

Two Solitudes Revisited: A Cross-Cultural Exploration of Online Image Searcher's Behaviors

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Abstract. This paper presents and discusses the results of the second phase of the project that aims to investigate the roles and usefulness of search characteristics and functionalities used for image retrieval in a bilingual context, from the user's point of view. The difficulties encountered by image searchers are described. Finally, suggestions to be integrated in a search interface model are presented. This exploratory study provides an understanding of how users with different linguistic and cultural background search for images.

Keywords: Digital images, search interface, image retrieval, cross-language information retrieval, multilingual information.

1 Introduction

The image retrieval process supposes that users must search a database that contains many thousands, even millions of images. Ideally, the search interface must be hospitable and support query formulation with as little effort and frustration as possible for the user. It should also allow users to retrieve images from all origins, including images indexed in a language that does not match the query language.

However, many factors can overwhelm the image searcher, including functionalities that are well-designed but not particularly adapted to the retrieval of images indexed in an unknown language. The results of our previous study [13] on image searchers' behaviours of four different linguistic communities revealed significant differences in the searching process. These differences must be taken into consideration when developing any search interface used for image retrieval.

Despite the fact that some search engines already offer sophisticated search mechanisms and features, much remains to be done to ensure universal access to many textual or non-textual documents. The general goal of our research project proposes to develop an interface model for image retrieval in a bilingual (English and French) context, that is, when the query language differs from the indexing language. In particular, this study addresses the following three objectives:

1. To identify the characteristics and functionalities of existing search interfaces and similar tools available for image retrieval.
2. To investigate the roles and usefulness of these search characteristics and functionalities for image retrieval in a bilingual context.
3. To design and develop an interface model that allows image retrieval in a bilingual context.

This paper presents the second phase of the project aiming to investigate the roles and usefulness of the search characteristics and functionalities for the image search process in a bilingual context, from the user's point of view. Image searchers are viewed as informants who can help Web designers fill gaps with their knowledge.

2 Related Works

2.1 Content-Based Image Retrieval

The main focus of image retrieval research has been on how people search for and describe images. However, despite widespread studies on image searchers' behaviour or performance when searching for images, little is known about the image search functionalities that individuals actually use for image retrieval.

Image retrieval can be performed using the "Content-Based Image Retrieval" (CBIR) techniques. CBIR systems take advantage of the physical characteristics of the image [17] and do not involve the use of metadata, such as keywords, tags or any textual descriptions associated with the image at any stage. Images are indexed and eventually retrieved with the values associated with certain parameters, such as colour, texture and shape [2]. These low-level characteristics are generally automatically extracted from image files, as opposed to the so-called "high-level" indexing terms assigned following the analysis of the image by a human indexer.

With some CBIR systems, the users can submit an image or a drawing and the engine will retrieve images similar to these visual queries. It is also possible to search with a dominant colour. This feature is already offered by several search engines, therefore allowing the search to be conducted through millions of images using this technology based on colour histograms. Some CBIR devices have been expressly designed to help filter and identify skin tones and shapes that could indicate the presence of sensitive content, such as nudity.

Regardless of some weaknesses such as relevance of results, speed of execution of retrieval tasks and overall user satisfaction, the retrieval systems that use low-level characteristics are already offering interesting searching features and are advantageous in the case of browsing, that is, when image searchers do not have a very clear idea of what they are looking for [11]. Nevertheless, CBIR systems still present a number of imperfections and remain at the experimental stage [8], [5].

The future of these systems depends very much on the technological progress that will occur and the interest they will generate. Further, the usability of these systems, in terms of effectiveness, efficiency and satisfaction, will probably be a key element in the decision of the everyday image searchers to adopt them or not.

2.2 Text-Based Image Retrieval

Most search engines allow the users to look for images with the usual textual queries. With the “Text-Based Image Retrieval” (TBIR), the search engines will try to match the query words with the indexing terms associated with the image. In most cases, queries remain very short and less than developed. In 2010, Choi and Hsieh-Yee, [3], revealed that the average number of terms used in an image query was 3.12 terms. This finding is similar to that of previous studies on Web image queries [7], [9], [12]. Short queries such as “Kate Middleton”, “Olympic games”, “iPhone5”, will be generally successful since most search engines use the text surrounding the image for describing and indexing the content of an image.

The use of the adjacent text allows fast and rather accurate indexing of billions of images. Nevertheless, two significant weaknesses tend to appear with this mass automatic indexing process. On the one hand, the surrounding words are often unconnected to the image or ambiguous. On the other hand, image retrieval will be unsuccessful if different languages are used in the description of the images, since it is difficult to map semantically equivalent words across different languages [10]. To these difficulties, we must add that the text-based approach may greatly limit the possibilities in terms of semantic interpretations of the image content. Consequently, the amount of resulting images will often be overwhelming, discouraging, even frustrating sometimes.

Research results from the field of image retrieval tends to indicate that a combination of the two types of retrieval systems (CBIR and TBIR) could overcome most difficulties of each individual approach [14].

2.3 User-Centered Techniques in Image Retrieval

Over the years, several studies were realized on text-based retrieval activity. For example, Fidel (1997) [6] suggested that image needs among users range from two extremes, the Data Pole (images as information, i.e., x-rays, maps) and the Object Pole (images as illustration, i.e., aesthetic objects), with the majority of cases falling at some point in between the two poles. Several studies ([7], [9], [16]) revealed a transformation in the way queries are formulated in the image retrieval process. Most recently, Wetsman et al. [18] stated that task type influences the use of query modes. Chung and Yoon [4] examined how the image need context impacted the kinds of attributes used in image seeking. This change leads to a reassessment of the way in which the image must be searched and whether the search tools traditionally employed for image searching and browsing are well-suited to all types of images.

The focus of these projects did not reveal much about the search functionalities use by image searcher. In fact, little is known about the interactions that take place between the image searchers and the retrieval system. The examination of Web image searcher’s behaviour, therefore, seems crucial in order to improve retrieval systems. In the same way, it is crucial to continue the study of retrieval strategies of image searchers in order to establish better search tools that will be more appropriate to the needs and behaviours of image searchers.

3 Objectives

For the first phase of the study, a best practices review was performed in order to acquire knowledge of the existing search functionalities, and to assess how they can be integrated in the development of a bilingual search interface dedicated specifically to images. However, this review only provided a list of functionalities available to search for images. We can speculate if differences exist according to the linguistic preferences of the image searchers in terms of query types and the use of some search functionalities since this exploration is taking place within the very unique cultural context of Québec, a Canadian province with a predominantly French-speaking population and the only one whose sole official language is French at the provincial level.

To gain valuable information on the usefulness of these search functionalities, the next logical step was to talk to real users and analyze their behaviours and needs when searching for online images. There has been little research on investigating the characteristics and functionalities necessary to support image retrieval in a bilingual context and to integrate these characteristics and functionalities into a comprehensive yet flexible interface model. This project proposes to fill this gap and answer the following research questions:

1. What types of queries are used by individuals during the image search process?
2. Which functionalities are currently used for the image search process?
3. Which functionalities are considered to be useful to the image search process?
4. To what extent are there differences in the image search process between two groups of individuals with different languages?

4 Methodology

For this study, we used the methodology identified and described by Behesthi, Large and Clement [1] of “Informant Design,” where participants’ input is required at various stages of the design process [15]. Participants are viewed as a major source of information that can help researchers fill their knowledge gaps.

For the first step of our data collection a bilingual (English and French) questionnaire containing closed and open questions was developed and administered to two groups of participants: 20 English-speaking and 20 French-speaking respondents. The quantitative data was analyzed according to statistical methods while the content of the open-ended questions was analyzed and coded to identify emergent themes.

For the second phase, data was collected with semi-structured interviews conducted in two languages: English and French. The semi-structured interviews aimed to gather participants’ knowledge and understanding of their perceptions for the image retrieval process. They also allowed users to articulate and express their experiences as image searchers. Two interview guides (English and French) were developed to assist in collecting the data. Five English-speaking and five French-speaking respondents accepted to be interviewed.

During the interviews, the participants were asked to identify and discuss the features and functionalities they usually employ to search for images. The answers received from participants were expected to help us understand the behaviours and needs of people who are frequently searching for online images and to identify cross-cultural difficulties. Some interview questions, as well as the topics explored during the interviews, depended on the direction in which the participant led the discussion. This approach was taken in order to determine how the participants experienced image searching which was directly related to their experience and search goals. As much as possible we asked respondents to express their thoughts and experiences without forcing them to answer in a formal manner.

The data from the ten interviews (approximately 45-60 minutes each) was audio-recorded and transcribed. Interviews have been analyzed and coded to determine emergent themes that could enrich our understanding of the image searcher's perspective. All text has been coded by at least two evaluators. An intercoder reliability test was conducted to ensure coding consistency. Participants' responses and related issues that arose during the interview process were grouped and analyzed as complete quotations and filed according to topic or issue. Responses have been analyzed thematically with emergent themes ranked by frequency and subsequently categorized.

5 Results

5.1 Type of Queries

Among French-speaking searchers, image retrieval is characterized typically by a two stage process: a short, general keyword search is first performed in the search box, followed by browsing of the results. French Participant 1 (FP1) states: "Mais je vais écrire peu importe – je vais décrire ce que je cherche dans une – dans la façon la plus simple possible sans utiliser trop de mots, parce que plus t'en mets, plus tu sors de trucs qui ont des fois pas rapport." [*But I will write whatever – I will describe what I'm looking for in a – in the simplest possible way without using too many words because the more words you use, the more stuff you get and it doesn't match.*] FP3 and FP5 also emphasize the importance of being specific when inputting a query. All five participants start a search with a minimal number of keywords, typically between one and three. FP2 usually launches a search with a single keyword, while FP3 adds that they rarely need more than two or three because they usually find what they are looking for with that number of keywords. Boolean operators are typically not used for images. FP1 states using them for textual searches, but only implicitly for images: "Je fais ma recherche sur le même principe, même si j'utilise pas le mot «AND» puis «OR» ." [*I do my search following the same principle, even though I don't use the word 'AND' or 'OR'.*]

Among the French-speaking participants, the intent behind the search reflected a mix of personal, work or school related needs. The preferred image browser was Google Images, but other tools were also used: JSTOR (FP1) and ARTStores (FP4) as well as Yahoo and Bing images, museum websites, and Wikipedia. The main arguments for relying on Google Images to perform their search is simplicity, ease of

use and familiarity. When asked why they did not search on other websites, FP1 stated “C’est pas un réflexe.” [*It’s not a reflex.*] FP2 and FP3 mentioned returning to the website for future searches: “Oui, pour qu’on y revienne souvent.” [*Yes, so that you return to it often.*] and “Ou parce qu’on l’a juste utilisé beaucoup, donc c’est devenu [habituel].” [*Or because you used it a lot, so it became natural.*] FP4 explains their lack of use of Flickr as an image retrieval tool because they did not put any effort in trying to understand how it works: “J’ai pas encore fait l’effort de comprendre comment ça fonctionne.”

The use of other websites to get more background information about a search was also common among French-speaking participants. FP2, FP3 and FP4 all gave the example of paintings and using Wikipedia as a source of information to learn more about a painter, the title of a work, the date, or the period. This information would help them to formulate more specific queries. FP5 added online forums to Wikipedia as a source for background information. The purpose of searching for background information is to build a specific vocabulary that would allow them to target known-items in their search: “Dans le sens que si jamais je connais pas le nom de la toile, tu sais.” [FP3] [*In the sense that is ever you don’t know the title of a painting, you know?*]

Among English-speaking participants, the image retrieval process is also based on a general keyword search followed by browsing the results. For all these five participants, the search query consists of very few keywords without having to use phrases or advanced searching options such as Boolean operators demonstrated by examples they gave for their search such as “Jennifer Aniston hair” (EP1), “rag weed” (EP4), and “heart disease” (EP5). Some of these participants indicated that they tend to refine their queries based on the results that they get from their search. English participant 2 (EP2) stated that: “I usually start with the best terms that I can come up with, and if that works then great but if it doesn’t then I try narrow my search or broadening it and come up with better search terms”

Similar to the French-speaking participants, English-speaking participants search for images either for personal use or for school projects, only EP4 indicated searching for images for job related needs. All five participants indicated that they almost always start with Google to search for images, but Flickr/Flickr creative comments (EP2), Tumbler (EP3), and Bing (EP5) were also mentioned as secondary searching systems. The reasons for relying heavily on Google ranged from it offering free images (EP5), simplicity (EP1-5), to offering the basic [information] needs (EP4). When some participants were asked why they do not use other systems such as Flickr, they noted that because it requires them to create accounts which in turn hinder their accessibility to the site (EP3-4) and also requires them to identify themselves (EP4). EP3 states: “I could use Flickr but I’m just, don’t even want to go there I feel like I have to sign up”.

But unlike French-speaking participants, English-speaking participants did not rely on other websites to get background information about a search, except for EP2 who uses Wikipedia to validate search terms in Russian. Nonetheless, EP2 and EP5 indicated using other websites such as Flickr for browsing their friends’ images without actually using it to search for images, as can be seen in EP5 statement: “like a couple of my friends have a Flickr account so I look at their photos but I don’t use it specifically for an image search”.

5.2 Functionalities Currently Used

None of the five French-speaking participants said they use advanced search functions when looking for images. At the most, they use the size and/or resolution of an image as selection criteria when browsing the search results. FP1 uses size, shapes and colours as a way to select and refine the results: “Généralement je vais juste comme vraiment faire un scan visuel de chaque page.” [*Generally, all I will end up doing is a visual scan of each page.*] Searching by colour is seen as useful in the context of work-related searching, as stated by FP2: “Dans tous ces métiers-là où souvent ils recherchent des formes, des images, la couleur.” [*In all these professions, where they often search shapes, images, colour.*]

English-speaking participants also indicated that they rarely, if ever, use advanced search functions such as colour, shape, and texture when looking for images. Nonetheless, all five participants said they would use the size function to select a desired image from the search results, usually after visually browsing what they retrieved. EP1 indicated the familiarity with other functionalities, but not using them in the search process: “the features that I use...choosing the size, but other than that I know that the features are there and I know if I need to refine it more”.

5.3 Functionalities Considered Useful

When asked about the usefulness of various functionalities, French-speaking participants all recognized that while they may not use a specific function, there may be cases where it would be important to have it. FP1 says that it is important that searching by size and colour exists – “Je trouve que c’est important que ça existe.” – but later admits to not usually using them. There was also a lack of knowledge regarding the possibility of searching by similar image, or searching by drawing, as offered in some systems. Both functionalities were viewed as potentially interesting. FP4 had just recently discovered the possibility of searching with a similar image and said: “Je viens juste de découvrir cette fonction qu’a Google, là, où on peut mettre l’image et qui donne des images semblables. Je l’ai découvert il y a, genre, deux, trois jours, puis ça a changé ma vie.” [*I just discovered that function in Google, where you can put the image and it returns similar images. I discovered it about two, three days ago and it changed my life.*] FP4 later explained that they used this function to identify various paintings they had saved on their hard drive without any information about the title or the painter.

One functionality French-speaking searchers deemed useful, which English-speaking searchers did not appear to value, is the automatic translation of queries. All five participants recognized the usefulness and often the requirement of having to search in languages other than French, with English being the most important language. They all, however, cautioned on the quality of automatic translation, fearing the results for anything longer than a couple of words. FP2 stated her lack of confidence in automatic translation more strongly than the others: “Aucune confiance” [*No confidence*]. FP2 preferred to rely on dictionaries and self-translation for higher quality search terms.

The issue of automation also came up with various searchers regarding the development of a taxonomy to help index saved images. FP1 would like to have a

combination of automatic suggestions and their own keywords: “Je pense qu’un mix des deux: pouvoir utiliser tes mots-clés, comme ça si tu trouves ce que tu veux, tant mieux.” [*I think a mix of both: using our own keywords and that way if you find what you want, even better.*] FP5 would prefer to use their own keywords: “Bon, c’est assez fendant, mais oui, je préfère utiliser mes mots.” [*Look, it’s a little pretentious, but yes, I prefer to use my own words.*] FP4 tied automatic translation and the suggested taxonomy: “Si je pouvais définir mon propre et ensuite qu’il fasse la traduction.” [*If I could define my own terms and have it translate them.*]

While searching for images using other images sounded “fun” (EP2), “cool” (EP3) and “helpful” (EP5) for English-speaking participants, the consensus indicated that it is just an “extra perk” (EP3) and not as important as other features such as accessibility (EP1). Searching for images by drawing also seemed “fun” (EP2), but four participants indicated that they probably will not use such functionality because they lack drawing skills (EP1,2) and it requires a lot of time. EP3 states that: “based on what I could draw and like the way I draw it and the size or shape or the texture I don’t think that would be very helpful to me personally, and I think that even in general I think you will get a lot of [ambiguity in the] results”.

As stated earlier, English-speaking participants do not rely on automated translation tools mainly for two reasons: first, they do not usually perform bilingual/multilingual search, except for EP2 who searches in multiple languages including Spanish and Russian very frequently. Second, they acknowledge the availability of whatever they look for in English since it is the dominant language on the internet (EP1,4). Even for those participants who indicated using Google translate in some occasions, translation quality offered by those tools was an issue for not relying on them as indicated by EP2: “[because] often I’m little skeptical whether or not that really is the proper translation”.

On the other hand, other functionalities were suggested by those participants that they considered useful to search for images online, including a tool to adjust the images on the spot while retrieving images (EP1), automatic spell check (EP2), a tool that would enable them to insert special characters like accented letters in French (EP4), a toolbar to enhance the accessibility to the search tool (EP5), and the ability to tag images with accurate descriptors (EP2,4).

5.4 Differences in the Image Search Process between the Two Language Groups

As can be seen from the results of interviews both for French and English speaking participants, keyword searching seems to be the main approach for searching images online, without relying on advanced techniques such as using Boolean operators or searching using similar images or having the ability to search by drawing. The search keywords are very few and descriptive as much as possible in order to enhance the accuracy and relevancy of the results. Unlike English-speaking participants, French-speaking participants occasionally use other features such as shapes and colours to refine a search, but most importantly they indicated the importance of having a bilingual search tool that could help them search in their secondary language, which is English.

6 Discussion and Conclusion

The main contribution of this phase of our research project is to help understand the difficulties encountered by image searchers when conducting simple image retrieval activities. It also highlights several interesting suggestions that could eventually be in a search interface model in order to ease the search process. Findings from this study have provided us with directions that lead us to the initial organization of the search interface model. The initial structure will be based on: (1) the potential characteristics and functionalities extracted from the existing interfaces review; (2) the results of the survey and interviews; and (3) the results of previous studies on search behaviours of image users and the comments received from the participants.

Above all, the results of this exploration of the image searchers' perspective intended to bridge a gap for unilingual individuals. The bilingual search interface we propose to develop in the ultimate phase of our research project will constitute a definite benefit for image searchers unfamiliar with more than one language, by giving them user-friendly bilingual access to visual resources, such as works of art, architecture, material culture, archival materials or visual surrogates.

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