, location, event or technical attributes.

Ørnager [18-20] studied requirements for indexing and retrieval in newspaper photo archives. The 15 archives concerned were of the paper bag type. Requests received by archivists were studied by interviewing archivists and by observing journalists formulating their requests. According to the archivists, one half of requests were simple, concerning persons, and another half dealt with themes. Ten per cent of requests were

defined as complex, requiring an in depth-interview. Ørnager proposes a user typology based on observing the journalists giving requests to the archivists. The typology includes *specific*, *general*, *storyteller*, *storygiver* and *only-size-matters* inquirers. Ørnager concludes that the interests of the users are difficult to define. Newspaper image archives hold pictures from wide subject domains and journalists' subject fields are all the topics in the world.

Batley's [1] research on searching behaviour was conducted in an experimental environment. A database containing 950 photos was created on videodisc for research purposes. Searchers could use three strategies: 1) random browsing by using a joystick, 2) specific browsing, where the user first selects a subject area from the menu and then browses a group of related photos and 3) searching with keywords selected from a keyword list. Research subjects (41) were given different types of tasks. The study established that the use of browsing increased as the specificity of given tasks decreased. Keywords were used most in searching for images for specific tasks (e.g. The River Dee). For general needs (e.g. a ruined castle) all strategies were applied almost equally frequently. Abstract (e.g. a busy street scene) or subjective (e.g. a pretty scene) tasks mostly led to random browsing.

The aim of the present study was to form a general picture of the journalist's searching behaviour in a digital newspaper photo archive. Searching for photos in the newspaper environment is an integral part of the journalistic work process. To specify, the goals of the preliminary study were to clarify

1. the characteristics of illustration tasks and work tasks related to illustration
2. the attributes of photos of interest to journalists when searching for photos themselves or requesting photos from the archivists
3. the selection of photos and the selection criteria applied (i.e. the relevance assessments made by the journalists in the work task situations)
4. end-user behaviour in searching for photos.

This was a preliminary study in a project developing indexing and retrieval methods for digital photo archives. The ultimate goal was to develop ideas for potential applications of feature-based indexing and retrieval methods in newspaper photo archives.

We also studied the archiving and indexing practices in the newspaper archive by examining the archiving processes including photo selection, the attributes of photos archivists indexed, sources of information they exploited in indexing and descriptions attached to photos by photo agencies and photographers. These results are reported elsewhere. This paper will focus on the results concerning the needs for photos in journalistic illustration processes, searching behaviour of journalists and the photo selection criteria they apply. The possible applications of feature-based indexing and retrieval methods in the newspaper photo archive are also discussed.

## 2 Study Environment

The study was conducted in *Aamulehti*, the second largest daily newspaper in Finland. In *Aamulehti*, the digital photo archive came into use in spring 1996. The archive is quite new and it contains only the newest photos. The paper bag and on-line bibliographic archives containing older material are still used to some extent. Photos from these old archives are scanned for the digital archive if they are published.

The archive is divided into a *photo cache archive* and a *permanent archive*. Photos are scanned by photographers or delivered by photo agencies into the cache archive where they are kept for three weeks. About 20% of all photos stored to the cache are archived in the permanent archive. This includes all published photos and selected non-published photos. The selection is done mainly by archivists. In 1996, some editorial sections took part in the selection but this interest declined in 1997, even though journalists criticised the selections made by the archivists.

In *Aamulehti*, the photos for the newspaper issue are selected by journalists, sub-editors, lay-out designers, and other editorial staff henceforth referred to as *journalists*. Searching for and selection of photos is usually embedded in other tasks (e.g. writing articles, designing lay-out). All editorial staff have access to the digital photo archive at their terminals and usually they conduct searches themselves. A few journalists do not yet use the digital archive and sometimes the active end-users also send requests to the archivists after unsuccessful retrieval attempts or when older photos are desired.

The storage and retrieval system in use is NewsLink<sup>1</sup>, which is based on the TRIP fulltext retrieval programme. The text archive containing published newspaper articles runs on the same system and came into use a few years earlier than the photo archive. This may have affected the searching styles adopted by journalists in searching for photos. The photo archive is integrated into the lay-out programme so that photos can be called up straight to the page under construction.

Each record in the archive consists of the high-resolution image, a low-resolution copy of it and a

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<sup>1</sup> by JOB Systemintegration AB

structured set of textual descriptions. The textual descriptions include in total 39 fields for technical information (e.g. format, size), for information on photo source (e.g. photographer, photo agency, shooting place and date), for archiving data (e.g. record creation date) and for publishing (e.g. dates, sections) and subject information (e.g. caption, additional free text description, person and organisation fields). A thesaurus<sup>2</sup> is available for indexing and searching for themes. The same thesaurus is also used in the text archive and it was designed in the first place for indexing newspaper articles.

In addition to the indexing by newspaper archivists, the captions written by photo agencies form an important part of a photo's subject description. Captions usually describe what the photo represents quite concretely (when, where, who, what) and the news event the photo is associated with. Most international photo agencies produce this information in a standard way. For example, a typical caption may contain the following:

*[Gramm 1996]FILE - Republican presidential contender Sen. Phil Gramm, R-Texas, spends a solitary moment on his plane at the airport in Baton Rouge, La., Tuesday night, Feb.6, 1996. Battered by back-to-back defeats in Iowa and Louisiana, Gramm called top supporters around the country on Feb.13, and told them he would quit the race on Wednesday.*

NewsLink supports Boolean queries in the fields of textual descriptions. Searchers can use either a simple or an advanced search form (Figure 1). The simple search form provides a field for entering Boolean queries and a menu for selecting time limits (record creation date), which makes it easy to restrict the search to the newest photos only. In the advanced search form, searchers can exploit all searchable fields of textual descriptions. This includes theme classification organised into three-level on-line menus.

**Figure 1: Simple and Advanced Search Forms of the NewsLink System in Aamulehti (texts translated in English by the authors)**

Query results are displayed as a set of thumbnail images. Any double-clicked thumbnail image is enlarged. The caption of the activated thumbnail image is shown in the bottom left corner of the window. More information is found from pop-up windows.

<sup>2</sup>Toimituksen tekstiarkiston asiasanasto [A Thesaurus for newspaper text archives]. 1991. Helsinki: Sanomalehtien Liitto ry.

### 3 Data and Methods

The data for this study were collected in the *Aamulehti* archive and newsroom in summer 1996 and spring 1997. During the study period the number of photos in the archive increased from 21 000 to 83 000. In summer 1996 many journalists were still familiarising themselves with the archive and requests were quite often sent to the archivists. The archivists estimated that in spring 1997 the rate of requests had decreased to one third from that in summer 1996.

The data concerning illustration was gathered by observing journalists in their work and by interviewing them. In addition a sample of photo requests received by the archivists was analysed. Different methods were used to produce complementary data. This is considered to improve the validity of the research [see e.g. 6].

*The observation* was conducted in the news sections in the evenings, when most of the photos are needed. In the current affairs sections the time for observation had to be fixed beforehand with the journalists, because the illustration processes were conducted by several journalists in different rooms. Journalists working days are busy and unpredictable and this characterised the data gathering [see also 17]. Most of the time spent in the observation phase was "hanging around" and watching everything that happened in the newsroom. The illustration tasks journalists conducted took only a small part of their working time and their daily schedules were difficult to anticipate. However, the time spent in the newsrooms was useful in understanding the context of the illustration: the different work tasks and the flow of the work in editorial office.

The observation was conducted in a participative manner. The observer followed journalists' work in their offices. The actions taken during observation were written down. The journalists explained what they were doing and the observer asked questions if it was necessary. The most problematic area on which to get data was selection criteria, which journalists obviously found difficult to explain. Otherwise the journalists were quite eager to describe their work.

The main focus was on the illustration processes. The journalists were asked to characterise their illustration tasks if they did not do this spontaneously, which was most common. When the journalists commented on the illustration tasks, created ideas for illustration and conducted searches their utterances were tape-recorded. Query statements made were written down. During the observations it became clear that the query statements did not reveal much about actual photo needs. Users sometimes composed restrictive queries based only on the photo source and date. While from the observer's point of view the queries sometimes seemed to have a tenuous relationship to the subject of the search, i.e. what the journalists said they were looking for, more attention was given to obtaining journalists' descriptions of their search topics. When the journalist selected the photo to be published, which might happen much later than the actual search, tape-recording was again used.

The processes of 20 illustration tasks conducted by eight journalists were observed from the creation of ideas to final selection of photos to be published. The illustration processes observed related to the eight editorial sections displayed below. The division of sections follows the practice commonly used in newspapers.

<b>Editorial section</b>	<b>Number of illustration processes observed (N=20)</b>	<b>Number of search topics (N=27)</b>
News sections: Economics, foreign affairs, front page, sports	7	8
Current affairs sections: culture, current affairs, sunday supplement	7	10
Pull-out supplement (deals mostly with TV, films and music)	6	9

**Table 1: Number of Illustration Processes observed and Search Topics Occurring in Different Editorial Sections**

In total, 27 search topics originated from 20 illustration tasks because some tasks involved different searching ideas. A search topic is defined here as a search for photo(s) concerning one illustration idea expressed by a journalist. For example, if a journalist said that a *photo of Bill Clinton* and a *photo on the theme of nuclear power* were optional photos for an article, these were considered as two search topics. If a journalist said that (s)he was looking for *something about the Russian Mafia* and tried search keys like *St. Petersburg* and *contract killings*, we considered there to be only one search topic, even if the searcher tried to find photos on different

topics.

The recorded tapes were transcribed and combined with the written notes to obtain a complete description of illustration processes. Every illustration process was then drawn as a continuum of moves or steps taken by a journalist. Even though there were differences in the illustration processes analysed resulting from the individual styles of journalists and from the characteristics of the illustration tasks, common patterns could be identified.

The aim of the *theme interviews* was, first, to check if the observations were in line with the views of the subjects. Second, the interviews were designed to help in explaining the observed searching behaviour. Third, the journalists had the opportunity of expressing their views on the archive. Interviews with three journalists (a group discussion with two journalists and a separate interview with one journalist) were conducted.

A total of 108 requests sent to the archive was collected by questionnaires, which the archivists filled in as they received the request. The requests were mostly given by telephone. In all, 49 requests were gathered in 1996 and 59 in 1997. The objective of the analysis of requests was to clarify the subjects of interest to journalists, bearing in mind that they express only the compromised needs [see 24] of journalists. In addition, because the requests were recorded by archivists they may not be in the original form as expressed by the journalists.

## 4 Photo Needs and Searching Behaviour of Journalists

### 4.1 Characteristics of the Illustration Processes

In *Aamulehti*, illustration is integrated into writing, editing and lay-out tasks. The journalists' work is characterised by tight schedules and unexpected changes in daily plans. We found that in daily routines, they did not seem to have much time to find "the best" photo. Rather they tended to make acceptable selections. The effort devoted to illustration, generating and evaluating ideas, searching for candidate photos and selecting the one to be published depended on time available and on the status of the photo on the page.

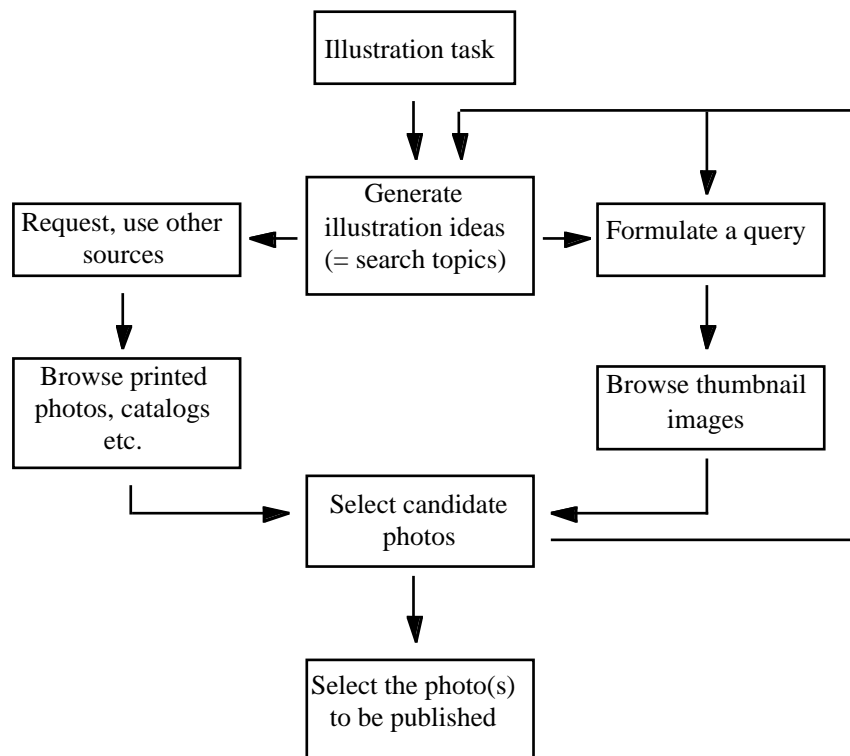
The observed behaviour indicated that the journalists often had many ideas in mind when they were looking for an illustration. The illustration of an article is a fairly open task, even though a photo is sought and selected for a particular article. Broader considerations such as the section and page lay-out also restrict the options for illustration. However, photos are often rich in elements and they may be used in various contexts and in many ways. As Ørnager [18-20] observed, photos are not always tied to the subject of an article. The function of the photo may be also to evoke associations. Furthermore, a photo may be made to fit the article by using only selected parts of it or by creating the associative link between the text and the photo in the caption [e.g. see 12]. In some cases the empty space on page can be filled by any "neutral" photo, text or graph.

There appeared to be differences in illustrating *news articles* and *feature articles*<sup>3</sup>. The differences were based on two dimensions: time span and objectivity. Speed is essential in reporting news events and photos of these events are needed urgently. Photos used to illustrate news are mostly current *documentary photos* and there is little time or space for developing illustration ideas. The main point is that the photo should represent the particular event that the article is reporting. These photos, when searched for in the archive, are searched for in the cache archive, to which photo agencies send photos relating to daily news. Feature articles are typically less date dependent and more subjective. They often provide more opportunities for illustrations than news articles. *Symbolic photos*<sup>4</sup> and *photos of themes* are often used to illustrate feature articles. *Portraits* are the most common photo type in a newspaper issue. According to journalists' comments the portrait is the easiest and quickest, but often the most boring way to illustrate an article.

After creating ideas, the journalist either searches for the photo in the archive or gives a request to the archivist. (A model of the illustration process is given in Figure 2.)

<sup>3</sup> The categorisations of different article types in the textbooks are various [for example, see 16]. For the purposes of this study it is sufficient to make a rough distinction between current news and other articles called here feature articles. According to the Vocabulary of Journalism [13] the feature articles are less date dependent and more general in their view than the news. They are often human interest articles.

<sup>4</sup> The definition for a symbolic photo is problematic. Symbolic photos are often considered a photo type. On the other hand, according to Miettinen [16] photos of news events and themes are symbolic if they contain drama and symbolism!



**Figure 2: A Model of the Illustration Process**

## 4.2 Photo Needs

The main focus of requests sent to archivists and search topics originated in the illustration tasks observed fell into four main categories:

1. concrete objects
2. themes interpretable from the photo
3. background information
4. known photo

The first category deals with photos of concrete objects like people, buildings or places. In the second category the main focus of journalists is on themes or abstractions interpretable from the photo. The third category deals with the photo's background information. Journalists are looking for photos that document something. Topics like specific news events and films and television programmes were included in this category. The fourth category deals with a known photo or series of photos, which are usually searched for or requested by publishing time, shooting date, place or the photographer.

Most requests received by the archivists were for photos of objects and presented in the form of proper names (Table 2). Almost half of all requests were for persons (e.g. "Mr. Olli Keskinen, face"). Other specific requests were mostly for buildings (e.g. "the Alexander school building, outside view") and geographic locations (e.g. "Rauma Old Town"). Some 20% of requests were made in the form of common nouns referring to objects. These objects were various, most frequently animals ("cow in the pasture"), vehicles ("a good photo of the front part of a bus") and people ("clergyman wearing bands").

Some 8% of requests were for themes (e.g. "gesture language"). Some of these requests were constructed by examples (e.g. "a photo of the savannah in Africa, a lion, giraffe or other wild animals or of the Serengeti" or "symbolic photos of medicine, for example a snake or diseases"). Some 8% of requests focused on the photo's background information. Half of these concerned films and television programmes searched for by the titles of films or names of directors. Half of the background requests were for news events, for example, "a photo of the repatriation of Russian war prisoners to the Soviet Union after the counterattack" and "a photo of the completion of the Näsideula scenic tower in 1971". Three requests were for a particular photo or series of photos. For instance, a journalist requested "the photos taken in Hervanta suburban market place last summer".

#### 4.2.1 Distribution of Requests

Topic type	n (N=108)	%
<i>Objects</i>	87	81
Proper names	64	59
Persons (49)		
Buildings, Geographical locations etc. (15)		
Common nouns	23	22
<i>Themes</i>	9	8
<i>Background information</i>	9	8
Events	4	4
Films, television programmes	5	4
<i>Known photo</i>	3	3

**Table 2: Distribution of Requests Received by the Archive**

The distribution of requests is in line with Ørnager's [18-20] results, where half of the requests were for persons (here 45%). To compare our results to Enser's [4-5] results, some classes must be combined. Enser's 'unique' category corresponds to objects expressed by proper names, background information and known photos. The 'non-unique' category corresponds to objects expressed by common nouns and themes. The results seem to support Enser's findings: 'unique' requests account for 70% of all requests.

More than a half of the requests were refined [see 4] by some technical or contextual criteria or criteria relating to the subject of photo. The most frequently used criterion was colour, reflecting the fact that old archives also include black and white photos, which are seldom wanted nowadays. The creation year of the photo was used frequently as well as expressions "current shots" or "old photos". A few requests were refined with cyclic time expressions, for example "a summer photo of Lake Näsijärvi". However, according to the archivists the season of the year is an implicit criterion. Even though archive photos are used, the journalists want to give an impression of actuality. Hardly ever are photos of other than the current season published. Shooting distance was also a common criterion and close-ups were most often desired. Horizontal or vertical direction of a photo was an uncommon criterion.

Refinements relating to the subject of a photo were attributes of main objects (e.g. "fish, extremely big", "judge wearing a wig"), places involved ("cow in the pasture") and action taking place (e.g. "the cork of the champagne pops"). The expression "symbolic" was also used frequently, especially in the category of themes (e.g. a symbolic photo of torture"). In all, criteria varied from concrete to highly subjective. For instance, one journalist requested for "a photo of a fur animal who doesn't want to relinquish its fur, wild or in captivity"!

The comparison of requests and photos finally published in the newspaper showed that not all the criteria journalists expressed in their requests need to be met to get the photo published. Furthermore, the comparison revealed that photos may be used in various ways, for example, as a model for a drawing, which was not expressed in the requests.

#### 4.2.2 Distribution of Search Topics in Observed Illustration Processes

The search topics occurring during the observed illustration processes were categorised in the same way as requests (Table 3). Most search topics (56%) concerned objects and especially persons, like the actress Julia Roberts. The category 'other objects' included only two search topics: a named building (the University of Tartto) and a named jazz band. Five topics fell into the category of themes, for instance, "holidays in the south". The seven search topics in the category 'background information' mainly concerned news events.

The small share of requests concerning news events (only one of current news in the sample) suggests that these photos are quite easily found in the archive (mainly among the daily photos in the cache archive) by the end users themselves. On the other hand, the journalists observed did not search for photos of objects defined by common nouns although one fifth of requests fell into this category. Few journalists expressed interest in such photos in the idea stage but they did not put these ideas into practice. Named persons were requested and searched for at an equal rate.

Topic type	n (N=27)	%
<i>Objects</i>	15	56
Proper names	15	56
Persons (13)		
Other (2)		
Common nouns	-	
<i>Theme</i>	5	18
<i>Background information</i>	7	26
News event	6	22
Films, etc.	1	4
<i>Known photo</i>	-	-

**Table 3. Distribution of Search Topics in Illustration Processes Observed**

The journalists interviewed stated that the types of search topics we defined are common and that they had had such search topics recently. However, in the interviews the journalists emphasised photos of abstract themes. These received much attention, presumably because journalists consider searching for these problematic while searching for photos of specific objects or news events was regarded as quite simple. The journalists also mentioned topics that are quite subjectively interpretable from photos. These concerned atmosphere and feelings, e.g. "love" or "a photo of a child's anxiety". Such topics were not found among the requests sent to the archivists. Their absence may be explained by the journalists' statements that it is easier to search for this kind of photo by themselves than to try to explain the topic to the archivist and "*after an hour you get a stack of photos which are totally wrong*".

### 4.3 Searching Behaviour

*"There may always be a better photo beyond the next click"*

Different types of search topics produced different kinds of searching behaviour. General search topics easily led to multiple sessions, various queries and heavy browsing. Specific needs led more likely to just one or two querying and browsing sessions. However, heavy browsing was necessary when the retrieved sets were large, e.g. 300 photos of Bill Clinton.

When a search consisted of multiple sessions, each session was an attempt to find useful images using a particular viewpoint or strategy. We found that the journalists did not pay much attention to selecting search keys or formulating a query. Different options or approaches recognised by the user were tested on a trial-and-error basis. The first search keys were often picked from the article to be illustrated. The journalists tended to make single-word or single-phrase queries. Both English and Finnish were used in searching. Because the number of retrieved thumbnails was usually large, it was common to restrict the query by date or by photo source. Use of date also reflects the fact that current photos are most desirable for the newspaper. Restricting a query by the photo source relates to cost factors. Different photo sources have different charging policies.

Most recorded queries were based on proper names of persons, countries, cities or buildings. Proper names were commonly used for searching for photos of given persons, places or buildings as well as for photos of news events. These were usually searched for and found by the scene of the event or by the participants' names.

Journalists also tended to convert general photo needs into more tangible queries. The journalists interviewed confirmed that they preferred proper names for terms referring to abstract concepts. They explained that it was easier to find photos through the names of persons, places or events and that sometimes they could not find photos when applying abstract concepts. The selection of search keys for abstract concepts was considered difficult. Journalists presumed that there were photos relating to these abstract themes in the archive, but they just had not discovered the right search keys to retrieve them. Sometimes they suddenly ran across photos of themes they had searched for before; sometimes they could not find a photo they had recently seen in the archive. Journalists claimed that they did not even consider illustrating with photos of themes when they had not time for a lengthy searching process.

Journalists described the alternative search strategies applied to find photos for general photo needs. They might try to remember earlier published photos of the current theme and search for a known photo (or a photo in the same series) with search keys relating to the subject of the article. Another strategy was to query by words relating to the background information of a photo. For instance, one of the journalists interviewed explained that he used search keys like 'rubber currency' or the names of some Indian tribes to find a photo of a rain forest.



Browsing was used a lot since single-key queries often retrieved large sets of thumbnail images. Journalists claimed that the general search keys and heavy browsing reflect the conception that very narrow queries exclude the best photos from the set. Journalists stated that they would rather have a set of 50 thumbnails than a set of five thumbnails. They also found that browsing often required less effort and time than formulating a refined query.

However, heavy browsing was not always considered a desirable choice. Sometimes journalists did not find any other way to locate a suitable photo. For example, two journalists mentioned searches for photos connected to places. These journalists had recently illustrated feature articles; the first of which was about travelling by hot-air balloon in Africa while the second dealt with Britain and British people. Both journalists had made queries of the same type: "*africa*" and "*britain*". The first journalist got over 500 thumbnail images and did not have time to browse through them. The journalist querying "*britain*" got some 2000 thumbnail images and, because he had time, he browsed through them. The result set of the latter searcher included, for example, all photos shot somewhere in Britain and most of these were obviously irrelevant.

The browsing threshold varied according to the journalist and the work situation: most journalists reformulated the query (usually by restricting by date) when the retrieval set was over 100 photos. Willingness to browse was dependent not only on time, but also on motivation. When a journalist truly wants to find the perfect photo for a particular article (s)he might browse a surprisingly large number of thumbnails.

Browsing was particularly common for journalists working in the foreign affairs and sport sections. These sections used a lot of photos of news events sent to the cache archive by international photo agencies. Journalists browsed the cache every now and then to check the newly arrived photos. Browsing was a way to gain insight into the daily photos. In news sections it was also common that queries became more specific during the day, because journalists learned the words by which the desired photos were described in the captions.

During each session, one or more candidate photos were selected. They were printed on paper or kept in mind and re-retrieved later. Candidate photos were compared and finally one was selected. The final selection might occur much later than the search and it was not always done by the person who first selected the candidate photos. One journalist explained his selection method as follows:

*"If I have some six photos, I may put them side by side on the table and leave them there for the rest of the evening (...) then it just turns out that this is the one. In a way they drop out automatically."*

Journalists did not exploit all the options the system offered for searching. First, they did not exploit the database field structure, which is one reason for the large and unfocused result sets. For example, the journalist searching for photos of Tom Cruise got as many photos of Cruise's actress wife as of the actual search topic. Second, journalists did not exploit the thesaurus, which led to problems when they were searching for photos of themes. The journalists could not find terms used in indexing and therefore missed relevant photos. The utilisation of database field structure and thesaurus required the use of the advanced search form, which the journalists considered too complicated to use.

#### 4.4 Selection Criteria

One goal of the study was to explore the criteria journalists apply in the selection of photos, i.e. when assessing the relevance of retrieved photos. It is widely agreed that relevance is a multidimensional concept and that the user's relevance criteria are situational and dynamic in nature. [E.g. 21]. Topicality is identified as one criterion among others. However, it can be seen as the core of relevance, the first step users take in their relevance judgements [8].

This study indicates clearly the diversity of the relevance criteria which journalists apply in selecting photos and the situational nature of their relevance judgements. The first criterion journalists applied was *topicality*. As stated earlier, the queries made by the journalists were often too general to properly restrict the set of photos in terms of topicality. The associated caption text seemed to be the most important source of information in judging the topical relevance: even though the photo looked relevant, the journalist needed to know what was really happening in the photo and what its background was.

After the topical relevance was ensured journalists applied more criteria. The *technical* and *contextual attributes* of the photo were assessed. Some of these criteria were applied quite generally. For example, the preference for technically good, not recently published and current photos (sometimes, though, the journalists were looking particularly for old photos) is likely to be common for most journalists. The cost of the photo was also an important criterion. It is dependent on the photo source, which the journalists usually checked when rating photos.

The selection criteria relating to the *visual attributes* of photos were closely connected to the individual illustration tasks. Sometimes the article type and style demanded photos in a particular style. For example, anniversaries, appointments, etc. were illustrated with "*passport photos*", as journalists called formal portraits. In

some cases the persons in the photo should not be recognisable. Often the message the journalist wished to convey through the photo was stated explicitly as a selection criterion. Journalists felt that these criteria were quite difficult to verbalise. They explained their choices either abstractly "*the photo provokes thoughts*" or more concretely "*because there are fleeing people*" or "*the photo underlines that she (Sharon Stone) is a star*". They used expressions like *dramatic, surprising, effective, shocking, funny, expressive, humanity* and *threat* as explanations for their selections. Photos of persons were selected, for example, on the following basis: "*lively*", "*attractive look*", "*funny gesture*" and "*you can hear what they think*".

The journalists paid much attention on the freshness of the photos. They rejected photos constantly by stating that they were "*typical*". According to journalists typical photos are of "*politicians* and *handshaking*", they are "*portraits*" and photos where "*persons pose*".

In the last selection phase, when the journalist selected the photo to be published from the candidate photos the selection was based solely on the visual attributes of the photo. At this point, candidate photos were supposed to be topically, technically and contextually acceptable. The *aesthetic attributes*, for example colour and composition, were also said to play an important role at this stage. The critical criteria for rejecting or accepting a photo depended on earlier selections. A photo already chosen on a page or nearby pages restricted the possibility of using other similar photos. Photos used recently in the newspaper were also kept in mind. According to journalists the goal is to make the illustration of the page attractive, balanced and dynamic. To achieve this there should be photos of different types (horizontal and vertical photos, portraits, group photographs, action, themes...) and with different visual features. Even small details mattered. The direction of a man's movement or look in a photo could lead to the selection of one photo and to the rejection of another.

The criteria and the importance of different criteria seem to depend on the work situation. The factors affecting the selection criteria are related to the article, the lay-out, the page as a whole, the section and its illustrative style, the whole newspaper and its editorial policy and the ethical rules journalists follow. When asked, the journalists interviewed could mention only one criterion which is always crucial when selecting photos: the technical quality of the photo.

## 5 Conclusions and Discussion

The objectives of this study were to ascertain the requirements for a digital newspaper photo archive where journalists conduct searches by themselves. The whole illustration process from the creation of ideas to the selection of photos was investigated. This made it possible to ascertain the type of photo needs typical for journalists, their searching behaviour and the criteria they apply in selecting photos.

As far as we know this is the first published study where end-users of a digital photo archive were investigated while searching for and selecting images in real work situations. The study was made comprehensive by exploring entire illustration processes as well as tasks and work situations related to these processes. On the other hand it consisted of a few unique cases in one newspaper, which makes us cautious in making generalisations. This preliminary study outlined an overall picture of a vast field and, though, much remains for further research projects.

### 5.1 Needs for Photos

The analysis of photo requests sent to the archivists and topics searched for by the journalists themselves emphasised the role of photos representing concrete objects like named persons, buildings or places. The results support the findings of Enser [4-5] that specific photo needs dominate the use of photo archives. In end-user searching, the share of topics dealing with recent news events and abstract themes was larger than in requests sent to the archive. On the other hand, the journalists did not search for photos of concrete objects defined by common nouns even though a fifth of requests was of this type.

The interviews provided some explanations for the searching and requesting behaviour adopted. Photos of named persons are often needed. The journalists considered proper name queries easy to do. This is obvious, since names (especially the names of persons) are quite specific and standard search keys and they are already indexed exhaustively in captions. Occasionally proper name queries retrieve excessively large thumbnail sets because newspaper archives typically hold many photos of certain public figures. Photos of current news events are easily found since these photos are searched for from the small cache archive. The ease of proper name querying may also explain the tendency to use proper names as search keys for photo needs not directly dealing with named objects.

The journalists emphasised the importance of photos of themes and would have liked to use them more. Searching for photos in this category was regarded as difficult. However, the share of searches focusing on themes was greater in self-made searches than in requests sent to the archive. Especially if the atmosphere or feelings associated to a photo were essential in an illustration task, the journalists expressed lack of confidence in mediated searches. The greater share of self-made theme searches may also be due to the iterative nature of end-user searching [see also 7]. When journalists explain their needs to archivists the search topics become more

tangible while searching by themselves makes it possible to be more explorative and rely more on browsing.

To find photos of generic objects (for instance, anonymous persons, animals, plants) the journalists seemed to trust the help of archivists more since they commonly requested such photos from the archivists. In the illustration processes observed a few journalists expressed ideas concerning such photos but they did not ultimately put these ideas into practice. An explanation for the difference in trusting the archivists is that the problem in searching for photos of concrete objects is mainly associated with guessing the right search keys. The archivists are more likely to succeed since they selected and indexed the photos in the collection. In searching for photos of themes, and especially when symbolic value, atmosphere and feelings are essential, the nature of the illustration task and the way the photos are interpreted is crucial. Very different photos may be relevant in a particular context and attempts to transfer the ideas to the archivist may be seen as a waste of time.

## 5.2 Querying and Browsing

The user interface of the *Aamulehti* photo archive was too complex for the non-professional searchers, creating an obvious bottleneck at the query formulation stage. The journalists used only the simple search form giving them two options: (1) input a Boolean query and (2) limit by date. The latter option was supported by pre-defined menu. The advanced search form offered the whole set of fields supported by the system in entering and selecting specified search keys.

The archivists classified the photos by subject and theme using a thesaurus. The thesaurus was interfaced to the advanced search form as a hierarchical selection menu. Unfortunately, the journalists did not use the advanced search form, which was deemed too complex. This fact may partly explain why the end-users felt uncomfortable with searches focused on themes or objects defined by common nouns.

The journalists mainly entered single word or single phrase queries. This worked quite well if photos of named objects were needed, since in most cases the resulting sets of thumbnail images were small enough for browsing. In other types of needs, single word queries did not always give an appropriate starting point for browsing. Either the search key did not find the relevant photos or the set of retrieved thumbnail images was too large for efficient browsing.

The results of this study suggest that browsing is an essential strategy in retrieving photos, supporting the earlier observations of Batley [1]. First, some criteria used in selecting photos are difficult to express by words but are easily applied when the photo is seen. For instance, they are based on a high level visual interpretation of a photo. Second, non-professional searchers have difficulties in formulating focused queries. Browsing is a method to compensate for these difficulties. Third, photo selection criteria depend on a particular work situation. These aspects are difficult to predict in indexing. Fourthly, browsing of thumbnail images is quite efficient and the journalists feel comfortable with browsing. Thus, in photo archives search capabilities should be based more on browsing than querying features.

Although the journalists prefer browsing, there is a limit to the number of thumbnail images worth browsing. The present photo archiving systems (the system investigated as an example) do not sufficiently support browsing. Querying is too complicated for end-users, resulting in large or incorrectly focused query sets. There is no mechanism for structuring the set of retrieved thumbnail images.

## 5.3 Challenges for Feature-based Indexing and Retrieval

The goal of this study was to develop ideas for the potential applications of feature-based indexing and retrieval methods in newspaper type photo archives. These merit investigation, since the development of traditional indexing methods has limited chances of solving the problems of end-user access. This pessimistic view is taken because manual indexing seems to require more resources than are and will be available. The authors do not claim that the development of traditional methods is useless, on the contrary. Some ideas on this subject will be reported elsewhere (forthcoming).

Automatic visual indexing and retrieval methods are currently working reliably on low-level attributes of images such as colour, texture, shape and spatial location. In the semantic-level retrieval, i.e. retrieval of object types or individual objects, progress has been more limited. Eakins [3] sees this approach as feasible in fairly restricted domains.

At first sight, the results of this study are not very favourable for feature-based indexing and retrieval methods in this application area: (1) Low-level visual features were not expressed as the main search criteria in any of the search topics analysed. (2) In nearly half of the search topics, the main focus was not on the objects seen in the photo and could not be extracted automatically from the photo. The focus was on the background information (e.g. a particular news event) or abstract themes requiring high human reasoning [3]. (3) In most searches for photos of named objects, text-based querying worked well.

A more thorough analysis reveals that the situation is not so poor for automatic visual methods. The journalists in our study used a digital photo archive supporting traditional textual query operations. Thus it is difficult to predict how they would change their searching behaviour if they could execute queries based on visual similarity of photos. However, it is difficult to envisage common uses for pure visual query without

textual search keys combined. The first problem is how to formulate a visual query. Usually this requires that something desired, a query image, has already been found. The size of newspaper image collections and the heterogeneity of images in these collections might make this approach problematic. However, querying by image might work in some special cases, when photos searched for have some very distinct features (for instance, photos of sailing boats at sea). The authors take the view that the main chances of applying automatic visual methods are associated with the browsing stage of photo searching.

The easiest way to make the query stage more effective in those topic categories which caused difficulties to the journalists is to apply traditional concept-based indexing and classification methods and develop user interfaces to support browsing. The selection of theme-based sub-sets from the database for browsing should be made convenient. If browsing tools are efficient users will be able to process larger query sets and rough classification schemes can be applied, thus making manual indexing a straightforward task.

Automatic feature-based methods could be applied in structuring the set of thumbnail images retrieved by keywords or index terms. The point is, within the retrieved set, to group visually similar photos together and organise the output by these groups. In that way the user can see different photo categories contained in the retrieved set. For instance, if the user has made a query using a person's name, the visual organizer could group the "passport" photos, single portraits, photos also containing other people and photos with special backgrounds.

Our prediction is that automatic visual methods combined with textual querying could offer a more solid base than visual methods alone for developing practical applications for environments similar to newspaper photo archives. Current methods of feature-based indexing could be applied for grouping query results to make browsing more effective. In the future we shall test this approach and investigate how useful journalists find these groupings and how they exploit this feature in browsing.

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# End-User Searching Challenges Indexing Practices in the Digital Newspaper Photo Archive

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**Abstract:** Previous research in conceptual indexing methods of images has furnished us with refined theoretical frameworks characterising various aspects of images that could and should be indexed using textual descriptors. The development of digital image processing technologies has bred a brigade of content-based indexing and retrieval methods available for applications. What the users need and in what kinds of environments different indexing and retrieval methods are relevant, has remained an area of less intensive research work.

This article presents the results of a field study concentrating on journalists as users of a digital newspaper photo archive. The expressed photo needs, applied selection criteria and observed searching behaviours in journalists' daily work were contrasted with the indexing practices applied by the archivists. The results showed that the journalists achieved satisfactory results when trivial query terms were available, e.g. when photos of named persons were needed. Browsing was the main searching strategy applied by the journalists, but the system did not support browsing well. The access problems faced by the users in particular photo needs are discussed in detail. The paper concludes by discussing the potential approaches in developing both the concept-based and content-based indexing methods as well as the user interfaces in photo retrieval systems.

## 1 Introduction

Advances in digital imaging technology have raised growing interest in the storage and retrieval of images and the requirements which image users address to retrieval systems. Operational digital archives are quite new a phenomenon and a little explored area of research. Relatively little is known about user needs, searching behaviour and the use of images.

Two main approaches are available for the indexing and retrieval of images. Operational retrieval systems usually provide access by exploiting textual representations describing various attributes of images. Much research has concentrated on identifying possible image attributes for conceptual indexing (e.g., Brown & Hilderley 1996, Jørgensen 1995, Jørgensen 1996, Jørgensen 1998, Markey 1986, Shatford 1986, Turner 1994) but less is known about conceptual indexing as a practice or how searchers define their needs for images and exploit indexing in real search situations.

The other approach is based on automatic content-based indexing of the visual image features (for reviews, see e.g. Eakins 1996, Enser 1995, Gong 1998, Gupta & Jain 1997). Despite the vast research on these technologies they have achieved a sufficient level of performance only with low-level image attributes such as colour and texture. In semantic-level retrieval, i.e. when we are interested for example in types or individual objects in the images, progress has been limited (Eakins 1996). Some commercial products are currently available (e.g. Image Surfer, QBIC, Vir Image Engine). Many applications have emerged in specific domains such as trademark images (e.g. Mehtre & al. 1998). However, we are still waiting for evaluation studies on how useful these technologies are for users retrieving images in practical work situations.

In this article, we consider the photo needs, photo selection criteria and searching behaviour of end-users as well as the indexing practices adopted by a newspaper photo archive. Digital technology has quite dramatically changed the storage and retrieval of newspaper photos. Every day large volumes of photos are transmitted from various sources through networks to newspaper archives. Journalists, graphic designers and other editorial staff are expected to exploit digital collections directly. The focus of photo archivists' work is shifting from searching to selection and indexing of photos for the archive. Fast growing collections and direct end-user access present new challenges for indexing and retrieval methods.

The aim of the study was to ascertain the end-user requirements for digital newspaper photo archives. Journalists' requests in newspaper photo archives has been studied by Ørnager (1995, 1996). However, her data are based on requests sent to manually operated archives. Our data were collected in a digital photo archive environment. To our knowledge this is the first study drawing on users' experiences in such

environment. Moreover, we interpret the findings from the viewpoint of digital image archive design.

By contrasting the indexing practices with the needs and requirements expressed by end-users we wanted to identify possible problems and find solutions to improve end-user access to photos. Both the development of indexing and retrieval methods based on textual representations of images and potential applications for content-based methods are discussed on the basis of the results.

The article is organised as follows. Section two reviews studies on concept-based indexing of images, image requests and searching behaviour in image collections. Section three introduces the research environment, data and methods. In section four, the indexing practices adopted in the archive are described. Section five sketches out the tasks and photo needs of end-users, searching behaviour adopted and photo selection criteria applied by journalists. Indexing practices and end-user requirements are contrasted and the problems identified in end-user access are reported in section six. In section seven we draw conclusions and discuss potential solutions to the problems identified.

## **2 Indexing and searching for images**

Earlier research on concept-based indexing of images<sup>1</sup> has concentrated on exploring and outlining theoretical frameworks (Brown & Hilderley 1996, Markey 1986, Shatford 1986). Jørgensen (1995, 1996, 1998) and Turner (1994) have investigated how humans perceive and describe images. The actual indexing practised in image archives has been given only little consideration (Ørnager 1995, 1996). Some studies have focused on user needs by categorising and analysing search requests received by the archivists (Armitage & Enser 1997, Enser 1993, Keister 1994, Ørnager 1995, Ørnager 1996). A few papers have addressed searching behaviour in digital image collections (Crehange et al. 1989, Batley 1998). A comprehensive review of the literature on image indexing and retrieval has been presented by Rasmussen (1997).

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<sup>1</sup> In this paper, the term 'photo' is used to refer to photographic representations documenting objects and events in reality (see Turner 1994). A term 'image' is used to refer to a superclass, which covers not only photos but also, for example, art images.



## **2.1 Concept-based indexing**

Some theoretical frameworks for image indexing have been proposed. For instance Brown and Hilderley (1996), Markey (1986) and Shatford (1986) have proposed different sets of attributes and levels of meaning for indexing. From the practical point of view a framework or template developed for indexing purposes should direct the indexer's focus while (s)he investigates an image and, thus, increase the consistency of indexing. However, the applicability of such frameworks has seldom been verified with empirical tests.

The work of the art historian Erwin Panofsky (1970) has had a major impact on the theoretical developments in image indexing. Panofsky's theory of three levels of meaning was first adapted by Markey (1986) and then by Shatford (1986), who introduced a faceted classification of image attributes. According to Shatford, viewing an image within four facets, namely, Objects (Who), Activities and Events (What), Place (Where) and Time and Space (When), it may be interpreted to represent both concrete and objective entities (ofness, e.g. objects, places, actions) and abstract and subjective entities (aboutness, e.g. feelings, concepts manifested or symbolised by objects). Moreover, she stated that an image is simultaneously specific and generic. For example, an image of the Brooklyn bridge is at the same time an image of a specific bridge, i.e. Brooklyn bridge and an image of a bridge.

Shatford's work as well as other studies on image indexing have convinced us that images are rich in elements and that fundamentally there are many possible attributes and levels of meanings to index. Indexing them all would mean a great level of detail. Thus, two important questions need consideration: (1) how the levels of indexing exhaustivity and specificity (for term definitions, see Soergel 1994) are selected in practice under given constraints (time, personnel) and (2) which aspects in the frameworks are important for the users of a particular image collection.

Indexing practices have been explored by Ørnager (1995, 1996) who interviewed and observed archivists in 15 Danish manually operated newspaper archives. Ørnager's study showed that archivists conducted detailed indexing of a photo only if they 90% thought it was necessary for finding it later. Archivists often utilised associated texts for indexing if these were available. Captions written by photo agencies were an important source of information for indexing the context of a photo. The archivists

stated that they commonly used specific names in indexing. All said that they index themes. Indexing of atmosphere or feelings expressed in a photo was also found to be important although only one half of archivists confirmed that they actually indexed these attributes.

A special characteristic of newspaper photos is that they are usually accompanied by related texts, e.g. captions and articles. Doubts have been expressed about the suitability of captions for query matching: captions are of varying quality, often short and present only one interpretation of the image subject (e.g. Enser 1995, Price & al. 1992). However, neither the quality of captions nor the retrieval performance of natural language querying on captions has been studied extensively in large, general type image collections.

## **2.2 User needs for images**

Some field studies on user requirements have been reported to date. Typically they explore requests received by archivists in manually operated archives. Enser (1993) categorised almost 3000 requests received by the Hulton Deutsch Collection. In Enser's typology, requests fell into two main categories: (1) unique requests of specific entities, events, locations and (2) non-unique requests expressed with generic concepts. Most requests fell into the unique category (69%). This was particularly the case among the requests from newspaper and magazine publishers (70%). Requests in both groups were often refined with time, location, event or technical criteria.

Keister (1994) grouped requests received by the Archive of the National Library of Medicine in two groups: (1) visual requests, in which the user constructs the image by defining what should be seen in it and (2) topical requests with unspecified visual requirements (e.g. cholera in France in the 19th century). She found that one third to one half of the requests were of the first type.

Ørnager (1994, 1995, 1996) interviewed archivists and observed journalists formulating their requests to clarify the needs of newspaper journalists. According to the archivists, one half of requests were simple, concerning persons, and another half dealt with themes. Ten per cent of requests were defined as complex requiring an in-depth interview.

The study by Armitage and Enser (1997) took a slightly different methodological approach by conducting a facet analysis of the concepts in the photo requests instead of grouping the requests as a whole. They examined almost 2000 requests using Shatford Layne's framework as the facet template in their analysis. The seven image collections from which requests were collected embraced still and moving images and various domains. Results from this study support the earlier findings in that the specifics were most often needed: the highest number of concepts fell into the facets of individually named concrete objects and places. The terms referring to object and event types were also common. Kinds of places and specific time definitions like dates and time periods also occurred while cyclic time expressions and all the concept incidences on the 'about' level facets were few.

The results of request-based studies are quite difficult to summarise because of differences in the nature of collections studied and different typologies in classifying requests. However, we may conclude that images of named entities (persons, other concrete objects) and events as well as types of entities seem to characterise typical expressed user needs. An interesting observation made by Keister (1994) is that a large proportion of requests was topical. This means that the need is not defined in terms of the content of the image but rather in terms of its context or background. The parallel existence of content-oriented and context-oriented image needs is a challenge for indexing methods. A particular image may be relevant to both types of needs.

Request-based user studies have shown the multitude of users' search criteria and provided some basis for identifying attributes of images that should be considered in indexing. However, these studies typically deal with needs as expressed to archivists. The users of images might not be very familiar with the collection which may affect the way in which the needs are expressed. Further, a request is a static expression of the user's need while the creative and iterative nature of image searching has been assumed, for example, by Crehange et al. (1989) and Shatford Layne (1994). Little attention has been paid to relevance criteria applied in the selection and use of images. Thus, on the basis of studies regarding requests it is hard to judge what conclusions are warranted for indexing methods in digital, direct access photo retrieval systems.

## **2.3 Searching behaviour**

Some papers have stressed the importance of browsing as a search strategy in image collections (Batley 1988, Besser 1990, Crehange et al. 1989, Shatford Layne 1994). However, the searching behaviour of users has not been studied with users in real work task situations. In the experimental study by Batley (1988) searchers were offered tools for three different searching strategies: (1) random browsing, (2) specific browsing, where a user first selects an area of interest and then continues by browsing and (3) searching with descriptors from an indexing language. The study established that the use of browsing increased as the specificity of a given task decreased. Descriptors were used most in searching for images of specific topics. For general needs all strategies were applied equally frequently. Abstract (e.g. love) and subjective (e.g. beautiful image) search topics mostly led to random browsing.

Indexing, querying and browsing in digital image collections is a triangle that has not been studied yet. If we assume that browsing is a more essential access method in image retrieval than in text retrieval, it should have some consequences for the applied indexing methods. The challenge is how indexing is developed to support browsing as a self-contained access method to images.

## **3 A Field study**

### **3.1 Research objective**

The aim of the study was to ascertain the end-user requirements in a newspaper photo archive. By contrasting the indexing practices adopted in the archive with the needs and requirements expressed by end-users we wanted to identify possible problems and find solutions to improve end-user access in photo archives.

To ascertain the indexing practices adopted by archivists we observed

- the characteristics of the indexing task
- sources of information exploited in indexing
- rules and principles followed in indexing
- photo attributes indexed
- the specificity of indexing

To ascertain the photo needs and requirements of end-users we observed

- the characteristics of illustration tasks in the news room
- search topics expressed
- searching behaviour adopted
- photo selection criteria applied

### **3.2 Research environment**

The study was conducted at *Aamulehti*, the second largest newspaper in Finland. At *Aamulehti*, the digital photo archive came into use in spring 1996 and in summer 1997 it contained already over 83 000 photos.

The archive is divided into a photo cache archive and a permanent archive. Photos are scanned by photographers or sent by photo agencies to the cache archive where they are kept for three weeks. About 20% of these photos are archived in the permanent archive. This includes all published and selected non-published photos. Selection of unpublished photos is mainly done by the archivists.

At *Aamulehti*, the photos for the newspaper issue are searched for and selected by journalists, sub-editors, lay-out designers and other editorial staff, called from here on journalists<sup>2</sup>. Journalists have access to the digital photo archive at their terminals and usually they conduct their own searches. A few journalists do not use the digital archive directly yet and sometimes active end-users also send requests to the archivists. The storage and retrieval system in use is NewsLink<sup>3</sup> which is based on the TRIP fulltext retrieval system. The text archive containing published newspaper articles runs on the same system and came into use a few years before the photo archive. This may reflect on the searching styles adopted by journalists in searching for photos. The archive is integrated into the lay-out programme so that photos can be called up straight to the page under construction.

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<sup>2</sup>In the *Aamulehti* newspaper, the writing journalists do also layout design. Similarly, the persons primarily responsible for the lay-out design conduct also editorial tasks: they edit ready-made texts, make titles and captions etc. In the newsroom, there seems to be a tendency to merge some professions earlier separated.

<sup>3</sup>by Job Systemintegration AB, Sweden.

Each record in the photo archive consists of the high-resolution image, a low-resolution copy of it, a thumbnail image and a set of textual descriptions.

NewsLink supports Boolean queries in the fields of textual descriptions. Queries can be formulated by using either a simple or an advanced search form (Figure 1). The simple search form provides a field for entering Boolean queries and a menu for selecting time limits (the date the photo arrived in the cache archive), which makes it easy to restrict the search to the newest photos only. The queries entered to the simple search form are matched to all fields of textual descriptions. In the advanced search form, searchers can restrict the query to only those fields wished. The advanced search form also offers on-line menus of three-level theme classification (Figure 2).

Figure 1. Simple and advanced search forms of the NewsLink system in Aamulehti (texts translated into English by the authors).

Query results are displayed as a set of thumbnail images (Figure 3). The size of the thumbnail images is fixed but the user may resize the window and thus decide how many of them are displayed at a time. Any double-clicked thumbnail image is

enlarged in a pop-up window. The caption of the activated thumbnail image is shown in the bottom left corner of the window. More information is found in the pop-up windows.

**Advanced Search**

Query Statement \_\_\_\_\_ Result \_\_\_\_\_

Record Date: From \_\_\_\_\_ To \_\_\_\_\_ Creation Date: From \_\_\_\_\_ To \_\_\_\_\_

Query: \_\_\_\_\_ Photographer: \_\_\_\_\_ Caption: \_\_\_\_\_ Portraits: \_\_\_\_\_

Name: \_\_\_\_\_ Source: \_\_\_\_\_ Name: \_\_\_\_\_

ID: \_\_\_\_\_ Country: \_\_\_\_\_ Free Description: \_\_\_\_\_ Status: \_\_\_\_\_

Status: \_\_\_\_\_ Field: \_\_\_\_\_ Organisation: \_\_\_\_\_

Country: \_\_\_\_\_

Restrictions: \_\_\_\_\_

Publishing Date: From \_\_\_\_\_ To \_\_\_\_\_

Thumbnail Images

**Classifications**

Level 1: Traffic, Geography, Law, Accidents, Education, Politics, Art & culture, Economics

Level 2: Ideologies, Independence, Int. politics, Nat. crises, Nat. politics

Level 3: Int. aid, Int. diplomacy, Int. cooperation, Int. conferences, Int. crises, Neutral countries, Power politics, Foreign poitics

Selected index terms:  
Politics / International politics / Foreign Politics

Cancel OK

Figure 2. The online thesaurus in the advanced search form. Selection of a term from the first (or second) level displays the narrower terms at the next level. (Texts translated into English by the authors.)

### 3.3 Data and methods

The data for this study were collected in the *Aamulehti* archive and news room in summer 1996 and spring 1997. The methods and data are described in detail in Markkula and Sormunen (1998).

The data concerning illustration was gathered by observing journalists in their work and by interviewing them. In addition, a sample of photo requests received by the archivists was analysed. In the archive, the behaviours of three archivists selecting

and indexing photos was observed. A theme interview was conducted. In addition, captions of 60 photos were analysed.

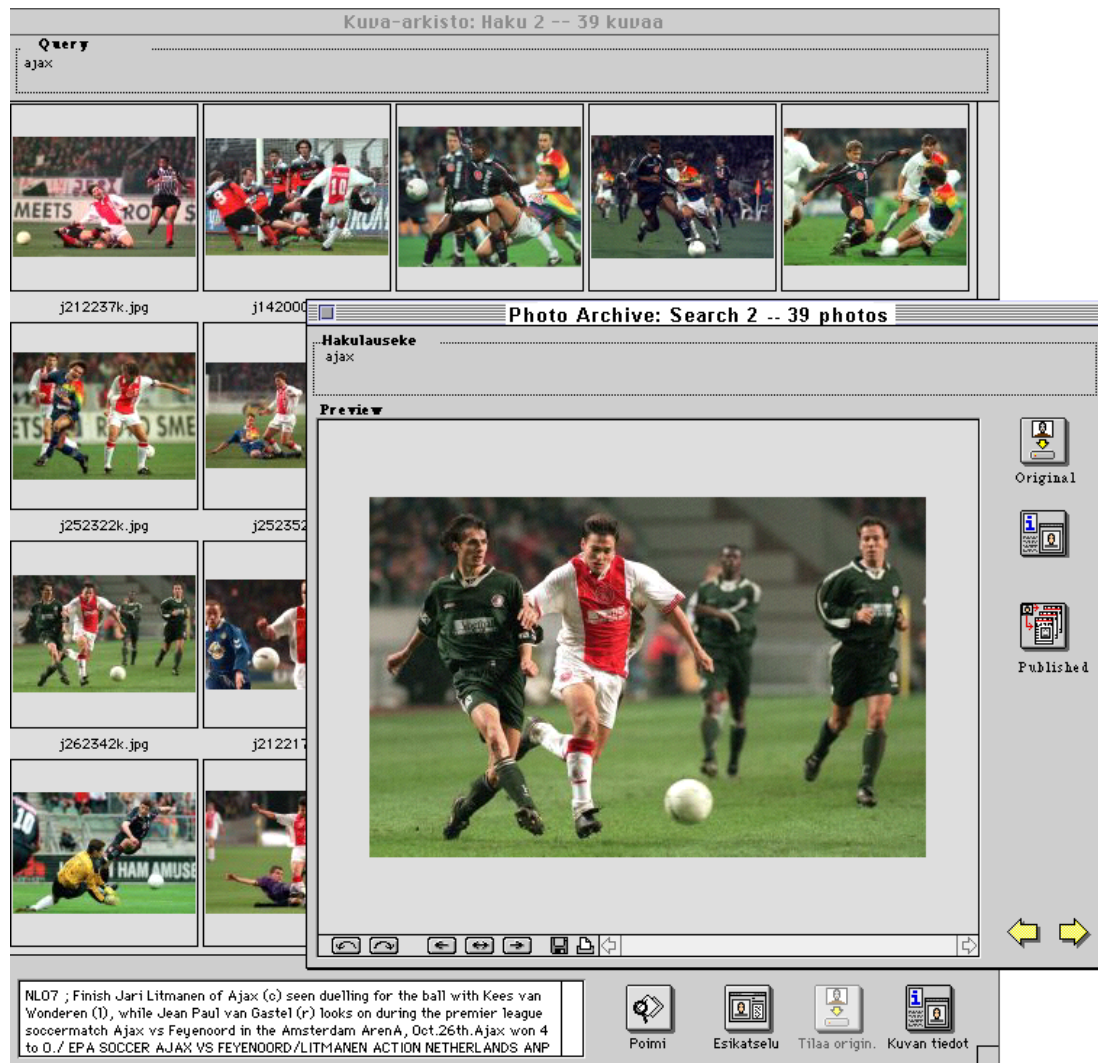


Figure 3. Query result window and an enlarged photo in a pop-up window.

The observations were conducted in a participative manner. The observer followed subjects work in their offices. The subjects explained what they were doing and were probed for details if necessary. The utterances of subjects during conducting illustration or indexing were tape recorded and actions taken written down.

In the newsroom, the processes of 20 illustration tasks conducted by eight journalists were observed from the creation of ideas to final selection of photos to be published. The illustration processes observed related to the eight editorial sections displayed in Table 1.



Editorial section	Number of illustration processes observed (N=20)	Number of search topics (N=27)
News sections: Economics, foreign affairs, front page, sports	7	8
Current affairs sections: culture, current affairs, Sunday supplement	7	10
Pull-out supplement (deals mostly with TV, films and music)	6	9

*Table 1. Number of illustration processes observed and search topics occurring in different editorial sections.*

In total, 27 search topics originated from the 20 illustration tasks. because some tasks involved different searching ideas. For example, if a journalist said that a photo of Bill Clinton and a photo on the theme of nuclear power were optional photos for an article, these were considered as two search topics.

The aim of the theme interviews was to check if the observations were in line with the views of the subjects. Secondly, the interviews were designed to help in explaining the observed behaviour. Thirdly, the subjects had the opportunity to express their views on the archive. Interviews with three journalists (a group discussion with two journalists and a separate interview with one journalist) and a group interview with two archivists were conducted.

A sample of 108 photo requests sent to the archive was collected by questionnaires, which the archivists filled in as they received the request. The requests were mostly given by telephone. The objective of the analysis of requests was to clarify the subjects of interest to journalists, bearing in mind that they express only the compromised needs (see Taylor 1968) of journalists. In addition, because the requests were recorded by archivists they may not be in the original form as expressed by the journalists. In summer 1996 many journalists were still familiarising themselves with the archive and requests were quite often given to the archivists. The archivists estimated that in spring 1997 the rate of requests had decreased to one third from that in summer 1996.

## **4 Results of indexing practices adopted**

### **4.1 Characteristics of incoming photos**

Photos arrived in the cache archive from two types of sources: from photo agencies and from photographers working for the newspaper. Photos from agencies were associated with international and national news events while the newspaper's photo production mostly dealt with local events. All incoming photos were supplied with (1) technical information, (2) information on photo source, at least the photographer and the agency, and (3) caption.

The captions written by photo agencies usually described in a fairly concrete manner what the photo represents (when, where, who, what) and the news event it is associated with. Most international photo agencies produce this information in a standard way (see IPCT-NAA 1993). The captions in the analysed sample were quite specific in the description of different photo attributes. If the specific name of an object, event or place was described in the caption, the generic terms of those attributes were typically neglected. Moreover, overall themes, feelings and atmosphere were rarely described in captions. A typical caption by an international photo agency is shown in Figure 4.

The newspaper's photographers attached information of varying exhaustivity to their photos. The captions were typically less comprehensive than those of photo agencies. According to the archivists, the captions written by photographers was often insufficient for indexing or retrieval purposes. Instead, the captions made in photo agencies were considered quite good.

### **4.2 The photo indexing process**

As mentioned earlier, all published photos were archived and some non-published photos were selected from the cache archive for the permanent archive. The published photos were identified by browsing the newspaper issue and retrieved from the archive by keywords picked up from the published caption or the illustrated article. The selection of unpublished photos was made by browsing the daily set of photos.

All the incoming photos were already supplied with some descriptive texts. Archivists edited these descriptions, translated keywords into Finnish if necessary and added

supplementary indexing before transferring the photos to the permanent archive. Only a couple of minutes were available for indexing each photo.



[AMERICA'S CUP] New Zealand's Black magic leads Young America as they sail downwind on the second leg of the Americas Cup Saturday, May 13, 1995 in the waters of San Diego. New Zealand won the America's Cup 5-0.

*Figure 4. Photo and caption by EPA.*

The photo itself and the texts associated with it (e.g. captions, articles if the photo was published) were the main sources of information exploited in the manual indexing process. The associated texts were used to identify and describe the specific entities (for example, the named persons, buildings and places) and the associated news event. The photo itself was examined for identifying details and more subjective attributes, which are usually disregarded in journalistic texts but which archivists found worth indexing.

The often insufficient captions written by the in-house photographers made indexing laborious. The archivists had to search through various sources (e.g., ask journalists, use encyclopaedias, retrieve associated articles from the text archive) for information needed in indexing.

Even though photo agencies made quite exhaustive captions and indexing could be based on these, the English language caused some difficulties. Understanding captions and translating keywords into Finnish demands quite good skills in English. The

archivists sometimes had to consult dictionaries. The transliteration of proper names from English to Finnish was sometimes problematic and the text archive was exploited in checking the Finnish spellings.

### 4.3 Tools and principles for indexing

The indexing interface (see Figure 5) of the NewsLink system provided a framework for indexing. The form offers in total 39 fields, which are arranged so that the fields containing the same type of information are grouped together.

The screenshot shows a web-based indexing form for a photo archive. The form is titled "Photo Archive: Edit photo no. 1293 in database Presskuva". It is organized into several sections, each with a label and arrows pointing to the relevant fields:

- Technical information:** Resolution (dpi) 72, Size (kB) 341, W / H Pixels 1472 \* 2000, Width (mm) 519.28, Height (mm) 705.55, Colour system Color, Format JPEG.
- Archiving information:** Note, Original, Archiving date (1995-08-06), Deleted, Country, Organisation, Other.
- Publishing information:** Name (a9526931.jpg), ID, Series, Status, Publ. date (0 / 0), Publication, Ed., Suppl., Page.
- Source information:** Photographer (Paul Sakuma), Source (AP Photo), Country, State, City, Copyright, Restrictions, Photo type.
- Subject information:** Caption (HIROSHIMA ANNIVERSARY Sunrise view of the A-Bomb Dome at Hiroshima's Peace Memorial Park, early Sunday), Free description, Thesaurus (Primary).

At the bottom right, there is a large "Archive" button. The form also includes various control elements like "Delete", "Edit...", "Add...", and "Insert..." buttons.

Figure 5. Indexing form in the NewsLink system.

Several fields are designated particularly for the subject information. Besides the 'caption' field, the fields 'free description', 'country', 'person' and 'organisation' are available for entering free text. A thesaurus is available for controlled indexing and searching for themes. The thesaurus mostly covers abstract themes (e.g. economy) but also some object classes (e.g. vehicles). The thesaurus was originally designed for indexing news articles. Indexers and searchers can exploit it by selecting themes from an on-line menu. However, for searching this feature is available only in the advanced

search form and currently the interface only allows the use of the three highest levels of the thesaurus hierarchy.

The archivists did not fully exploit the field structure of the system in indexing. When indexing photos coming from photo agencies, keywords were mainly entered to the 'free description field'. When indexing the newspaper's own photo production, the archivists mainly used the 'caption field' in indexing. To save time they often did not re-type the keywords already existing in captions to other fields. The archivists stated that it would have been important to exploit the field structure but felt that they wasted time by duplicating words.

The indexing policy in the archive did not seem to be well formulated. The principles followed were agreed upon in a few meetings of archivists. The brief rules recorded on paper were quite general stating that the 'free description' field was designated for describing concrete objects represented in the photo while thesaurus terms should be used for conceptual indexing. The instructions further advised that the 'person field' should be used for portraits of named persons to separate these from other photos with persons. The 'organisation field' was considered unnecessary in the context of photos because the organisation usually relates to the portraits and is described in the person field. The instructions recorded seemed to rely on the indexing practices applied in indexing news articles. For example, the 'country field' was recommended for a photo if it could be used to illustrate an article focusing on a particular country.

According to the archivists the basic principle in indexing was to be objective and concentrate on the concrete content of the photo. Indexing of more subjectively interpretable attributes like atmosphere, moods or symbolic meanings was not encouraged. The archivists stated that they aim at a description similar to a standard caption. They stated that first they identify and describe the concrete objects represented in the photo, second the context information and last they classify the photo with a thesaurus term.

#### **4.4 Image attributes indexed**

According to the observations and interviews all the facets presented in the framework by Shatford Layne were used at least sometimes in indexing. The most often used index terms referred to specifics, i.e. to individual objects, places, events

and linear time; and to the theme of the photo. Terms referring to types of objects, places, events or action and cyclical time expressions were used less. However, this reflected also the distribution of types of photos in the collection. A large share of photos was of persons.

The main concrete objects seen in the photo were described regularly. While the captions usually contained only proper names, the archivists also used common nouns and sometimes added synonyms in describing concrete objects. The archivists indexed details if they were considered important, e.g. if the photo was selected for permanent archiving on that basis. The observation showed that archivists also entered names in the 'person' field in the context of other photos than portraits (e.g. group of persons in a photo). Attributes of objects were sometimes indexed.

Specific events were usually already named in captions. Archivists added terms describing types of events (e.g. "music festival"). Actions taking place were often described in captions but by archivists only when seen as a major aspect in the photo (e.g. "Czechs celebrate the victory...").

Places described were most often geographical and terms used in indexing mostly proper names of regions, countries and cities. When local places were concerned terms referring to very specific locations, for instance street names, were also used. However, in indexing specific geographical locations the archivists seemed to have some problems since a term referring to a geographical location may represent various photo attributes:

- the shooting location, which is an attribute of the photo and not necessarily represented in it (e.g., indoor photos)
- the place concretely represented in a photo (of-level)
- the place symbolised by other attributes represented in the photo (about-level)

The instructions gave little help in identifying and indexing other attributes concerning places than the shooting location. The archivists found it difficult to decide if the of- and about-levels were represented in a photo. Even though the 'country' field was designated for indexing the of- and about-levels, names of places were often entered in the 'free description' field. The indexing of types of geographical places did not cause similar problems, since these terms usually refer to

only one aspect: the of-level. However, types of places were quite seldom indexed and mostly in the context of scenery or landscapes.

Terms referring to time may also represent various photo attributes. The shooting date was described in captions and transmitted to the appropriate field by the indexers. Other time attributes were indexed more rarely. Seasons or times of day were indexed only when seen as special characteristic of the photo (e.g., a night scene of a city). The about-level was indexed by archivists when easily identified (e.g., young lovers in photo symbolising spring). Confusingly, in the captions the time of day was often mentioned, even when not seen in the photo (e.g. indoor photos). Captions also included terms referring to time aspects relating to the news event (e.g. the date of the forthcoming elections).

The overall theme or topic of the photo was considered important to index and the archivists stated that they index themes whenever possible. The observations support this statement. The thesaurus was used for indexing themes if appropriate terms could be found, otherwise archivists entered keywords in the 'free description' field. The thesaurus was claimed to be too elitist including, for example the term 'art exhibitions' but not terms for snake (!) or agricultural exhibitions or fashion shows. It was also criticised for being more suitable in indexing the context than the content of photos.

Often the index terms used were mainly associated with the photo's context, not the actual content of the photo (e.g. "budget" when in the photo the Minister of Finance is getting out of a car). Themes indexed referred frequently to the domain of the news event (e.g. "economic policy"). In addition, persons, countries and organisations involved in the news events but not presented in a photo were indexed sometimes.

As stated earlier, the basic principle in indexing was to be objective and focus on the concrete content represented in the photo. However, the line between concrete and abstract or between objective and subjective is not obvious in actual indexing situations. As one archivist expressed her uncertainty "I don't know if that's objective or concrete, but that's what I see in the photo". The archivists stated that there is no need to index atmosphere, moods or symbolic meanings since journalists can interpret these aspects from photos when browsing. The archivists also said that the journalists should themselves think of the concrete attributes which could symbolise the desired

subject. Nevertheless, the observations revealed that they described these “soft attributes” whenever effortlessly depicted. A thesaurus term or keyword “symbolic photo” was added, but inconsistently, if the archivist classified the photo as symbolic. For example, the following text was written in the ‘free description’ field of the photo in Figure 6 (translated by the authors): “Ministers bow to Yeltsin at the Conference table. Symbolic photo of power and subservience.” The caption text by the photo agency is below the photo.

#### **4.5 The consistency of indexing**

The output of the indexing process seemed to be quite inconsistent. This is natural since the instructions for photo indexing were general and the goals of indexing were not very clear to the archivists. One indexer favoured whole sentences, and having a descriptive style produced detailed indexing. Another indexer relied on keywords and described only the main attributes.

The subject domain of the photo appeared to affect the exhaustivity of indexing. The photos of familiar topics were obviously easier to the indexers and more detailed descriptions were attached to these than to the others. The quality of captions also affected the indexing result. The more information there was available in the captions the easier it was to produce more exhaustive indexing.



*Figure 6. A description of a photo classified as symbolic (photo and caption by EPA).*



An obvious consistency problem is that controlled indexing was applied only to a share of photos. Thesaurus terms in traditional sense may not be appropriate with some photo types, e.g. portraits, but also the inadequacy of the thesaurus, loosely defined indexing practices and insufficient resources in the archive may be the reasons for missing index terms. The inconsistent use of thesaurus terms and the record field structure (see section 4.3) have serious consequences. Neither the users nor the system developers (e.g. in designing user interface) can exploit the advanced features of the database or the thesaurus if indexing practices are not consistent.

## **5 Needs and searching behaviour of journalists**

### **5.1 Characteristics of the illustration process**

At *Aamulehti* newspaper, illustration tasks are integrated into writing, editing and layout tasks. Work in the newsroom is characterised by tight schedules. We found that, in daily routines, journalists did not seem to have much time to find “the best” photo. Rather they tended to make acceptable selections. The effort devoted to illustration, generating and evaluating ideas, searching for candidate photos and selecting the one to be published, depended on time available and on the status photos would have on the pages.

The behaviour observed indicated that the journalists often had many ideas in mind when they were looking for an illustration. The illustration is a fairly open task even though a photo is sought and selected for a particular article and larger contexts as the page layout restricts the options. However, photos are often rich in elements and they may be used in various contexts and in many ways.

There appeared to be differences in illustrating news articles and feature articles. Speed is essential in reporting news events and photos of these events are needed urgently. Photos used to illustrate news are mostly current documentary photos and there is little space or time for developing different illustration ideas. The main point is that the photo is of the particular event that the article is reporting. Feature articles are typically less date dependent and more subjective. They often provide more scope for illustrations than news articles. Photos with symbolism and photos of themes are often used to illustrate feature articles.

After creating ideas, the journalist either searched for the photo in the archive or gave a request to the archivist. Requests were also given after unsuccessful attempts to find desired photos. The illustration processes observed seemed to follow a model outlined in Figure 7.

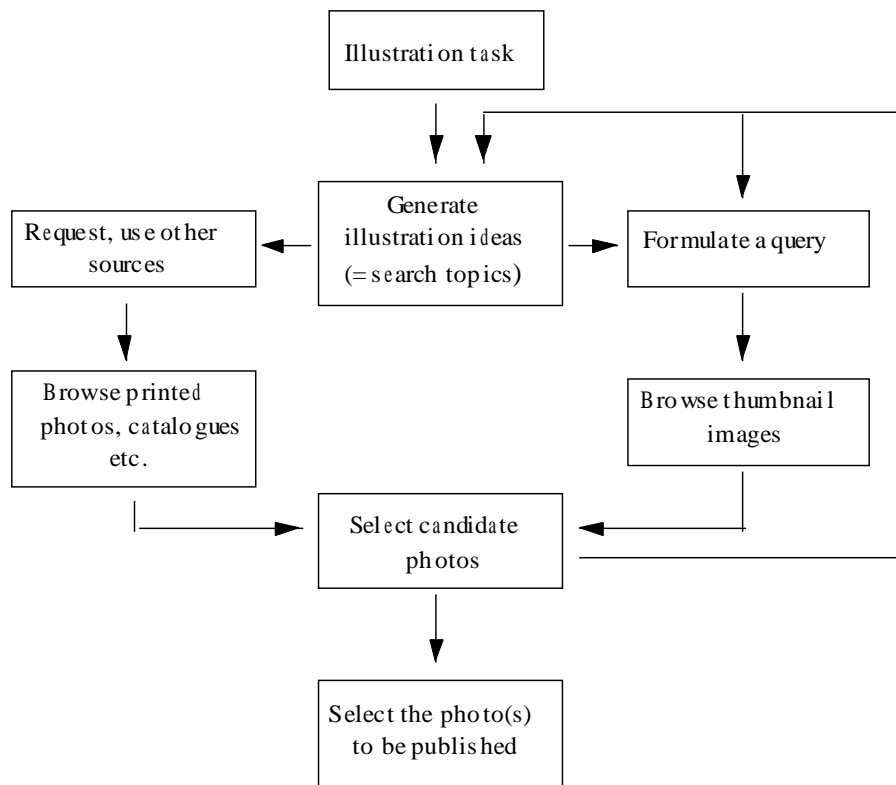


Figure 7. A model of the illustration process

## 5.2 Searching behaviour

An illustration process often consisted of many search sessions in which a journalist tested different ideas, viewpoints or strategies. Different types of illustration ideas (i.e. search topics) expressed by journalists produced different kinds of searching behaviour. General search topics easily led to multiple queries and heavy browsing. Specific needs led more likely to just one or two queries and browsing sessions.

When a search consisted of multiple sessions, each session was an attempt to find useful images using a particular viewpoint or strategy. We found that journalists did not pay much attention to the selecting search keys or to formulating a query. Different options or approaches recognised by the user were tested on a trial-and-error

basis. Typical queries were single-word or single-phrase queries and based on proper names of persons, geographical places or buildings.

Journalists also tended to convert general needs into tangible queries. They explained that it is easier to find photos with proper names than with words referring to object types or abstract themes. The selection of search keys for general search topics was considered difficult. Journalists presumed that the archive contained photos relating to topics of interest, but they just had not discovered the right way to retrieve them.

According to the observations, browsing was an essential strategy used by journalists. The journalists claimed that very narrow queries might exclude the best photos from the result set. They also found that browsing often required less effort and time than formulating a refined query. The browsing threshold varied according to the journalist and the work situation: most journalists reformulated the query when the result set was over 100 photos. However, sometimes more than one thousand photos were browsed. Willingness to browse was dependent not only on time available but also on the motivation to find a particularly good photo.

During each querying and browsing session, one or more candidate photos were selected. They were printed on paper or kept in mind and retrieved later. Candidate photos were compared later and finally those to be published were selected. Final selection might occur much later than searching and it was not always done by the same person who first selected the candidate photos.

The journalists did not take advantage of all the system features. First, the database field structure was ignored, which was one reason for the large and unfocused result sets. Furthermore, the journalists did not use the thesaurus, which led to problems when they were searching for photos for general needs. The utilisation of database field structure and thesaurus required the use of the advanced search form, which the journalists considered too complicated to use.

### **5.3 Search topics**

Results concerning user needs support the earlier findings by Armitage and Enser (1997), Enser (1993) and Ørnager (1995, 1996) in that specific needs dominate the use of newspaper photo archives (see Table 2.). Most search topics expressed in the requests and in illustration processes observed dealt with concrete objects represented

in photos and most of these were for named objects and particularly for persons. One fifth of requests was for types of objects. These were most frequently animals (“cow in the pasture”), vehicles (“a good photo of the front part of a bus”) and people (“clergyman wearing a collar”). In the illustration processes observed the journalists did not search for types of objects although few journalists expressed such needs at the idea stage.

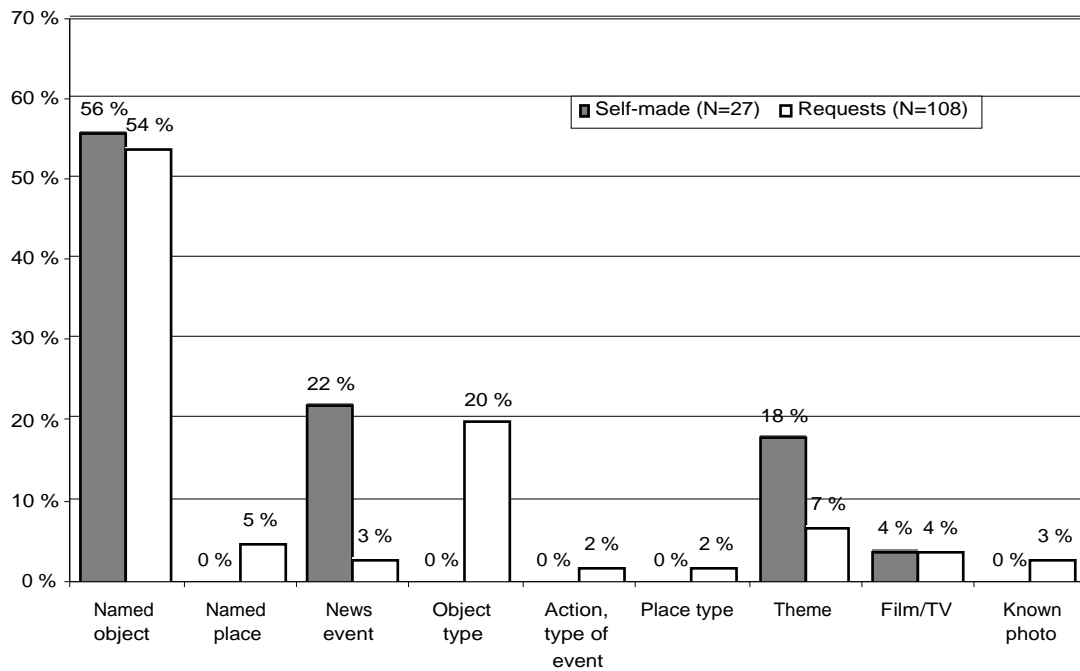


Table 2. The distribution of search topics expressed in requests and in illustration tasks observed according to their main focus.

The second common search topic type concerned documentary photos of events, that is, the photo’s context information was mainly in focus. In the illustration processes observed this group covered almost a third of all search topics and all dealt with recent news events. The small share of requests concerning events and only one of a current news event in the sample suggests that these photos are quite easily found by the end users themselves.

Photos of places were rarely requested and most of these were for individually named geographical locations (e.g. Rauma Old Town). In the end-user searches observed, search topics concerning places were lacking. In the interviews, the journalists reported difficulties in finding photos representing named geographical locations.

Themes or topics (e.g. “holidays in the south”, “child care at home”) covered less than ten percent of requests but in end-user searching almost a fifth were of this type. Few requests and search topics in the illustration tasks observed concerned films and television programmes, which seemed to be easily found by the titles of films or names of directors. In three requests the journalists were looking for a known photo.

In the interviews, the journalists emphasised the needs for photos dealing with geographical places, types of objects and themes. These received much attention, presumably because journalists considered searching for these problematic while searching for photos of specific objects was regarded as a trivial task. The journalists also mentioned search criteria which were quite subjectively interpretable from photos, e.g. “young love” or “a photo of a child’s anxiety”. Such search topics were quite uncommon among the requests sent to the archivists even though symbolic photos were some times requested. Their absence may be explained by the journalists’ statements that it is easier to search for this kind of photo by themselves than to try to explain the topic to the archivist and “after an hour you get a stack of photos which are totally wrong.”

More than a half of requests were refined (see Enser 1993) by some criteria. The most frequently used criterion was colour (in a third of requests), reflecting the fact that old archives also include black and white photos, which are seldom wanted nowadays. Shooting distance was a second common refinement in requests and close-ups were most often desired. Time expressions were used in over one tenth of requests. The shooting year of the photo was common as well as wishes for “current shots” or “old photos”. A few requests were refined with cyclic time expressions, for example “a summer photo of Lake Näsijärvi”. However, according to the archivists the season of the year is an important but implicit criterion. Even though archive photos are used, the journalists want to give an impression of actuality in the newspaper issue. Photos of other than the current season are hardly ever published.

To some 10% of requests, refinements concerning attributes of objects were added, for example, “judge with a wig”, “Raimo Helminen wearing the ice hockey league shirt of the Ilves team” or “fish, extremely big”. A few requests were refined with terms of action taking place in a photo (e.g., “the cork of the champagne popping”) or undesired action (e.g., “ice hockey star Teemu Selänne, rather not playing”). Other rare criteria dealt with the photo’s direction (horizontal or vertical), copyright and

source. A few place definitions occurred as well as requests for symbolic photos, for photos where people are not recognisable, where person is alone or two persons are together in the photo.

## **5.4 The selection criteria applied**

It is widely agreed that relevance is a multidimensional concept and that the user's relevance criteria are situational and dynamic in nature (e.g., Froehlich 1994, Schamber et al. 1990). The observations of journalists selecting photos clearly indicate the diversity of relevance criteria they apply and the situational nature of their relevance judgements. The selection criteria related to various factors. These were, for example, the article to be illustrated, the page lay-out, the section's illustrative style, the newspaper's editorial policy and the ethical rules of journalism.

The journalists made relevance assessments during the search session when they browsed the retrieval set and selected candidate photos as well as when they made the final selection among the candidate photos. The first criterion journalists applied during a search session was topicality. The associated caption text seemed to be an important source of information in judging the topical relevance. The journalists consistently read the caption texts of photos that seemed relevant. They needed to know what was really happening in the photo and what its original news context had been.

After topical relevance was confirmed important came the technical and biographical criteria (e.g. photo source, publishing information). The preference for technically good, not recently published and current photos is likely to be common for most journalists. The cost of the photo was also an important criterion. This depends on the photo source, which the journalists usually checked when rating photos.

The criteria relating to impression to be conveyed through the visual attributes of the photo were closely connected to the individual illustration tasks. These criteria were found quite difficult to communicate in words. The choices were explained either abstractly "the photo is thought-provoking" or more concretely "because there are people escaping" or "the photo emphasises that she (Sharon Stone) is a star". Journalists used expressions relating to the atmosphere or feelings expressed by persons in a photo like dramatic, surprising, affective, shocking, funny, expressive,

humanity and threat as explanations for their selections. Often “non-typical photos “ were sought. The journalists explained that a typical photo was of “politicians and handshaking”, they were “portraits” and photos where “persons pose”.

Sometimes the type and style of the article demanded a particular style from the photo. For example, birthday articles were illustrated with “passport photos” as journalists called formal portraits. In some contexts, for example, when the article discussed social problems, the persons in photo were preferred to be unidentifiable.

Even though expressive and also aesthetic criteria, like colour and composition, were applied during the search session, they played the most important role in the final selection phase. At this point all candidate photos had already been found acceptable in terms of topicality, technical quality, novelty, cost and other “basic” criteria.

The critical criteria to reject or to accept a photo depended on earlier selections. A photo already chosen for a page and nearby pages or used recently in the newspaper restricted the possibility to use other similar photos. According to the journalists the goal was to make the illustration of the page attractive, balanced and dynamic. This was achieved by using photos of different types (horizontal and vertical photos, portraits, group photos, action, themes...) and with different visual features in the page. Even small details mattered. The direction of a man’s movement or look in a photo could lead to the selection of one photo and to the rejection of another. The journalists could mention only one criterion which is always crucial when selecting photos: the technical quality of the photo.

## **6 Comparison of indexing practices and searchers’ needs**

The analysis of photo requests given to the archivists and topics searched for by the journalists themselves suggest that needs for photos of named objects (particularly of persons) dominate the use of the newspaper photo archive. These needs were well treated in indexing, since individual persons, buildings and other objects were described regularly by the archivists and also ready in the captions of incoming photos. The journalists considered proper name queries easy to do, which is obvious since names (especially the names of persons) are quite standard expressions for individual objects.

Photos of news events were also easily found by the end-users themselves. Photos relating to current news events are managed by scanning the relatively small set of recently received photos in the cache archive. The news context of the photo is described in the captions and all words in the caption can be used in queries. Typical news events are associated to named persons, organisations, places and specific time giving a natural way for journalists to make simple queries and form a result set suitable for browsing. Thus, searching for photos of the past news events also works out relatively well.

The study showed that the journalists had difficulties especially in the following search types:

- Searching for photos of object types (e.g. animals, plants, anonymous or unidentifiable persons)
- Searching for photos concerning themes (e.g. something about Mafia, economic recession)
- Searches requiring the use of the field structure (e.g. photos of geographical places, portraits) or other restrictive criteria.

## **6.1 Types of objects**

When the journalists were looking for photos of types of objects (e.g. animals, plants, unidentifiable persons), they seemed to rely on the help of the archivists since they commonly requested such photos. In the illustration processes observed a few ideas concerning photos of types of objects were expressed but never really searched for.

The interviews with journalists indicated that they had difficulties in finding search terms retrieving anything relevant or anything focused enough for browsing. In the captions, the objects represented in photos were described mainly by proper names. The archivists used common nouns and sometimes also synonyms in indexing objects. However, the journalists seemed not to utilise synonymous, narrower or broader expressions in querying.

Another problem is that the captions are written in different languages: English, Finnish and Swedish. Even though the archivists add Finnish terms effective searching seems to require the use of foreign languages. The third problem is that



newspaper photo collections and their indexing are news event oriented. These problems imply that there is an obvious gap between the terms associated with the photos and naturally discovered by the journalists.

## **6.2 Themes**

The share of searches focusing on themes was greater in end-user searches than in requests sent to the archive. When searching for photos of themes, the nature of the illustration task and the way the photos are interpreted is crucial. Very different photos may be relevant in a particular context and attempts to transfer the ideas to the archivist may be seen as a waste of time. The greater share of end-user searches regarding themes may also result from the iterative nature of theme searching. When journalists have to formulate their needs to archivists the search topics become more tangible, i.e. topical needs are transformed into concrete objects. End-user searching allows more exploring in the search process.

Nevertheless, the journalists assumed that they often could not find those terms the themes were indexed with. The archivists indexed themes regularly by exploiting the thesaurus whenever appropriate terms were found, but the journalists did not utilise the thesaurus in searching. The thesaurus was embedded in the advanced search form, which the journalists found too complicated to use.

## **6.3 Exploiting the field structure or other restrictive criteria**

Searching for photos of named geographic locations or symbolising those locations appeared to be problematic (for details, see Markkula & Sormunen 1998). The queries often retrieved all photos shot in the place concerned. The field structure for separating different place attributes was not consistently and fully exploited in indexing. In addition, the complexity of the advanced search form impeded journalists from exploiting the discrimination power of the field structure.

Even though the photos of named persons and other objects were easily found the sets of retrieved thumbnail images were sometimes too large for efficient browsing. The newspaper photo archives tend to include many photos of the same topics and particularly of persons. Possibility to exploit relevant criteria in narrowing the query were sometimes needed.

The criteria applied by the journalists in the selection phase and expressed in requests as refinements might be relevant criteria for this purpose. Some of the criteria related to the attributes of the photo itself. Most of these attributes were indexed. For example, photo source, publishing information, shooting year and the date the photo arrived at the archive were described for each photo and in a standard way. The problem is that only some of these were easily exploitable in the user interface. The vertical / horizontal direction of the photo, the shooting distance (e.g. close-ups) and the photo type (e.g. portraits, person alone or with other people) were also commonly expressed selection criteria. Unfortunately these criteria were disregarded or treated inconsistently in indexing.

## **7 Conclusions and Discussion**

Our study contrasted indexing practices and end-user searching in a digital newspaper photo archive. The characteristics of indexing environment were considered by observing indexing practices in real work situations. We also ascertained the types of photo needs typical to journalists, their searching behaviour and the criteria applied in the selection phase. This allowed us to identify problem areas in indexing and searching for photos. However, the study was about one newspaper and one digital photo archive, which makes us cautious in making generalisations.

No clear indexing policy or practice could be found in the archive studied. This seems to be partly due to the insufficient resources allocated to the maintenance of the archive. The study showed that only little time could be devoted to indexing each photo and thus very exhaustive indexing was not possible. This may be typical to media organisations processing huge amounts of photos daily (see also Ørnager 1995). Even though the archivists were aware of some shortcomings (e.g. the inconsistency of indexing or terms lacking from the thesaurus), the time constraints limited the further development of indexing.

The results obtained from the analysis of captions indicate that captions produced by photo agencies are suitable in query matching for some common needs. They were usually of good quality in describing specific objects, events and the news context of photos. Significant differences in the quality of captions between photo agencies were not found. Captions produced by the newspaper's photographers were an exception and often contained imperfect textual documentation.

The results showed that needs for photos of persons and other named objects as well as photos related to current news events dominate the use of newspaper photo archives. This observation is consistent with the earlier results obtained from request studies by Armitage and Enser (1997), Enser (1993) and Ørnager (1995). Our results indicated that these needs were rather well treated in indexing. The problematic area appeared to be in accessing photos of generic object types and themes (see Section 6). Such photos were needed but finding them and formulating queries in these cases was considered difficult. The dominance of specific search topics may partly result from the difficulties end-users had in formulating queries about general topics.

The results indicated that browsing is an essential strategy in searching for photos, supporting the observations made by Batley (1988). Firstly, browsing supported the development of illustration ideas. Secondly, some criteria used in selecting photos seemed to be difficult to express by words but were easily applied when the photo was seen. Thirdly, photo selection criteria depended on a particular work situation. These aspects are difficult to predict in indexing. Fourthly, the journalists felt comfortable with browsing. Thus, the design of indexing practices and the implementation of retrieval system should support more browsing rather than querying alone.

Browsing required sometimes a lot of time and effort. The journalists tended to make single word or single phrase queries, which did not always give an appropriate starting point for browsing. Either the query did not retrieve the relevant photos or the set of retrieved thumbnail images was too large for efficient browsing. The journalists had no means to organise the retrieved sets of thumbnail images. The present photo retrieval systems (the system investigated as an example) do not sufficiently support browsing.

## **7.1 New role of conceptual indexing**

In newspaper photo archives, traditional textual indexes can be produced automatically from the captions and other descriptions associated with photos. This means that all retrieval operations typical of referral databases are automatically available in this type of photo archives. Instead of using scarce resources available in redundant indexing of those attributes already described in captions, indexing by archivists should bring together photos that are instances of broad concepts or themes. From this perspective, the goals of conceptual indexing are clearly different from

those of captions and other associated texts. Conceptual indexing should help in the problems associated to topical queries (i.e. photos of object types and themes).

A traditional solution to the problems of topical queries would be exhaustive conceptual indexing using a domain specific thesaurus. The thesaurus would be organised as a semantic map (e.g. a hierarchy of topics) displayed to the user for browsing or navigation. Unfortunately, a specific thesaurus with a large vocabulary and exhaustive conceptual indexing is not possible in the newspaper environment. Resources required for creating and maintaining a large thesaurus and in applying inclusive indexing policies are not available.

One application could be the allocation of available resources to the development of a domain-specific but generic thesaurus. In this approach, the role of the thesaurus is to enumerate the basic categories to which all photos are assigned. As stated by Fugmann (1993), the size of the collection defines the requirements for the degree of order in it. In large collections, refined query strategies are needed. Based on the basic categories, the user could preselect one or more small sub-collections for querying and browsing. The simple search strategies applied by the journalists could work reasonably well in them. The cognitive effort devoted to indexing would not increase because the thesaurus is small and the vocabulary easy to remember.

Even though the journalists found it difficult to express their general needs with defined queries, they could give examples of possible photos or areas of interest. In such needs browsing is the best strategy. As O'Connor (1993) puts it, there are no fixed starting points or sampling locations in the archive but the collection can be divided into broad portions likely to be more or less fruitful. Conceptual indexing based on broad categories is one method helping to find browsable query sets.

Another goal for conceptual indexing is to compensate for the inadequacies of free-text searching. Soergel (1994) refers to this problem with the viewpoint exhaustivity of indexing. In our data, for instance, the separation of photos representing or symbolising a particular country (e.g. rural or urban scenes) from all those taken in that country was difficult. Other needs to make distinctions were observed between different time concepts (e.g. wintertime photos vs. photos of winter), between unidentifiable and identifiable persons, between different appearances of persons (e.g., face, full portrait, minor role). Soergel points out that emphasising viewpoint

exhaustivity in indexing gives the searcher an opportunity to achieve higher discrimination, but not necessarily at the cost of decreased recall. Unfortunately, expanding and refining indexing practices to this direction will soon lead into a collision with the economic constraints of indexing. The viewpoints applied have to be carefully selected on the basis of user needs analysis.

Indexing of moods, feelings or symbolic meanings depicted from photos seems to be somewhat problematic. It is difficult to anticipate which of the various attributes of objects or details represented in a photo would possibly be important to the users. Indexing all of them would require so detailed indexing that is not possible in practice. As pointed out by Shatford (1986), the interpretation of atmospheres, moods, feelings or symbolism is likely to be subjective. These attributes were indexed in the archive studied only if it did not require extra effort and time, that is, if the atmosphere or symbolic meaning was found obvious. However, the journalists interviewed did not consider searching for photos with desired symbolic meanings or moods particularly problematic. They reported that they often could find photos with search terms such as “love” or “fear”. They also stated that they were aware of problems associated with interpreting and describing these attributes. This result suggests that probably the archivists do not need to worry about indexing symbolic attributes. The users face more problems in other areas of searching.

## **7.2 The user interface**

The study showed that the indexing practices need cultivation. However, in our view the most essential improvement at this stage is to invest on the design of the user interface. Query options based on the produced indexes should be made visible to users. Even though many relevant photo attributes were indexed, the user interface supported only some of these in searching.

The user interface of the photo archive was too complex for the non-professional searchers creating an obvious bottleneck at the query formulation stage. The advanced search form offered the whole set of fields supported by the system in entering and selecting specified search keys. Also the thesaurus was interfaced to the advanced search form as a hierarchical selection menu. Unfortunately, the journalists did not use the advanced search form, which was deemed too complex. This fact may partly

explain why the end-users felt uncomfortable with searches focused on themes or objects defined by common nouns.

The display of all the possible attributes exploitable in querying simultaneously may make the user interface too complicated. Some photo attributes might be left to be utilised only in the browsing phase if the query set is too large for efficient browsing. To solve the display problem, some rating based on user needs is required to rank those indexing features that have to be visible in the first place.

Indexing is not always the optimum stage to solve retrieval problems. One option is to develop user support at the retrieval stage. For instance, automatic query expansion could be applied to help end-users to solve the problems identified in queries of generic object types and themes. A searching thesaurus integrated into the user interface could be a useful enhancement. The negative effects of query expansion are not very probable since the captions are quite compact pieces of texts. One may predict that promising results achieved in some studies (e.g. Kekäläinen & Järvelin 1998) could be reproduced in this environment.

The need to use query terms in a foreign language is a problem that could probably be solved by applying crosslingual retrieval methods. Crosslingual retrieval methods should reduce the need for translating the keywords already present in captions. Promising results have been obtained from the dictionary-based crosslingual information retrieval of newspaper articles by Pirkola (1998) and Ballesteros and Croft (1998).

### **7.3 Content-based indexing: good for browsing?**

The results of this study were not very favourable for applying content-based indexing and retrieval methods in newspaper type of photo archives. Low-level visual features were not expressed as the main search criteria in any of the search topics analysed. In nearly half of the search topics, the main focus was on the context information (e.g. a particular news event) or on themes requiring high-level human reasoning. Indexing on a high level of abstraction is currently possible only by using textual descriptions (see Eakins 1996).

The journalists in our study used a digital photo archive supporting traditional textual query operations. Thus it is difficult to predict how they would change their searching

behaviour if they could execute queries based on visual similarity of photos. However, it is difficult to envisage common uses for purely visual queries without textual search keys combined. The first problem is how to formulate a visual query. Usually this requires that something desired, a query image, has already been found. The size of newspaper photo collections and the heterogeneity of photos in these collections might make this approach problematic. In this kind of an environment, the main chances to apply automatic visual methods are associated with the browsing stage of photo searching.

Content-based methods could be applied in structuring the set of thumbnail images retrieved by keywords or index terms. Within the retrieved set, visually similar photos could be grouped together and the output organised by these groups. In that way the user can see different photo categories contained in the retrieved set. The selection criteria applied by the journalists suggest some idea for organising the image set. For instance, if the user has made a query using a person's name, the visual organiser could group the "passport" photos, single portraits, photos also containing other people and photos with special backgrounds. The applicability of low-level content-based indexing methods in the searching for high-level needs of real users is a question of future research. The approach suggested is further developed in Sormunen, Markkula and Järvelin (1999).

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