# Emerald Insight

## Journal of Documentation

Expeditions through image jungles: The commercial use of image libraries in an online environment

Ayse Göker Richard Butterworth Andrew MacFarlane Tanya S Ahmed Simone Stumpf

## Article information:

## Users who downloaded this article also downloaded:

## For Authors

If you would like to write for this, or any other Emerald publication, then please use our Emerald for Authors service information about how to choose which publication to write for and submission guidelines are available for all. Please visit www.emeraldinsight.com/authors for more information.

## About Emerald www.emeraldinsight.com

Emerald is a global publisher linking research and practice to the benefit of society. The company manages a portfolio of more than 290 journals and over 2,350 books and book series volumes, as well as providing an extensive range of online products and additional customer resources and services.

Emerald is both COUNTER 4 and TRANSFER compliant. The organization is a partner of the Committee on Publication Ethics (COPE) and also works with Portico and the LOCKSS initiative for digital archive preservation.

# Expeditions through image jungles

## The commercial use of image libraries in an online environment

Ayse Göker
*Robert Gordon University, Aberdeen, UK, and*

Richard Butterworth, Andrew MacFarlane, Tanya S. Ahmed and Simone Stumpf
*City University London, London, UK*

## Abstract

**Purpose** – Searching for appropriate images as part of a work task is a non-trivial problem. Journalists and copywriters need to find images that are not only visually appropriate to accompany the documents they are creating, but are acceptably priced and licensed. The paper aims to discuss these issues.
**Design/methodology/approach** – A work-based study methodology and grounded theory are used to collect qualitative data from a variety of creative professionals including journalists.
**Findings** – The authors report the findings of a study to investigate image search, retrieval and use by creative professionals who routinely use images as part of their work in an online environment. The authors describe the commercial constraints that have an impact on the image users' behaviour that are not reported in other more academic and lab-based studies of image use (Westman, 2009).
**Practical implications** – The authors show that the commercial image retrieval systems are based on document retrieval systems, and that this is not the most appropriate approach in the journalism domain.
**Originality/value** – The authors describe the properties of an "information expedition"; the image seeking behaviour exhibited by journalists in an online environment, and contend that it is significantly different to existing image seeking models which represent other user types.
**Keywords** Information retrieval, Grounded theory, Image use, Image retrieval, Work-based study
**Paper type** Research paper

## Introduction

The web has made a huge number of digital images available to users quickly, and comparatively cheaply. There is a range of creative professions which make use of digital imagery, and finding an appropriate, acceptably priced image on a tight, commercially driven timescale is a non-trivial problem. Clearly a major factor in finding a good image is the image retrieval systems that professionals use, and better design of those systems should result from a better understanding of the tasks undertaken by image searchers, their motivations and constraints. Currently creative professionals use a range of image libraries available on the web (described below) to source images from, and a set of authoring tools (Adobe Photoshop, Microsoft Word, WordPress, etc.) to create documents that use those images. In this work we look at the image retrieval task and the libraries and search engines that support that task.

Image seeking and retrieval is often seen as a subset of the broader field of information seeking and retrieval, and likewise image retrieval search engines are typically simply re-engineered versions of document or web page search engines.

In typical image retrieval interfaces users enter a few keywords that they believe articulate their information need, and the search engine returns a list of images, ordered by relevance, that match the keywords. There is obviously no significant difference here between image retrieval and document retrieval. There are, however, significant differences between users' motivations for retrieving images and documents; images are very rarely an information end in themselves, creative professionals such as copywriters and journalists use images to support and illustrate their copy. Given that there are inherent differences between images and documents, this paper presents work done as a wider requirements gathering exercise for a project to develop an image retrieval system that is not simply a derivative of a document retrieval system. The aim of the paper therefore is to characterize the image seeking behaviour of professional image searchers.

The structure of the paper is as follows. The concept of information foraging is reviewed in the light of our aim, and research questions stated. We examine related work in image seeking and retrieval to motivate our study. The methodology we used to undertake the study is then described, with participants and procedure outlined and the data analysis method justified. We then analyse the results from the qualitative data collected. We discuss the implications of the research and a summary and conclusion is provided at the end.

### Information foraging or journeys?

One way to characterize the image search behaviour of professional search is information foraging theory. This theory was first posited by Pirolli and Card (1995) and uses ideas from biology as a metaphor to describe the cost/benefit analysis of users searching for information. Users seek for information in patches (e.g. from a variety of sources, using a variety of mechanisms), have a particular diet (e.g. appropriate sources for the information need) and follow a scent to find information (e.g. web navigation). This widely used metaphor has been used in many areas including image retrieval (Liu *et al.*, 2010). The theory focuses on the general user, but how well does it match the information seeking behaviour of professional image searchers? The position put forward in this paper is that a journey is a better metaphor for these types of users, and we describe the behaviour of such as user "information expeditions", a concept we explore in this paper. In this concept we consider "work" to be that carried out in a high-pressured professional environment such as a newsroom, where deadlines are tight and time is short for the end user. Search goals are defined as finding images within the context of the given work task (getting to a known end point), with search strategies defined as the process (journey) used in the said work task with search criteria defined as the tactics used within search strategies (choosing particular routes or paths).

In this light, our study set out to create a better understanding of the search processes that creative professionals undertake in order to source appropriate images. We seek to answer the following research questions:

*RQ1.* How do professional image searchers form search goals? What influences their decisions about what would be a good and appropriate image?

*RQ2.* What are the contextual and work-related aspects that affect how such users go about searching for images?

*RQ3.* What are the search strategies they use to source images?

*RQ4.* What are the search criteria used to articulate their image needs to search engines?

### Related work

Although there has been a considerable amount of research into image retrieval systems, image indexing and image searching behaviour, most of this work looks at specialised domains and users. There exist very few work-based studies of image users performing tasks in their own environment using image search engines. We very broadly divide related work in image use into two sections: "image seeking" which looks at the human side of the equation; how users understand and interpret images, and "image retrieval" which looks at the system side, in particular how tagging and classification schemes can be used to describe images to support image tasks like search and discovery.

*Image seeking: the user side*

Hollink *et al.* (2004) provide a useful classification for the user (or "searcher") in image retrieval. The "searcher" is said to be influenced by three key factors: the domain within which the user is searching, their level of expertise and finally the specific task the user is performing. The domain in which the task is being performed is influenced by the "breadth of the domain", the "size of the vocabulary" and "levels of expertise". This "level of expertise" is an instance of the main sublevel of the user's expertise, which is their level of their domain-specific knowledge. The searcher's level of expertise will influence their ability to search for images. The "task" includes the "goal", the retrieval strategy and the retrieval method. The retrieval strategy is categorised as "search by association" which can also be described as browsing, "search by category", or could be a "targeted search" where the user is looking for a specific image (Smeulders *et al.*, 2000). We use this categorisation of retrieval strategies in the analysis of our data.

However, "searchers" also have mental models. Heidorn (1999) provides a comprehensive overview of research into mental models in image search. Mental models of users can utilise concepts (people, places, etc.) and content (colour, shape, etc.) information for searching, depending on the domain of work and the available vocabulary. Therefore information processed can be visual (non-linguistic) or non-visual (linguistic). Work in the area includes Matusiak (2006) who investigated the role of mental models in the image retrieval process in digital collections. The search patterns of college students were compared with those of community users and it was found that the students who had more experience of searching for information using the internet found it easier to select keywords, whereas the community users preferred to browse in order to find the same information.

Research into image use includes Choi and Rasmussen (2002, 2003) who looked at historical images, while Goodrum and Spink (2001) looked at image search using a search engine, and Keister (1994) looked at medical image collections in her research. She found that user needs were highly subjective and that it would be difficult to translate these emotional and aesthetic needs to the indexing of images. Ornager (1995) investigated the use of image newspaper archives in Denmark using archivist classifications for queries and establishing term association clusters. Enser (1993) carried out a large scale study of 1,000 image requests received by telephone, and classified them into unique and non-unique request with can be refined or unrefined, in advertising, journalism and printed book domains. Jörgensen and Jörgensen (2005) analyse logs from an image search engine undertaking a quantitative analysis of the session and queries. More recently Westman and Oittinen (2006) looked at image retrieval within the field of journalism and found some interesting behaviour regarding the image searching of journalists and archivists

within this specialised domain. They found that 40 per cent of queries were for a specific person, although there were a significant number of queries for general objects and themes as well. They also showed that image retrieval tasks were greatly affected by contextual factors. Few of these studies refer to real-time pressures on user found in online journalist environments (Markkula and Sormunen, 2000 briefly mention this in passing) and they focus on information searching rather than information behaviour as a whole in environments where there is no archivist or intermediary to assist the seeker.

A key issue that emerges from the literature reported above is the role of the task in information retrieval. Toms (2011) identifies a number of definitions of task including "a piece of work to be done" from the Oxford English Dictionary, and identifies the importance of the process "of getting from goal to outcome that will ultimately determine the success of that final product". Tasks are integrated with the users work (Vakkari, 2001), for example, in the case of the journalist finding an image to fit with a story they are currently drafting. Borland (2000) demonstrates that tailoring work task situations to the relevant cohort is important for end user engagement. There are a number of theories for task based including an influential one derived by Vakkari (2001) based on Kuhlthau's model of information seeking. Fidel (1997) reviews the image retrieval task specifically, and identifies the importance of identifying tasks which require data (e.g. a map to specify a journey – a source of information) and those that require objects (e.g. a specific person or place related to a story). Fidel places tasks on a continuous pole from data to object, with various points in-between (we found evidence of both ends of this pole being used in tasks). Markkula and Sormunen (2000) suggest a process model for illustration tasks, which are focused on retrieving images for articles (we show below that for professionals this search task is broader than for illustration purposes only).

### Information retrieval: the system side
If mental models and tasks broadly describe the user side of the equation, then key to the system side is the descriptions that are attached to images to facilitate their retrieval. Clearly if the descriptions attached to images match the descriptions formulated by searchers' mental models then there is a high chance that searchers will find the images they need (if they exist).

*Metadata: descriptions of images.* Hollink *et al.* (2004) investigated the different types of descriptions given to images drawing on the work of Shatford (1986), Armitage and Enser (1997) and Jaimes and Chang (2000). The research developed a framework for the classification of image descriptions and proposed three levels of image descriptions within image search: the non-visual metadata, perceptual descriptions and conceptual descriptions which clearly rely on mental models (see above). The "non-visual" level includes the following classes: creator, title date, location, material, rights, style, measurements, culture and relation to other images. The "perceptual" level describes the elements in the image itself, the position of these elements and the relative spatial relations between the elements. The composition of the image is one aspect of this level, as is the colour, shape, texture and orientation of the image. No knowledge of the domain is required at this level. Finally the third level is the "conceptual" level that is broken down further into the "general", "specific" and "abstract" conceptual sublevels – the Panofsky-Shatford models modified by Armitage and Enser (1997). Domain-specific knowledge is required at the "specific" conceptual sublevel, and a highly subjective approach is required at the "abstract" conceptual sublevel. The experience of the user

within their work context is critical in understanding how queries are articulated, what search terms are used, how the search process unfolds, and what images are finally retrieved and selected as being the most relevant to their task. We use this framework in the analysis of our results.

A similar theoretical approach to describing images was presented by Shatford (1986) who makes a distinction between the "ofness" of an image; the people, places and objects that are (fairly) objectively present in an image, and the "aboutness" of an image; the more subjective or implicit meaning of an image. For example, an image may be of Winston Churchill, but different viewers will have their own subjective interpretations of what the image is about; it may be about war, politics or aristocracy and so on. Clearly Shatford's ofness and aboutness are analogous to Hollinks's perceptual and conceptual levels.

Ingwersen (1992) defines "aboutness" in a broader information retrieval context as referring to the question "What is this document, text or image about?" Four types of "aboutness" are identified: author, indexing, user related and request. Ingwersen's work is important because it bridges the gap between the user and system sides, defining a concept of aboutness that is relevant to both sides, and makes the link between the user's understanding of aboutness and the system side description of what the image is about clearer.

*Systems for capturing or creating image metadata*. It is also worth noting how the descriptions get attached to the images. Again there is significant difference between documents and images, in that the content of an electronic document is explicit in the document, whereas the content of an image is much more implicit. There has been much work investigating the possibility of automatically extracting the content from images (Smeulders *et al.*, 2000) in order to create "content based image retrieval" (CBIR) systems, however, as argued by Enser *et al.* (2007) there is a "semantic gap" between users' descriptions of images and the descriptions that CBIR systems can extract. In essence CBIR systems can at best capture syntactic descriptions of images, not the perceptual or conceptual levels of description that are important to users.

If automated image analysis cannot create adequate descriptions of images then human cataloguers need to, however, this is obviously problematic as tagging images by hand is very slow, expensive and time consuming. Furthermore, although we could expect a cataloguer to accurately describe the objective ofness of an image, there will still be serious problems describing the subjective aboutness of an image. Crowd sourcing and folksonomies (e.g. Kazai, 2011) and tagging games (Konkova *et al.*, 2014) may be valuable here though, as it should be possible to set up systems where users in the same domains or doing the same work tasks collaboratively tag images, and while those descriptions may be subjective they are more likely to be relevant and meaningful to other users within the same social or work grouping.

*Commercial context and systems*. A range of commercial and open source image libraries and search engines are available, with a range of markets and using a number of metadata schemes for images. Very generally speaking there is a continuum of image providers, where image quality, cost and search functionality decreases between the high and low ends.

The "top end" of the market is served by image libraries like Getty and Corbis. Getty and Corbis trade in high-quality images created by professional photographers. Several other image libraries; Reuters, Associated Press and Agence France-Presse offer professional images specifically for editorial use by news journalists. Generally speaking

these high-end services are subscription based and offer sophisticated tools for cataloguing and retrieving images. Getty's advanced search interface is shown in Figure 1.

"Microstock" sites such as iStockPhoto, JupiterImages, Fotolia and Alamy form a "mid range" set of image libraries. Their content can be supplied by amateur photographers and hobbyists. Typically microstock systems do not offer search interfaces that are as flexible as those offered by Getty and Corbis, although iStockPhoto (which is owned by Getty) does have quite a sophisticated search interface making use of a controlled vocabulary.

The lower end of the market is served by the ubiquitous Google Images and image sharing sites like Flickr and Stock.XCHNG which allow the sharing of images through a creative commons licence. Such sites do not offer sophisticated search functionality or any particular guarantee of image quality, however, they do offer an immense number of images which are likely to be free to use. These systems are used by the participants of this study (see below).

## Methodology

We adopted a qualitative approach adapting the contextual inquiry technique (Beyer and Holtzblatt, 1998) which allows the gathering of indepth data from users within their own
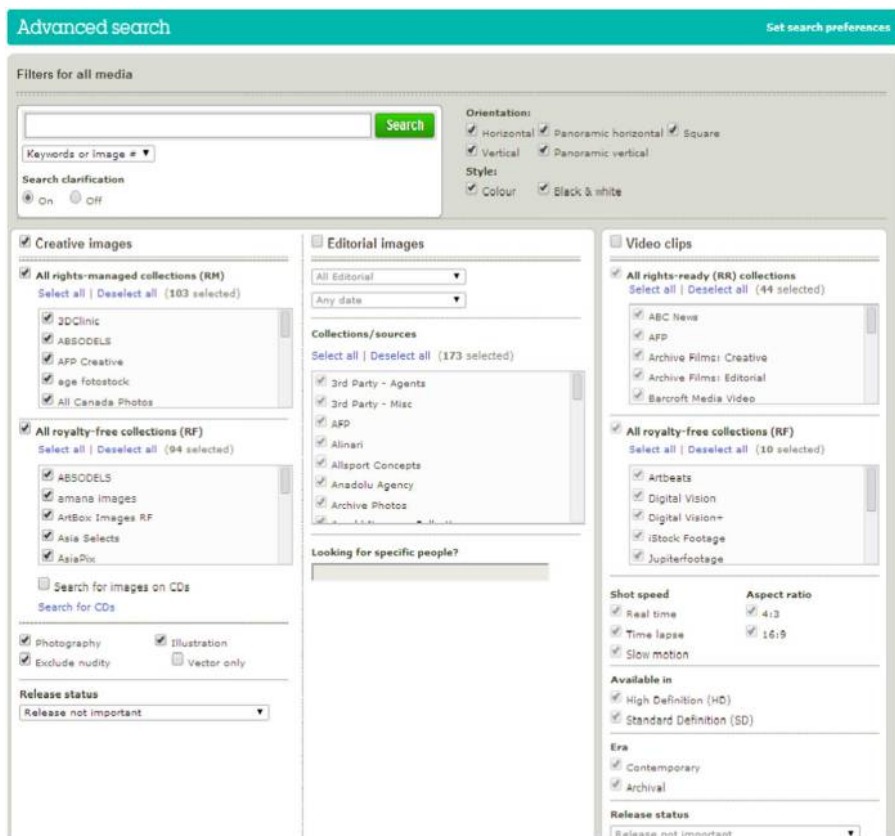


**Figure 1.**
Getty images
advanced search
interface

environment and context, with as little interference from the interviewer as possible. It consists of "shadowing" or observing the user in their own environment, with the opportunity for the researcher to ask questions for clarification. No analysis of data takes place at this stage, thus leaving both the participant and the interviewer free to be more engaged, and at ease, with the process. Contextual inquiry allows the interviewer to see the underlying structure or processes that form the participant's work pattern, where the challenge for the interviewee is "to make the unarticulated knowledge about work explicit" and to "uncover the low-level details of work that have become habitual and invisible" (Beyer and Holtzblatt, 1998). We supplemented this approach with a semi-structured interview to elicit further background information about image search. This work took place as part of a wider investigation into commercial image use which included image consumers, curators and creators. Only the results of the interviews with the image consumers are reported here.

### Participants
In total, 13 participants were observed and interviewed of which ten were image consumers and are reported in this paper. The image consumers were workers at advertising and graphic design agencies (3), bloggers and website owners (3), digital creative agencies (2) and news agencies (2) involved in both print and the web.

### Procedure
The interviews with participants lasted at least one and a half hours each, and were structured into two main parts: an interview and the contextual inquiry of image query tasks. The participants were informed of the "switchover" between the two different parts, as the participant "led" the observation phase of the interview. All of the interviews were recorded to help with the analysis of the data afterwards. The interviewer visited most of the image consumers at their place of work, apart from one participant who worked from home where a neutral setting in the form of a café was used.

In the interview the participants were informed about the project and what the motivations to conduct the interviews were. Questions posed were left as open ended as possible and included the following: their job role and what their work entails, what situations require them to search and retrieve images in their work, the frequency of image search tasks, how they go about finding images, what problems or issues require them to look for images, what criteria they use to select images, what tools they use to achieve this, what keywords are used and where these come from, what problems they encounter (if any) when looking for images, and what might make the search easier and more effective in the future.

In the observation, participants were encouraged to describe the process and context of use in searching for images, using a think aloud protocol whilst undertaking a live search. Users were encouraged to illustrate their searching by using an example from their own work, which allowed them to describe the process they used and how they used images and for what purpose – a real work task as distinction from simulated work tasks described by Borland (2000). The researcher asked questions to clarify issues or to tease out more information as and when appropriate.

### Data analysis
The raw data collected from the contextual inquiry was analysed using a modified grounded theory approach (Strauss and Corbin, 1998), where the findings emerge from

the data itself, rather than the other way round. This is an inductive approach where we move from more specific experiences of those we interviewed, to reveal more general findings that seek to "explain" how users search and retrieve images in their work. Transcripts from the interviews were then analysed, and categories coded included: goals requiring image search; the retrieval specification; and method for the image search (see Table I) (Smeulders *et al.*, 2000), and finally the selection criteria by keywords used (see Table II) (Hollink *et al.*, 2004).

Additionally users' background and level of expertise, applications used and image retrieval sources in the form of image libraries used, were also recorded for all. Issues encountered by users searching for images, which acted as potential barriers to effective search, were also categorised. These issues were subcategorised into internal work dependent issues (domain) and external tool issues (image libraries and other image search interfaces). The coding of the data from all the interviews has allowed us to uncover commonalities between the users' experiences when searching for images.

## Results
### The roles that images play
Images used by creative professionals tend to carry a small amour of objective and perceptual information (they are of one or two people or places) but can carry a significantly greater amount of conceptual, subjective and aesthetic meaning. Plate 1 shows a well-known photo of a protester standing in front of a column of tanks in Tiananmen Square. The perceptual content of the photo is small: a man; some tanks; a road. However, the subjective, implied meaning of the photo is substantial, and indeed whole academic papers have been authored analysing both its meaning and the way that it has been used journalistically and politically (e.g. Lee *et al.*, 2011). Within the context of our work it is a clear example of the sort of image that journalists seek out; simple, clear objective content which can generate a wide range of subjective, complex and information rich interpretations by viewers of the image. The creative professionals we interviewed in this study are not predominantly interested in high-art images where meaning and an extensive narrative are explicit in the image, or in

**Table I.**
Image retrieval
specification
and method

| Search by association | Category search | Targeted search |
|---|---|---|
| Browsing (no preconceived idea of content of image at all) | (Requirements or conditions specified beforehand) use of keywords with/without operators | (Very precise set of conditions specified) specific query with time, content, location or event specified |

**Table II.**
Image selection
criteria and
keyword use

| Non-visual | Perceptual | Conceptual |
|---|---|---|
| Title, date, photographer, size/resolution, location, rights, source/ownership, description/tags | Subject/object, type, technique, colour/lighting, composition of elements (colour, shape, texture) | General (topic/subject, person/object, scene/activity) Specific (topic/subject, person/object, scene/activity) Abstract (meaning/narrative, relation to other topics/subjects, mood/emotion) |

**Plate 1.**
A classic
news image

medical images where important features are subtle and can only be interpreted by highly skilled viewers.

In all the work tasks we observed (except one, described below) the images sought were not an information end in themselves; they were used to accompany text and information in other media in order to fulfil one or more of the following three forms of image use identified by Conniss *et al.* (2000); to give the overall document more impact (emotive/persuasive purposes), to illustrate information in the document (illustration) or to improve the aesthetics of the document (aesthetic value). These fit the conceptual image selection criteria defined by Hollink (2004) and provide the context of use.

All of our interviewees described using images in one or all of those roles. In a well-designed document, such as a magazine advertisement, an image should fulfil all three of these functions whereas in a news report an image may be purely there as an informational prop to the text.

In all but one of the work tasks described by the participants the text came first, and images were sourced and selected to match that text. The exception being a picture editor whose job included sourcing a collection of interesting and visually striking images for an online slide show, and then creating a narrative text to accompany the images.

The priority given to the three roles varied between participants depending on their worldview; the content writers and bloggers require images that primarily draw attention to their articles:

> It is useful to illustrate what is being said [with images], for social media this is important, people are not interested in reading a dry block of text. Images used are dependent on the "number of salient points being made" in the post (Senior Copywriter and Editor).

Time is clearly a crucial factor here; ideally all of the interviewees would want to source an image that fulfilled all three roles effectively, but in the more time pressured roles, like online news journalism, the illustrative role (Conniss *et al.*, 2000) is given primary

importance, and if images can be sourced that also fulfil the other two roles then that is a bonus, but not essential. Part of the job of the picture editor working on a UK news agency website was not to source images directly, but to choose from a set of images sourced by the journalist who wrote a piece. In this instance the journalist is searching for images that fulfil the illustrative role, and the picture editor is then choosing amongst those images the ones that fulfil the aesthetic and impact roles.

An interesting contrast in priorities driven by users' differing worldview was demonstrated between a picture editor working on a national newspaper and a copywriter creating a website advertising a holiday cottage in a rural location. The picture editor needed to source an image of a particular Ukrainian holiday resort looking "opulent", whereas the copywriter needed an image of the countryside surrounding the holiday cottage looking attractive enough that people would want to holiday there. The picture editor's primary task was to get the "ofness" or perceptual aspect of the image right – the image had to be of the correct location, and its "aboutness" or conceptual aspect, whether it looked "opulent" was secondary, but desirable. The copyrighter on the other hand could not source an acceptably priced image of the locale that looked appealing, and therefore an image was used which was not of the locale, but looked like it and looked appealing. This was obviously a compromise which the copywriter was not entirely comfortable with and given extra funding would have preferred to source an image which was of the correct locale. In this case the picture editor prioritised the illustrative "ofness"/perceptual aspect of the image over the aesthetic "aboutness"/conceptual aspect of the image, whereas the copywriter did the opposite.

### Contextual factors

Analysis of the data demonstrates how the information retrieval process is strongly affected by contextual factors, namely; the resources available, the access mechanisms to those resources, the work task and personal influences. Image searchers form subjective aesthetic judgements about the contents of different resources. Graphic designers reported that the content of iStockPhoto was more edgy and real whereas Getty images tend to be "too perfect". It was also noted that most users grew accustomed to using one or two image libraries, and would not use another library as familiarity with one interface and system had already been achieved. The journalists in the study were an exception to this, as part of their role included accessing many different image libraries.

In total, 40 per cent of those interviewed used iStockPhoto and Flickr, 30 per cent used Shutterstock and 20 per cent used Stock.XCHNG, Wikimedia Commons and Getty Images. There was an unsurprising match between the funding available in the work task for images and the type of image library used; journalists used all of the image libraries available, but concentrated on the "high end" news libraries and Getty, the graphic designers typically used the "mid range" libraries and the blog authors used the "lower range" libraries. Interestingly all the interviewees reported having used Google Images, particularly in the initial research stages of a work task.

Being professional image users many of the interviewees had developed a high level of skill and understanding of the different resources and their access mechanisms. Different search strategies were formed based on the different access mechanisms:

> For Flickr you have to use short keywords to have relevant searches […] Flickr uses titles to index the images, there is some irrelevancy in image searches there (Junior Copywriter).

The work task itself imposes very significant restrictions on the image retrieval task; several of the interviewees were creating materials on very restricted budgets, and therefore there was no scope for using images that required payment. The blog copywriters in particular found themselves limited to Flickr and similar resources that provide "free" or Creative Commons images. On the other hand a picture editor working on a national newspaper routinely uses at least ten image libraries to find relevant images and has access to over four hundred libraries.

*Search strategies and search criteria*
Typically a search starts with a "search by association", based on Smeulders *et al.*'s (2000) categorisation to scope out the broad sets of images that are available. Google Images is often employed at this stage to create broad ideas about possibilities of the images that might be available:

> I like to start with the broadest canvas possible, which will be a Google image search using simple terms. I will look at several pages of Google search results and will not narrow down the search too early. This is a large part of my job (Strategic Planner).

One of the important work tasks undertaken by the copywriters and graphic designers is the creation of a "brief" – the "starting" phase (Conniss *et al.*, 2000). A brief is not a finished product, but a specification of work to be done. A brief is a collaborative document between a client who requires some copy or an advert and the creative professional who will provide the result. The client and producer negotiate the brief until both parties understand what the other wants/is willing to produce, Images play a critical role in creative briefs; they are used to encapsulate the subjective "feel" of the required product rather than its objective content. Our participants described the process of creating briefs using image search engines in a very speculative, non-targeted manner.

However, in cases where the work task requires a completed product searches become quickly "targeted", in that the searchers quickly form a picture in their heads of the required image, and then the rest of the search process involves finding an image that matches the internal image:

> The keywords are definitely subconscious for us, we start to think with pictures in our head and then we will search in libraries (Creative Director).

The image search process for web and graphic designers begins with the reading of the brief or the development of a design concept or strategy. For the bloggers, web content writers and those selecting images for editorial content, the search process begins with reading the written article, picking up key points from the text, using the title or looking at the topic being covered.

Most of the participants used "targeted search" and in some instances "category search" for broader searches within topics when appropriate. The copywriters working on blog articles had a clear idea of certain keywords that they were promoting, and therefore performed targeted search on these keywords, although they did perform category searches as well. This is fairly consistent with the "scoping" phase identified in Conniss *et al.* (2000).

Search queries typically consist of one to three keywords per query; users are accustomed to Google and expect the image search engines to work in the same way. Most of the participants have considerable experience within their respective domains and generate search keywords in an intuitive manner. They also tend to use fewer,

more selective keywords. This may be due to an awareness of the controlled vocabularies employed by several of the image libraries. The majority of queries (64 per cent) were for specific objects, people or events. General category searches accounted for 31 per cent of queries. Only 5 per cent of queries were abstract or conceptual.

It is also worth noting that searching was also constrained by the physicality of the image, particularly when the image was to used in print media, the searcher needed to be sure that the image was available at an appropriate resolution. Related to the physicality of the image was an interesting comment by a graphic designer that the colouring of the image was not at all a key factor in the search process; if an image was found with acceptable content and form, but not coloured in an appropriate way then the colouring, brightness and contrast could always be manipulated using image manipulation tools like Adobe Photoshop.

### The image search behaviour of the journalists

The model of image retrieval that emerges with copywriters and graphic designers is fairly consistent with the models of image retrieval that are described in the literature (e.g. Ornager, 1995), except our work shows a much greater influence of commercial factors and constraints, as would be expected of a study with professionals. However, the participants who worked in news agencies exhibited a different behaviour in that they had to deal with finding images to match emerging stories and news reports. This is different from the "applying" phase identified in Conniss *et al.* (2000) which assumes a pull functionality, whereas the domain exhibits push functionality, i.e., information filtering rather than information retrieval. The images that best matched those stories come into the news agencies "on the wire" almost concurrently with the news stories themselves. These images are "fresh"; they may be photographs taken at the scene by staff or freelance photographers, and will at best have rudimentary tags associated with them. They will not have been classified by a trained or qualified archivist or librarian:

> [Keywords are not included] as such. It tends just to be the who, where, why, when sort of thing (Picture Editor).

This renders a lot of the image search strategies fairly useless, and this is demonstrated by the fact that the image searchers in the news organisations overrode the very sophisticated search features on Getty to simply show all images sorted by "Most recent images first" with very few other search criteria and filtering applied:

> We always use the simplest of keywords you can possibly use for search results, as this is a news based search where you always want the most recent pictures anyway (Picture Editor).

In contrast the timeliness of the image is of at best secondary concern to the other searchers in our study. None of the other interviewees mentioned timeliness as an important factor and this factor is not particularly prominent in the literature (see above).

News organisations tend to filter images from the "News wire" (generated by Reuters, AP, The Press Association, etc.) where between 6,000 and 7,000 images are received every day. Due to the high volume of images being received, they have to be adept at scanning incoming images very quickly to select the most visually appealing and relevant ones. The image searchers will follow the paths set by others; as a news story develops competitor news agencies will be publishing their own news stories about the event, and a picture editor will sometimes take a competitor's published image on the story as a starting point for their own search; this will give the searcher an

idea of which photo agencies or individual photographers are generating interesting images. For example, during the work task observation a story broke about the wife of a British politician hiring a stylist using public funds. The image search started with a Google image search, which pointed to the story published in rival newspapers, which gave a pointer to where the images could be found on the Reuters news wire. The behaviour exhibited here differs somewhat from the "selecting" and "iteration" phase identified by Conniss *et al.* (2000) which assumes a "static" collection with a subset of images chosen from the results set given the relevance criteria. This difference is due to the "information filtering" nature of the task identified above. The "ending" phase (Conniss *et al.*, 2000) in the domain is by its nature exhaustive.

Similarly, if the story is happening internationally then looking at the news report in the media local to the event allows the picture searchers to "borrow" the expertise and knowledge of the local journalist. For example, during the work task observations a news story emerged concerning a Ukrainian politician and the (UK based) picture editor made a particular point of looking through images used and made available by TASS, the Russian news agency, as well as the more "usual" press sources.

Other interesting and novel search strategies were also apparent. For example, the picture editor knew that the keywording on iStockPhoto and Getty was particularly good (probably because of their controlled vocabularies) and having found an image there would copy and paste the tags from that image into other search engines to see if the other engines came up with better images based on those tags.

A characteristic of the images that are found through information filtering behaviour is that the searchers are predominantly conducting targeted searches looking for the "ofness" (events, people, places) of an image, although once suitable candidates are found, the decision then becomes much more related to the subjective "aboutness" of the image. For example, a picture editor selected the most "poignant" image from a set of possibilities, and in another example, described more fully above, an image was selected to accompany text that described a holiday resort as being "opulent".

## Discussion

Previous descriptions of image retrieval, and indeed of information retrieval more broadly, have categorised searches according to the orderliness and clarity of the searchers information goal; searches are broadly placed on a continuum from targeted search (where the user knows exactly what they want) to browsing (where the user has no explicit idea of the image they are after). These descriptions are largely based on experimental studies of users employing a single database of images to find search results. Our work fills a gap in the literature by studying image search behaviour in a commercial context, showing first, the effect of commercial constraints on search behaviour, and second, the effect of having access to many and diverse image libraries with rapidly changing content in the absence of a professional intermediary such as a librarian to assist the user. In this section we discuss our findings with an emphasis on the implications for the design of better image search tools.

### Commercial constraints

All our interviewees had developed quite complex personal strategies for finding images which relied on a fair degree of tacit knowledge about the content of different libraries and their access mechanisms. We saw interesting strategies developed in the way that searchers used the keywords from one library known to have good

keywording as search terms in other libraries. Clearly there is scope for automation here, to avoid the task of copy and pasting keywords from one library to another. However, it is unlikely that the owners of image databases that have created expensive controlled vocabularies and keywording systems would look kindly on systems that leverage those keywords to make it easier to find images in their competitors' image libraries.

High-end image libraries such as Getty offer extensive advanced search facilities which would support the tasks we saw the copywriters and bloggers undertake well. However, we did not see much evidence of this because the high-end libraries were priced out of the range of several of the participants. The participants constrained into using the cheap or free image libraries clearly had to make compromised decisions (as evidenced by the decision to use the image of the "wrong" locale by the copywriter working on an advertising website for a holiday home). We do not have the evidence to know whether the "right" image is "out there" and could not be found because of the weaknesses of the access mechanisms in the low-end image libraries, or whether an appropriate image does not actually exist. Our work does suggest scope, however, for an inexpensive commercial service offering sophisticated search facilities over "free" content.

The priority given by blog copywriters to images with high-impact offers another interesting challenge; "impact" is a subjective quality, not likely to be picked up by automated image analysis or by the normal process of tagging, which tends to describe the objective "ofness" of an image. Crowd sourcing and social media do offer a possibility here, however, as several systems exist where viewers vote on their favourite, or "stand out" images. Using this sort of system to capture descriptions of images is likely to better capture the "impact" of an image, and this would serve the advertisers and copywriters in our study well. It is also interesting to note the use of Google Images essentially as a brain storming tool, to find out what is "out there" and to generate ideas. Our study, and other descriptions of image seeking in the literature suggest that image searchers create an internal picture of the required image early on in the search process, even in exploratory browsing, and the search process then becomes fairly targeted, with the aim of finding the image in the searcher's head, or close enough to it. There is therefore scope to create a commercial system which incorporates the results of a Google search as an initial scoping exercise and then suggests images that are held in the commercial library that are similar (either semantically by keyword or syntactically by query by example) to images selected from the scoping Google search.

All the work tasks except one searched for images to accompany text, and several copywriters described how they took terms and keywords directly from the text to "seed" searches in image databases, and again this could be a process that could be semi-automated, with keywords automatically extracted from text and images automatically added to the text as suggestions.

*A brief creation tool?*
We observed how image search engines are used as a tool in the process of creating briefs. Previous research has demonstrated the importance of these briefs in creative environments (Inskip *et al.*, 2009). A more task-based view of this process is that a general purpose tool – the search engine – is being used in a fairly specific task and there is considerable scope for designing a tool that specifically supports the creation and negotiation of a brief, and the image search function is, to an extent, hidden

within the tool. The fundamentals of this proposed tool were suggested by the study reported here, but there are other aspects to the tool which require further investigation; in particular the communication dynamics between the client and producer, as we envisage a tool which not only supports the process of creating a brief, but also the process of negotiation between the client and producer. Furthermore we also see interesting possibilities in the way that the tool could automatically collect metadata about images; once an image is positively chosen to be a good candidate to accompany a piece of text, then the tool can learn that association and could suggest that and similar images when presented with similar text in the future. We have obtained funding to investigate the viability of a brief creation tool and create a prototype system based on the design suggestions given above.

*Information expeditions*
We propose that the behaviour observed of the journalists' image search behaviour is analogous to an expedition. This behaviour arises from "information filtering" required in the domain. The final point of the expedition is well defined (it is the source of the Amazon or the top of a mountain) but the route for getting there is not clear, requiring a lot of skill to get there and also including highly reactive context dependent behaviour (to avoid poisonous snakes, mountain lions and open crevasses) as part of the journey.

Information expeditions are highly targeted, but are very different in character to information seeking behaviour described elsewhere because it takes place using a set of information sources, which though individually may be well structured, collectively are very unstructured, with widely varying content and access mechanisms. So, there are several factors which combine to cause information expedition behaviour to emerge.

Plethora of sources: although picture editors reported using several "trusted" sources, they have access to several hundred image libraries. The core trusted resources are typically specifically aimed at news agencies or, like Getty, general purpose image sources. The more peripheral libraries typically serve specific domains, such as artworks or historical images specific to a particular location.

Significant tacit knowledge and craft skill: we saw the journalists undertake several clever strategies to find appropriate images, not only using image libraries but normal web searches and trawling the website of their competitors to create enough search "seeds" that they can then go on to find appropriate images. Interestingly, even though they had to deal with several thousand images on the news "wire", they did not report that they felt they had to deal with information overload. They had clearly developed coping strategies for dealing with that amount of images.

Time pressure: the work of a picture editor is highly pressured, particularly when the news agency publishes online as well as in print; the time required to source an appropriate image may be measured in a few hours.

Accuracy: the final image must be correct; if it is illustrative of an event, person or place, it must be of the correct event, person or place. However, the definition of "correct" depends on the user's worldview (see the Ukrainian holiday resort example above).

It is clear that the search facilities offered by the different commercial image libraries are not designed to support this behaviour. This is clearly evidenced by the journalist bypassing all the (sophisticated and well designed) search

functionality on the Getty site to simply list all images by date order. Evidence from a large body of literature shows that general image searchers can specify a query then browse or browse then query (depending on the context), whilst image filtering behaviour found in this study show that users focus on browsing to undertake a search.

### Images per screen?

Given that the journalists did not report information overload when dealing with a huge amount of images, and several copywriters described trawling through many pages of image search results to find the image they are after and get a sense of the sort of images that are out there. Butterworth and Göker (2011) suggest that the typical output of an image search engine – a couple of dozen images – is unnecessarily small and that users could cope with, and find beneficial, an interface that displays many more: possibly a few hundred images per screen. There is also evidence from other literature which shows that professional searchers can browse hundreds of images if the task requires it and opportunity allows (Conniss *et al.*, 2000; Markkula and Sormunen, 2000).

This argument is based on two tenets, both of which our work supports. First, that the sort of images used by creative professionals are of one or two people, places or objects (they carry a small amount of "ofness" information). Creating the fairly small thumbnail images required to fit hundreds of images on a screen would not lose that small amount of ofness. Second, the user creates an internal picture of the image they want early on in the search process and then searches for that image. If lots of small thumbnails are simultaneously presented to the user then they will be able to visually scan them, to find the image that most closely matches the picture in their head. This is likely to be more efficient than paging through a set of results in a typical image search engine.

### Summary and conclusions

Our work looked at the image seeking behaviour of creative professionals, specifically to answer four research questions on seeking behaviour: forming search goals, image use, search strategies and search criteria – answering these questions provides insight into the "information expeditions" metaphor we use in this paper. In several areas what we saw was consistent with image seeking behaviour models described in the literature, but commercial constraints affected the seeking behaviour in ways not previously reported. We also contend that the behaviour we describe as an "information expedition" – clear, well-defined goals, but unstructured information sources and tacit skill needed to get there – is not explicitly addressed in the literature (Westman, 2009). There is also evidence that information filtering functionality is required for images, which is informed by image use and determines search goals, with appropriate strategies and criteria for filtering adopted by users' in the journalism domain.

The outcome of the study is a set of design recommendations that question whether the document retrieval model that most search engines are based on (keywords go in, and a linear list of about 20 results come out) is appropriate for image retrieval. In terms of interface design we propose that many more images than 20 or so can be comfortably presented to the users in the creative domain. We have proposed a high-density interface which displays many images (Butterworth and Göker, 2011) and have undertaken an evaluation of it which will be published at a later date. In terms of

looking at the users' tasks the study also shows that the interviewees do not want to search for images, they want to create and negotiate briefs, and that there is a large amount of scope for the design of tools that address this primary need directly, making the image searching task much more automated and in the background, freeing up the user to address the main task in a more focused manner.

Further research into time factors is required and the impact that limited time has on information seeking in online journalist environments where large amounts of information must be filtered and evaluated quickly. In particular a research question arises from the research presented here:

*RQ5.* Is the extremely time pressured nature of an online newsroom the primary cause of information expeditions as an emergent behaviour of journalists?

## References

Armitage, L. and Enser, P. (1997), "Analysis of user need image archives", *Journal of Information Science*, Vol. 23 No. 4, pp. 287-299.

Beyer, H. and Holtzblatt, K. (1998), *Contextual Design: Defining Customer-Centered Systems*, Morgan Kaufmann, San Francisco, CA.

Borland, P. (2000), "Experimental components for the evaluation of interactive information retrieval systems", *Journal of Documentation*, Vol. 56 No. 1, pp. 71-90.

Butterworth, R. and Göker, A. (2011), "The potential of a 'high density' image retrieval interface", *Proceedings of HCIR 2011*, Mountain View, CA, available at: https://sites.google.com/site/hcirworkshop/hcir-2011/posters – visited (accessed 9 April 2015).

Choi, Y. and Rasmussen, E.M. (2002), "Users relevance criteria in image retrieval in American history", *Information Processing & Management*, Vol. 38 No. 5, pp. 695-726.

Choi, Y. and Rasmussen, E.M. (2003), "Searching for images: the analysis of users' queries for image retrieval in American history", *Journal of the American Society for Information Science and Technology*, Vol. 54 No. 6, pp. 498-511.

Conniss, L.R., Ashford, A.J. and Graham, M.E. (2000), "Information seeking behaviour in image retrieval: visor I final report", Library and Information Commission Research Report No. 95, Institute for Image Data Research, Newcastle upon Tyne.

Enser, P.G.B. (1993), "Query analysis in a visual information retrieval context", *Journal of Document & Text Management*, Vol. 1 No. 1, pp. 25-52.

Enser, P.G.B., Sandom, C.J., Hare, J.S. and Lewis, P.H. (2007), "Facing the reality of semantic image retrieval", *Journal of Documentation*, Vol. 63 No. 4, pp. 465-481.

Fidel, R. (1997), "The image retrieval task: implications for the design and evaluation of image databases", *New Review of Hypermedia and Multimedia*, Vol. 3 No. 1, pp. 181-199.

Goodrum, A. and Spink, A. (2001), "Image searching on the excite web search engine", *Information Processing & Management*, Vol. 37 No. 2, pp. 295-311.

Heidorn, P.B. (1999), "Image retrieval as linguistic and nonlinguistic visual model matching", *Library Trends*, Vol. 48 No. 2, pp. 303-325.

Hollink, L. (2004), "Classification of user image descriptions", *International Journal of Human-Computer Studies*, Vol. 61 No. 5, pp. 601-626.

Hollink, L., Schreiber, A.Th., Wielinga, B. and Worring, M. (2004), "Classification of user image descriptions", *International Journal of Human Computer Studies*, Vol. 61 No. 5, pp. 601-626.

Ingwersen, P. (1992), *Information Retrieval Interaction*, Taylor-Graham, Los Angeles.

Inskip, C., MacFarlane, A. and Rafferty, P. (2009), "Towards the disintermediation of creative music search: analysing queries to determine important facets", *International Journal of Digital Libraries*, Vol. 12 Nos 2-3, pp. 137-147.

Jaimes, A. and Chang, S.-F. (2000), "A conceptual framework for indexing visual information at multiple level", *Proceedings of SPIE Internet Imaging, Vol. 3964, San Jose*.

Jörgensen, C. and Jörgensen, P. (2005), "Image querying by image professionals", *Journal of the American Society of Information Science and Technology*, Vol. 56 No. 120, pp. 1346-1359.

Kazai, G. (2011), "In search of quality in crowdsourcing for search engine evaluation advances in information retrieval", *Lecture Notes in Computer Science*, Vol. 6611, pp. 165-176.

Keister, L.H. (1994), "User types and queries: impact on image access systems", in Fidel, R., Smith, P.J., Hahn, T.B. and Rasmussen, E.M. (Eds), *Challenges in Indexing Electronic Text and Images*, Information Today, Inc., New Jersey, NJ, pp. 7-22.

Konkova, E., Göker, A., Butterworth, R. and MacFarlane, A. (2014), "Social tagging: exploring the image, the tags, and the game", *Knowledge Organisation*, Vol. 41 No. 1, pp. 57-65.

Lee, C., Li, H. and Lee, F.L.F. (2011), "Symbolic use of decisive events: Tiamanmen as a news icon in the editorials of the elite US press", *The International Journal of Press/Politics*, Vol. 16 No. 3, pp. 335-356.

Liu, H., Mulholland, P., Song, D., Uren, V. and Rueger, S. (2010), "Applying information foraging theory to understand user interaction with content-based image retrieval", in Belkin, N.J. and Kelly, D. (Eds), *The Information Interaction in Context Conference (IIiX 2010)*, ACM Press, New Jersey, NJ, pp. 135-144.

Markkula, M. and Sormunen, E. (2000), "End-user searching challenges indexing practices in the digital photograph archive", *Information Retrieval*, Vol. 1 No. 4, pp. 259-285.

Matusiak, K. (2006), "Information seeking behaviour in digital image collections: a cognitive approach", *The Journal of Academic Leadership*, Vol. 32 No. 5, pp. 479-488.

Ornager, S. (1995), "The newspaper image database: empirical supported analysis of users' typology and word association clusters", in Fox, E.A., Ingwersen, P. and Fidel, R. (Eds), *Proceedings of the 18th Annual International ACM SGIR Conference on Research and Development in Information Retrieval*, pp. 212-218.

Pirolli, P. and Card, S. (1995), "Information foraging in information access environments", in Katz, I.R., Mack, R., Marks, L., Rosson, M.B. and Nelison, J. (Eds), *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI'95)*, ACM Press, New Jersey, NJ, pp. 51-58.

Shatford, S. (1986), "Analyzing the subject of a picture: a theoretical approach", *Cataloging & Classification Quarterly*, Vol. 6 No. 3, pp. 39-62.

Smeulders, A.W.M., Worring, M., Santini, S., Gupta, A. and Jain, R. (2000), "Content-based image retrieval at the end of the early years", *IEEE Transactions on Pattern Analysis and Machine Intelligence*, Vol. 22 No. 12, pp. 1349-1380.

Strauss, A.L. and Corbin, J.M. (1998), *Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory*, Sage Publications, Thousand Oaks, CA.

Toms, E.G. (2011), "Task-based information searching and retrieval", in Ruthven, I. and Kelly, D. (Eds), *Interactive Information Seeking, Behaviour and Retrieval*, Facet Publishing, London, pp. 43-60.

Vakkari, P. (2001), "A theory of the task-based information retrieval process: a summary and generalisation of a longitudinal study", *Journal of Documentation*, Vol. 57 No. 1, pp. 44-60.

Westman, S. (2009), "Image users' needs and searching behaviour", in Goker, A. and Davies, J. (Eds), *Information Retrieval in the 21st Century*, John Wiley & Sons, Chichester, pp. 63-83.

Westman, S. and Oittinen, P. (2006), "Image retrieval by end users and intermediaries in a journalistic work context", *Proceedings of the 1st International Conference on Information Interaction in Context IIiX*, pp. 171-187.

**Corresponding author**
Dr Andrew MacFarlane can be contacted at: andym@city.ac.uk