

## APPLIED THEORY

### SUMMARY

- ◆ Presents three problems with existing information architecture frameworks
- ◆ Suggests that information architects should allow users to flexibly navigate through complex information spaces in the service of particular tasks and goals
- ◆ Introduces a faceted classification framework and provides an example

## Facets Are Fundamental:

## Rethinking Information Architecture Frameworks

ABE CRYSTAL

### INTRODUCTION

Information architecture (IA) has been widely practiced for nearly a decade. During this period, some common frameworks for designing information architectures for large information systems have become popular. In particular, Rosenfeld and Morville's work (2002), which combines principles from information and library science with models from human-computer interaction and user-centered design, has had great influence, and many practitioners view it as the canonical work on IA. Other discussions of IA such as Brinck, Gergle, and Wood (2002) take generally similar approaches.

In these frameworks, the information architect is expected to develop an understanding of users' information needs and mental models, using research methods such as interviews, contextual inquiry, surveys, and card sorting. Based on this research, the information architect then develops an architecture that can support users' tasks and documents this architecture using standardized deliverables such as blueprints (or sitemaps) and wireframes (page diagrams or low-fidelity prototypes). The information architect then evaluates the architecture through usability testing or similar methods, and works with interaction and visual designers and developers to implement the information architecture in a functional system.

Typically, the architecture is composed of four major components – organization, navigation, labeling, and search (Rosenfeld and Morville 2002). The information architect's role is to organize information appropriately by creating a hierarchical structure that is comprehensible to users, provide navigation structures that enable users to move through the information space, label categories and groups of content in sensible ways, and design search systems (including retrieval algorithms and metadata) that allow users to search for information effectively.

In general, this framework is eminently sensible and has served a crucial role in demystifying the abstract notion of "information architecture." But no framework is perfect. This article introduces the particular problems I have with existing frameworks. I argue that these problems all point toward making faceted classification a more fundamental part of IA processes. (In the context of typical IA practice, faceted classification differs from standard classification practices in that "Unlike a simple hierarchical scheme, faceted classification gives the users the ability to find items based

on more than one dimension” (Adkisson 2005). My goal is not to replace the current model but to augment it with additional approaches that can make IA more flexible and powerful. Specifically, my aim is to encourage information architects to provide navigation systems and user interfaces based on an underlying framework of faceted classification. These systems and interfaces will enable users to flexibly navigate through complex information spaces in the service of particular tasks and goals.

To this end, I introduce the idea of a faceted classification framework, and provide an example of a model framework, called “Facets are Fundamental” (FaF). The purpose of the FaF framework is to explicitly designate faceted classification (rather than a hierarchical classification) as the starting point of the IA development process. In addition, FaF distinguishes between facets and attributes. Both of these approaches encourage information architects to employ non-topical methods for organizing and representing information.

## **DEFINING FACETS**

Making facets fundamental requires clearer definitions of basic terms: what facets are, how they are chosen and defined, and how they are used. Yee and colleagues (2003) define facets as “orthogonal sets of categories.” They note that facets may be either flat (containing a single level of values) or hierarchical (containing multiple levels of values in an ancestor-descendant structure). Furthermore, facets may be single-valued (allowing just one value to be assigned to an item) or multi-valued (allowing more than one value to be assigned to an item).

This specification of facets makes useful basic distinctions. However, a more general way of thinking about using facet classification is to model an information space that contains resources, which are described by facets (which are composed of schemes and structures). See Figure 1 for an illustration of this model of faceted classification.

In addition, we can distinguish between facets and attributes. Facets entail an actual classification system (the scheme and structure), and so are defined by human interpretation and judgment. Attributes are simple values, not associated with a classification system, and are intrinsic to the nature of an object. Information architects can identify multiple facets and attributes for different types of resources, and apply these as needed (see Figure 2).

We can further distinguish between facets and attributes by comparing them across four dimensions: scope, control, definite-ness, and origin (see Table 1).

The first distinction is one of scope. A common distinction in information science is between data (typically raw observations or measurements) and information (typically data that has been analyzed or synthesized to add structure and meaning). An attribute, then, represents a piece of data. For a fine arts retrieval system such as FLAMENCO, the year a particular work was created would be an attribute. In contrast, the period with which a work is associated would be a facet. While the year is simply a raw fact (data), the period represents a critical judgment encompassing culture, history, and aesthetic theory (information).

The second distinction is the level of control provided. An attribute represents syntactic control where the issue is not defining meaning but representing known meaning in a

comprehensible (and often machine-processable) way. On the other hand, facets represent semantic control – creating order and systematically organizing information in a meaningful way to facilitate information retrieval (or other purposes of an information system).

A third distinction, which encompasses both scope and control, is that of definite-ness. Because attributes represent data and syntactic control, they are essentially well-defined. Facets, on the other hand, are intrinsically ill-defined. What makes facets interesting and powerful is the “order-making” (Marshall, 1998) that they represent – taking a messy, diffuse information space and making it ordered and useful.

A professor in a seminar I took in college memorably described the challenge of critical analysis as follows: “The conflict of interpretation is essential to the humanities.”

Interpretation and conflict often go hand-in-hand. Facets are about interpretation, so they are about conflict. They are about applying a distinct point of view to help make sense of large information spaces. But that viewpoint is almost necessarily individual, controversial, and problematic. Of course, in some cases, attributes can be controversial too. But for many applications, a date is a date, and a price is a price. Whereas, a historical period, a user’s task, an envisioned audience for a document are all subjectively defined and open to interpretation and controversy.

Finally, we can distinguish between attributes’ inherent origin and facets’ assigned origin. An attribute is inherent in some item or object. For example, the size of a file (in bytes), the date a document was last modified, the price of an item in a catalog, or the dimensions of a painting are all intrinsic – if that item or object exists (within the context of a particular organization and its information space), so do its attributes. In

contrast, a human “sense-maker” or “order-maker” – the information architect – must assign facets. Facets such as topic, theme, audience, task, role, and genre are created through human analysis and interpretation.

## PROBLEM 1: TOPIC-CENTRICITY

Despite many efforts to integrate information architecture with user-centered design, the existing frameworks are largely based on the characteristics of Web sites, not people’s information needs and behavior. These frameworks are better suited to answer “Where does this Web page fit?” than “What information do users need, and how will they look for it?” In my view, the existing frameworks are almost exclusively hierarchy-centric and sitemap-centric.

For example, Rosenfeld and Morville (2002) write that “The foundation of almost all good information architectures is a well-designed hierarchy or taxonomy” (65).

Similarly, Brinck and colleagues call for information architects to “create and evaluate your core structure” (130). These well-meaning approaches have helped bring order to the Web, but at the same time, they have placed the focus of IA on developing a topical hierarchy. However, topic or “aboutness” shouldn’t be the only focus of IA, because users look for more than topic or aboutness when they evaluate information.

In fact, an extensive body of research has investigated the criteria users rely on to assess whether a document or Web page will be relevant and pertinent to their needs (Borlund 2003; Crystal and Greenberg 2006; Mizzaro 1997; Tombros, Ruthven, and Jose 2005). The key insight of this work is that users identify many aspects of documents as important – not just what the document is about, but also its structure, level of difficulty or

technicality, practical implications, approach or methods discussed, and so forth (see Figure 3).

Another line of research has examined the criteria that users identify for multimedia objects, such as personal photographs (Naaman and colleagues 2004). Here, too, people identify a wide range of criteria beyond the subject of the photograph (see Figure 4).

These studies illustrate the multitude of criteria that may influence users' relevance judgments and information seeking. People are making multidimensional, holistic, and highly personal and idiosyncratic judgments. In contrast, IA frameworks are single-dimensional and reductively focused on topical organization. To move forward, IA frameworks and practices should incorporate these wider and more nuanced conceptions of relevance, and faceted classification provides a way to do so.

## **PROBLEM 2: FACETS ARE SUPPLEMENTAL**

As Bates (2002) argues, faceted classification should be the foundation of Web-based information retrieval systems. Facets can be incorporated directly into information retrieval interfaces, and user studies have shown this approach to be effective (Yee and colleagues 2003). As evidenced by the numerous presentations on facet-based approaches at the 2005 IA Summit (see Table 2), facets are quickly becoming part of mainstream IA practice.

In what sense, then, are facets being treated as supplemental by information architects? The key issue is the widely-used – but unnecessary and confusing – dichotomy between hierarchical and faceted classification (Bates 2002; Rosenfeld and Morville 2002). As

described earlier, a hierarchical structure can be applied to a particular facet (Kwasnik 1999; Yee, and colleagues 2003).

For example, consider the information architecture of a help system for a spreadsheet application. This information system might typically be organized in a single hierarchy encompassing a range of topics. It's not necessary to abandon this hierarchy to incorporate faceted classification and access. Rather, the information architect can incorporate additional facets, each with its own hierarchical (or other) structure, to complement the topical facet. An "audience" facet, for example, could enable users to find help information relevant to their background and experience—a student just learning to use a spreadsheet needs very different help than a financial analyst who works on complex models every day. In short, facets should be seen as fundamental to IA, not supplemental. Rather than thinking of facets as a way to improve IA, we should think of facets as the foundation of IA.

### **PROBLEM 3: CONFLATING ORGANIZATION AND REPRESENTATION**

Rosenfeld and Morville (2002) and Brinck and colleagues (2002) distinguish between organization and navigation systems. Unfortunately, these distinctions simply aren't clear. In some examples provided by these authors, a particular set of links is called "navigation" while another set is called "organization." No fundamental analytical distinction is drawn between these two different "types" of links. One of the most problematic examples is the "global navbar." This group of links, typically placed at the top of each page on a Web site, contains links to widely-used pages and functions, such

as Home, Help, and Search. On some sites, the global navbar might contain links to both sections of the site, and to specific tasks.

For example, a global navbar for an e-commerce site offering pet supplies might include these links:

- ◆ Cats
- ◆ Dogs
- ◆ Birds
- ◆ Fish
- ◆ My account
- ◆ Search
- ◆ Contact us

This set of links is referred to as “navigation,” yet it clearly relies upon an underlying organization system—grouping items for sale by type of animal and the site’s functions by type of task. In Rosenfeld and Morville’s terms, this is a “hybrid” organization scheme because it contains more than one mode of organization. Rosenfeld and Morville (2002) caution against such hybrid approaches but go on to say, “the exception to these cautions against hybrid schemes exists within the surface layer of navigation ... many web sites successfully combine topics and tasks within their global navigation” (65). In other words, hybrid organization is dangerous and confuses users—except in global navbars, where it is perfectly acceptable.

We can replace this confusing distinction between “organization” and “navigation,” with a clearer distinction between organization and representation. The organization system is created by the information architect to “make order” (Levy 1995) within the information space. Representations are a separate layer that builds on the organization system to make specific information objects accessible to users. A framework based on this distinction also provides an elegant way to model “hybrid” organization approaches. In an integrated framework, the “surface layers” (such as global navbars) are not part of the organization system – they are representations of different information objects, combined in a way that supports users.

## **A SOLUTION: FACETS ARE FUNDAMENTAL**

The Facets are Fundamental (FaF) framework is an attempt to address the problems identified above. In FaF, developing an information architecture begins with developing facets and attributes (rather than developing a hierarchy or set of categories, as with existing frameworks). These facets and attributes are then used to “make order” by classifying the information space. Finally, representations of the information space are developed to provide access to the structured information.

The outputs of FaF-style IA work are illustrated in the wireframes/page description diagrams shown in Figure 5, Figure 6, and Figure 7. These diagrams provide abstract representations that show what facets are needed for a particular page (or type of page), with example information and links for each facet. The diagrams shown here are intended to provide an example of the types of deliverables an information architect working with FaF would provide and to emphasize that FaF builds on existing IA

practices. The key difference is the discipline provided by FaF – it encourages the information architect to explicitly represent different facets, thereby creating more balanced designs that provide a wide array of criteria to users.

In this way, FaF guides the information architect to consider the broader conceptions of relevance and pertinence that users value (see “Problem 1, Topic-centricity,” above).

Consider Figure 6. This particular representation is an example of a page or subsite targeted to a particular audience. It thus includes links to pages which are relevant to this audience. These pages might come from the AUDIENCE facet (typically, informational pages on a topic relevant to this audience). Or they might come from a TASK or GENRE facet. The information architect selects pages that are relevant to prospective students by drawing from each facet in the classification system. In this wireframe, the links have been explicitly grouped by facet to emphasize this approach. However, in real-world designs, many pages would mix facets to create “hybrid” representations. The underlying organization system, though, always remains structured by facets and attributes.

## **IMPLICATIONS FOR INFORMATION ARCHITECTURE PRACTICE**

So what? What difference does this approach make for practicing information architects?

What problems will it help to solve?

The purpose of the FaF model is to move toward a practice of IA that is grounded in structuring large-scale information spaces, and providing access to these spaces with powerful, task-appropriate user interfaces (see Figure 8). While it may require significant investments to transition beyond existing page- and Web-site-centric

practices, this move will ultimately have great benefits for information architects and users. I outline four major classes of benefits below.

### **Support faceted user interfaces**

The first benefit is the ability of faceted classification to support user interfaces that enable users to directly navigate through a well-structured information space. Current validated implementations of this approach include the FLAMENCO fine arts image search (Yee and colleagues 2003) and various e-commerce sites, such as Wine.com, BarnesAndNoble.com, and TowerRecords.com. Interestingly, few examples of sites that provide faceted access to large textual collections are available – perhaps because developing and applying facets for these collections is challenging and resource-intensive.

In general, so-called “faceted browse” interfaces largely contain attributes, rather than facets. This state of affairs offers two opportunities for information architects:

1. Drawing clear distinctions between facets and attributes, and incorporating both into IA development and interface design as appropriate
2. Creating appropriate interfaces matched to the attributes and facets available, as discussed in the next section

### **Support user interface innovation**

A core tenet of FaF is the importance of choosing appropriate – and often innovative – interaction designs to support access to the information space. Standard IA practice has been closely associated with two interaction styles – hypertext and search. But in many

cases, information access and usability can be enhanced by providing more direct and dynamic interaction styles. By making the mapping of facets to interface components and interaction styles the basis of information architecture and user interface design, rather than an afterthought, significant improvements are often possible.

An excellent example of this approach is Amazon.com's diamond search (see Figure 9). This direct manipulation interface provides an elegant visual representation of attribute values, which users can restrict to match their search preferences (Costa and colleagues, 2005). This interface may be compared to the far less intuitive and pleasurable interface, using drop-down menus and input fields, that a typical Web interface to this type of data would provide (see Figure 10).

The contribution of the Amazon design is twofold. First, it matches the selected attributes of the items in the information space (in this case, diamonds) with an appropriate *interaction style* (sliders), and appropriate *representations of information* (images that communicate the selection criteria, labels that identify different levels of each criterion, and access to more detailed information without changing context). The richness of the representations in the Amazon design enables it to rapidly communicate much more information to the user than the representation in the Dirt Cheap Diamonds design. Second, the Amazon design provides an innovative visualization that makes the selected interaction style intuitive, pleasurable, and usable. The value of the FaF framework, then, is clarifying the role of attributes and facets in IA so that appropriate interaction styles and representations can be developed for each within the context of a particular information space.

One might reasonably ask whether the Amazon diamond search example, which builds on attributes (as is typical in e-commerce), has much to contribute to the classic IA problem of providing access to large sets of unstructured text (such as a corporate intranet). For this IA challenge, a second example illustrates how innovative user interfaces can leverage attributes and facets to improve information access. The Relation Browser (see Figure 11) combines three interaction styles – mouseovers on visualizations, click-to-hold restriction of range, and incremental text search.

The design enables direct manipulation-like access both to large textual collections (Zhang and Marchionini 2005) and to collections of items such as a library's holdings of films. The system has been shown to be effective, particularly in supporting complex, exploratory search tasks (Zhang and Marchionini 2005).

If the classical IA model, then, was intended to create a large hierarchy, and provide access through hypertext and search, the FaF model is intended to identify facets and attributes and provide access through rich, dynamic interfaces matched to the information space, users, and tasks.

### **Support non-topical information architecture**

Earlier I argued that topic or “aboutness” is only one element of users' holistic relevance judgments. By emphasizing faceted organization, we open the door to non-topical facets, so information architects can put these facets on equal footing with topic. For example, Merholz (2005) has argued for the value of genre and suggested letting users refine by genre (see Figure 12).

The FaF model supports and advocates exactly such approaches. The fundamental weakness of standard IA frameworks is that they begin with the idea of a single, unified hierarchy. Because topic is the dominant method of organizing information, such hierarchies are almost inevitably based on topic (albeit with bits of other facets, such as task and audience, included). Emphasizing non-topical IA thus has two benefits. First, it gives users access to the wide range of cues that they depend on to augment or filter topicality when assessing the usefulness of information. Second, it encourages “clean” classifications – by removing the constraint of a single hierarchy, we remove the temptation to create “hybrid” classifications that combine multiple facets. Such hybrid schemes can confuse users and quickly become unwieldy (Rosenfeld and Morville 2002).

#### Fit the database model of content management systems

A final benefit of the FaF is technical – a natural fit with the database-driven content management systems (CMS's) needed to manage large information spaces. Just as in FaF, most CMS's model information as a structured set of information objects, rather than a collection of pages in directories (see Figure 8). Unfortunately, most existing CMS implementations are ill-suited to fully support the FaF model. What is needed are better CMS's that can support this flexible model by modeling both attributes and facets, and allowing a distinct classification scheme and structure to be specified for each facet.

I anticipate that such systems will be available in the future and that they will tightly integrate with applications to develop and deploy user interfaces for access to the information space. Early attempts at this approach can be seen in commercial systems, such as Endeca's software (<http://endeca.com/>), which provides a back end for managing structured information and components for integration into user interfaces.

## APPLYING FAF TO EXISTING INFORMATION SYSTEMS

As Figure 8 illustrates, significant changes in IA practice such as FaF can't be implemented overnight. An information architect working on an existing information space would gradually introduce elements of FaF to improve information access. This work should begin with a prioritization phase in which the most important classes of document or information objects are identified for analysis. Facets and attributes can then be developed and tested for these classes. Finally, manual (human tagging) and automatic (machine processing of information content) methods can be applied to assign facets and attributes to selected objects.

Once objects are classified, the information architect can again take a phased approach to introducing faceted access in the user interface. A first step would be to replace a standard search engine based on text analysis (or a taxonomy) with a faceted search system such as Endeca. Later, other elements of the information system can be redesigned to incorporate facets, and to use more sophisticated, dynamic user interfaces.

## CONCLUSION

I began by criticizing today's IA frameworks, as embodied by the canonical Rosenfeld and Morville (2002) work. Despite their weaknesses, these frameworks have provided great value by making effective IA practices widely understood and used. As IA practice matures and becomes widespread, though, it is important to periodically reflect on the frameworks that serve as the tacit basis of the field.

The frameworks in widespread use today have helped information architects develop the field by providing a common basis for collaboration, conversation, and research. I hope we will continue to see these frameworks evolve because it is by developing more robust frameworks that we can further advance the field. I hope this paper can serve as a first step in that work, and galvanize the development of innovative IA that helps people find and use information even more effectively.

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**Figure 1.** General model of faceted classification. Example schemes are from fine arts classification (Yee and colleagues 2003).

**Figure 2.** Facets and attributes can both be applied to a resource in an information space.

**Figure 3.** Relevance criteria identified in a user study of academic researchers (Barry 1994).

**Figure 4.** Usage of various metadata categories in a user study of a photograph retrieval system (Naaman and colleagues 2004).

**Figure 5.** This wireframe illustrates how a home page for an academic Web site could be composed from elements that have been classified using facets.

**Figure 6.** This wireframe illustrates a subpage of a site. Bold and light formatting are used to indicate priority to the wireframe consumer (typically, a visual designer).

**Figure 7.** This wireframe illustrates another subpage. It shows the use of “content chunks” and “see also”--IA components recommended by Rosenfeld and Morville (2002), which can also be incorporated in FaF-style IA work.

**Figure 8.** Model of IA practice implications.

**Figure 9.** Amazon.com’s diamond search user interface.

**Figure 10.** Diamond search at DirtCheapDiamonds.com.

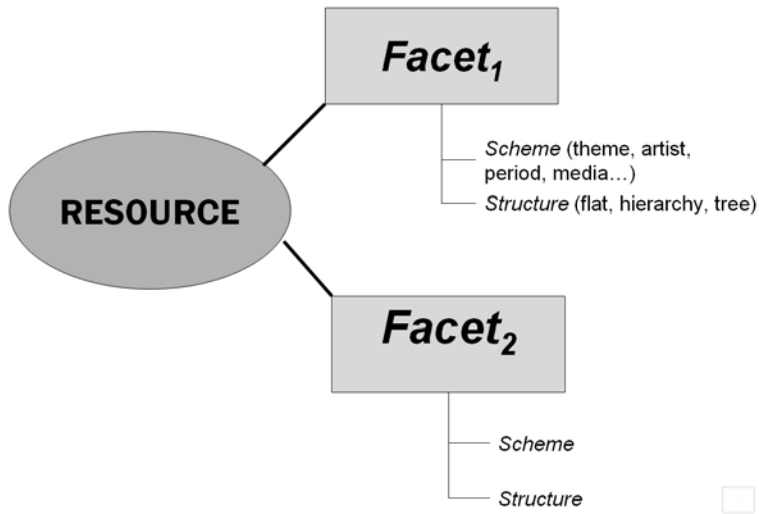
**Figure 11.** Relation Browser being used to search a collection of films.

**Figure 12.** Mockup of a search engine that clusters results by genre (<http://www.peterme.com/archives/000488.html>).

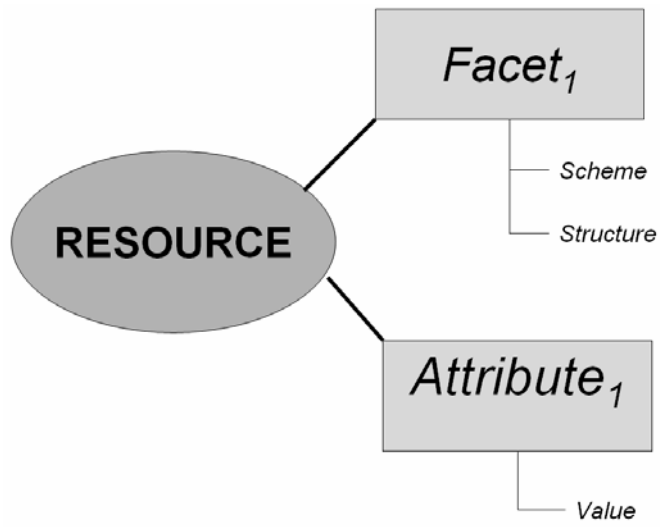
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## **ABSTRACT FOR *TECHNICAL COMMUNICATION ONLINE***

This article presents three problems with existing information architecture frameworks. First, they are too focused on organizing information based on topic. Second, they treat facets as a supplemental form of classification. Third, they conflate the organization and representation of information. Analysis of these three problems suggests that information architects should provide navigation systems and user interfaces – based on an underlying framework of faceted classification – that allow users to flexibly navigate through complex information spaces in the service of particular tasks and goals. To this end, this article introduces a faceted classification framework, and provides an example of a model framework, called “Facets are Fundamental” (FaF). The purpose of the FaF framework is to explicitly designate faceted classification (rather than a hierarchical classification) as the starting point of the IA development process. Both of these approaches encourage information architects to employ non-topical methods for organizing and representing information.



**Figure 1.** General model of faceted classification. Example schemes are from fine arts classification (Yee and colleagues 2003).



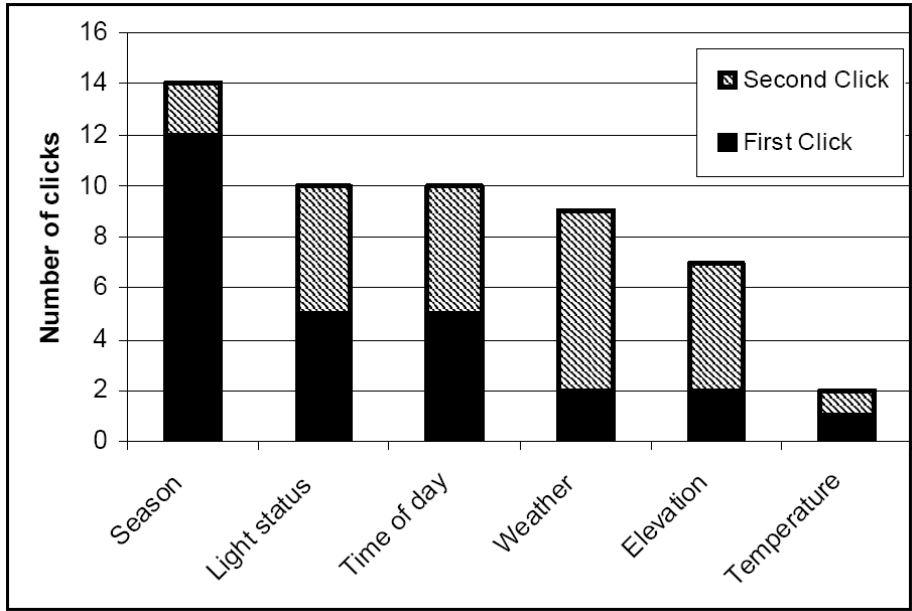
**Figure 2.** Facets and attributes can both be applied to a resource in an information space.

**TABLE 1: COMPARING FACETS AND ATTRIBUTES.**

Dimension	Attribute	Facet
Scope	data	information
Control	syntactic	semantic
Definite-ness	tight, widely accepted	loose, controversial, problematic, culture-bound
Origin	inherent	assigned

Criterion category	Frequency	Percent	Documents	Respondents
Depth/scope	64	14.4	52	16
Objective accuracy/validity	13	2.9	12	8
Tangibility	29	6.5	22	10
Effectiveness	16	3.6	13	6
Clarity	9	2.0	8	5
Recency	25	5.6	21	6
Background/experience	19	4.3	18	10
Ability to understand	9	2.0	6	5
Content novelty	53	11.9	35	10
Source novelty	10	2.3	10	8
Stimulus document novelty	5	1.1	5	4
Subjective accuracy/validity	45	10.1	31	13
Affectiveness	25	5.6	21	9
Consensus within the field	20	4.5	17	11
External verification	19	4.3	15	9
Availability/environment	21	4.7	19	11
Personal availability	5	1.1	3	3
Source quality	14	3.2	14	7
Source reputation/visibility	18	4.1	16	8
Obtainability	10	2.3	10	3
Cost	2	0.4	2	2
Time constraints	6	1.4	6	6
Relationship with author	7	1.6	6	4
Column total	444	99.9 <sup>a</sup>	—	—

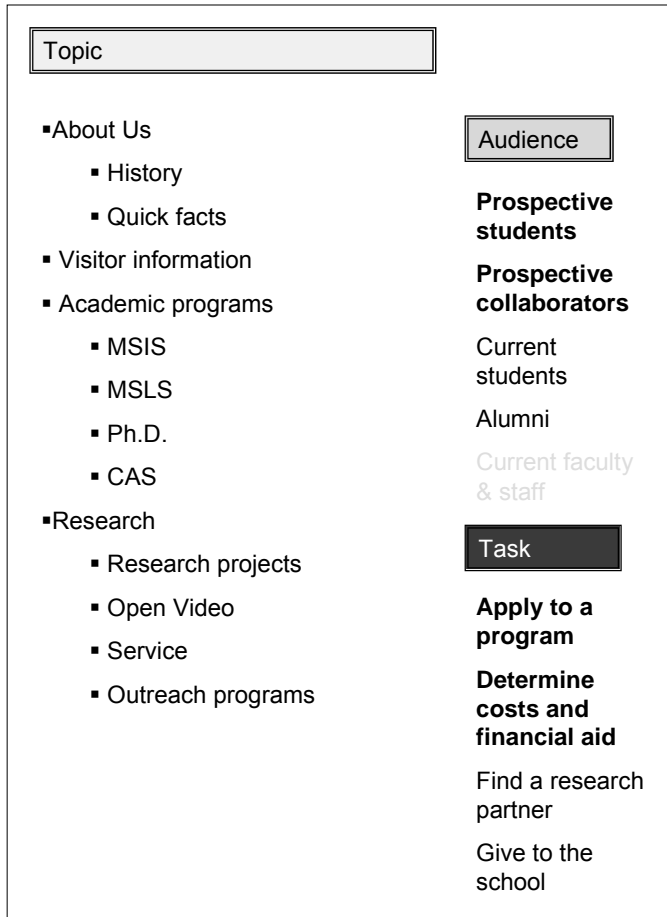
**Figure 3.** Relevance criteria identified in a user study of academic researchers (Barry 1994).



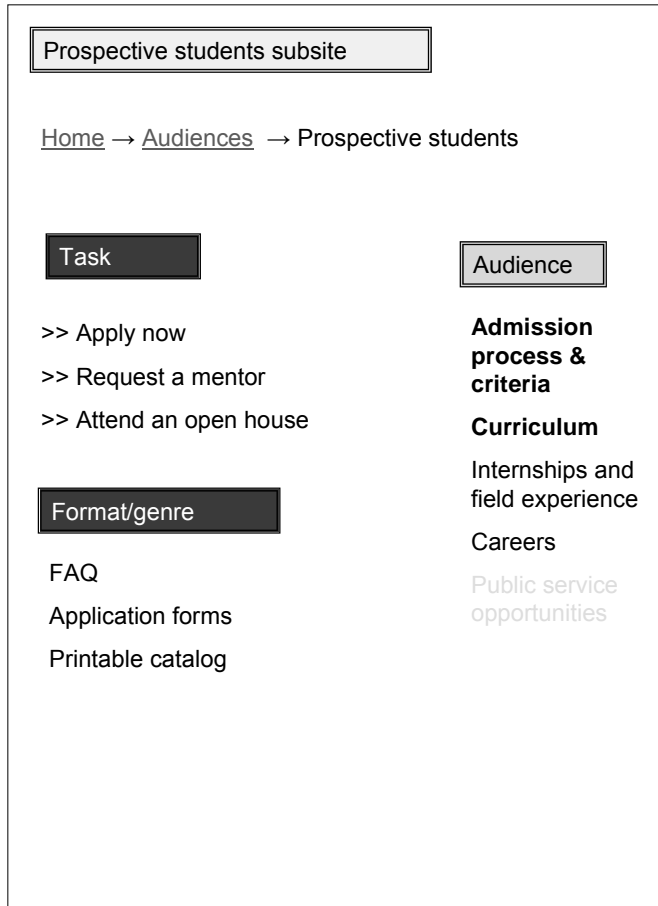
**Figure 4.** Usage of various metadata categories in a user study of a photograph retrieval system (Naaman and colleagues 2004).

**TABLE 2: TITLES OF SESSIONS INVOLVING FACETS AT IA SUMMIT 2005**

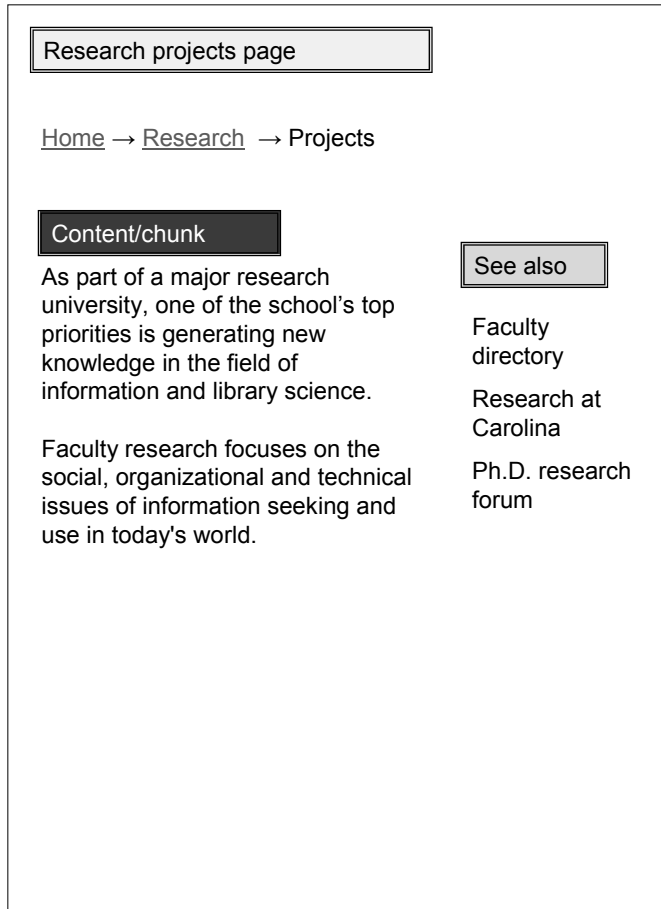
Faceted Classification in the Government of Canada: Toward a Global Approach to Information Architecture
The Faceted Interface: PC Connection Case Study
Faceted Browsing
Developing a Faceted Classification
One Size Does Not Fit All: A Story of Faceted Browse at Yahoo!



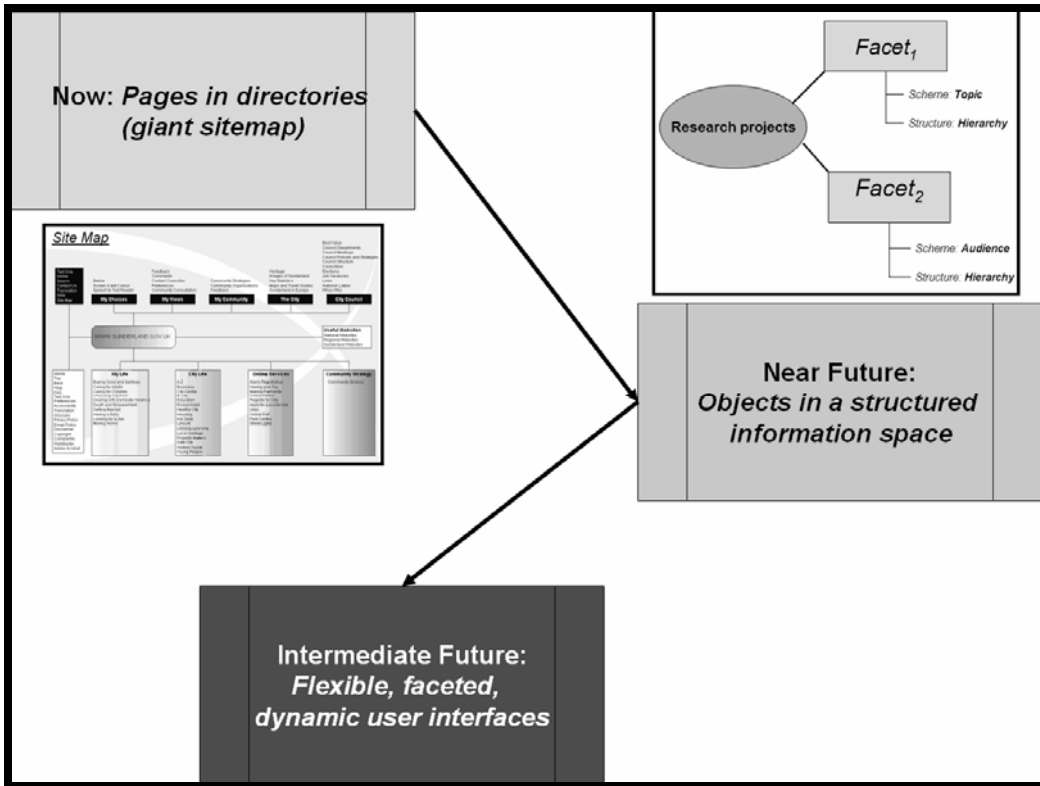
**Figure 5.** This wireframe illustrates how a home page for an academic Web site could be composed from elements that have been classified using facets.



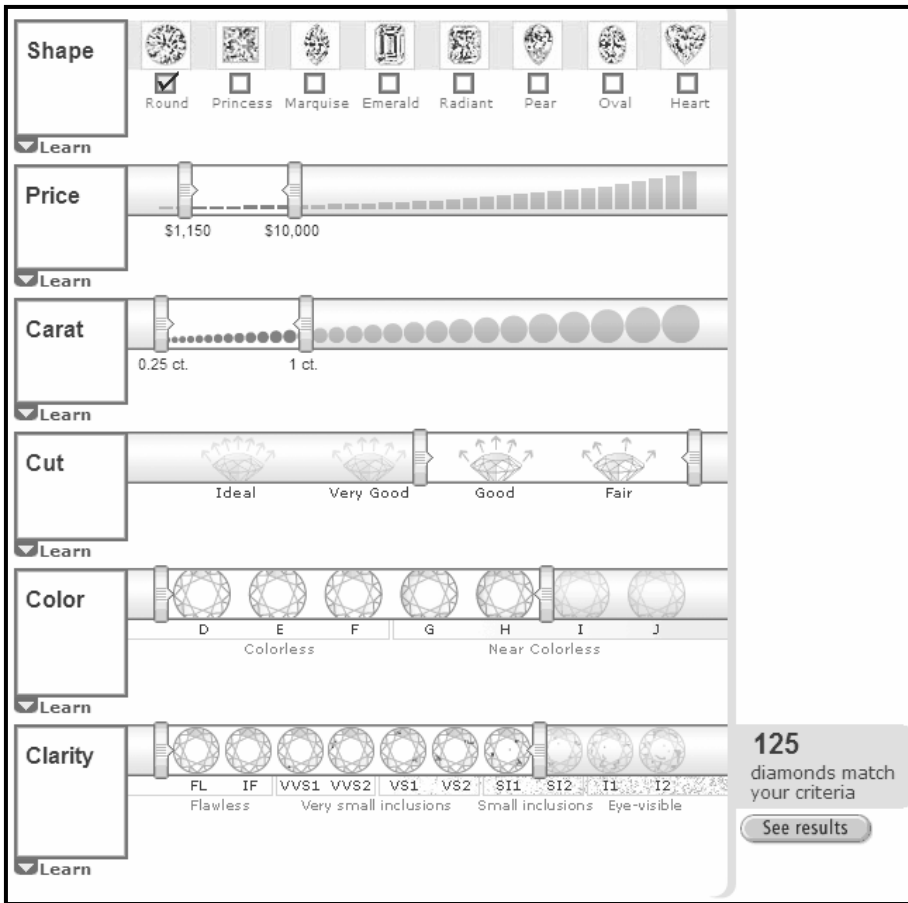
**Figure 6.** This wireframe illustrates a subpage of a site. Bold and light formatting are used to indicate priority to the wireframe consumer (typically a visual designer).



**Figure 7.** This wireframe illustrates another subpage. It shows the use of “content chunks” and “see also”--IA components recommended by Rosenfeld and Morville (2002), which can also be incorporated in FaF-style IA work.



**Figure 8.** Model of IA practice implications.



**Figure 9.** Amazon.com's diamond search user interface.

**Dirt Cheap Diamonds**  
A James Allen Company

Visit our new website  
*James Allen*  
Only Life is More Beautiful

**Toll Free 877-826-9866**  
Huge Selection, Fair Prices, Straight Talk

Loose Diamonds | Engagement Rings | Diamond Jewelry | Education | Fun Stuff | Ordering Info

### Loose Diamond Inventory

Shape	Carat Weight	Color	Clarity	Certification	Max Budget
Round	1 To: 1.25	F To: H	VS2	GIA	50000

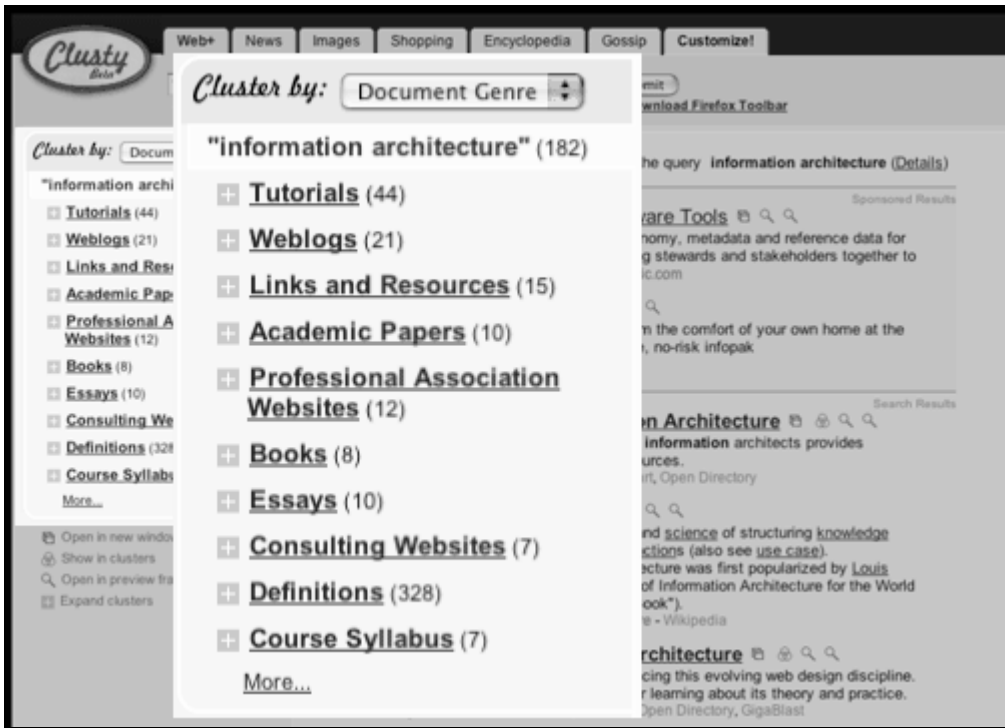
Start Search

Loose Diamonds  
Loose Diamond Search

**Figure 10.** Diamond search at DirtCheapDiamonds.com.



**Figure 11.** Relation Browser being used to search a collection of films.



**Figure 12.** Mockup of a search engine that clusters results by genre  
(<http://www.peterme.com/archives/000488.html>).