ANALYSING CREATIVE IMAGE SEARCH INFORMATION NEEDS

Elena Konkova[1], Andrew MacFarlane[1] and Ayse Goker[2]

[1]Department of Computer Science, City University London, London EC1V 0HB

[2]School of Computing Science and Digital Media, Robert Gordon University, Garthdee Road, Aberdeen, AB10 7QB

ABSTRACT

Creative professionals in advertising, marketing, design and journalism search for images to visually represent a concept for their project. The main purpose of this paper is to present an analysis of documents known as briefs to find search facets, which are widely used in creative industries as a requirements document to describe an information need. The briefs specify the type of image required, such as the content and context of use for the image, and represent the topic from which the searcher builds an image query. This research takes three main sources – user image search behaviour, briefs, search engine meta-data – to examine the search facets for image searching in order to examine the following research question - are meta-data schemes for image search engines sufficient for user needs, or is revision needed? This research found that there are three main classes of user search facet, which include business, contextual and image related information. The key argument in the paper is that the facet 'keyword/tag' is ambiguous and does not support user needs for more generic descriptions to broaden search or specific descriptions to narrow their search – we suggest that a more detailed search facet scheme would be appropriate.

1. INTRODUCTION

Images[1] are widely used in various types of creative projects: advertising, illustration of books and print media, decoration, creation of a suitable mental atmosphere. Professionals involved in the process of image selection include image consumers from advertising and editorial communities (advertising and marketing agencies, graphic designers and journalists) and image providers such as private photographers, image stock libraries and photography agencies. These professionals search and disseminate images through commercial libraries, social networks and indexed search engine results. Usually the search is based on a number of queries with an average length of about two words (Jorgensen and Jorgensen, 2005). Often these queries are derived from briefs, which are the requirements document for a creative project containing information about its background and objectives, target audience and the message carried, time and budget limits, contact information of stakeholders, etc. The briefs specify the type of image required, such as the content and context of use for the image, and represent the topic from which the searcher builds an image query.

Specialized communities of creative professionals develop their own vocabularies over time, analysis of which can give insight into the special language and word meanings used within the community. This knowledge will help to identify the most important facets for organizing images. We assume that a brief is a very detailed way of describing an image need along with giving a well-specified context of use, and that analysis the brief can serve as a basis for a development of a new image search approach.

The aim of this paper is to investigate the semantics of creative image search through a detailed briefs' analysis and to structure and categorize search facets for image search. We contribute to the literature on information needs and their articulations in the image search community. The research question addressed in this paper is – are search facet schemes for image search engines sufficient for user needs, or is revision needed? We also analyse image needs as articulated in interview with creative searchers' and analyse the systems which they use in order to match the concepts identified in the briefs – this is carried out to inform the design of image retrieval

[1]Images exist in diverse fields and disciplines: art and design, education, advertising, journalism, medicine, geography, law-enforcement, and space science. However, this study will focus on creative images. There are many types of images e.g. slides, drawings, video, etc., but in this work we focus on photography.

systems from the perspective of a creative image searcher. These systems include both search engines or institutions who provide access to images on their websites.

In the next section we describe the existing image retrieval approaches, as well as academic methods of image organisation. Section 3 describes data collection used in this study for the interviews, systems and image briefs. Analysis of the collected data is provided in Section 4, starting with the interviews to identify and analysis used system ending with a comprehensive facet analysis for briefs. A comparison of the facets to those of the briefs' analysis is presented in Section 5. Conclusion and future work are covered in Section 6.

2. RELATED WORK

2.1 IMAGE NEEDS AND SEARCH

There are many studies which analyse image information needs of specific user groups. For example, Westman and Oittinen (2006), Markkula and Sormunen (2000), Ornager (1995) specialised in image needs for newspapers. Chen (2001) researched user's needs in the context of art history by analyzing queries of twenty nine students of Art History, Jorgensen and Jorgensen (2005) analysed image searches and queries, user query modification strategies, and user browsing and downloading of results through search logs from a commercial image provider. However, to the best of our knowledge, there are no studies that have examined the whole creative project as a context for search, nor work that has analysed briefs other than Inskip et al (2012) who addressed music needs rather than image needs. There is a clear gap in the literature which needs to be addressed, particularly as briefs are a key document in the creative arena.

Image search is informed by a number of factors: image needs (specific and concrete/vague search for some abstract concept or mood/inspirational browsing), offered functionality of image search systems, chosen search strategies (verbal or written request to intermediates, textual query, content-based query, category search, browsing) and search techniques (selected categories, single keywords, combined terms, Boolean modifiers, wild card, truncation, spelling/syntax alternatives, filters), the domain within which the user is searching, his level of expertise, and the task they perform (Westman, 2009; Hollink et al., 2004).

2.2 IMAGE ATTRIBUTES

Irrespective of the retrieval approach (concept-based or content-based), the indicator of a good image retrieval system is its "ability to respond to queries posed by searchers" (Hare et al., 2006). There are a number of established frameworks for organising image collections including (Jaimes and Chang, 2000; Eakins & Graham, 1999, Armitage and Enser; 1997; Westman, 2009; Hollink et al., 2004). Based on the detailed analysis of these frameworks, Westman (2009) groups image attributes into three main levels: non-visual image information, syntactic image information and semantic image information. *Non-visual image information* is the information that is not presented in the image and taken from the image's metadata: biographical attributes (creator, title, and date), physical attributes (type, location), and contextual attributes (reference). *Syntactic image information* refers to image's visual characteristics: global distribution (colour, texture), local structure (shape), image composition (spatial layout of the components). *Semantic image information* is a conceptual image content. Its interpretation requires some "personal and cultural knowledge". Semantic attributes could be generic, specific and abstract. Generic attributes show "types of objects or scenes", specific attributes describe "identified and named objects and scenes", and abstract attributes represent symbolic meanings and emotions, which is assigned by people and known to be subjective (Westman, 2009, p.67).

2.3 FACETED SEARCH

A key concept in search is that of 'keyword', which is a search term representing some part of a user's information need (or on occasion the information need as a whole) – see section 2.1 above. Because of the semantic gap, 'keywords' for searching are assigned to images (or 'tagged') using the image attributes described in section 2.2, and these keywords will be assigned to facets – these are "essentially independent properties or

dimensions by which we can classify an object" (Russell-Rose and Tate, 2013). Image attributes will determine the type of facet used by an indexer. Once indexed the user can search using the keywords assigned to the object, using a subset of facets to filter the results to specific images of interest. Facets are of two types: *single-select* or *multi-select* (Russell-Rose and Tate, 2013). *Single-select* facets have values which are mutually exclusive e.g. an image can only have one size. *Multi-select* facets have more than one values e.g. target market can be both the US and UK. In search keywords within facets are applied disjunctively (e.g. using the Boolean OR operator), whilst keywords across facets are applied conjunctively (a Boolean AND). In this way the user can build up an appropriate query in a faceted search image retrieval system to meet their information needs.

In our research we investigate the cited search categories and their use in a commercial product for the creative industries, and also to reveal what is missing and why it is important.

3. DATA COLLECTION AND METHODOLOGY

The general approach taken is very similar to that of Inskip et al (2012) who interviewed music creative professionals and examined the system they used to find music using briefs – with an analysis of the briefs and search engines to find facets. However we used interview transcripts only and did not carry out observations of users working in real contexts due to time and resource constraints. The work took place in three distinct phases: 1) analysis of the contextual interviews; 2) analysis of the search engines and 3) analysis of image briefs. The results of the contextual interviews were used to inform the analysis of search engines, and search facets identified using from search engines were used to analyse the briefs. The evidence from these three phases is then brought together to provide an overview of search facets for image search engines. In the sub-sections below we elaborate on each of these phases describing both the methods for analysing the data as providing a description of the data collected for the analysis.

3.1. CONTEXTUAL INTERVIEWS

As an initial step of information needs and behaviour research within the creative industries, we undertook an analysis of 13 interview transcripts. The interviews were held with current users of image retrieval systems (ten image consumer and three image providers). The interviewees included media agencies and departments, designers, news agencies and bloggers, as well as individual photographers working in various areas like fashion photography, photojournalism, still life photography and artistic photography. The interviews were loosely structured into two main parts: the traditional interview and the contextual inquiry of image query tasks. The interviews provided an overview of the research context covering such areas as image usage and search process, image search systems and satisfaction of using them. Information on real work tasks was collected through the information rather than observation, which was sufficient for our needs. The interview transcripts were analysed by using a simplified Grounded Theory approach (Strauss et al, 1998), where the findings emerged from the data itself, i.e. moving from more specific experiences of interviewees to more general findings in image search and retrieval. More details on the methodology can be found in Goker et al (2015).

Table 1 Analysed image search systems

Image Search System	**Type**
ISS1	Image search engine
ISS2	Stock Image Library
ISS3	Stock Image Library
ISS4	Photo-sharing social network
ISS5	Photo-sharing social network

3.2. COMMERCIAL SEARCH SYSTEMS

Based on the interviews, we revealed three main types of commercial image search systems that are widely used in creative industries: *image search engines* (Google, Yahoo!), *microstock and stock image libraries* (Getty,

Corbis, Alamy, iStockphoto, Fotolia, Dreamstime, Associated Press, etc.) and *photo-sharing web services* (Flickr, WikiMedia Commons, Panoramio, Stock.XCHNG) – see table 1. We selected five most popular systems for further detailed analysis (one image search engine, two photo-sharing web services and two microstock/stock image libraries). The search systems are anonymised as the functionality analysis is commercially sensitive, and the aim of the research is to compare the facets with the briefs rather than address the differences between them. The search facets of these search engines was collected from each service, compared and analysed – which was a simple process of listing, merging and eliminating facets to provide the final set. This information was used in part to analyse the briefs (section 3.3).

3.3. BRIEFS

There is a vast range of creative projects that include imagery: advertising, publishing, design, editorial illustrations, marketing and promotional materials for private and corporate use (see table 2 for a list of stakeholders). The need for images is communicated through 'briefs'. These briefs are the requirements document describing needs of image consumer and can take a form of an email chain or a widely circulated word/PDF document. Briefs were regularly referred to in the interviews as a starting point for formulating an image query. The importance of briefs in creative environments has been demonstrated in the music domain by Inskip et al (2012). As a query comprises only a limited amount of needed image features, the analysis of briefs as whole was considered necessary. For this purpose a set of 85 real image briefs have been collected to analyse their structure, description facets and vocabulary used in them. These briefs vary in form and structure. The majority of briefs come from a photography crowdsourcing platform called ImageBrief, which allows image consumers to create a natural language description of their image need via a brief publishing interface with a number of predefined fields including wanted and unwanted image features, reference images, budget and time limits and usage details. The second largest source of briefs was a MeetUp group called *Photographic Assignment*, which contains a selection of real life photographic assignments used for educational purposes. These briefs contain a detailed description of an actual task; however, the business side of assignments was usually omitted. A small percentage of the examined briefs was found through Google Search and contained photographic assignments of universities, governmental organization and various companies populating their corporate image bases. The analysed briefs were created using various publishing interfaces and approaches, however, the impact on brief structure and expressed need is considered to be minimal, as users were able to express their image needs in a form of a free text.

Image Providers	**Image Consumers**
Individual Photographers, Photo Agencies, Image Libraries	Advertising or marketing professionals (individuals, agencies, companies' departments), book publishers, designers (individuals, agencies, companies' departments), news professionals (companies' and individual bloggers, news agencies), private and corporate individuals

Table 2 Stakeholders in creative image search

Over half the briefs were for promotional and advertising use, about 25% for editorial use, with the rest being searches of images for books and CD/ DVD covers, items for personal or corporate use and items for resale. Briefs were usually of up to one page length and contained description of the project's background, terms and conditions of acquiring the image and the actual description of the image and its purpose. The goal for the analysis of briefs is to contribute towards understanding of semantics of creative image search and thus towards development of an appropriate image retrieval system.

There is a need to analyse consumers' image search facets not expressed in a free text form to evaluate whether they match the structure of existing image retrieval systems. A range of facets utilized within the existing commercial image search engines (section 3.2), as well as image attributes classification schemes (section 2.2)

were used as a basis for coding the briefs. Coding was an iterative process during which a number of codes were eliminated and added leading to a comprehensive set of facet codes. After all iterations 1508 phrases were split into 21 facets, which were then grouped into three main higher level classification categories - Business, Image and Context (see section 4.3 for more detail).

4. ANALYSIS

Based on the specified image requirements (expressed in a brief) an image consumer either iteratively formulates search queries to search existing (stock) image collections or handles a modified and tailored project brief to a photographer for a commission (assignment) photo. In existing image collections search is iterative with query clarification along the search session with the help of textual and content-based refiners. While in case of assignment images, query is clarified with a photographer in person, often using example images or style references from existing external/personal collection of a photographer's portfolio to support the description.

Whilst briefs can be used for commission photography, briefs are a very detailed of needs for images which also provide a well-specified context of use – as such they can serve as a basis for the development of a new image search approach. To demonstrate this point we investigate current image retrieval systems, and then analyse the image briefs' structure.

4.1. CONTEXTUAL INTERVIEWS

In this section we examine the creative search process in terms of querying (section 4.1.1), filtering results (4.1.2), presentation and use (4.1.3) and then examine the image search systems used in this process (4.1.4).

4.1.1. QUERYING

At the beginning of an image search process, searchers usually come up with a mental image of what they want to find - a targeted search. This leads to a search using specific search terms, which yields low recall results. The searcher may therefore use more generic search terms in subsequent iterations. However, some users may start with generic terms in order to "examine" the collection first and narrow down the query after viewing interesting images using specific terms. Only if the topic is new or unfamiliar will the user start by browsing the collection. Most of the interviewees employed Google Images as a brainstorming tool to find what is "out there" and to generate ideas. This is known to be search by association in the image (Datta et al, 2008). Examples of users' search preferences from transcripts are:

> *"I think we'll start with a visual concept of what we want, even if it's in our head… We start to think in pictures in our head and then we will go ahead and start searching on the library."* (Designer)
> *"There are some times that I purposely keep the word quite generic, because it helps kind of get a bigger perspective on the subject matter."* (Advertiser)
> *"So it's trying to be as specific as I can… I find it's easier to be quite narrow and go I want the watch, the brand than to come up with something quite broad."* (Graphic designer)
> *"… it's very useful to have suggested key words, some websites have - you search for something and it will give you like a cloud or an array of key words that you wouldn't naturally think of yourself."* (Copywriter)
> *"I guess the main changes are interface changes and maybe some sort of live search as well. So you start typing key words and you're really getting results.* (Designer)

Most of the searches employ general objects and conceptual events for their searches, using affective abstract terms (e.g. happy kids), location (e.g. UK fashion) and colors (e.g. red scarf) as refinements for search. As the images were searched to accompany some text, some searchers took search terms directly from the brief text and used them as queries. Some searchers formulated ideas based on perceptual features of the image in order to "draw" a query. These searchers may derive the end image by creating a composite image drawn from retrieved

images. These users may benefit from systems supporting sketch-queries and other content based image search mechanisms.

4.1.2. FILTERING

There are a number of filters that can be set up to clarify image needs. The criterion include image price and license type, size, orientation, layout and color scheme. For most image consumers the primary factors that influence their search is price due to budgetary constraints. Some stakeholders such as small companies and freelance designers undertake an initial search for free Creative Commons collections or use advanced search in image search engines to limit the retrieved results to images that can be used free of charge. In pursuit of free or less expensive shots, users spend up to an hour on a photo-sharing website such as Flickr browsing the collection, employing basic search functionalities offered by the website. Sometimes the budget of the project can impose some cost restrictions on finding an appropriate image. Some examples of budget restrictions from the transcripts:

> "*I can look for free images to come up with a sketch for client. In case he likes the project, I buy the better quality images from image libraries*" (Designer)
>
> *"I love and get used to Getty search. But in case client does not have enough money to afford use of this particular library, I try to find what I like there and then search for similar images in more affordable collections using keywords from the found image*" (Designer)

The question of licensing is an important factor and restrictions can be put on the image use (how, where, and when). Exclusive use of some images may be required, which impacts on what is to be paid for the image. Other criterion that also matter are image size, image orientation (portraiture, landscape, panoramic, etc.), clear background for further image editing and "copyspace", which is a search feature in iStockphoto for images with clear space to insert some text. Colour, however, is known to be a less important criterion in image search, as it is an easily edited feature in contrast to composition for instance (e.g using photoshop). Examples of significant image features from the transcripts:

> *"… it's more about the angle of the shot, the lighting, the situation…Once you nail that then everything else, whether it's portrait or landscape, can cook itself, basically."* (Advertiser)
>
> *"… what I didn't want was a lot of detail in the background..."* (Advertiser)
>
> *"The main kind of, where is the focal point, empty space has been the massive useful one."* (Graphic designer)
>
> *"Colour's never really been much of an issue because it's always been, do you want it black and white, or do you want it in colour?... I'd rather the composition be right than the colour be right."* (Graphic designer)

4.1.3. PRESENTATION AND FURTHER USE

Presentation and further manipulation of images are also important aspects of any image search system. One need expressed by users is the diversity of presented results. This could be achieved through a faceted concepts presentation of image responses. The presentation feature that annoyed interviewees - who used to deal with large amounts of images per search - is the limit on presentation of search results per page. As alternatives, infinite scrolling and high density interfaces can be used. Examples of required image presentations from the transcripts:

> *"… for example you found an image that you like - imagined that in the centre of the screen. Then all around that have options for going off in different directions… But then, if you clicked on one of those, they would become the central image and the tangent would extend in that direction and go back to where you were in this direction."* (Designer)
>
> *"Love Google Images... I love web pages where you can just keep scrolling down; I find that a lot faster than flicking through pages…"* (Copywriter)

"One thing that I really don't like is that… you can only see X amount of photos on a screen at once." (Designer)
"I want to be able to see everything in one hit." (Blogger)

Further sorting and search refining by date, source, size, price, relevancy and popularity were also considered necessary. Refinement by conceptually and content similar images was considered to be important. During concept definition stage (sketches, discussion with colleagues, and concept confirmation by clients) users need 'comp images' (complimentary images), which are free, low-resolution version of images used to evaluate image suitability in a particular creative project, or even combinations of several images. Examples from the transcripts:

"…what I don't do is add a comp image from a stock library which has their watermark on it. For two reasons, one client will either - will know exactly where we got it from and can go and get it themselves. We might lose £5 on that, but it might add up. The second reason is I don't think it looks great to have, potentially, a low res picture with a watermark on it." (Designer)
"When we do mock ups for this, there's a combination of six images" (Advertiser)
"A lot of the time what we really need to do is mash up two or three images…" (Copywriter)

In terms of storage, users tend to have folders/bookmarks of interesting images (even with some tags) and people/groups that could be used in new projects. Some image searchers keep notes of photographers whose works they found interesting and refer to them later on for illustration of similar topics. But they do not store already used images for further projects. Examples of bookmarking practices from the transcripts:

"Sometimes I'll sign up to specific groups that are, I think, worth coming back to another time for that particular reason." (Copywriter)
"I will only use them for the one purpose. I don't know why, it feels like I'm selling the client down the river" (Designer)
"I've got a folder on my machine that plays as my screensaver that is a whole bunch of images that I love that I'm just like, that's interesting, that's fantastic." (Graphic designer)
"…we use light boxes within iStock to hold - and they are just labelled with the client's name." (Designer)

Particular image search problems named by users are the difficulty of finding illustration for the most up-to-date topics like IT, presence of "too perfect" and "not natural" corporate shots and problems in formulating search queries for "conceptually general topics" (e.g. "Problems of salary cuts").

4.1.4. IMAGE SEARCH SYSTEMS

Current image consumers and image providers use a wide range of systems to search and disseminate images: from the personal web spaces (e.g. Photoshelter, Demotix), blogs and social networks (Flickr and Facebook) indexed by image search engines (Google Image Search) and free user-generated image collections (Flickr, WikiMedia Commons, Panoramio, Stock.XCHNG) to royalty free microstock libraries (iStockphoto, Fotolia,Shutterstock, Alamy, ThinkStock) and specialized image collections (Getty, Science Photo Library, Reuters, IPS, Agence France-Presse, and Associated Press). The image collections are usually used as a source of instantly available images at a competitive price. Google is used by most participants to conduct an initial search and to reveal the broad perspective of a topic. Flickr is appreciated by users for Creative Commons images, enjoyable browsing and search within image producers' photostreams. However, some users stated that they would use Google or Flickr only as a last option for a number of reasons. Firstly, they are used to stock systems, which have enough images both to choose from and to browse through. Moreover, they consider the quality of free images being inappropriate for their work, thus the search within free systems being a "purposeless waste of time".

All existing image search systems have a niche. For example, Flickr is known for a huge selection of holiday pictures and photos of pets; Wikimedia has a good range of celebrity images; microstock websites are searched for generic items; while stock websites are used to find specific people or images of a specific period of time. Very often materials come from the client's media centre or press centre or could even be screen grabs of games and movies.

The analysis of interview transcripts revealed potential directions for further analysis. First of all, it provided us with contextual information about information needs of the participants. Secondly, based on the interviews we generated a list of commercial systems which are used within the community for image search and selected a set of the most popular ones for the further analysis of their functionality. Moreover, the transcripts analysis highlighted the importance of documents called briefs, which are requirements for a creative project. This led us to the current research of structure and semantic nature of briefs and their role within a lifecycle of a creative project.

4.2. COMMERCIAL SEARCH SYSTEMS

Given the various types of commercial image retrieval systems identified in the previous section by creative professionals, we focus here on an analysis of metadata used by the systems and functionality given to the user to formulate a query. All five image search systems to some extent allow users to search images by bibliographic, descriptive and business facets (see table 3). Bibliographic facets are usually immutable over time and are set when the image is created/uploaded. Descriptive facets are more variable in nature and may be subjective. Business facets are specific for each buying scenario and depend on a specified business model. There are also a number of image content features that might be either assigned in a form of a keyword a human or a Content Based Information Retrieval (CBIR) algorithm, where the last way of assignment is less subjective. Those marked with (*) have corresponding CBIR algorithms along with descriptive approaches.

Facet			#Systems	Examples
Image	*Bibliographic*	Media/File type	5	JPEG, TIFF
		Size	2	59mb, 29.5kb
		Format	4	17in x 13in @ 300ppi
		Timestamp	5	Uploaded 1,2 days, 1 week
		Geolocation	3	Lat/Long, France
		Source [image provider name, domain address]	5	Photographer name, collection
		ID, title, description	4	'Cute baby eating biscuit'
	Descriptive	Category	5	News, Sport, Documentary
		Keyword/Tag	4	Agility, risk
		Colour*	2	Colour, B&W
		Composition (copyspace)*	1	Position of objects
		Presence of people*	3	1,2 or more people
		Reference (Query-by-example)*	1	Uploaded image
		Adult material filtering*	3	Exclude nudity
Business		Price range	2	Per image, range slide bar
		Rights	5	Royalty free, rights managed
		Usage (use, circulation, size of placement)	1	Presentation, website, business package
		Target market	1	Creative, editorial
		Territory of use	1	Worldwide…
		Duration of use	1	…for 5 years

Table 3. Image Search Systems' predefined search/refining features.

Search engines (ISS1) and photo-sharing (ISS4, ISS5) websites are more bibliographic and description based (keywords, timestamp, geolocation, etc.), while commercial stock libraries (ISS2, ISS3) pay great attention to a business side of image search (i.e. budget limits, future image usage, etc.). Commercial stock libraries take a domain analytic approach to image description making them appropriate for specific users such as creative searchers, while search engines and photo-sharing websites are focused on the average user. Stock libraries put a lot of effort into tagging, along with various sorts of guidelines for photographers. There is a great emphasis on people tagging in one of the stock libraries (ISS2) , thus a range of refiners serves specifically this purpose, i.e.

number of people (*No people, One person, Group of people*), their age (*Adult, Children only*), gender (*women, boys, young men*) and ethnicity (*Caucasian Appearance, Multiracial Group, Mixed Race Person*). They also put their creative effort in tagging concepts (*innovation, leadership, luck*), topics (*business travel, education, global warming*), people's emotions (*impatient, bossy, playful*), relations (*siblings, heterosexual couple, neighbour*), and even sayings (*key to success, surfing the net, time is money*).

Both stock systems (ISS2, ISS3) emphasise the importance of compositional and photo effect tagging, which differentiate them from other image search systems. These terms include specification of shot angle (*front view, aerial view, eye level*), shoot distance (*close-up, macro, wide angle*), composition (*isolated objects, headshot, waist up*), photo effects (*blurred background, multiple exposure, high key*), shoot location (*indoors, outdoors, studio shot*), as well as various specification of text-based colour description (*desaturated, monochromatic, black background, vibrant colour*).

All examined systems are based on keyword search supporting Boolean and phrase searching, with most systems supporting predictive search. Stock libraries are based on controlled vocabularies and reduce search ambiguity by clarifying search term meaning (e.g. "orange" – colour, fruit, telecom company, city in Texas), photo-sharing network search operates on user-generated tags and file metadata, while image search systems also take into consideration text surrounding the image (i.e. content of a webpage containing the image). Although ranking algorithms are different in all five systems, in general results may be sorted by date, relevancy and popularity. The examined search engine and one of the photo-sharing networks contain restriction functionality known as "Safe Search" that prevent adult content from appearing in your search results. The algorithm is based on a number of factors, including keywords, links, and image content. One of the stock libraries also has "Exclude nudity" feature. The search engine and stock image libraries allow search of similar images, however, the underlying algorithm differs. In case of the search engine, it is content-based search based on colour-, texture-, and shape- histograms, while in case of stock libraries it is a description-based search. There are a number of content-based functionalities provided both by the examined search systems, i.e. search by colour, face detection, CopySpace™. Most systems support refiners of bibliographic and physical features: file type, source, size, timestamp and geolocation. Moreover, all systems allow filtering by licence type (Right Managed, Royalty Free, Creative Commons). As ISS1, ISS4, ISS5 are not designed to sell images, they do not have e-commerce mechanisms. In contrast ISS2 and ISS3 allow their users to specify a number of criteria (i.e. license type, format, duration and territory of use, industry, exclusivity) that define the final price of an image. ISS3 also allows limits on price range, which are not stated explicitly, but presented in a form of schematic price range from lowest price level (one dot) to the highest price level (four dots).

4.3. BRIEF FACETS

A total of 21 facets were identified in the analysis (see table 4), which were then grouped into three main higher level classification categories - Business, Image and Context as follows;

- *Business category 'B'* refers to business decisions about time and budget frames, rights needed including model releases required, and quantity of images asked for.
- *Image category 'I'* refers to image description including description of specific, general and conceptual image features, syntactic features like colours and textures, lightening, style, composition, format and size, required post-processing, as well as links to similar images or suggestions about image content. It corresponds to Westman (2009) categorization of image attributes.
- *Context category 'C'* gives background information on the context of use (client, contextual post-processing, purpose), as well as includes additional relevant material (book reviews, articles to illustrate, place description, etc.).

We describe each of these facets below and give specific examples for use for each facet.

4.3.1. BUSINESS FACETS 'B'

The Business class facets include budget, deadline, rights, territory of use, duration of use, model release and image quantity. *Budget* is a project budget available per image (*Project Budget (USD) $250-$750*). *Deadline* is

a time limit for photo offers (*3 days left*). *Rights* include Creative Commons, Rights-Managed, Royalty-Free rights schemes needed by the client, as well as exclusivity of use (*do not submit any royalty free images; Exclusive use? Exclusive use in specified regions*). *Territory of use* is usually relevant for Rights-Managed rights scheme and refers to the territory the image will be used on, where "worldwide" usually refers to the use of the image on the Web (*Use: UK and Europe, Where? Worldwide*). *Duration of use* is also usually relevant for RM rights scheme and refers to the time during which the image will be used by the buyer (*One time use, 12months, starting from April 24, 2012*). Buyers may also need a *Model release*, which is a legal release typically signed by the subject of a photograph granting permission to publish the photograph in one form or another (*must be model-released, no models under 18 years*). Buyers may ask for an image which contains (recognisable) people. The last feature in this category is *Quantity*, which specifies number of photos needed as total or as a choice range (*a range of images, 3 shots, up to 20 images*) by the client.

No	**CLASS**	**FACET**	**FACET CODE**
1	B	Deadline	DL
2	B	Budget	B
3	B	Rights	R
4	B	Territory of Use	TU
5	B	Duration of Use	DU
6	B	Model Release	Rel
7	B	Quantity	Q
8	I	Colours &Textures	C&T
9	I	Composition	Comp
10	I	Light	L
11	I	Post-processing	PP
12	I	Size	Size
13	I	Generic Semantics	G
14	I	Specific Semantics	S
15	I	Conceptual	C
16	I	Ref similarity	RS
17	C	Usage	U
18	C	Target market	TM
19	C	Purpose	Pur
20	C	Additional Info	AI
21	I	Subjective evaluation	SE

Table 4 – Categories and Facets arising from the Brief Analysis.

4.3.2. IMAGE FACETS 'I'

The Image category classes include non-visual, syntactic and semantic information. Non visual image features are: file size, file type and format. Media type (photo, video, drawing, etc.) fact was omitted from this analysis, as initially we searched for briefs that contained photo assignments. The feature of *size* is closely connected with a notion of quality and media where an image is going to be used (lower quality for web, higher resolution for printing). The size either is known (*the image size is 637 pxl x 226 pxl, 72 dpi, a couple of inches high*) or the image is asked to be of high quality/resolution (*large resolution files, vast shot*). Syntactic features include: colours & textures, composition, lighting, applied post-processing and style. *Colours & Textures* refer to the overall colour scheme of an image, as well as background and isolated objects colours and textures (*only b&w, must contain a prominent red object*). In case of this work *composition* is a collective term including such features as format of an image (*landscape, portrait, square, panoramic*), shooting distance (*close-up, face*

portrait, an overall view), angles (*camera angle directly front on, looking into the camera*), mutual location of objects (*no cars directly in front of the theatre, isolated*), focus (*shots with nice background blur*) and copyspace (*will carry words "Real life. Real taste", space for type over bottom half of image*). *Light* describes various lighting schemes (*natural lighting, some orange subtle lighting 'orange pings', long shadows*), that could be influenced by time of a day (*feel like it was taken at about 4 pm in the afternoon, daytime images*) and location of a shot (*indoor/outdoor/studio settings*). *Post-processing* refers to additional editing and retouching of an image content required (*can be treated, have to be cropped or manipulated*). Image style reflects a *subjective evaluation* of glamour, natural, stocky concepts (*not touristy shots, a classy image, not cheesy stock shots*). Semantic subclass describes general, specific and conceptual features of an image. *Generic Semantics* are general (not opinionated) descriptions of what should or should not be on an image (*beach with great surf waves, young adult woman*). It should be noted that in the examined briefs some of the semantic descriptions are just thoughts on was is required to provide context for the reader. *Specific Semantics* is specific entities/places/people that should be represented on the image (*portrait of new astronomer at Greenwich observatory, a hand holding an iphone4, view along the Southbank towards Tower Bridge and The City Hall*). *Conceptual* features are descriptions of ideas, concepts, events (*positive busy images of every day street life, innocence, freedom, beauty*). Sometimes for users it is easier to show what you want than try to describe. In this case they attach a *reference (*image, link to an image or any other visual aid) that supports description of an image need by showing wanted and unwanted features. It may refer both to content similarity (*as close to the apple ones as possible, reference is attached*), as well as style similarity (*similar in style to National Geographic, were looking for a similar style to the reference images attached, like 50s documentary*).

4.3.3. CONTEXT FACETS 'C'

Context class includes such facets as usage, client's industry, target audience, purpose of use, additional information relevant for the project. *Usage* is a description of where the image is going to be used (for printing, to reproduce, will be used for a new website, book jacket, half or quarter page). *Target market* specifies target audience/industry for the image, which is either said explicitly (*IT service provider specialising in "cloud services", readers are aged 14 to 22*) or is given in a form of a hint (*client: Coca-Cola, for Timotei, this target audience is very practical and down to earth*). This category could potentially be split into client industry and product target audience (*consider: client is an insurance company, target audience could be housewives, active tourists, businessmen, etc.*). *Purpose* is an objective of an image (*the development of the project home in Australia, for a road trip story, Job title: Real Life. Real Taste*). By *additional info* we mean a range of information, including description of additional relevant material (*book reviews, links to music or other external materials*), description of colour and texture features that refers to the image context (*front page contains variations of green, Carbon Fiber can be very reflective*), include contextual post-processing, i.e. use of the image within a predefined template, GUI, text (*put type around*). *Subjective evaluation* is opinionated description of affect the images should have on a viewer *(no stages, posed, cheesy shots, dark and moody, evokes fun, warmth and positivity*).

4.4. BRIEF ANALYSIS

In order to evaluate semantic diversity and structure of briefs we calculated facets distribution in two ways. First, the quantitative distribution of facets across all briefs, summarizing all instances of a facet to reveal which appear most frequently overall. Secondly we consider the number of times a particular facet appeared in a brief.

4.4.1 FREQUENCY OF ALL INSTANCES OF FACETS

$$d(x) = \frac{\sum x * 100}{\sum f}$$

Equation 1 – Calculation for distribution of facets in briefs

The method used to calculate frequency of facets is declared in equation 1, where d(x) is a percentage of facet instances across all coded phrases, $\sum f$ is the sum of all coded phrases and $\sum x$ is sum of phrases of a particular facet.

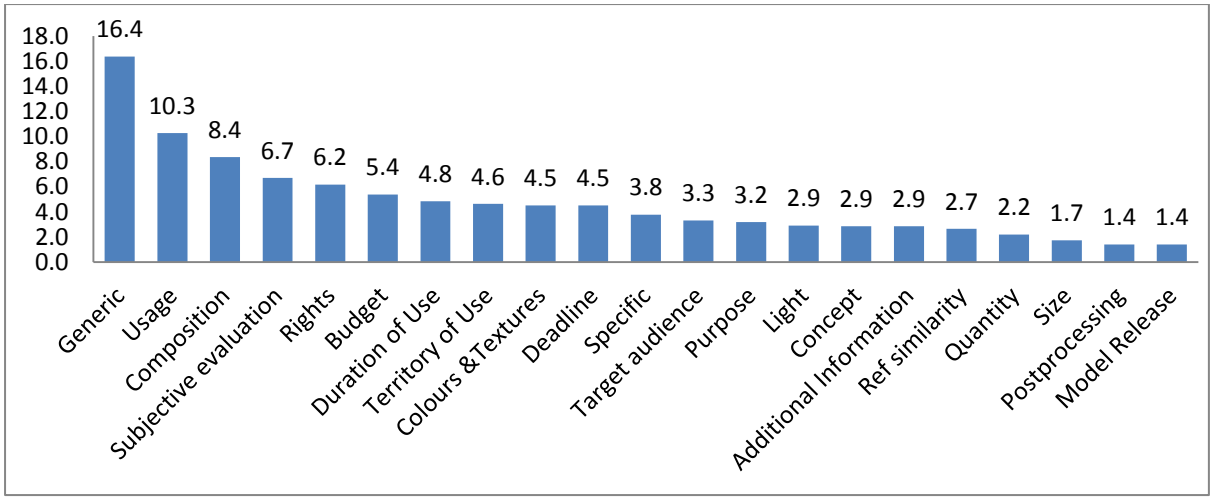

FIGURE 1 DISTRIBUTION OF IMAGE FACETS – CODED ITEMS

This distribution gives an overview of the semantic diversity of a brief as a document, outlining the most informative elements of a brief. Below we consider top and bottom 5 facets of this distribution (Table 5) along with corresponding system development recommendations. It is not surprising that the general description of image content, which usually serves as a query basis, was the most frequent facet. The Usage facet is the next most frequent, which is supported by only one of the reviewed image search systems. Being a valuable source of information about image contextual use, it could help in tailoring search results to peculiarities of usage (e.g. logo image vs. book cover). However more focused usage modes and describing their peculiarities could be useful for image recommendation services and image filtering – facets in the image retrieval system tended to be rather broad. The Composition facet could be a basis for industry specific CBIR algorithms. Given that colour features are not a particular requirement among creative professionals, other content detection approaches like shooting angle, distance, exposure, etc. are more of interest. Subjective evaluation of image content is a feature that might be crowdsourced via social media to achieve an evaluation of an image impact based on a community view (e.g. Pinterest). As it was mentioned earlier such information should be managed by recording the demographic groups of interest e.g. age, occupation of the target audience. The most popular business facet is *Rights*, which often requires negotiation.

Reference similarity is usually provided as an attachment or a link to a resource containing image similar in content or style and usually referred in a brief just once to point out the similarity feature of interest. Thus, in a quantitative sense this facet is not weighty. The same corresponds to quantity, size and model release. While post-processing, referring to re-touches and cropping the image needs, are rarely mentioned, presumably because re-touching is not a problem for creative professionals.

	Semantic diversity distribution		**Structural distribution**	
	Top 5	Bottom 5	Top 5	Bottom 5
1	*Generic*	Reference similarity	*Usage*	Concept
2	*Usage*	Quantity	*Rights*	Specific
3	Composition	*Size*	*Generic*	*Post-processing*
4	Subjective evaluation	*Post-processing*	Budget	*Size*
5	*Rights*	*Model release*	Deadline	*Model release*

Table 5. Top and bottom 5 facets of two facet distribution types: semantic diversity and structural.

4.4.2 FACET PRESENCE IN BRIEFS

Some facets like budget deadline, image size, etc. are usually mentioned only once, in contrast to extended description of generic, compositional image features, descriptions of target audience and purpose of use, etc. However, not all facets have equal weight in a brief e.g. budget is often a constraining feature for images. We

therefore consider the frequency of facets across briefs i.e. presence of a facet per brief. The calculation was very simple – a Boolean expression was used to establish the presence of particular facet in a brief and accumulated for a given facet (see figure 2).

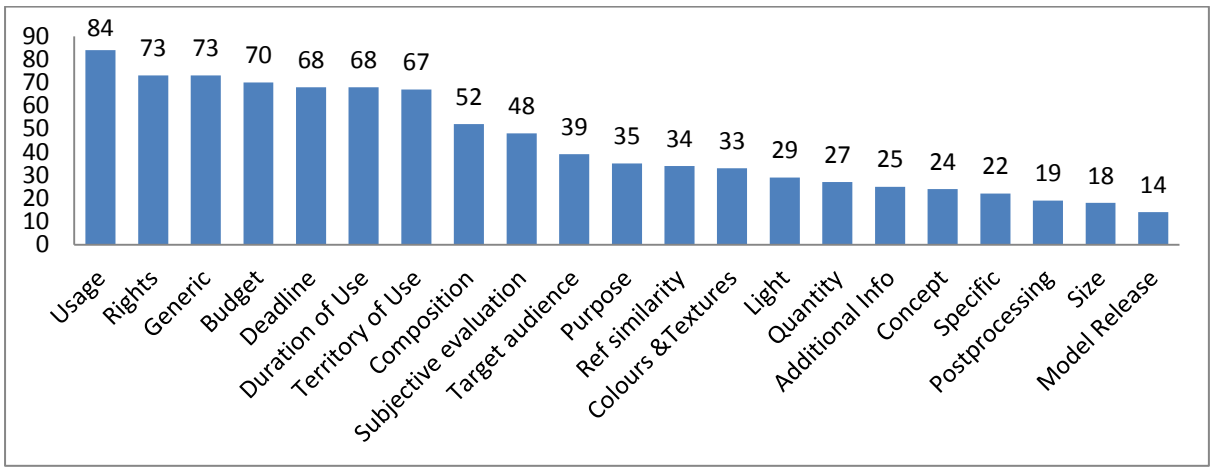

FIGURE 2. FACET PRESENCE ACROSS ALL BRIEFS [QUANTITY]

This distribution is partially influenced by a brief creation interface of our major brief source ImageBrief. Its interface has mandatory fields that a photo buyer has to fill in, which along with free -text description field include 'budget', 'deadline' 'intended usage', 'where?', 'how long?' and 'exclusive use?' fields. This demonstrates the importance of rights, budget, deadline, duration and territory of use and usage facets in almost all briefs – these would need to be specified irrespective of the design of a particular interface. The Generic facet, ranked second with rights, demonstrates the requirement for a generic description of an image need in almost every brief, and is independent of interface design.

The Bottom five facets are not influenced by the interface structure. As with the distribution of coded facets in figure 1 size, post-processing and model release facets are rarely used, but also show that specific and conceptual features are of less interest in image needs than generic descriptions of image content. A more detailed view into briefs' structure demonstrates that even when conceptual descriptions are used, image searchers will need to clarify a concept description with some generic examples.

5. DISCUSSION

Creative professionals have developed complex personal strategies for image search which depend on commercial constraints such as time and budget, as well as their tacit knowledge about content and functionality of various image search systems. The search happens across low end search systems like Google Images and Flickr, mid range microstock libraries like Fotolia and iStockphoto and high end stock image libraries like Getty and Corbis, where searchers have to compromise between cheap or free content and advanced search facilities. This complexity is because of the environment in which the search is conducted, where there is no intermediary to assist the seeker. This forces the user to adapt to existing systems rather than express their image need as it is.

However, an image search query has to originate from somewhere; it appears within a context of a particular creative project, which is usually specified in a form of a brief. A brief, as well as a query itself, can be of any level of specificity, ranging from looking for exact copies of an attached reference image to asking for a creative input of a photographer. However, even if it is an inspirational, idea-seeking search; a brief gives much more contextual information than a single word query aimed for browsing. This information should be carefully considered, as it is the starting point for initial image recommendations leading to iterative clarification of a searcher's need.

Image related features had been researched for a while and a number of sophisticated search approaches have already been employed by existing commercial search systems. High end stock libraries, which usually operate

on a controlled vocabulary, invest a lot of resources in creative tagging. Their main emphasis is keywords related to concepts, ideas, human emotion and moods, as well as thorough description of people presented on images. Based on analysis of search systems' functionality, we may conclude that people presence is used in filtering for search, as it is supported by the majority of search systems either through tagging or by means of CBIR (e.g. face detection).

Match Type	List of facet matches: Brief=Image search engine [facet class]
Full Match [Total=17]	Budget=Price Range [B]. Rights=Rights [B]. Territory of use=Territory of use [B]. Duration of use= Duration of use [B]. Colour/Texture=Colour [I]. Composition=Composition [I]. Size=Size/Format [I]. Generic Object; Specific Object; Concept; Subjective Evaluation; Light; Purpose, Additional Information=Keyword/Tag [I,C]. Ref Similarity=Reference [I]. Usage=Usage [C]. Target Market=Target Market [C].
Partial Match [Total=1]	Model Release=Presence of people [B,I].
Brief Only [Total=3]	Assignment Photography: Deadline, Quantity. Non-Search criteria: Post-Processing.

Table 6 – Matches on Brief Facets with those on Image Search Systems

A brief, being a requirements document, usually contains a quite detailed description of an image which is in some way 'drawn' with words. Searchers usually provide generic description of what should and should not be on a search image, using conceptual descriptions mostly when they are seeking for inspirational ideas or for illustration of a topic that is not familiar to them. Table 6 shows the matches between the facets identified in briefs and those used in image search systems. Overall there is a very close correspondence between the facets and the majority of the brief facets are supported in one way or another, sometimes in the case of Keyword/Tag in a number of brief facets are represented. However there is a clear case for a more detailed facet scheme in search engines, as users need to be able to refine their searches by narrowing or broadening their query (see section 4.1.1). Users may start with generic terms (in a Generic object facet) and then refine their query by identifying specific terms (through a Specific Object) facet to narrow down their search. However users may also start a search from Specific Object terms and find generic terms from the image description to broaden their query. A more detailed facet scheme would give the user this flexibility, which a Keyword/Tag facet cannot – it is harder for users to pick out specific or generic terms from a facet that is too ambiguous. A key recommendation of this work is that image retrieval systems avoid 'Keyword/Tag' facets and provide more helpful ones for the users.

In 40% of examined briefs, reference images are also included to support the written descriptions. However, without a proper clarification a reference could be more misleading than helpful (e.g. reference photo of a girl on a beach: is it a girl on a beach that needs to be on a required image or the same feeling of freedom it has to convey?). Thus, an interface supporting interaction with a reference image helping to clarify the reference intent (written description of emotions the image conveys, circling of interesting content parts of an image) is worth being developed.

Based on the interviews and briefs' analysis, we can also conclude that in case of a targeted search, creative professionals usually go into in-depth specification of image syntactic features such as shooting angle, distance, exposure, copyspace, caring less about features that can be easily edited such as colour and other post-processing filters. A composition facet contains a lot of field specific terms, which might be further researched. Moreover, the link between compositional features and the image meaning could also be researched in more detail. There are a number of related works researching image and photography semiotics (Lacey, 2009; Barthes, 1981; Barthes, 1977; Harrison, 2003). However, a summary for a practical implication of those finding for a system design is needed.

While the content part of a search image is often defined in great detail, opinionated subjective evaluation of an image is a popular facet which is very difficult to employ in a search engine without further work. For example the issue of evaluating a 'WOW factor' or 'stocky' look of an image can be crowdsourced through social indexing to gather domain knowledge from the creative community. Moreover, the solution will be even more valuable if contextual information of a project could be linked with demographics of evaluators.

From the exploitation perspective, the system should support bookmarking of both image providers and images themselves, as well as support secure sharing of an image among creative project participants including a client. Moreover, given that creative professionals did not report information overload when dealing with huge amounts of images interface solutions should consider use of infinite scrolling or high-density interfaces (Butterworth and Goker, 2011).

6. Conclusion and Future Work

The research aim was to look more closely at the image information needs of creative professionals and analyse the semantics and structure of documents known as briefs, which are commonly used in creative fields and incorporate a range of descriptive and bibliographic image facets, as well as additional contextual details and business related information of a creative project. We saw that in some areas facets used in briefs were consistent with literature describing image search processes, but still had its own peculiarities and commercial constraints. We also compared our findings with information coming from contextual interviews and functional analysis of commercial image retrieval systems. Most of the issues highlighted in the interviews were confirmed by examples in briefs. Revealed search facets coming from briefs were also compared with functionalities offered by top commercial systems and some gaps were highlighted. In particular it is clear that a more fine grained system of facets is required to support creative user needs (e.g. Keyword/Tag is to ambiguous) and any image search system needs to reflect these identified needs through an appropriate faceted search scheme – this addresses our central research question.

The outcome of this study is a set of search facets for an image search system for creative professionals, which might not be used a conventional search engine based on keyword queries with further refiners, but actually as part of a brief creation tool that will support information needs of a user with more detailed and contextually rich description of images. Two main directions of further research are study of a composition facet from CBIR and semiotics perspectives and a linkage between project's contextual information and image recommendations potentially based on social proofing (e.g. there has been a substantial growth in social curation of photo and image collections). These recommendations are tailored for creative image search in advertising, marketing, design, etc. Further research of peculiarities of editorial images is still required. Designing a new or improving an existing image search system for creative professionals, we should keep in mind richness of contextual and business information searcher has in mind while searching.

Acknowledgements

This work has been enabled through the funding support from the UK Technology Strategy Board for the PhotoBrief Project (Ref: TP12144-76203). Our thanks project partners, Ambiesense and MediaReach for their enthusiasm and support in our work.

References

Armitage, L. and Enser, P., 1997. Analysis of user need in image archives. Journal of Information Science August 23, 287-299.

Barthes, R., 1981. Camera lucida: reflections on photography. Hill and Wang.

Barthes, R., 1977. Image, music, text. Fontana Press.

Butterworth, R., Goker, A., 2011. The potential of a 'high density' image retrieval interface. Proceeding of HCIR 2011. Available on https://sites.google.com/site/hcirworkshop/hcir-2011/posters [visited: 24th April 2015].

Chen, H. L. 2001. An analysis of image queries in the field of art history. Journal of the American Society for Information Science and Technology, *52*(3), 260-273.

Datta, R., Joshi, D., Li, J., and Wang, J.Z. (2008). Image Retrieval: Ideas, Influences, and Trends of the New Age. ACM Computing Surveys. Vol. 40, no. 2, 5:1-60.

Eakins, J. P., & Graham, M. E. (1999). Content-Based Image Retrieval: A Report to the JISC Technology Applications Programme, January, 1999. *Inst. for Image Data Research, Univ. of Northumbria at Newcastle*.

Goker, A., Butterworth, R., MacFarlane, A., Ahmed, T., and Stumpf, S. (2015). Expeditions through image jungles: the commercial use of image libraries in an online environment. Journal of Documentation (to appear).

Hare, J. S., Lewis, P. H., Enser, P. G., & Sandom, C. J. (2006). Mind the Gap: Another look at the problem of the semantic gap in image retrieval. In *Electronic Imaging 2006* (607309-607309). International Society for Optics and Photonics.

Harrison, C., 2003. Visual Social Semiotics: Understanding How Still Images Make Meaning. Technical Communication, 50(1), February, 46-60.

Hollink, L., Schreiber, A.Th., Wielinga, B., and Worring, M. (2004). Classification of User Image Descriptions. International Journal of Human Computer Studies 61/5, 601-626.

ImageBrief Web Site. Available on http://www.imagebrief.com/ [visited: 24th April 2015].

Inskip, C., MacFarlane, A., Rafferty, P. 2012. Towards the disintermediation of Creative Music Search: Analysing Queries To Determine Important Facets. *International Journal on Digital Libraries*, 12(2-3), 137-147.

Jaimes, A., Chang, S-F. (2000). A conceptual framework for indexing visual information at multiple level. In: Proceedings of SPIE Internet Imaging 2000, Vol. 3964.

Jorgensen C. and Jorgensen P., 2005. Image Querying by Image Professionals. Journal of The American Society for Information Science and Technology, 56(12), 1346-1359.

Lacey, N. 2009. Image and Representation: Key concepts in Media Studies, 2nd Edition. Palgrave Macmillan.

Markkula, M., Sormunen, E., 2000. End-User Searching Challenges Indexing Practices in the Digital Newspaper Photo archive. Information Retrieval, 4, 259-285.

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. 212-218.

Photographic Assignment Meetup webpage. Available on http://www.meetup.com/Photographic-Assignments/ [visited: 24th April 2015]

Russell-Rose, T., Tate, T. (2013). Designing the search experience: the information architecture of discovery. Morgan Kaufmann.

Strauss A.L., Corbin, J.M., 1998. Basics of Qualitative Research: Techniques and Procedures for developing Grounded Theory. Sage publications.

Westman, S., Oittinen, P., 2006. Image retrieval by end-users and intermediaries in a journalistic work context, IIiX: Proceedings of the 1st international conference on Information interaction in context , 102-110.

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, 63-83.