TIIARA: A New Bilingual Taxonomy for Image Indexing†

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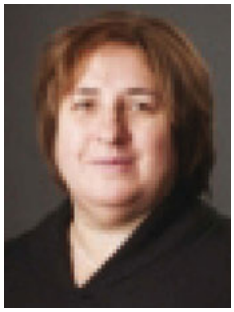

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Abstract: This paper presents the final phase of a research project that aims to develop a bilingual taxonomy (English and French) for the indexing of ordinary digital images. The objective of this last stage was to ask a representative sample of image searchers to complete retrieval tasks of images indexed using the new taxonomy TIIARA to measure its degree of effectiveness and efficiency. During this experiment, a sample of 60 participants were asked to indicate where in the taxonomic structure they thought they would find each one of the 30 images shown. Respondents also completed a questionnaire intended to obtain their general opinion on TIIARA and to report any difficulties encountered during the retrieval process. 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. The findings of this ultimate phase of the research project indicated that, despite the fact that some categories still need further refining, TIIARA already constitutes a successful tool that provides access to ordinary images. Furthermore, the bilingual taxonomy constitutes a definite benefit for image searchers who are not very familiar with images indexed in English, which is still the dominant language of the Web.

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All things are difficult before they are easy. Thomas Fuller*, Gnomologia,* 1732

1.0 Introduction

The long debate over the best vocabulary to use for image subject indexing has been going on for decades. One school of thought insists on the importance of choosing a vocabulary that assures maximum control in order to avoid the usual pitfalls of polysemy and synonymy (Hudon 2003, 2006; McClung 2009). Others argue that, given their versatile nature, images can only be well represented using the maximum freedom offered by uncontrolled vo-

cabularies (Matusiak 2006; Svitlia and Jörgensen 2009). Nevertheless, perhaps a compromise can be found in the form of taxonomies that offer both a form of hierarchical control and a vocabulary more closely connected to the terminology image searchers use on a daily basis.

In recent years, taxonomies—especially the ones created for specific domains—have become essential tools for a growing number of applications. This paper presents the final phase of a research project that aims to develop a bilingual taxonomy (English and French) for the indexing of ordinary digital images (e.g. images representing everyday-life objects, scenes or people). First, the development of TIIARA (Taxonomy for Image Indexing And RetrievAl) was based on an extensive analysis of existing specialized terminologies used by professional indexers to describe images, as well as the tags employed by regular Internet users. This exploration was undertaken to measure how these terminologies could be integrated in the development of the taxonomy. An evaluation of 150 vocabulary resources that organize and describe images (libraries, museums, search engines and commercial websites) was carried out. This examination of best practices for the organization of digital images used by indexing specialists and non-specialists alike was a crucial step, since it provided the basic guidelines and standards for the categories, formats of terms and relationships to be included in the new bilingual taxonomy (Ménard and Smithglass 2012).

Second, the development of TIIARA[1] consisted of several steps that were iterative in nature, and, as such, an incremental user testing was carried out in different phases in order to validate and refine the taxonomy components. For this validation phase, the card-sorting technique was used. Analysis of the data provided by the card-sorting proved to be an invaluable source for identifying difficulties encountered using the taxonomy structure and dynamically suggested ways to improve it (Ménard 2012). Once the structure was considered stable enough, two indexers (one English and one French native speakers) were selected to index a small image database (IDOL—Images DOnated Liberally—which includes 6,015 images offered voluntarily by photographers) using TIIARA. A detailed comparison of the indexing terms assigned by the two indexers was undertaken and revealed not only potential holes in the taxonomy, but also the difficulties and complexity encountered during the indexing process (Ménard 2013).

This paper presents the third and last phase of the project, wherein TIIARA was tested with a sample of images and image searchers. The paper is structured as follows: Section 2 surveys previous studies in image management and access; Section 3 presents the objective of the research; Section 4 describes the methodology used in the study; Section 5 reports the main findings, which are then discussed in Section 6; and Section 7 concludes the paper and suggests future directions.

2.0 Related works

Text-based image indexing and retrieval have been studied extensively over the years (Panofsky 1955; Krause 1988; Markey 1988; Armitage and Enser 1997; Jörgensen 1998, 2003; Markkula and Sormunen 2000; Conniss et al. 2000; Conniss et al. 2003; Goodrum and Spink 2001; Choi and Rasmussen 2002, 2003; Matusiak 2006; Enser et al. 2007; Enser 2008; Greisdorf and O'Connor 2008; Ménard 2008; Rorissa 2008; Chung and Yoon 2009; Svitlia and Jörgensen 2009; Benson 2011). These studies describe the considerable amount of work that accompanies image organization.

One of the main problems acknowledged in the pertinent literature is the subjectivity inherent to the very nature of images (Shatford 1986). The choice of vocabulary can, of course, reduce the possibilities of indexing inconsistency. Traditionally, image indexing has been done with controlled vocabulary not necessarily created for the specific nature of the images, with a resulting inconsistent degree of precision. For example, Library of Congress Subject Headings (LCSH), Getty's Art & Architecture Thesaurus (AAT) and the Thesaurus for Graphic Materials (TGM) constitute interesting alternative controlled vocabularies because they are universal enough to be useful for almost all types of images. However, these terminologies are sometimes too sophisticated for the everyday image searcher (e.g. non professional image users such as students). In addition, as Furnas et al. (1987, 964) stated, "People use a surprisingly great variety of words to refer to the same thing." As a result, images indexed with these controlled vocabularies will not necessarily match all queries.

Among all controlled vocabularies offered for image indexing, taxonomies recently appeared as an innovative usable tool for a majority of users. The main purpose of taxonomies "includes domain simplification, description and charting for reliable and speedy navigation" (Lambe 2007, 83). According to Gilchrist (2003, 16), this type of controlled vocabulary "may also use a combination of classification and thesaural techniques applied to a wider range of object types (and museums documentation and image retrieval may be mentioned here)." It is an established fact that taxonomies play an important role in many contexts. For example, they help to better understand the queries in Web searching, to improve search results (White et al. 2010) and to support query refinement (Sadikov et al. 2010). Nevertheless, if taxonomies can simplify the searching process and facilitate finding the

Figure 1. Examples of retrieval tasks

"right" information near effortlessly, the extensive work needed to create and eventually obtain these ideal results requires a well-thought-out plan. Unfortunately, few studies described the basic processes of their development (Wang et al. 2006; Hedden 2010; Lambe 2007; Whittaker and Breininger 2008; Pincher 2010; Ménard 2012).

3.0 Objective and research questions

When designing a controlled vocabulary, it is important to obtain information on the users themselves. Taxonomy development is no exception, and it supposes a constant interaction between users and choice of vocabulary. The objective of the final phase of the research project was to ask a representative sample of image searchers to complete typical retrieval tasks of images indexed with the new taxonomy in order to measure its degree of effectiveness and efficiency. The performance testing was also expected to identify usability inconveniences of the new taxonomy that may not have been revealed by less formal testing. The experiment also aimed to evaluate the quality of the vocabulary, the structure of the taxonomy and the selection of specific subcategories. Finally, the testing was intended to verify whether TIIARA was equivalent in the two targeted languages: French and English.

With this ultimate phase of the study, we proposed to answer the four following research questions:

1. How does the new TIIARA taxonomy support image retrieval in terms of effectiveness?
2. How does the new TIIARA taxonomy support image retrieval in terms of efficiency?
3. To what extent are there differences between the two groups (French and English native speakers) in terms of retrieval effectiveness and efficiency for images indexed with the new TIIARA taxonomy and, if so, what are these differences?
4. How do image searchers react to the use of the new TIIARA taxonomy?

4.0 Methodology

4.1 Participants

This phase of testing entailed an evaluation of the performance of TIIARA, which involved a usability test under experimental conditions that included a sufficient number of respondents to form at least two comparison groups and the manipulation of certain variables while keeping others constant (Sproull 1995).

For the TIIARA testing, a non-probability sample of 60 (30 English-speaking and 30 French-speaking respondents) was used. All participants were recruited with ads and listserv postings that explained the tasks required and the estimated time needed to perform these tasks. Word-of-mouth was also used for recruitment. For ethical considerations, our participants were aged 18 years and older. In addition, to ensure the homogeneity of the group of participants (Fortin 1996), two other selection criteria were defined: participants needed to have French or English as their mother tongue and, given the nature of the tasks to be performed during the experiment, the participants should have had no professional experience in a field involving image indexing and retrieval. These criteria were used to control the bias that may come from heterogeneous participants. However, we were aware that the sample size and too much homogeneity could limit the generalization of the statistical results to the single category of participants selected for our research (Fortin et al. 2006). A monetary compensation of $10 was allocated to each respondent deemed suitable for the experiment.

4.2 Data collection

During this experiment, the participants were shown each of the 30 images randomly selected (Figure 1) from the IDOL database (Ménard 2012), in the same order of presentation.

Using TIIARA, participants were asked to indicate where in the taxonomic structure they thought they

would find each one of the images. For each image retrieval task, the following variables were recorded:

– The taxonomic path used by the participant for each attempt
– The result for each attempt (success or failure)
– The time spent for each attempt
– The number of attempts used for each one of the 30 retrieval tasks (max. 3 attempts per image)
– The final result of each one of the 30 retrieval tasks (success or failure)

Once the retrieval simulation was completed, participants answered a questionnaire to give their general opinion on TIIARA and to report any difficulties encountered during the retrieval process. The questionnaire evaluated the quality of the entire taxonomy as well as the overall satisfaction from an end-user's perspective. The questionnaire was administered to participants using the online survey tool Survey Monkey. The survey comprised 12 closed questions with responses indicated on Likert scales (see Table 4) to gather participants' general impressions of the taxonomy. The questionnaire also contained four open-ended questions that asked users to provide feedback about TIIARA. According to Peterson (2000), both types of questions should be used together since each type of question comprises different advantages and disadvantages.

The retrieval experiment and questionnaire were pretested by four respondents (two English-speaking and two French-speaking). The retrieval simulation was conducted in a relatively short period, from May 1 to June 14, 2013, to prevent the effect of data contamination. The completion of each test (retrieval tasks and questionnaire) took between 45 and 60 minutes.

4.3 Data analysis

Descriptive statistics were used to investigate the differences between the two language groups. The quantification of the image retrieval performance was based on the usability measures recommended by the ISO 9241-11 standard, that is, effectiveness and efficiency (Association française de normalisation, 1998). In general, effectiveness refers to the ability to achieve a given goal, while efficiency refers to the ability to perform a given task with minimum time and effort (Brangier and Bracenilla 2003; Ménard 2009). Traditionally, several indicators can be considered for these two measures. For our research, the measures were defined as such:

– Effectiveness of image retrieval: measured by the success rate of retrieval, calculated by using the number of images retrieved divided by the total number of images to be retrieved
– Temporal efficiency of image retrieval: measured by the average time (in seconds) for each retrieved image
– Human efficiency of image retrieval: measured by the average number of attempts made for each retrieved image

The content of the four open-ended questions was analyzed and coded to extract direct responses made by the participants, for example, the participants' responses to questions such as "Did you have any difficulty using the structure?" Thematic passages were also used in the constant comparative method of data analysis adopted in this study, for example, difficulties encountered when using TIIARA (e.g., "If there was a person in the picture, I tended to focus on them rather than the concept or object they were holding. Very anthropomorphic of me." [E2]). This feedback proved useful for the further refining stage of TIIARA.

5.0 Findings

5.1 Characteristics of participants

This study involved two linguistic groups: 30 French native speakers and 30 English native speakers. Among the 60 participants, 36 were female and 24 were male. There were 13 French-speaking men and 17 French-speaking women, and 11 English-speaking men and 19 English-speaking women. The majority of participants (40 respondents) were under 26 years of age, 14 respondents were aged 26–35, 1 respondent was aged 36–45, 3 respondents were aged 46–55, 1 respondent was over 55 years of age and 1 respondent did not answer. Our sample showed a variety in the education level with most participants (27 respondents) having earned at least a bachelor's degree. The majority of the 60 were students (37 respondents) or employed for wages (13 respondents).

5.2 Effectiveness

For this study, we considered the success rate, that is, the ability to achieve the objective (retrieving the image shown), as the main indicator of effectiveness. Table 1 shows the average number of retrieved images (out of 30) for each of the two language groups.

English-speakers correctly retrieved on average 18.9 out of 30 images, and French-speakers properly retrieved on average 16.0 out of 30 images. To better understand the results, we examined the data more in depth and found that all 30 images were found by at least one English-speaker, yet only 27 images were found by at least

Language group	Number of retrieved images N = 30	Deviation	Number of participants
English	18.9	3.04	30
French	16.0	2.47	30
Total	17.5	3.08	60

Table 1. Effectiveness of image retrieval (in retrieved images)

one French-speaker. This means that three images were not correctly retrieved by at least one French-speaker. To push the analysis further, we found that 23 images were found by at least 10 English-speakers, and that 19 images were found by at least 10 French-speakers.

5.3 Efficiency

Regarding efficiency, we distinguished between two forms: temporal efficiency and human efficiency (Brangier and Bracenilla 2003; Ménard 2008).

5.3.1 Temporal efficiency

First, temporal efficiency was measured by the time in seconds, on average, used to retrieve an image. Table 2 shows the mean average time required to retrieve an image.

Language group	Average (in seconds)	Deviation	Number of retrieved images
English	19	4.73	30
French	19	4.45	27
Total	19	4.56	30

Table 2. Temporal efficiency (in seconds)

As stated in the previous section on effectiveness, all images were correctly retrieved by at least one English-speaker and 27 out of the 30 images were correctly retrieved by at least one French-speaker. There were no differences in the average amount of time to correctly retrieve images between the French and English groups, with both groups taking on average 19 seconds. Participants were faster when they correctly retrieved images compared to when they did not correctly retrieve an image. English-speakers on average took nearly 24 seconds per attempt for those cases when the image was not correctly retrieved, and French-speakers on average took 23 seconds.

5.3.2 Human efficiency

Human efficiency is measured by the average number of attempts used to retrieve an image. Table 3 shows the average number of attempts required to retrieve an image.

Language group	Average (in queries)	Deviation	Number of retrieved images
English	1.58	0.17	30
French	1.60	0.17	27
Total	1.60	0.17	30

Table 3. Human efficiency (in queries)

Each participant was given a maximum of three attempts to correctly retrieve the image. On average, English-speakers took 1.58 attempts to correctly retrieve an image and French-speakers, 1.60 attempts. Again, all images were correctly retrieved by at least one English-speaker and 27 of the 30 images were correctly retrieved by at least one French-speaker.

5.4 Image searchers reaction to the use of TIIARA

5.4.1 General perception

After completing the 30 retrieval tasks, participants were asked to answer a short questionnaire to obtain their general opinions on the taxonomy and to report any difficulties encountered during the retrieval process. The first section contained 12 statements on the personal perception of the taxonomy that respondents needed to grade on a Likert scale. Table 4 presents the results for the complete sample of 60 participants.

As we observed in table 4, a majority of respondents agreed to most statements (S1 to S7 and S11 and S12). However, some concern was expressed about the capability of categories to retrieve images "easily" and "quickly" (S8 and S9). This underlined that some TIIARA subcategories may need further refinement to meet the expectations of image searchers in terms of effectiveness and efficiency. Also, we noticed an even more important difficulty encountered by the participants when beginning the searching process, where 55% disagreed and 15% strongly disagreed to the following statement (S10): "I always knew which category to use to begin my research." This finding clearly highlights that some category labels may not have been intuitive enough to be well understood by all users and will need to be improved.

N= 60	Strongly agree		Agree		Neutral		Disagree		Strongly disagree		Not applicable	
	n	%	n	%	n	%	n	%	n	%	n	%
1. In general, I am satisfied with the results obtained at the time of the retrieval.	0	0.0	**27**	**45.0**	14	23.3	15	25.0	3	5.0	1	1.7
2. The structure is easy to use.	7	11.7	**30**	**50.0**	8	13.3	14	23.3	1	1.7	0	0.0
3. It was easy for me to learn how to use the structure.	14	23.3	**27**	**45.0**	13	21.7	6	10.0	0	0.0	0	0.0
4. The categories available were easy to understand.	4	6.7	**31**	**51.7**	16	26.6	9	15.0	0	0.0	0	0.0
5. The categories available were easy to use.	5	8.3	**32**	**53.3**	10	16.7	11	18.3	2	3.3	0	0.0
6. The categories available were clearly organized.	6	10.0	**26**	**43.3**	16	26.7	11	18.3	1	1.7	0	0.0
7. The categories available gave a complete outline of the images contained in the database.	1	1.7	**19**	**31.7**	**19**	**31.7**	18	30.0	3	5.0	0	0.0
8. The categories available allowed me to retrieve the images easily.	2	3.3	9	15.0	20	33.3	**27**	**45.0**	2	3.3	0	0.0
9. The categories available allowed me to retrieve the images quickly.	2	3.3	14	23.3	21	35.0	**22**	**36.7**	1	1.7	0	0.0
10. I always knew which category to use to begin my research.	0	0.0	5	8.3	13	21.7	**33**	**55.0**	9	15.0	0	0.0
11. The categories were not always developed sufficiently.	4	6.7	**33**	**55.0**	10	16.7	12	20.0	1	1.7	0	0.0
12. The categories available made me want to explore the image database.	9	15.0	**35**	**58.3**	14	23.3	1	1.7	1	1.7	0	0.0

Table 4. General perception of the taxonomy

5.4.2 Difficulties

The participants were also encouraged to point out difficulties they encountered using TIIARA. The overall reaction to TIIARA seems promising. Two difficulties came back repeatedly in the respondents' comments. First, some participants stated, "Some images can be categorized in more than one folder. Hence it was difficult to find them" [E27]. This type of incongruity, however, is related to the indexing process and to the guidelines received by the indexers that stipulated that each image would be indexed with only one indexing term, that is, to stay in only one TIIARA subcategory. In many cases, this provided a maximum of precision, but also led to very different and awkward retrieval results. Given the possibility that the indexer could have assigned more than one subcategory, we can suppose it would have enhanced the retrieval results.

Second, some respondents indicated another type of difficulty: "I was unsure whether to look at the image as a whole or the individual things in the pictures, for example, talking on a mobile phone as an activity or the mobile phone itself. Another would be looking at just a toy or considering it a celebration or even just identifying the child in the photo" [E10]. Once again, this difficulty could be explained by the indexing decisions that were taken according to the indexing policy provided.

5.4.3 Categories to be merged

When asked about the categories that could be merged to simplify the searching process, most participants seemed satisfied with the first-level categories of TIIARA and did not express many suggestions about possible merging. However, one category that looks confusing for some respondents is "Abstract Ideas:" "The Abstract Concepts category shouldn't exist" [E8], "La catégorie idée abstraite. Je ne pensais jamais à aller voir dans cette catégorie. J'ai l'impression que quelques images ont été mit [sic] là pour des mauvaises raisons" (Our translation: The category "Abstract Ideas." I never thought of using this category. I feel that some images were put there for wrong reasons) [F27].

5.4.4 Suggestions

The participants were also invited to propose suggestions to improve TIIARA. Here, participants expressed several

interesting ideas that will be taken into consideration in the ultimate phase of TIIARA refinement. For example, several participants wished to have more categories: "None. It seems structured well enough. They can, however, add categories" [E20]. And once again, a majority of respondents would be satisfied to have images placed in several categories: "La possibilité de voir la même image répertoriée sous plus d'une catégorie, si un peu redondant, serait un atout pour éviter les culs-de-sac en recherche" (Our translation: The possibility to find the same image listed under more than one category, if a bit redundant, would be an asset to avoid dead-end searching results) [F29]; "Possibly have one image in many categories" [E27].

5.4.5 Overall grade

Finally, the respondents were invited to evaluate the taxonomy on a scale of 1 to 10, with 10 being the highest grade possible. Here again, the results obtained are encouraging. For example, some participants indicated their satisfaction: "I think the structure was quite well-conceived, as can be evidenced by the number of images I was successfully able to locate despite the great number of categories. Overall, I think it was quite intuitive and comprehensive, and that is reflected in my rating of an 8" [E9]; "I thought that the structure made sense to me" [E22]. However, some participants also expressed some concern when trying to identify a subcategory in which the image should appear: "I would rate the scale a 6. It is initially pretty straightforward, but once you get further in, the categories need better defining" [E6]; "Je pense que la structure a une note de 5, parce qu'elle n'est pas difficile à utiliser mais certaines catégories portent à confusion" (Our translation: I think the structure can be rated 5 because it is not difficult to use, but some categories are confusing) [F14].

6.0 Discussion

The first three research questions relate to the effectiveness and efficiency of TIIARA. From the data gathered in this phase of testing, we found no differences in terms of efficiency, both human and temporal. Both English-speakers and French-speakers correctly retrieved images in the same amount of time and with a similar number of attempts. In terms of effectiveness, TIIARA appeared, on the surface, to be better for English-speakers. French-speakers retrieved fewer images than English-speakers and, out of the 30 images (see examples in Figure 1), three were not correctly retrieved by any French-speakers. We attribute this difference not to the interface itself, but rather to the indexing of those images. The French indexing relied on the "Abstract Ideas"category more often than the English indexing. In fact, if we were to determine that an image was correctly retrieved by French-speakers based on the French and English indexing, then all images would have been correctly retrieved by French-speakers. Furthermore, in some cases, French-speakers may have even found the image on their first attempt, but because the French and English indexing differed, and were tested separately, they did not.

If most TIIARA categories and subcategories seem intuitive and comprehensible for most participants, it is a different story for the "Abstract Ideas" category, which continued to cause difficulty for image searchers as it did for indexers during the indexing process. Even if few images were indexed with a term extracted from that category (Ménard 2013), this category includes terms that refer to a different level of description, that is, the iconological level identified by Panofsky (1955). Panofsky distinguished three levels of subject matter or meaning: pre-iconographical description, iconographical analysis and iconology. Pre-iconographical description relates to everyday objects and events and requires no specialist knowledge. Iconographical analysis deals with images, stories and allegories for which knowledge of specific themes or concepts is needed. Describing an image at the third level (iconology) necessitates interpretation of the "intrinsic meaning or content." It seems that participants encountered difficulty looking for images with that specific category or did not even browse that category at all. As observed by several studies (Jörgensen 1998; Hollink et al. 2004), users still favour conceptual image description compared to perceptual or iconographic description. This observation is important and leads to the possibility that "Abstract Ideas" could be removed from TIIARA since it is proven to be difficult to use for indexing (Ménard 2013) and almost ineffective for image retrieval. However, before permanently removing that category from TIIARA, more testing seems necessary.

In a previous study (Ménard et al. 2013), participants were asked to identify the main difficulty they encountered when searching for images. Many elements of frustration emerged from the data collected, from image resolution to image quality. However, some respondents openly admitted to still having difficulty formulating a query that would lead them to the image they are looking for. Consequently, once fully operational, TIIARA could become an interesting feature that could support image retrieval in a bilingual environment. The idea of incorporating a taxonomy to help image retrieval has been suggested by many image searchers who participated in our exploration on the roles and usefulness of search characteristics and functionalities for image searching in a bilingual context (Ménard et al. 2013). Very few search engines offer their users the opportunity to browse a taxonomic structure to initiate their queries, using or even re-

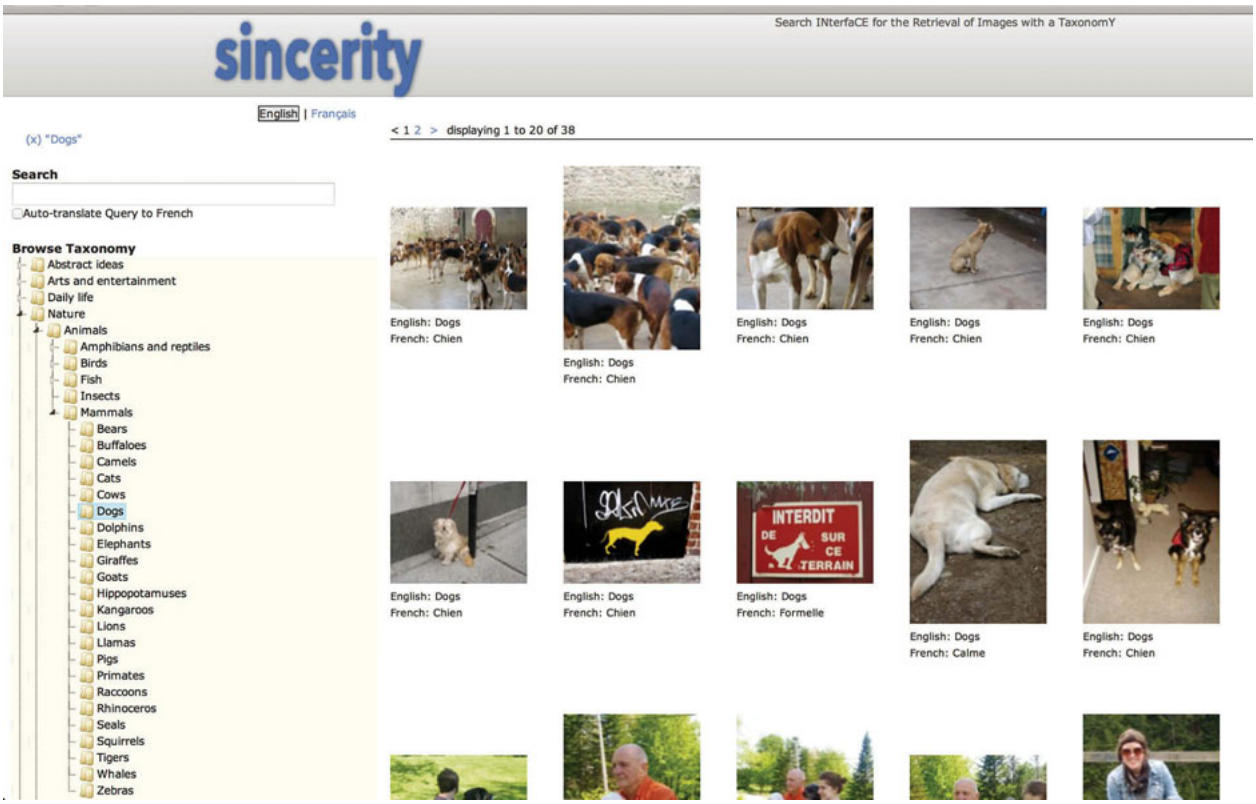

Figure 2. Search engine (SINCERITY) that includes TIIARA

fining the results with a panoply of subcategories. We are presently building a search interface model dedicated to image retrieval in a bilingual (English and French) context, that is, when the query language differs from the indexing language. TIIARA has been implemented as one of the search features offered in the new search engine (SINCERITY: **S**earch **IN**terfa**CE** for the **R**etrieval of **I**mages with a **T**axonom**Y**) (Figure 2).

The final phase of the project that aims to develop the image searching interface will involve an exhaustive user-testing process to ensure that the final product is clear, comprehensive and consistent. The objective of this testing will be to invite a sample of image searchers to retrieve images with the new interface. Testing will be done using the entire IDOL database (6,015 images). The participants will be free to use their own keywords or browse the taxonomy to formulate their queries.

7.0 Conclusion and further work

In this paper, we reported the testing of a bilingual taxonomy that allows searchers to navigate a large collection of images using loose, hierarchical categories. The TIIARA taxonomy focused on helping to find ordinary images in a faster and more efficient manner. Despite the fact that some categories still need further refining, the results obtained during the ultimate phase of the testing indicated that the taxonomy constitutes a successful way to provide access to image collections.

Large volumes of images are now available online. The growth of the Internet has highlighted the pressing need to develop tools for the description of images in order to facilitate their retrieval, since they are found in most Web resources, from digital libraries to museums. Among the many types of images accessible, the ordinary image occupies an important place in users' searches on the Web and constitutes the main objective of this research project. Nevertheless, as a logical follow-up to this project, we intend to apply the methodology to other types of images and non-print documents, such as audio files or videos, for example.

In addition, for this research project, we have limited the taxonomy to only two languages (French and English). In the future, we would like to integrate more languages in TIIARA. Even if constructing multilingual vocabularies necessarily means important challenges in terms of cost and expertise, the growing diversity of languages of the Web calls for reliable tools that give access to multilingual documents, including images.

Note

1. A complete description of the taxonomy development can be found in Ménard, Elaine. 2012. TIIARA: The

"making of" a bilingual taxonomy for retrieval of ordinary images. *Library Hi Tech* 30 no. 4: 643-54.

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