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An integrative approach to the design of knowledge organization systems

Abstract
This paper describes a design process for knowledge organization systems (KOS) that negotiates between the communicative goals of an author, the information needs of an audience, and the structure of existing subject literature. In the proposed process, the category structures that constitute typical KOSs are designed in the context of envisioned audience interactions with an information system’s resources, and as the support through which an author (or classificationist) expresses rhetorical goals regarding the subject matter being collected, organized, and made available for access.

1: Introduction
Within information science, it is common to describe information systems, including all forms of information repositories and the tools used to arrange, manage, and access their contents, as instrumental, task-oriented artifacts that, in an ideal scenario, facilitate users’ work seamlessly and invisibly. In this conception, the goal of information access tools, including knowledge organization systems (KOS) and search facilities, is user control over the collected resources. Jonathan Furner (2009) describes such capabilities evocatively in the language of ethics, asserting that users have a right to access information according to their own cultural traditions, social values, and personal expectations.

Alongside this longstanding ideal, however, lies an alternate conception of information systems as a type of creative, original expression similar to any form of document or artistic work (Andersen 2008; Feinberg 2008). The emergent popularity of social software environments emphasizes the potential importance of information systems for their expressive power, as it becomes easier for people to create and share their own collections of organized resources (Jenkins 2008). Systems such as Flickr, del.icio.us, and Facebook don’t merely aggregate submitted materials for retrieval but enable the exploration of document subsets selected, arranged, and made available for access by particular users. The experience of such “expressive bibliographies” relies on the unique interpretive frame with which an individual might endow a particular collection of resources and associated metadata. An information system’s usefulness and interest, in this view, is located partly in its ability to illuminate perspectives that differ from a user’s current way of thinking and that challenge existing ideas and expectations regarding the collection’s subject matter.

This paper proposes a design process and set of associated tools that provide a means through which the tensions between these two conceptions of information systems can be actively confronted and the potentially different goals of designers (who have ideas to communicate) and users (who have information needs to resolve) can be explored and negotiated. In existing modes of classification design, the concepts that populate a KOS, as well as the relationships that structure the system, are revealed through analysis of the subject domain and associated documents, not actively shaped according to a designer’s rhetorical purpose. In contrast, the proposed process simultaneously considers subject literature, user interaction, and the designer’s communicative goals in making design decisions about category semantics.
2: Design process development

In the spirit of design research, as described by Cross (1999), the process was developed and refined via the production of two complementary prototypes for systems that organize and provide access to information on the subject of vegetarianism. Each prototype was created to present a different perspective on its subject matter. A key goal in prototype development was to express each position on the subject systematically and persuasively to an identified target audience of current non-vegetarians with some interest in reducing meat consumption. One prototype advocated vegetarianism as an ethical imperative; the other prototype, while also supporting vegetarianism, did so from a cost-benefit perspective, not a moral one. The creation of multiple prototypes enabled the development of a design process that is robust and flexible enough to support a variety of both communicative goals and strategies and potential user interactions.

The process that emerged from creating the prototypes involves an interlocking set of activities that focus on the articulation of design goals through the prism of user experience. This type of approach is grounded in Donald Schon’s (1983) idea of problem setting as a key design activity, as opposed to problem solving, and so the outcome of the process is a design or plan, as realized through a set of three coordinated design documents, and not an implemented system.

Because an explicit design goal of these prototypes was to create a persuasive interpretation of the subject matter being aggregated, organized, and made available for access, the eventual design product, the organized collection of resources, was conceptualized as a form of document and vehicle of rhetorical expression. Instead of an information professional creating an access and retrieval tool for a set of users, this project was conceptualized as an author creating a document for an audience. While this distinction is perhaps subtle, it foregrounds the communicative goals of the author (or information system designer) as an active agent with a set of ideas to share with a defined public, and it situates the audience’s information needs in relation to that rhetorical goal.

In this formulation, while the perceived information needs of the audience are important, they are not the default goals of the system. Instead, the author needs to figure out how to negotiate these audience needs in a way that simultaneously facilitates the persuasive communication of the system’s argument. For example, to configure a collection of resources that supports the contention that vegetarianism is an ethical imperative, it is not necessary, from the basic requirements of the argument, to include a set of vegetarian recipes in the collection, or other material related to the practice of being vegetarian, as opposed to the decision to become vegetarian. However, if the author wishes to communicate this argument persuasively to an audience of people that is, at the moment of encounter with the system, merely considering a reduction in meat consumption, and who may not currently have the strength of conviction to forgo all meat eating, the provision of recipes and other materials that demonstrate the practicality and pleasure of a vegetarian lifestyle, because it may satisfy audience information needs and lead them to further interaction with the system, may be seen as a powerful and necessary component of the overall rhetorical strategy.

In addition to considering the information needs of the audience, the author also needs to explore audience beliefs and values regarding the subject matter of the collection, in accordance with established practice in rhetorical discourse. Perelman and
Olbrechts-Tyteca (1969), for example, describe how successful rhetorical arguments are based on existing audience values, and one can see the Aristotelian concepts of ethos (believability of the author) and pathos (use of the emotions in rhetoric) as both centered around a keenly observed sense of what will resonate best with a particular group. The adaptation of genre conventions, which may also be seen as a form of persuasive mechanism, similarly relies on being able to identify which changes to established conventions an audience will accept, and which may be seen as violating basic purposes associated with that community’s use of the document form (the plasticity of genre conventions within communities is discussed by Bazerman (1988) and Bhatia (2004) among others). In the proposed design process, all of these persuasive possibilities, with their associated reliance on audience goals, beliefs, and values, are considered in formulating an evolving rhetorical plan, or design strategy brief.

In the proposed design process, primary activities include:

- **Envisioning**: persona and scenario development.
- **Strategizing**: making a plan to achieve the nascent vision.
- **Learning**: examining the conceptual landscape of the subject domain.
- **Sketching**: manipulating the conceptual landscape into categories and relationships that implement the strategy and support the envisioned user experiences as depicted in the personas and scenarios.
- **Revisiting, reflecting, and refining**: revising scenarios, briefs, and category structures into a coherent set of documents that together make up a comprehensive design prototype.
- **Analysis and critique**.

The following sections describe each activity.

### 3: Envisioning: persona and scenario development

First, the designer builds *personas* as a way to encapsulate characteristics of a selected target audience, as described in Pruitt and Grudin (2003). Ideally, the personas are constructed by synthesizing user research. Next, the designer imagines a diverse set of experiences that show how these personas might interact with some potential organized collection of information resources, using a variation of the scenarios technique commonly employed in human-computer interaction design (Carroll & Rosson 1992). In contrast to traditional design processes for controlled vocabularies, which do not typically explore how a scheme for organizing information might be embedded within a particular resource collection and possibilities for user interaction, these scenarios envision the user’s total experience with a digital library. By reflecting on these scenarios, the designer can begin to perceive the extent of the design problem, or what the as-yet-undetermined system for organizing the collected resources might need to do. The scenarios might, for example, illuminate potential areas of conflict between users’ document access goals and the designer’s communicative goals, and might also present a variety of potential outcomes for system interactions, to then be characterized according to a continuum of success and failure. It might be considered an acceptable design outcome, perhaps, if a user is not entirely convinced by the information system’s presentation of the subject matter (if the user does not, say, commit to stop eating meat due to ethical concerns), but is intrigued enough by the system to consider its position potentially valid (if the user perhaps acknowledges that causing animal suffering may
indeed be morally problematic). Achieving this communicative goal on the part of the designer may, in turn, require that the system accommodate the user’s potential information needs, even if those needs don’t directly serve the designer’s rhetorical strategy. For example, users looking for information on the health benefits of a vegetarian diet may be excellent audience candidates for the information system, and while such information might not explicitly support an ethical stance on meat eating, having such resources available could persuade that group of users to continue interacting with the collection.

4: Strategizing: making a plan to achieve the nascent vision
The designer uses the ideas generated from initial scenario development to postulate a tentative strategy for how the still-amorphously-defined information collection might effectively communicate its position to the targeted audience. This strategy is presented through a systematic design document, called the brief, which includes the following sections:
- The position, or point of view on the subject matter being organized.
- Audience characteristics.
- Manifestation, or the form in which the position will be expressed, such as a digital library made available over the Web.
- Resource selection principles and resource characteristics.
- Options for user access to the collected resources.
- Integration possibilities for the resources and associated metadata with other design elements.
- Persuasive strategies through which the position will be most effectively communicated to the audience. These might include argumentation strategies, determination of an authorial voice, and a plan for selectively adapting genre conventions to facilitate the designer’s rhetorical goals.

5: Learning
In a loose approximation of traditional controlled vocabulary design, the designer surveys subject literature, compiling a sourcebook of concepts to use as raw material for implementing the strategy outlined in the brief. While the brief guides this concept collection, leading the designer to omit areas that do not seem relevant to accomplishing the communicative goals as conceptualized for the selected target audience, the learning activity may also lead to revision of both scenarios and strategy, as more detail about the conceptual landscape sparks additional ideas.

6: Sketching
Once a number of source concepts have been gathered, the designer begins “sketching” categories and defining potential hierarchical and associative relationships. These sketches map out a potential KO infrastructure to support the user interactions described in the scenarios and the rhetorical goals documented in the brief. At this point, the sketches merely define and relate categories: they do not assume the detail of any particular form, such as a thesaurus. (However, as the design proceeds to implementation, these sketches would form the basis of a thesaurus, or an information architecture, or whatever structure the design situation seems to require.)
Similarly to the learning phase, while this activity might be shaped by the interim thoughts documented in the scenarios and brief, the process of defining, arranging, and relating categories may also generate revised interpretations of the design problem and means to its solution, and so lead to revisions in the scenarios and brief.

7: Revisiting, refining, and reflecting
Synergistic development of scenarios, brief, and category sketches continue until a viable design emerges through the intersection of the three documents, which together represent the potential user experience of the information system (through personas and scenarios), the communicative goals and strategies of the designer (through the design strategy brief), and the KO infrastructure to support both user experience and communicative goals (through the category sketches). Together, these documents represent a considered negotiation between an author’s desire for expression, an audience’s information needs and associated tasks, and the existing shape of the subject literature.

As insights gained from developing the three documents accumulate, each document changes to reflect the author’s emerging sense of the design: the features it should include, the categories that should structure it, and the way these fit together. The scenarios are rewritten to show in fairly detailed fashion how the category structure will be revealed to the target audience, and audience interactions that show the potential success and failure of the rhetorical strategy are described. The following figure shows how a scenario from one of the prototype designs maps out the form, content, and style of an entrance page for an envisioned Web-based digital library:

![Flourish: The Vegetarian Way](image)

**Figure 1: Prototype digital library interface as sketched in stabilized scenario**

When the three documents coherently reflect each other, and an integrated set of ideas has stabilized, the design is ready for analysis and critique.

8: Analysis and critique
The candidate design is systematically examined and potentially revamped before proceeding to implementation. Such critiques are established practice in many design
fields (Zimmerman et al. 2007). The results of the critique may result in another round of design activities. For example, in the development of prototype designs for vegetarianism collections, a detailed critique uncovered, among a variety of significant structural suggestions, that an idea expressed as part of the strategy brief, that the ethics of vegetarianism should be connected to the concept of sustainability, and that these motives should be explicitly related, was not perceived in the prototype design. The means by which this idea was to be expressed, though category inclusion, resource selection, and relating of resources, needed to be more concretely defined, and additional strategies potentially proposed.

9: Process flow
The following diagram shows the activities described in the previous sections and their relationships to each other as the design plan is being created:

![Figure 2: Map of proposed design process](image)

As clarified by the diagram, the proposed design process is neither linear nor circular in the sense of repeating a successive set of steps; while all the activities are independent, they may be occurring simultaneously, and the knowledge gained in one activity may necessitate revisiting another. How, then, is one to know when a design is ready to proceed to an implementation phase? This determination will depend on the judgment of the designer and the constraints of the design situation. Eventually, after a round of analysis and critique, when the accumulated suggestions primarily consist of refinements, as opposed to reconstructions, enough decisions will have been made so that a path to initial implementation can be discerned.
10: Design outcomes

The outcome of this process comprises the three related design documents developed during the coordinated activities: user scenarios, strategy brief, and sketches of category structures. Together, these three documents present a unified design vision for a collection of information resources that is organized and arranged to persuasively communicate a unique perspective on the subject matter that it makes accessible. The scenarios describe the user experience, including possibilities for success and failure in terms of satisfying information needs. The brief describes the designer’s rhetorical goals and a set of strategies for persuasively communicating the designer’s position on the subject to a targeted audience. The category sketches describe a system of related concepts, conveyed in a form less strict than a typical controlled vocabulary structure, that provide the infrastructure through which the communicative goals and associated user experience can be supported. The coordinated vision expressed through this document set can then be used as the preliminary blueprint by which the described information system proceeds toward implementation.

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