Lynne C. Howarth and Thea Miller
Faculty of Information Studies, University of Toronto
Toronto, Ontario, Canada

Assessing Metadata Categories and Visual Displays for Retrieving Digital Cultural Resources

Abstract: Focus groups tested the appropriateness of a seventeen-element categorization model for uniquely identifying and retrieving digital objects from cultural repositories. Findings suggest that, while only a subset of categories ranked as important to selecting images, the type of material and a context for searching also influence the utility of a category.

Résumé : Des groupes de discussion ont testé l'adéquation d'un modèle de catégorisation comprenant 17 éléments visant l'identification unique et le repérage les objets numériques des entrepôts culturels. Les résultats suggèrent que, même si un sous-ensemble de catégories sont considérées comme importantes pour sélectionner des images, le type de matériel et le contexte de recherche influencent également l'utilisation d'une catégorie.

1. Introduction and Background to the Research

For the past quarter century, efforts to facilitate the discovery of digital objects in repositories developed by libraries, archives, museums, and art galleries, have concentrated to a large part on creating domain-specific content metadata. Information retrieval systems that could exploit that metadata most effectively have not received the same attention. Yet, increasing numbers of metadata project implementations suggest the need for systems that can search across digital cultural repositories, and display a growing body of content-rich results sets in various languages and scripts. Such volume and variety introduces opportunities for innovative approaches to presenting responses to end-user queries. Displaying search results in language-independent, visual clusters that represent meaningful categories to an end-user unfamiliar with the structures of naming devices inherent to underlying metatags offers a useful alternative to textual labeling that characterizes more traditional data displays.

2. Rationale and Conceptual Framework for the Research

Recognizing the potential of using visualization tools, such as those offered by topic maps, in combination with grouping like information within readily identifiable categories, research was undertaken to design and test mediating models for a search system that could extend beyond the numerous silos of metadata-enabled digital objects currently supported within cultural institutions. The result was a two-pronged approach wherein a semantic bridge was developed to link different content metadata schemas, and a search interface designed to identify and retrieve objects from diverse repositories for which metadata records had been created.

In conceptualizing a possible semantic bridge to assist with sorting through or "making sense" of a multiplicity of data structures and naming devices characteristic of different

metadata schemas, De Mey's (1982, 4) observation that, "The central point of the cognitive view is that *any* such *information processing*, whether perceptual (such as perceiving an object) or symbolic (such as understanding a sentence) *is mediated* by a *system of categories or concepts* which for the information processor constitutes a *representation* or a *model* of his *world*." [emphasis in original] proved particularly relevant. Symbol grounding – a concept within cognitive psychology that explores the link between syntax and semantics – offered an epistemological framework for assessing how categories derived and tested as part of the research related to the real world (Tschacher and Dauwalder, 1999). The insights of both De Mey (1982), and Tschacher and Dauwalder (1999) were essential to modeling and refining the common categories that, together with the search interface, would facilitate the clustering and visual display of digital objects from multiple cultural repositories.

3. Research Design and Objectives

In earlier research (Howarth, Cronin, and Hannaford, 2002), a set of seventeen common category labels (see Table 1) – a "semantic bridge" representing commonalities among

Element Label	Definition
Contact Information	Information on how to communicate with someone about a work, i.e., names, phone numbers, etc.
Rights/Restrictions on Use	Legal limitations/rules that affect how you can *use* a work *after* you have been given access to it
Edition	Information on a work's version
Roles	The function of an individual or organization associated with a work
Summary & Description	Details about a work that illustrate its main points
Identifiers	Unique names or numbers assigned to a work so that it can be distinguished from others, for example, its ISBN
Sources, References & Related Works	Other works that are related to the work you are seeking or were used to develop the work you are looking for
Language	The language or dialect of a work
Physical Format	The physical appearance of a work
Subject	The topic of a work; its intellectual content
Date & Time Period	Dates associated with a work, as well as time period information regarding a work's content can be obtained through this category
Terms of Access & Availability	The legal limitations/rules that affect your ability to access a work. This relates to privacy or intellectual property concerns
Methodology	The procedures/techniques used to make or change a work
Genre Type	The nature or style of a work's intellectual content
Names	Names of individuals or organizations associated with a work, such as creators, publishers, sponsors, etc.
Title	The name or phrase assigned to a work for identification purposes
Place	Locations associated with a work, for example, where a work was created, published, is housed, etc.

Table 1: Element Labels and Definitions: The 17 Common Categories Model

755 tags from nine metadata schemes[1] – was derived and tested for clarity and potential usefulness. Then followed the design of a proof-of-concept "gateway" or transparent,

language neutral query interface, for searching metadata-enabled repositories of digital objects. (Howarth and Miller, 2005).

With prototype and common category model now aligned, two cohorts of end-users – a convenience sample of graduate students from the Faculty of Information Studies, University of Toronto – were recruited to provide feedback on the mediation tools. Consequently, a total of ten groups of individuals, five groups with formal training in online searching (n = 16 participants), and five groups without (n = 17 participants) [2] engaged in focus group studies to address the following two objectives:

- To assess the relevance of a set of (17) search categories to a series of individual images of information objects; and
- To obtain participant feedback on a series of different visual displays showing results from the same query term

This paper summarizes the quantitative and qualitative data gathered and analysed relative to the common search categories. It compares and contrasts how those participants in the focus groups either with or without formal training in online searching interpreted the semantic bridge of common categories. While data concerning preferences for different visual displays of results from the same query term were collected and analysed, they extend beyond the limitations of this current paper and will be discussed elsewhere in a forthcoming article.

4. Data Collection

A brief questionnaire asking for biographical information, such as level of education, and relative experience with Internet and online database searching, was administered at the beginning of each focus group session. This information was solicited, not only to confirm appropriate inclusion of participants within either the "trained" or "untrained" searcher group (see also Endnote 2), but also to providing context for differences that might occur within responses to each activity in each focus group. Participants were given a tent card to have at their place identifying them by a participant code (not by name) that was recorded on focus group session documentation to ensure confidentiality.

An activity was designed to address each of the two objectives outlined in section 3, above. Quantitative data were collected and analysed from each activity. Each of the two activities was followed immediately by discussions conducted by a professional facilitator. These qualitative data offered rich explanations for choices made and/or preferences ranked as required by the activity. For purposes of this paper, only data obtained from Activity One is examined.

Activity One

Activity One engaged participants in viewing four individual images of objects from among four separate sets of images from a virtual repository (see Figures 1 and 2 as examples). Each participant was given a set of 17 cards, with each card having a description relating to a different category, as well as a number in the upper corner for coding purposes (see Figure 3). A first image was placed on the table. Each person was then asked to (1) select the cards with the description that they thought applicable to the

object shown in the image, and (2) place these cards near the image, in order of importance. An observer (not the facilitator) recorded the numbers. The cards were subsequently returned to each participant, and the next image in the set of four was then displayed. This sequence continued until the four images had been seen and dealt with fully by each member of the focus group. No verbal opinions were solicited at this point; discussion followed at the end of the activity as a whole.

Figure 1 Postcard (image 2.4)


Figure 2 Horse toy (image 3.2)

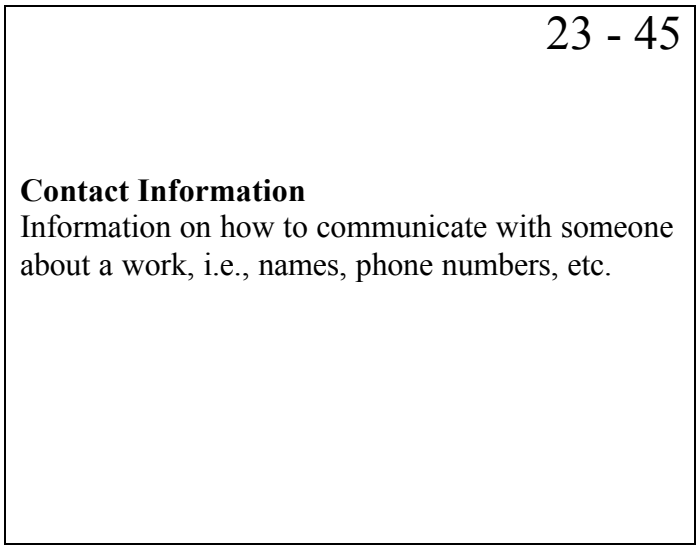

Figure 3. Sample card with category label and definition (center); sample codes for the focus group and participant (first two digits), and the category (second two digits), appear in the upper right corner of each card.

Participants were asked to consider what information would be helpful to them in finding and selecting an item. For example, if they wanted to know the topic of an item or its content, they might choose the category, labelled *Subject*. If that were the most helpful category for the participant to know about the image (digital item), then that card would be placed closest to the image or in the first sequence of the individual's ordering of preference.

At the completion of Activity One, participants were asked by the facilitator to comment on what choices they had made and why. While responses varied according to the particular image, and have provided the research team with a wealth of individual opinions and suggestions, the following section on findings provides a high level summary, consolidating overall outcomes rather than session-by-session findings, or assessments for individual images, or sets of images. Such detail warrants a lengthier forum that this conference paper affords.

5. Data Analysis and Findings

Overall Usage of Categories

One "non-experienced" participant (see Endnote 2) selected all seventeen categories as being useful to finding and selecting three of the four items in his or her assigned set of images. A second "non-experienced" participant did likewise for one of the same images – a photo image of a rare leather-bound French language monograph published in 1731. None of the focus group members identified as "experienced" searchers used any more than thirteen of seventeen categories. For both cohorts, between eight and nine categories sufficed in identifying and selecting the majority of images. Table 2 lists, in rank order from most to least frequently used, the seventeen categories – i.e., those devised for the proposed semantic bridge. Seven of seventeen (41.2%) categories were selected in only one third (32.6% or less) of all instances (n= 132). The negligible assignment of the category "Language" may reflect the predominance of images

depicting non-textual materials. Earlier research (Howarth and Hannaford, 2003) had found that the terms, "Genre Type", "Methodology", and "Roles" were considered ambiguous, confusing, and even misleading. That the latter two were relatively little used aligns with previous findings; that "Edition" ranked 13 of 16 (two tied ranks at 5 – see Table 2) is less readily explained. Like "Language", it may be of less use in an environment dominated by digital non-print objects.

Overall Rank (usage)	Category	Number (out of total 132) and percent
1	Date & Time Period	117 (88.6)
2	Physical format	112 (84.8)
3	Title	105 (79.5)
4	Names	103 (78.0)
5 (tied)	Summary and description	96 (72.7)
5 (tied)	Place	96 (72.7)
6	Subject	84 (63.6)
7	Genre type	76 (57.6)
8	Rights/Restrictions on use	50 (37.9)
9	Sources, References & Related Works	49 (37.1)
10	Contact information	43 (32.6)
11	Terms of Access and Availability	42 (31.8)
12	Methodology	41 (31.1)
13	Edition	37 (28.0)
14	Identifiers	31 (23.5)
15	Roles	27 (20.4)
16	Language	18 (13.6)

Table 2: Ranking of Categories by Usage (i.e., number of times used)

Relative Usefulness of the Categories

Focus group participants were asked to arrange their cards (categories) with the most important (in terms of usefulness) immediately adjacent to the image. Categories ranking in the top three differed based on whether or not one had formal training in online searching. The rankings compare as follows (where 1 = most frequently ranked as most helpful to identifying and selecting an object):

Non-experienced	**Experienced**
1. Physical format	1. Title
2. Subject	2. Physical format
2. Title	3. Subject
3. Genre type	3. Names

While two categories, namely, "Genre type" and "Names" differ between the cohorts, the relative rankings of overlapping categories change only in their ordering. A review of transcripts from selected focus group sessions sheds some light, if contradictory at times, on the differences between the ranking of categories by each cohort. An individual participating in a focus group with other "non-experienced" searchers explained:

> I found myself really going toward, umm, what I thought would describe the whole work most broadly like Title or Names and that sort of thing, Description first, and then things like ISBN or even legal rights I usually put at the bottom because I always think finding the work is more important than finding out how you can use it once you found it, so that really guided how I was ranking…

Another participant echoed that, " … I seem to always start from the most general to the most specific, going from genre to legal liability… You know, that kind of thing. So it seems to be the Google method, I suppose." A third colleague from the same cohort added, though seemingly contrary to the final tally, that: "I always start with a subject and a title no matter what. To me intellectual content seems to be more important than physical format." Overall, comments from those assigned to the "non-experienced" groups made reference to moving from general to specific information about an object. "I mean, as long as the subject, the title, and the creator are right near the top, that's definitely the most important, the most like general information about it and then everything else …" The tied ranking of "Subject" and "Title" reflects their importance as access points for novice searchers; that "Physical format" ranked first may be attributable to the non-textual nature of the majority of images included in activity one.

Focus group participants who had received formal training in online searching offered opinions that seemed to underscore their preference for greater precision in their approaches to finding and selecting the digital objects. As one member noted, "I found for everything I wanted to know first the Title, second the Subject, third the Date basically and then, you know, depending if it was a piece of artwork, say, then I would want to know maybe the Rights, what Rights govern how to use this, whereas if this was a postcard or something distributed publicly then maybe I would want to know something different." A greater level of sophistication *vis-à-vis* the types of information that might prove useful was reflected in the comment that, "You could do it one way, but if you were, like, trying to locate a unique or a particular image for other purposes, then you would need all the technical backup information, the permissions, where it's from, provenance, and so forth." A similar reference to search *strategy* emerged in the following:

> … for me it was just Title or maybe Subject or Creator just to at least get the initial access to it. And you know the Physical Format for the other things like the rug or the horse, but for me it was just, you know, the primary step of getting it there first, before wondering OK, what else would I like to know about this, like, I don't know what else there was, maybe material or how it's made or copyright legal issues.

For "experienced" searchers, the overriding source of frustration with Activity One was being asked to select categories and rank them as to their relative usefulness while lacking any particular *context* for the search. As one participant noted, succinctly, " It's difficult to identify or to order what's most important if you don't know what the question is you're being asked." A second added that, " … if you gave me some sort of a

context, my choices probably would have been much different and there is no guarantee if I came in tomorrow my choices wouldn't have been somewhat different." Whereas formally trained searchers were almost insistent on the need for context to inform their choices of category, "non-experienced" users were more likely to suggest that their selections would differ depending on the type of material. "I just thought it was funny that what I chose, the subject or whatever I chose to describe it, changed depending on the piece." Another participant noted with reference to images in his or her image set that:

> I think it's interesting in some ways that the content of the images actually informed the way that I wanted to approach it too. So The Scream [*an image in his or her group's assigned* set] is familiar. We know the title, you know, it's a poignant title, so therefore the title comes to the forefront of my mind when I think about trying to find it. Whereas the cartography or the map [*another image in the* set] is something about time. And you know, there's an information that comes from the image itself, rather than me going at it from a scenario of what I need it for necessarily.

It should also be noted that frequency of use of a category (see Table 2) was not necessarily a predictor of the estimate of relative usefulness to a potential end-user. While "Subject" ranked within the top three most helpful categories for "experienced" and "non-experienced" cohorts, alike, in the study, it was sixth in the listing by usage. "Genre type" merited third place for its importance to those without formal training in online searching ("non-experienced"), but ranked behind "Subject" in usage. Likewise, "Date & Time Period", which was the category most often selected by both cohorts (see Table 2) was nowhere to be found in a comparable assessment based on relative usefulness, though it was mentioned in focus group discussions.

6. Conclusions and Implications of the Study

On balance, what does this small slice of a focus group study that involved two activities (for quantitative data), as well as facilitated discussions (for qualitative data) have to say about the "semantic bridge" that Activity One was designed to test? While previous research had extracted from metadata schemas a common category set with seventeen elements (see Table 1), slightly less than half (47% or 8 of 17) were selected with any notable frequency (usage > 57%). But while certain categories were chosen by focus group participants to identify and select a digital image, their relative usefulness did not necessarily correspond to their ranking in the list of all categories – that is, usage and utility could and did differ. Of the eight most frequently used categories, only "Physical format", "Title", and "Names" ranked among the three assessed as most useful by study participants. "Subject" was not as much used as it was highly valued.

Perhaps of most interest to this research in terms of its intention to refine the seventeen category "semantic bridge" in order to provide a more robust framework for proposed visual displays, was the near consensus on the relative utility of a subset of categories to "experienced" and "non-experienced" participants, alike. Apart from minor differences in their ordering, "Title", "Physical format", "Subject", "Names", and "Genre type" were

the five categories considered most helpful to identifying and selecting digital objects. While individuals commented that both context and the type of material might variously influence their choices of categories, findings suggest that future efforts towards developing cross-repository retrieval systems could focus on the design of visual displays for a small but consistently useful set of semantic categories for clustering search results.

Ultimately, the findings from this research were intended to provide some level of baseline data as well as to validate category names, definitions, and concept inclusions. This contextual and semantic validation will be key to refining a cross-domain search tool and user interface (Howarth and Miller, 2005) that exists currently as a proof-of-concept.

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Endnotes

[1] Using crosswalk methodology, eight "source" metadata schemes, including the Encoded Archival Description (EAD), the Dublin Core (DC), the Government Information Locator Services (GILS) metadata scheme [now Global Information Locator Service], the Text Encoding Initiative (TEI) Header, the Visual Resources Association (VRA) Visual Document Description Categories, the Consortium for the Interchange of Museum Information (CIMI) metadata set, the Content Standard for Digital Geospatial Metadata (CSDGM), and the Online Information Exchange (ONIX) publishing standard, were mapped to one "target" standard for encoding and exchanging bibliographic records, namely, the Machine-Readable Cataloging (MARC21) format. Previously validated crosswalks linking one or more of the full nine standards were employed as "benchmarks" in the process to minimize inconsistencies in interpretation and mapping. For a more detailed description see Howarth, Cronin, and Hannaford (2002).

[2] Participants who had completed the course, *FIS1325 Online Searching*, or who self-reported receiving on-the-job training in online searching were considered to have received formal training in online searching of databases, Internet search tools, etc. Those who had not taken or completed FIS 1325, or any other kind of systematic training (through a workplace or other educational venue) were considered to have no formal training in online searching. The former are referred to in the text as “experienced”, the latter as “non-experienced”.

References

De Mey, M, 1982. *The Cognitive Paradigm*. Dordrecht: D. Reidel.

Howarth, L.C., Cronin, C., and Hannaford, J. 2002. "Designing a Metadata-Enabled Namespace for Accessing Resources Across Domains." In *Advancing Knowledge: Expanding Horizons for Information Science: Proceedings of the 30th Annual Conference of the Canadian Association for Information Science/Association canadienne des sciences de l'information – held with the Congress for the Social Sciences and Humanities of Canada, University of Toronto, Toronto, Canada, 30 May-1 June, 2002*. Edited by L.C. Howarth, A. Slawek, and C. Arsenault. Pp. 223-232.

Howarth, L.C., and Hannaford, J. 2003. "Deriving a Multilingual Gateway to Cultural Repositories." In *Bridging the Digital Divide: Equalizing Access to Information and Communication Technologies: Proceedings of the 31st Conference of the Canadian Association for Information Science/Association canadienne des sciences de l'information – held with the Congress for the Social Sciences and Humanities of Canada, Dalhousie University, Halifax, Nova Scotia, 30 May-1 June, 2003.* Edited by L.Spiteri and W. Peekhaus. Toronto: CAIS. Pp. 196-209.

Howarth, L.C., and Miller, T. 2005. "Designing a Language-independent Search Prototype for Accessing Multilingual Resource from Metadata-enabled Repositories." In *Proceedings of the 33rd Conference of the Canadian Association for Information Science/Association canadienne des sciences de l'information – held with the Congress for the Social Sciences and Humanities of Canada, University of Western Ontario, London, Ontario. 2-4 June, 2005.* Electronic proceedings only at: URL: http://www.cais-acsi.ca/proceedings/2005/howarth_2005.pdf Accessed April 20, 2006.

Tschacher, W. and Dauwalder, J-P. 1999. Situated Cognition, Ecological Perception, and Synergetics: A Novel Perspective for Cognitive Psychology?" in Tschacher, W. and Dauwalder, J-P., eds. *Dynamics, Synergetics, Autonomous Agents: Nonlinear Systems Approaches to Cognitive Psychology and Cognitive Science.* Singapore: World Scientific. Pp. 83-104.