Experientialist Epistemology and Classification Theory: Embodied and Dimensional Classification

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ABSTRACT: What theoretical framework can help in building, maintaining and evaluating networked knowledge organization resources? Specifically, what theoretical framework makes sense of the semantic prowess of ontologies and peer-to-peer systems, and by extension aids in their building, maintenance, and evaluation? I posit that a theoretical work that weds both formal and associative (structural and interpretive) aspects of knowledge organization systems provides that framework. Here I lay out the terms and the intellectual constructs that serve as the foundation for investigative work into experientialist classification theory, a theoretical framework of embodied, infrastructural, and reified knowledge organization. I build on the interpretive work of scholars in information studies, cognitive semantics, sociology, and science studies. With the terms and the framework in place, I then outline classification theory's critiques of classificatory structures. In order to address these critiques with an experientialist approach an experientialist semantics is offered as a design commitment for an example: metadata in peer-to-peer network knowledge organization structures.

1. Introduction

The literature of peer-to-peer computing has addressed computational issues, like scalability and performance, and policy issues, like copyright and privacy. Semantic issues, especially those related to knowledge organization and classification, have only recently, been addressed, (Semantic Grid, 2005). This discussion of the semantics in peer-to-peer computing borrows from discussions of ontologies in the Semantic Web community. The central issues surrounding the semantics of both the peer-to-peer and the Semantic Web are issues related to meaning, and representation. For semantics in peer-to-peer computing to work, the mechanisms for representing meaning must interoperate. Each individual or institution that is a part of the peer-to-peer network must understand the other. This is the same for the semantic web. Ontologies, built by different authors must represent information that it is meaningful to the next user of that ontology. For machines, specifically agents, to work in this environment, authors of ontologies must represent knowledge in a way that allows agents to inference from the structures, and through machine reconciliation processes, to interoperate. Machine reconciliation can be accomplished by either merging or mapping ontologies. Current work in merging matches strings of text in a specific structure (Noy and Musen, 2001). Mapping in this particular case is more sophisticated. Mapping raises

semantic interoperation of ontologies into a more abstract concept matching procedure (Maedche et al, 2002). Human interoperability and machine interoperability are both required for a true semantic web – a web that allows meaning to interoperate. I argue that in order for both of human and machine types of interoperability to work, the design commitment of interoperable systems must be founded on an experientialist semantics. Work in experientialist semantics is design work. It is design work that will help build, maintain, and evaluate classificatory structures so that networked semantic computing environments will work for humans. This paper outlines design commitments drawn from work in *Classification theory and experientialist epistemology* (Lakoff, 1987).

I ask a basic question: what kind of metadata structure is needed for a peer-to-peer computing environment that shares ontologies? The next sections outline the definitions and background research used to address this question. First, these commitments are placed in the context of current assumptions about semantics in ontology work and peer-to-peer computing. I then combine design commitments from these three literatures, classification theory, experientialist epistemology, and semantics of ontologies and peer-to-peer computing, and then offers a theoretical framework for an *experientialist semantics*, a methodology and architecture for creating data structures for an interoperable semantic peer-to-peer computing environment. The structure of the paper is as follows. Section 2 outlines the background and purpose for discussing experientialist design of classificatory structures. Section 3 outlines the purview of experientialist design – in meaning (individual and social) and structures (formal and associative). Section 4 details four design criteria for experientialist design of classificatory structures (malleable, proximal, schematic, and linked structuration). Four critiques of current classificatory structures are presented in section 5 and related to design commitments of experientialist epistemology. Finally, section 6 discusses the results of experientialist design, namely, experientialist semantics, and provides an example of a design that accounts for experientialist design commitments. I close with a brief conclusion in section 7. I will not consider the literature of computer supported collaborative work (CSCW) in this paper, but it does constitute an interesting future avenue of research. Likewise, this theoretical framework stands as a first step in a research area that will incorporate empirical work.

2. Spheres of research

In this paper I draw on three spheres of research: Classification Theory, Experientialist Epistemology, and the semantics of ontologies and peer-to-peer computing. Classification Theory is the body of literature in Information Science that is concerned with creating conceptual structures for information needs that is based on an understanding of relationships among concepts in the universe of knowledge. Classification Theory offers critiques as well as design recommendations to Information Science.

Experientialist Epistemology is the body of thought that grows from the work of Lakoff and Johnson (Lakoff and Johnson, 1980; Lakoff, 1987; Johnson, 1987). Experientialist Epistemology places the locus of knowledge and understanding at the intersection of the human body and the mind's use of metaphor. Experientialist Epistemology claims that both basic level categories and abstract level categories are embodied and are metaphorical. They are embodied in that our bodies have structure, we perceive through a structured biology, and that we experience the world through our bodies and their structures. We extend these basic experiences and perceptions to more abstract thought through metaphor. We are able to extend the basic experience of being in a room by equating being in a discipline or field of study (say Information Science) because both being in a room and being in Information Science are modeled cognitively on a container metaphor (Lakoff, 1987). Experientialist Epistemology offers Classification Theory and peer-to-peer computing a plausible perspective on the typology of conceptual structures and a methodology to create those conceptual structures.

Peer-to-peer computing is a distributed computing model in which different computers are interconnected and communicating together. File sharing, instant messaging, and distributed computer processing are all functions of peer-to-peer computing. Ontologies are formalizations of concepts using formal logical parameters. Gruber (1993) defines an ontology as "a specification of a conceptualization." For our purposes, ontologies are formal expressions of concepts and their relationships. They are formal in that these expressions are based in a logical context with superordinate and subordinate concepts. Ontologies are also formal in that they are used by machines to process relationships between information objects. The vision of the semantic web makes ontologies the structures on which agents will infer

meaning and process commands. Ontologies are the backbone of the semantic web's semantics. Increasingly, ontologies play a more important role in peer-to-peer computing and the semantic web (Semantic Grid, 2005).

Ontologies, peer-to-peer computing, and both classification theory and experientialist epistemology converge at the intersection of knowledge organization and human-centered design. However, research on ontologies can and does happen without a human design element. This research concerns itself with formalizing the technologies and intellectual structures that will allow agents to operate merging and mapping techniques without human intervention. This kind of engineering is limited, because it does not account for how well this kind of ontology will work when implemented. In order to address this concern the human must be a part of this engineering process. The human must figure in to the design process. Experientialist epistemology offers the designer a set of tools that help insert the human in the design process. The next section of this paper outlines how experientialist epistemology does that.

3. Experientialist design

It is suggested here that, experientialist informed classificatory structures be built, maintained, and evaluated on how well they fulfill individuals' information needs. The impetus for incorporating an experientialist epistemology into classification theory and practice is based on findings in classification theory and in information behavior (see Section 5 below). It is also grounded in current network engineering efforts in the metadata, ontology, and peer-to-peer communities. Each of these efforts, classification theory, information behavior, and the network engineers identify needs – needs that can and should be satisfied by well-designed classificatory structures. All three of these spheres come together as an experientialist approach to classificatory structure design. This section of the paper outlines where an experientialist approach to classification can address these needs. The experientialist approach offers guidance on need-based design commitments of classificatory structures. Explicitly, an experientialist approach to classification seeks to build a multidimensional classificatory structure that accounts for the intersections of individual and social meaning, and an intersection of formal and associative structures. In the following sections these intersections are described from the three different viewpoints. Each viewpoint is a level of analysis. The first is the embodied level outlined by Lakoff and Johnson (Lakoff, 1987). The next is an infrastructural viewpoint provided by Bowker and Star (1999). The final viewpoint is a reification viewpoint provided by Berger and Luckmann (1967).

3.1 Individual and social meaning

Meaning is the central issue for experientialist epistemology (Lakoff, 1987). Meaning is individual in that it is seated in our individual bodies. It is cognitive in that it grows from how we manipulate concepts, but it is also social. Meaning is social in how language extends preconceptual notions into both basic and abstract concepts like tiger, water, anger, and mother. Classificatory structures are languages, and are used by individuals and groups (Jacob, 2001). Lakoff's theory of meaning offers classification theory insight into the individual and social dimension of meaning. At this level, meaning is an individual experience. It relates to an individual's conceptual structure, and its metaphorical extensions. At this level the social weighs in on the individual and influences how she or he interacts with a classificatory structure. This is different from the infrastructural experience outlined by Bowker and Star (1999).

Bowker and Star (1999) highlight the tension between individual and social meanings in classificatory structures. In their critique, classification, as an object of study, is akin to accreted standards and practices. Standards and standardization enforces a social infrastructure on the classificatory experience, and individuals react to these imposed standards. Thus nurses work within and around the Nursing Interventions Classification (Bowker and Star, 1999). These workarounds provide evidence for the individual nature of, and expression of, meaning in classificatory work. Bowker and Star (1999) offer the term boundary infrastructures to illuminate the edges of overlap between individual and social meaning. Boundary infrastructures are the melding of individual and social practices and standards. They shape our experience of classification. This concept is similar to Star and Griesemer's (1989) boundary objects. Boundary objects stand as socio-material artifacts that allow different discourses or communities to work together. The example provided by Star and Griesemer is the species record of California fauna. Each community concerned with the fauna of California, amateur naturalists, professional zoologists,

administrators of museums, and concerned benefactors of museums all cared about the species record. However, each community cared about the species record in a different way, for a different reason, and as a consequence, worked with these artifacts in very different ways. Each negotiated an individual and social meaning from these objects, in a given infrastructure. At this level, the level of objects and infrastructures at the boundaries of communities and work, meaning is an experience that is fixed in the world, not the mind. At this level, there are artifacts, standards, and practices that must be accounted for to understand fully the experience of working with classificatory structures. At this level, then, the design of classificatory structures must account for objects, infrastructures, and practices that allow a negotiation of meaning both individual and social.

Finally, the Marxist dialectic process of externalization, objectification, and internalization (Berger, 1967) is another interpretation on the relationship between individually and socially constructed meanings. In this process, where a need is externalized an individual acts. This act, externalizing a need, results in an object. That object, whether it is conceptual or material, is then part of a social universe. This object can, if it is stable enough, be internalized. The process of stabilizing the object and internalizing the object is a social act. It is a social act of meaning making. I will use the term reification to signify this dialectic process. The process of reification is at work in the foundations of classificatory structures. What is considered to exist, whether it is conceptual or real has gone through, at the very least a rhetorical act of reification. It is then picked up as a subject in the classification scheme. Literary warrant (Beghtol, 2002) is used to justify this method of constructing classification schemes.

However, reification is also a process that individual scholars in all disciplines engage in. Latour (1999) posits that the ontological nature, the very existence of microbes before Pasteur's work, is an open question. That is, the construction – or the objectification of the idea of microbes is part of a rhetorical strategy that influences our understanding about the limits of our own knowledge. In much the same way, classificatory structures can act in the same rhetorical way – disappearing and making manifest concepts that are part of the literature at any given time. Thus we have open design questions that stem from the intersection between social and individual meaning-making. How does the current practice of classificatory structure design reflect a user experience of working with these classificatory structures? And how can an experientialist approach aid the user in bettering that interaction?

3.2 Formal and associative structures

For Lakoff (1987), not only is meaning both social and individual, meaning is also formal and associative. Meaning is formal in its structure. The body has structure. Concepts are structured around the body and each other. Thus, to be happy is to be up. To be sad is to be down. (Lakoff and Johnson, 1980). This example, along with other formal structures can be extended into more abstract metaphors. Through this extension, associations are made. These associations are often metaphorical extensions. Thus, an argument can be settled in a way that denotes finality, because it was once up in the air as to who was going to win the argument. These examples are extensions of a metaphor that states ARGUMENT is WAR. And it is in metaphorical extensions (associative structures) where deviation from strict formal structures influences meaning. In this case, argument is serious. It can be won. Someone should win, yet of course, a truce can be agreed upon – the debaters can agree to disagree. Associative structures are the opposite of formal structures. Associative structures are not accommodated by most formal systems of knowledge organization, like controlled vocabularies. A user cannot disagree with a classification system to the extent that it helps that user organize, retrieve, or disambiguate information. Negotiation must follow formal lines of the controlled vocabulary not associative lines of thought. Issues related to associative structures are of growing interest to knowledge management researchers. They include ideas of information sharing through the creation of an information sharing culture, or Ba (Nonaka and Konno, 1998), and through best-practice knowledge bases that are driven and organized by storytelling (Snowden, 2002). These associative structures must be addressed in classification theory (Priss, 2001 and 2002). The experientialist approach to conceptual structures provides a means to address associative structures. At this level formal and associative structures are individual and embodied. They are part of the structured and unstructured dialogue that is an intrinsic part of classificatory practice (Bowker and Star, 1999; Jacob, 2001). Experientialist approach to classificatory structure design accounts for this dialogue as a part of the human experience with classificatory structures.

Bowker and Star (1999) are also concerned with formal and associative structures. In a closing chapter of their book, they ask, "How are categories tied to people?" (Bowker and Star, 1999 p. 314). In this question, and in the text that follows, they point to work that can be done to associate individuals with formal categories. From a perspective on boundary infrastructures Bowker and Star ask questions related to the social aspects of associations that grow up at the edges of more formal systems. Tantalizing as the ideas seem Bowker and Star leave these questions for future research. Their plan for this future research includes ethnographic as well as historical studies. This seems to be a torch no one in classification theory has picked up, though this work builds on Bowker and Star's work. And in these future studies, the experience of classification will be studied as an intersection between formal categories and the workarounds and interpretations invoked to make sense of those formal categories. At this level, experience of classificatory structures is part of the infrastructures of work domains. At this level categories are imposed by standards, but interpreted by a small group. Categories, though formal are made to work by extensions and associations. The experientialist approach to classificatory structure design would offer explanations and design commitments that make sense of this act of interpretation and meaning making.

3.3 Experientialist thought, infrastructures, and reification

Lakoff, Johnson, Bowker, Star, Berger, and Luckmann each in their own way account for the intersection between individual and social, and the formal and associative aspects of meaning. They have examined embodied cognitive and linguistic approaches to meaning. They have studied the negotiated and bounded limits to meaning through infrastructures, and offered classification an explanation, through the social construction of norms and mores, for the experience of reification of meaning and its affect on individuals in society. My interpretation of an experientialist approach to classification theory builds on these ideas and commits to an understanding of classificatory structure design that operates on many dimensions – individual and social dimensions, as well as formal and associative dimensions. The experientialist approach shapes classificatory structures that work through modeling classification as an experience itself.

4. Experientialist epistemology, the embodied mind, and classification

The experientialist epistemology put forth by Lakoff and Johnson (Lakoff, 1987) places the locus of meaning and understanding in the human mind and in the human body. Meaning is not external. It is not disembodied. Conceptual structures do not exist independent of human bodies, individually or collectively. For classification theory to adopt experientialist epistemology as a guiding design principle, it must make classification malleable, proximal, schematic, and linked. Each of these qualities is a quality at work in conceptual and preconceptual structures discussed by Lakoff (1987). They are provided here as guiding tropes for experientialist classificatory structure design. Below is a brief definition of these terms and their association to classificatory structures.

4.1 Malleable structuration

For classificatory structures to be malleable, they must be able to bend and rearrange conceptual relationships to illustrate proximity, a change in scheme, or to create links. Completely concretized classification does not work. Procrustean classification, classification that does not expand beyond its first, enumerated top-level classes, does not work (Olson, 2002). If a classificatory structure does not change, or aims at uniformity in a violent manner, then the design commitment does not reflect the experience of classification. Decadal classification schemes like the *Dewey Decimal Classification* (*DDC*) have been criticized from their inception to the present (Ranganathan, 1967; Olson, 2002). More fluid classification schemes, like Colon are praiseworthy precisely because of their, in part, malleability. However, malleability is not the rule, but rather the exception of many library classification schemes. The rationale behind decisions are largely socio-economic, but also are bound by technological constraints – constraints that sound methodology coupled with the prowess of contemporary technology might be able to transcend.

4.2 Proximal structuration

In order for something to be proximal, it must be nearby. It might be said that it is around us – in the area. When scholars discuss their expertise, they employ a metaphor. Metaphysics and Hamlet? That is in my area. When concepts are known concepts, they are metaphorically considered nearby concepts. The-

se nearby concepts are familiar to us. We understand nuances affiliated with these concepts. Thus in the example above, the nuances familiar to someone with the expertise of metaphysics and the Shakespeare play Hamlet can argue the finer points (another geospatial metaphor) of concepts and their interrelationships. In scholarly communication scholars argue over these concepts and their locations with respect to other concepts – be they abstract or concrete. If concepts are nearby, they can also be unfamiliar or remote to someone's understanding or their conceptual schemes. Thus feminist accounts of Shakerism may be a cluster of concepts that seems proximal to liberation theology, but not proximal to demographics. However, this is a matter of interpretation. Experientialist approaches to the design of conceptual structures asks classification theory to consider what is considered proximal, and what kind of structures should be built that allow us to alter proximal relations among concepts. In this case, we might want to make feminist accounts of Shakerism more proximal to demographics.

Proximity also relates to familiarity with conceptual relationships. If a user has grounded their information searching (and browsing) in a particular area of a library, or using particular moves in a database, then there is an embodied quality to the familiarity and hence proximity of the classificatory structure to the user's conceptual structures.

4.3 Schematic structuration

Concepts and terms for controlled vocabularies must be schematized. That is, as current practice mandates, the controlled vocabulary terms follow a particular scheme. However, they often, for the sake of control, follow one and only one scheme. Experientialist epistemology posits that the human mind does not operate on a single schema. Fundamentally, the human mind works with categories in different and often metaphoric ways (Lakoff, 1987). In order for controlled vocabularies to be malleable they must operate in a number of schemas. They must also allow end-users the ability to make some concepts proximal and others not. In order to do this, controlled vocabularies must offer a number of schemas around which concepts can be ordered. Examples of schemas may look like this.

– Radial (there is a center and a periphery around which related concepts cluster)
– Graded (there is not clear distinction between what is in and what is out, it is graded – ex: chair vs. stool, socio-economics vs. economic sociology)
– Contained (some things are inside other things are outside – ex: sociology of knowledge is contained in sociology)
– Origin-Path-Destination (there is a trajectory or a story that goes with these schemas)
– Metonymic (part stands in for the whole)

These schemas can be illustrated by the example – Shakerism. Shakerism is a religion that has been continuously practiced in the United States from 1774 up to the present day. Shakerism is classed as a religion. As such there are a number of relationships that other topics and subjects have to Shakerism. These can be illustrated radially, graded, contained, by an origin-path-destination metaphor, or by metonymy. For example, radially, Shakerism occupies a central position in relation to feminism, religion, American utopian groups, etc.

4.4 Linked structuration

Concepts, as per Lakoff (1987), do not exist as individua, that is, they are not a unique and self-contained essence. Thus there is not only one dog in the world, but rather a collection of entities that we consider dogs. There is not one love in the world. Rather, there is a collection of concepts that constitute the category love. Concepts are always part of a concept schema or are categories of things – very rarely (if at all in classificatory structures) are instances unique (Lakoff, 1987). Waiter as a concept is an example. In a particular schema, for example, going to a restaurant, a waiter is a category, which might contain particular instances that represent waiter the category. This follows design principles of likeness and class membership of knowledge organization schemes. However, the explicit or tacit linking of concepts together must be placed in the control of users, expert or non-expert users. Users, as they interact with classificatory structures should be able to link entities together, along a variety of schemas. Without this capability, the classificatory structure would not be malleable, nor would it allow proximity.

4.5 Experientialist design criteria

These four experientialist design criteria, malleability, proximity, schemas, and linking, place the classificatory enterprise in the hands of the user. They partially model the structuring methods outlined by Lakoff (1987), and in doing so, seat the agency of con-

ceptual structuring with the user. Classificatory design and technology should follow suite. Neither these criteria, nor the experientialist approach advocate that the user create classificatory structures ex nihilo. Rather, these design criteria, and more concretely, the classificatory structure designed using these criteria place control of the conceptual structures into the hands of the user. With these structures, classificatory structures that are potentially malleable, proximal, schematic, and linked, the experience of classification is a user-centered experience, derived from work on the embodied mind.

4.6 Embodied mind

The term embodied mind focuses attention on the individual and his or her manipulation and interpretation of conceptual structures. It is one level of analysis in understanding the semantic nature of knowledge organization structures and processes in the networked environment. This unit of analysis, the individual, is integral to our understanding interactions and compensatory behaviors in knowledge organization infrastructures. If we question the nature of classificatory structures, as I advocate a theoretical framework of classification should do, then we must, through individuals, see how classificatory structures would be manipulated for use. Classificatory structures might be manipulated by individuals in special domains, by domain leaders wanting to shape terms and concepts in the field, by popularizers who offer introductions to terms and concepts often considered arcane or too specialized for the average end-user. Information professionals can manipulate classificatory structures to help with information provision, and other aspects of their work. But is manipulation desirable? Does enabling classificatory structure manipulation further work in information organization and aid in the design of more useful information systems? Bates has found spontaneous classification behavior in users (Bates, 1998 p. 1192). And the work done by Bowker and Star point to implicit (as in not written down) user manipulation of formal structures. Likewise, the social tagging phenomenon, as seen in the photo-sharing web site, *Flickr* (2005), is a testament to how users interact with classificatory structures. They make them malleable. In the next section issues raised in classification theory research are used as tests for the validity of the four design commitments outlined above. From this comparison I hope to answer the question as to what an experientialist approach to classificatory structure design add to the design of usable systems.

5. Do classificatory structures engender experientialist epistemology?

Is there something to be gained from adopting an experientialist approach to the design of classificatory structures? Is there more to the design of classificatory structures than current practice? Classification theory offers critiques of classificatory structures. These critiques often deal with hospitality, warrant, bias, and fulfillment of user needs. Each of these critiques is an area that current classificatory practice, according the classification theorists, must address. It must do so to make classificatory structures work better. That is, classificatory structures should be, according to classification theory more hospitable to new concepts and terms and relationships. Designers of classificatory structures should be mindful of a number of warrants including literary, user, scholarly, and cultural warrants. The designers of classificatory structures should understand bias in classificatory structures, and most importantly, user needs should be fulfilled by classificatory structures. Through these four concerns, classification theory should guide the construction of classificatory structures that enable the multi-dimensional experience of classification. What, if anything, does an experientialist approach to classificatory structure design have to say to this work in classification theory? The section below moves from a general discussion of conceptual relationships to a more specific discussion of conceptual relationships as they are implemented in classification schemes. This section outlines the definitions and examples of four critiques of classificatory structures provided by classification theory. For each it addresses how an aspect of experiential approach to design might influence this critique. The section closes with an answer to the question as to whether classificatory structures engender experientialist epistemology.

5.1 Hospitality

Classification theory's concern with hospitality in classification schemes relates to how relationships between concepts – old and new concepts – in the classificatory structure are made and sustained. Well designed classificatory structures should make room for new concepts. In the example of HIV, classes must be created in various disciplines in a subject classification scheme like DDC because HIV can be studied from a number of disciplinary perspectives. Faceted classification structures advocated by S. R. Ranganathan (1967, 1987) are one of the canonical answers to hospitality. His architectures and me-

thods for constructing faceted classification allowed for an ever-growing universe of subjects. However, hospitality also affects larger parts of the classification structure, beyond facets. As of this writing, the future location of the Medical Sciences in the *Universal Decimal Classification* (*UDC*) is under discussion. They might be moved to illustrate a better relationship between Applied Technology and Biology (UDC Forum listserv). In a classificatory structure designed by an experientialist approach, *UDC* could move Medical Sciences. And Elroy, for example, a hypothetical taxonomist using *UDC*, would be able to manipulate these concepts, as needed. In a classificatory structure designed by an experientialist approach, Elroy might understand his user needs so well that Medical Sciences might be split in some cases, as he is classifying documents. I, as a user, then should be able to manipulate classificatory structures, while still using *UDC*. This would then be linked in an experientialist classificatory structure that allowed me to create a schema for my users. This schema would further be linked to the authorized *UDC* schema for Medical Sciences.

By manipulating a classificatory structure in this way, not only is the structure made hospitable, but it helps fulfill user needs. The classificatory structure is made hospitable through the experientialist interpretation of what relationships should be constructed and maintained. It is made hospitable through the interpretation of meaning that is individual and associative in nature. The classificatory structure not designed with an experientialist approach is formal and social only. By adding the experientialist approach, and its accompanying characteristics of malleability and proximity, and its schematic, and linking capabilities, users can create meaning out of the intersection of individual, social, formal, and associative structures. Each of these four criteria for experientialist design: malleability, proximity, schema, and linking addresses the critique that classificatory structures should be hospitable because they allow the user to make meaning at these intersections mentioned above.

Manipulating classificatory structures in this way also fulfills user needs. It does so by allowing information professionals to adjust universal schemes to fit with their immediate context and their user groups. More about fulfillment of user needs follows below.

5.2 Warrant

Warrant is the rational justification for the introduction of a term or concept into a controlled vocabulary. Warrant is based on literature, users, scholarly opinion (or expert opinion), and is culturally biased (Beghtol, 2002). Warrant provides the limits a classificationist sets on source of concepts and terminology, and as a result on the inclusion or exclusion of concepts and terminology. The critique in the design of classificatory structures that relates to warrant – is whether or not a scheme for classification accounted for culturally specific concepts. This is the case highlighted by Beghtol (2002). In an experientialist design of classificatory structures an information professional, or any other user, could link documents or surrogates of documents to the classes built out of warrant. This technique is used by automatic classification technologies to help with categorization (Verity, 2002). This allows the classificatory structure to add and represent the experience of user's knowledge of what information goes in what class. This situates the experience of justification for expansion and inclusion in the hands of the user of the classificatory structure.

5.3 Bias

Bias comes from the linguistic nature of classificatory structures. Language is part of a time and place, and is part of social and political mores and struggles. Bias thus appears obvious in areas of classificatory structures that relate to social, political, temporal, and cultural opinion. Race, sex, status, and disease are examples of classes that have and continue to be critiqued because they show bias for one party over another (Olson, 2002). Dimensionality (Tennis, 2002) or dialogic approaches (Jacob and Albrechtsen, 1999) are offered as ameliorations in the theoretical literature. Bias is experienced by the user of a classification scheme. An experientialist approach to design would allow an end user to manipulate this bias, perhaps even annotating it for their use, through linking and a rearranged scheme. Bias, along with hospitality and warrant affect the user's interaction with a classification scheme. Each affects the ultimate goal of classification, which is to fulfill user needs.

5.4 Fulfillment of user needs

There are many accounts of what users need from classificatory structures. The dominant contemporary discourse addresses user needs from domain analysis, discourse analysis, and ecological design. Domain analysis, discourse analysis, work and task analysis are current ecological initiatives in classification

theory and information system design (Albrechtsen and Pejtersen, 2003; Pejtersen et al., 2001; Jacob and Albrechtsen, 1999; Hjorland, 2002). I have, for the purposes of illustrating their similarity, grouped a number of different initiatives. Cognitive work analysis (Albrechtsen and Pejtersen, 2003) is different from domain analysis (Hjørland, 2002) in a number of ways. However, both of these look to the ecology of the user of classification schemes as the chief source of evidence for creating classification schemes. They differ, in this regard, as to what priority is given to tasks in an ecology versus historical and institutional structures of an ecology.

These approaches take the domain (at various levels) to be the unit of analysis when building, or making recommendations on the construction of information systems. This practice, creates a method for analyzing the domain, it then collects data from that domain, and recommends or designs a system or parts of a system that fulfill user needs. In this ecological paradigm user needs are fulfilled by a close study of the domain or the ecology of the user. Classificatory structures then are elicited from studies of the ecology and the user. Classificatory structures serve as transparent mechanisms used to bring documents and tasks into alignment through researched terminological control. Thus both the experience of classification and the sources (both warrant and bias) of classification are self-contained and self-referential systems. The experience of classification is not seen as something that changes in a dramatic way over time. The focus is on work, classificatory experience and structures are secondary.

However, what happens when things change in this domain? What happens when we have to take into account a shift in warrant, in bias, or in hospitality? This is an even more compelling question when real-time peer-to-peer interaction occurs. If peers in a distributed network can adopt a classificatory structure to account for user needs in real-time, and then share this change over a peer-to-peer system, then the classificatory structure must allow for that change. This problem is compounded when sharing ontologies, whose purpose is to make machine and human interoperable, the conceptualization of a domain. Even in this peer-to-peer environment, the fundamental questions remain. What can be changed in classificatory structures if they are designed to be transparent mechanisms used only to reflect the known universe in the ecology that was studied? Do classificatory structures need to be more than transparent mechanisms for terminology control in this ecological paradigm? The experientialist program would say yes. Classificatory structures in the experientialist approach would look to classificatory structures as malleable, allow for concepts to be nearby or not, allow for the adjustment of schemas and links. By taking the experientialist approach, classificatory structures become the object of study, not the work task. Experientialist design addresses the classificatory structure. It only secondarily investigates the domain or ecology, or it combines work done in domain analysis to inform experientialist design. The experientialist design commitment offers structures and the user interaction with structures as one (of many) solution to the problem to solving user needs. These experientialist characteristics, malleability, proximity, schematic, and linking, according to the experientialist design commitment, can also satisfy user needs that stand as independent elements of a classificatory structure – independent of ecology or domain. They can be used as design criteria for classificatory structures in a dynamic and constantly evolving ecology like a peer-to-peer system.

5.5 Accounting for experience of classification in classificatory structures

In the above sections four critiques of classification have been introduced. Each has been addressed in relation to the design commitments of experientialist epistemology. What now has to be addressed is how an experientialist approach to classificatory structure design can resolve issues of hospitality, warrant, bias, and fulfillment of user needs. The next section outlines some functional requirements of classificatory structures built from an experientialist design commitment. From there, a case study is provided to illustrate the user-beneficial force of experientialist designed classificatory structures.

Currently classificatory structures do not allow for experientialist design. As outlined above, methods of classificatory structure construction, like ecological investigation, domain analysis, or bias investigation, posit solutions to critiques of classification schemes. However, development in classificatory structures has not followed the methods. The critiques levied against classificatory structures by classification theorists could be addressed with an experientialist approach. Experientialist ideas of malleability, proximity, schemas, and linking should figure into classificatory structures. They should be brought into classificatory structure design to address, structurally, the critiques of classification theorists. Ho-

wever, too much malleability, proximity, schemas, and linking in a classificatory structure make a controlled vocabulary uncontrolled. How can classificatory structures accommodate experiential design while shaking off concerns of hospitality, bias, warrant, and fulfillment of user needs raised by classification theorists? It can do so through experientialist semantics.

6. Experientialist semantics

Experientialist semantics is the structure built from experientialist design approach to classificatory structures. Experientialist semantics are structures that are malleable, proximal, and allow for the manipulation of schemas, and linking between schemas. Such classificatory structures suit individuals, infrastructures, and larger social contexts. Experientialist semantics acknowledges and actively constructs classificatory structures that are dimensional – individual, infrastructural, and social. The empirics come from the research literature in classification theory on bias, ecological initiatives ,etc. Here I rely on the value of that research to make my claims about the value of experientialist semantics to address the concerns of classification theory as outlined in section 5. above.

6.1 Design for experientialist semantics

The design for a system of experientialist semantics – is a design that accommodates individual and social classification structures and formal and associative classification structures. It does so by providing mechanisms that are malleable, that can shape the proximity and schemes of concepts and concepts structures, and allows structures to be linked in various ways. Experientialist design of classificatory structures happens in context. Examples of experientialist semantics provided here for illustration are not the only examples possible. What is essential to an experientialist semantics is that it incorporate experientialist design criteria mentioned above: that an experientialist semantics have malleability, proximity, schemas, and linking.

6.2 Example of experientialist semantics: a schematic view

Figure 1 is a schematic view of experiential semantics in a peer-to-peer environment. In this schematic, five functional areas are outlined. First is the peer-to-peer environment. In this environment peers store files or information objects. Each of these files is organized

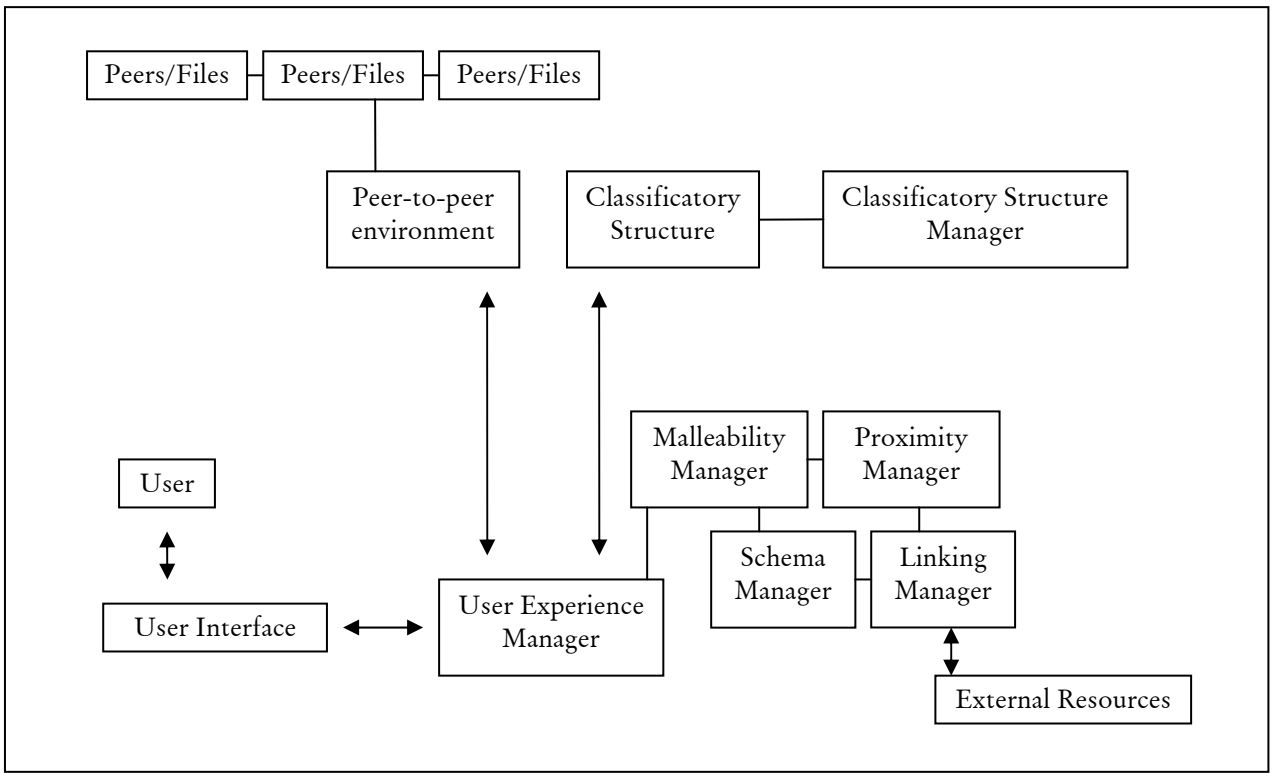

Figure 1. *Schematic view of experiential semantics*

for that peer's use. The files and the organization scheme are available on the network. The user, functional area 2, comes to the peer-to-peer network to share and retrieve files. The user might also come to this peer-to-peer network to communicate, ask questions, or use services. The semantic web would like to build information systems not for information retrieval as much as for service provision via information in distributed systems. The popular example is booking a flight (Frauenfelder, 2001). This peer-to-peer environment is linked to functional area 3, a User Experience Manager. The User Experience Manager is an umbrella application that manages and records the work done in the four subsidiary applications – each design from the four experientialist design criteria. The four subsidiary applications are a Malleability Manager, Proximity Manager, Schema Manager, and Linking Manager. Each of these works in conjunction with the Classificatory Structure. This Classificatory Structure may be set by the user, or any of the peers in the network. It is included in the model when the User Manager incorporates it to organize materials. The Classificatory Structure and the accompanying Classificatory Structure Manager together form functional area 4. This area can be local or authoritative. If it is authoritative then the Classificatory Structure Manager is supervised by an outside authority. *Library of Congress Classification* is an example. If the Classificatory Structure Manager is local it is maintained by the user. The final functional area outlined in figure 1 above is the External Resources area. This area expands warrant through linking. Linking and schema manipulation alters the Classificatory Structure and the other functional areas in this schematic.

6.3 Example of experientialist semantics: records and architectures

Kazaa Media Desktop is a peer-to-peer file sharing system. It offers users a number of fields for searching. The record structure contains these fields:

Artist
Title
Media Type
Album
Publisher
User
Keywords/Description

These fields constitute and improvement over other peer-to-peer sharing technologies. However, the Keywords/Description field does not allow the user to experience classification. To search on the Keywords/Description only allows a string-matching search. In contrast, a Keywords/Description field designed using experientialist approach would allow the user to manipulate classificatory structures for retrieving and sharing purposes. An experientialist approach to designing the Keywords/Description field would not be string matching, but rather metadata manipulation. Figure 2 below illustrates how a metadata structure for a Keywords/Description field compares with a string-only structure for Keywords/Description field. The major different between the two records is how well structured the relationships are in the networked environment. In the example in Figure 2 below, the experientialist designed record structure points to the classificatory structure the string 'penguins' comes from. It also provides a coordinate of that concept in the scheme. This allows the user to manipulate the classificatory structure locally, while not affecting the connection with DDC. The experientialist design approach also requires metadata fields for malleability, proximity, schemas, and linking. The word "agent" appears in Figure 2 below. This word is meant to contain programs that can be manipulated by the user and on the user's behalf in the networked environment. They are instrumental in the peer-to-peer network because of its dynamic nature. It is supposed that an agent would keep up with updates and revisions of DDC in this example, and with other user's manipulations of classificatory structures.

7. Future work

Here I have outlined the beginning theoretical work in experientialist semantics. Future work will involve more detailed explorations into peer-to-peer semantic architectures, refining and elucidating example metadata structures, identifying levels of analysis in meaning and structuration, and comparative studies of experientialist semantics and other classification frameworks (for example other ecological initiatives). This area of research also engenders other types of research such as case study research, and empirical evaluations of systems built according to experientialist design commitments.

Keyword/ Description xml record	<?xml version="1.0"> <keywords-description>[string] </keywords-description> </xml>
Keyword/ Description xml record with 'Penguins' as string	<?xml version="1.0"> <keywords-description>Penguins </keywords-description> </xml>
Experientialist Designed Keyword/ Description xml record	<?xml version="1.0"> <keywords-description> <classificatoryStructureName>[agent] </classificatoryStructureName> <classificatoryStructureNamespace>[url] </classificatoryStructureNamespace> <classificatoryPositionCoordinates>[agent] </classificatoryPositionCoordinates> <userString>[string] </userString> <ExperientialistSemanticsCoordinates>[agents and other tags] </ExperientialistSemanticsCoordinates> </keywords-description> </xml>
Experientialist Designed Keyword/ Description xml record with 'Penguins' as string and metadata value	<?xml version="1.0"> <keywords-description> <classificatoryStructureName>[DDC-agent] </classificatoryStructureName> <classificatoryStructureNamespace>http://www.oclc.org/dewey/ </classificatoryStructureNamespace> <classificatoryPositionCoordinates>[Coord-agent] </classificatoryPositionCoordinates> <userString>Penguins </userString> <ExperientialistSemanticsCoordinates> [Malleability agents, Proximity agents, Schema agents, Linking agents, tags for each] </ExperientialistSemanticsCoordinates> </keywords-description> </xml>

Figure 2. *A comparison of Keywords/Description fields – one experientialist semantics, the other string-match field structure*

8. Classification built for its purpose

The experientialist approach to the design of classificatory structures is an approach true to the purpose of classification itself. If the purpose of classification is to represent concepts in relationships among one another that can help a user find information, then being able to manipulate these structures is an integral part of classificatory structure design. This is very important in a dynamic environment like a peer-to-peer network. In this environment users interact with files shared. If they are to find and work with files shared in this peer-to-peer network, users must see the relationships between concepts used to organize these files, or else these imposed relationships are useless. Relationships between concepts in a classificatory structure can be expressed in many ways, and more importantly, they can be experienced in many different ways through the embodied mind, through an infrastructural boundary object, or because of social reification. However these relationships are represented, they are not represented once and for all. Classification happens in time and for a purpose. Times change and purpose changes, and so too must classificatory structures. If a classificatory structure works it will not need to be changed. However, what works as mentioned above is directly related to design, and the purpose classificatory structures are put to. These purposes change and a consequence classificatory structure design must change. This is part of the experience of classification. Experientialist approach to classificatory structure design is one answer to the problem of change. It is an answer that builds on successful methods of knowledge organization, while questioning assumptions about structures and methodologies for peer-to-peer networked based classificatory structures. In the networked environment the experience of classification should be a user-focused experience. In the networked environment built on experientialist semantics, the experience of classification is a user-focused experience.

References

Albrechtsen, H. and Pejtersen, A. M. 2003. Cognitive work analysis and work centered design of classification schemes. In *Knowledge organization* 30:213-27.

Bates, M. J. 1998. Indexing and access for digital libraries and the internet: human, database, and domain factors. *Journal of the American Society for Information Science* 49:1185-1205.

Beghtol, C. 2002. Universal concepts, cultural warrant, and cultural hospitality. In López-Huertas, M. J. ed. *Challenges in knowledge representation and organization for the 21st century: integration of knowledge across boundaries: Proceedings of the Seventh International ISKO Conference, Granada, Spain, July 10-13, 2002*. Advances in knowledge organization, vol. 8. Würzburg: Ergon, pp. 45-49.

Berger, P. and Luckmann, T. 1967. *Social construction of reality: a treatise in the sociology of knowledge.* Garden City, NY: Doubleday

Bowker, G. and Star, S. L. 1999. *Sorting things out: classification and its consequences.* Cambridge, MA: MIT Press.

Flickr. 2005. Available: http://www.flickr.com/

Frauenfelder, M. 2001. A smarter web. *Technology Review* November. Available: http://www.cognit.com/home_multi/html/Technology_Review_Frauenfelderall.pdf

Gruber T. R. 1993. Toward principles for the design of ontologies used for knowledge sharing. In Guarino, N. and Poli, R. eds., *Formal ontology in conceptual analysis and knowledge representation*. Dordrecht: Kluwer. Available: http://citeseer.ist.psu. du/gruber93toward.html

Hjørland, B. 2002. Domain analysis in information science. Eleven approaches – traditional as well as innovative. *Journal of documentation*. 58:422-62.

Jacob, E. K. 2001. The everyday world of work: Two approaches to the investigation of classification in context. *Journal of documentation* 57:76-99.

Jacob, E. K. and Albrechtsen, H. 1999. "When essence becomes function: post-structuralist implications for an ecological theory of organisational classification systems." In Wilson, T.D. and Allen, D.K. eds., *Exploring the contexts of information behaviour, Proceedings of the Second International Conference on Research in Information Needs, Seeking and Use in Different Contexts, 13-15 August 1998, Sheffield, UK.* pp. 519-34.

Johnson, M. 1987. *The body in the mind: the bodily basis of meaning, imagination, and reason.* Chicago: Chicago University Press.

Lakoff, G. 1987. *Women, fire, and dangerous things: what categories reveal about the mind.* Chicago: University of Chicago Press.

Lakoff, G. and Johnson, M. 1980. *Metaphors we live by.* Chicago: University of Chicago Press.

Latour, B. 1999. *Pandora's hope*. Cambridge, MA: Harvard University Press.

Maedche, A, Mortik, B., Silva,N., and Volz, R. 2002. MAFRA: a MApping FRAmework for distributed ontologies. Available: http://sra.itc.it/people/agostini/RA/WSeminars/material/Dellerba11Dec02/ Mafra.pdf

Nonaka, I. and Konno, N. 1998. The concept of 'Ba': Building a foundation for knowledge creation. *California management review* 40n3:40-54.

Noy, N. F., and Musen, M. A. 2002. Anchor-PROMPT: using non-local context for semantic matching. Available: http://www-smi.stanford.edu/pubs/SMI_Reports/SMI-2001-0889.pdf

Olson, Hope A. 2002. *The Power to name: locating the limits of subject representation in libraries.* Dordrecht: Kluwer.

Pejtersen, A.M., Albrechtsen, H., Cleal, B., Hansen, C.B., and Hertzum, M. A. 2001. *Web-based multimedia collaboratory. Empirical work studies in film archives*. Risø-R-1284(EN) (CHMI-02-01).

Priss, U. 2002. Associative and formal concepts. In Priss, U., Corbett and Angelova eds., *Conceptual structures: integration and interfaces, Proceedings of the 10th International Conference on Conceptual Structures*. Dordrecht: Springer Verlag, pp. 354-68. Available: http://www.upriss.org.uk/papers/iccs02.pdf

Priss, U. 2001. Multilevel approaches to concepts and formal ontologies. In: *Proceedings of the 12th ASIST SIG/CR Classification Research Workshop*, pp. 53-66. Available: http://www.upriss.org.uk/papers/sigcr01.pdf

Ranganathan, S. R. 1967. *Prolegomena to library classification*, 3rd ed. Bombay: Asia Publishing House.

Semantic Grid. 2005. www.semanticgrid.org

Snowden, D. 2001. *Complex acts of knowing – paradox and descriptive self-awareness.* Paper available: http://www-1.ibm.com/services/files/complex.pdf

Star, S. L. and Griesemer, J. R. 1989. Institutional ecology, 'translations' and boundary objects: Amateurs and professionals in Berkeley's Museum of Vertebrate Zoology, 1907-39. *Social studies of science* 19:387-420.

Tennis, J. T. 2002. Subject ontogeny: subject access through time and the dimensionality of classification. In Lopez-Huertas, Maria J., ed. *Challenges in knowledge representation and organization for the 21st century: integration of knowledge across boundaries: Proceedings of the Seventh International ISKO Conference, Granada, Spain, July 10-13, 2002*. Advances in knowledge organization, vol. 8. Würzburg: Ergon.

Verity. 2002. Verity.K2 Enterprise Technical Overview. Available: http://www.quiver.com/products/k2_enterprise/pdf/MK0385a_K2E_TechOverview.pdf