The Durability of Culture and the Stories We Tell
Narrative in Long-term Knowledge Management

William A. Stubblefield
Collaborative Systems Department
Sandia National Laboratories
Albuquerque, New Mexico, USA
wastubb@sandia.gov

Abstract

Culture, considered both cognitively and socially, is among the most durable of human creations. This applies to individual communities of practice, as much as to larger ethnic or national groups. Consequently, designers of long-term knowledge management [KM] systems should pay close attention to the role of culture in creating, sustaining, and interpreting knowledge. This position paper looks at the interplay of two activities that are essential to understanding culture for purposes of design: ethnographic field work and the interpretation of stories people tell us about their work, goals, and community. It argues that, when interpreted in the context of a broader field effort, the stories people tell us are valuable clues to the community's cultural invariants.

Introduction: Culture and knowledge management

Knowledge is irreducibly a quality of human beings, implicit in their actions, utterances, and relationships. In practice, and possibly in principle, it cannot be formalized in any operational sense: the syntactic structures stored in a knowledge management system must be interpreted and acted upon by people. Indeed, we could express the frequently mentioned distinction between knowledge and information in exactly these terms. If a symbolic structure can support meaningful algorithmic manipulation, then it is information. If it must be interpreted by a human being before being meaningfully applied, than its role is in supporting knowledge.

The roots of this view lie in embodied and situated models of cognition. Embodied theories (Damasio 1994; Deacon 1997; Lakoff 1987; Lakoff and Johnson 1999;

LeDoux 1996; Varela and others 1993) hold that intelligence is not a product of formal symbol manipulation, but depends fundamentally upon such features of our biological embodiment as perception, emotion, developmental learning, innate cognitive and learning biases, and states of consciousness. Situated theories (Brown and Duguid 2000; Lave and Wenger 1991; Stubblefield 2000; Suchman 1987; Wenger 1999) extend this to the social context, arguing that much of what we would call knowledge exists in our interaction with the physical and social worlds. Such extensions as tools or the representation of information are an inherent part of cognition (Hutchins 1995b; Nardi 1996).

These ideas influence the design of KM systems in two ways:

1. They clearly define the abilities and limitations of KM systems. Rather than "capturing" or "preserving" an organization's knowledge, they are a source of information and tools to assist the people who must accomplish these goals.

2. Insuring that the information stored in a KM system will continue to be useful over the long-term requires understanding these invariants underlying the social context of system use, and designing the system to support and draw support from these social structures.

Field work for KM System Design

This analysis underscores the importance of ethnographic fieldwork to knowledge management system design (Coyne 1995; Hutchins 1995a; Kuniavsky 2003; Laurel 2003; Preece and others 2002; Winograd 1996). Ethnographic fieldwork contrasts with many common approaches to user-oriented design, such as focus groups, interviews, and participatory design (Schuler and Namioka 1993). The main distinction between ethnographic methods and traditional ways of gathering information about user needs is that, whereas the latter relies upon people's accounts of their work, community, and information needs, ethnography favors observations of people at work, of the artifacts they employ, and the structure of their community. The goal of an ethnographic effort is, through the interpretation of empirical observations, to construct a model of people's work and community that will support design. A desirable feature of these models is

their articulation of abstract, invariant structures in the user community. By this, I mean models of relationships, activities, technology use, incentives, values and other social structures that describe many instances of behavior, and change only slowly.

For example, I have built a number of knowledge and information management systems for my employer, Sandia National Laboratories, that exploit such invariants. For example:

1. Because of the critical nature of our work in the national security sector, Sandia has evolved a strong culture of personal responsibility. Engineers do not easily delegate responsibility for system design, engineering, validation, or other activities essential to the success of a project. This affects our designs in several ways. We must be careful not to try and reduce the control engineers have over their work activities through excessive process formalization. We must make the sources and validation criteria for all knowledge explicit. In our design processes, we emphasize participatory methods, and often give more control over the design to users than we otherwise might.

2. As an advanced engineering laboratory, Sandia has a unique, often paradoxical approach to the common distinction between experts and novices. Because of the difficulty and criticality of our work, the insights of experts are highly valued. However, the value placed on innovation and developing human abilities lead us to give significant responsibility to young engineers, although under supervision of senior people. This means that, although we must honor the needs of both these groups, we must do so in ways that avoid obvious expert/novice distinctions.

3. Although privately managed, Sandia is a government laboratory. This means we are subject to the political constraints inherent in any government activity. The organization of our projects, and their schedules, budget and strategies must address these political factors.

In constructing this abstract, structural understanding of the user community, we draw on both ethnographic methods and more traditional design approaches. One source of knowledge that has been very important to us, and that seems to touch on both approaches has been in the stories users tell us about their work and community.

Although ethnographic methods favor observation over user accounts as a source of data, they do not ignore the things people tell us. Rather, they treat these accounts as data to be interpreted in the context of a broader ethnographic effort, rather than direct system requirements. This is the basis of our own approach to understanding user stories.

The Deeper Structure of User Stories

As designers, we typically encounter two types of stories from users of a proposed system: narrative accounts of how the user hopes the system will function; and more general stories about important situations events in their community. Both types of stories present significant information in a narrative form, and both are told from a particular individual's point of view. Also, both are suggestive of these deeper structures in the user community.

Narrative serves a number of roles in any community, defining ethical values, social norms, ways of working, and essential knowledge (Bruner 1990; Bruner 1991). The stories shared in a community are constantly interpreted and re-interpreted in the telling. In a sense, stories are less important for their immediate content, than for the more durable ways of thinking, communicating, and collaborating implicit in their structure. Two features of socially shared narratives that are particularly useful are their open endedness, and the tendency of particular stories to be instances of more general narrative forms.

The open ended nature of narrative underscores its importance for design. For example, Scenarios (Carroll 2000) are a narrative-based approach to software interaction design. In contrast to use-cases and other highly formal ways of characterizing the narrative structure of interactions, Scenarios are informal accounts of a person's use of a proposed system. It is this informality that makes them so flexible and powerful for exploratory design. They are open-ended in their presentation of use scenarios, and consequently, encourage the elaboration and re-interpretation central to design.

We may think of a particular story as an instance of a more abstract narrative form. For instance, countless stories, from the ancient Greeks to The Matrix, are instances of a general hero story form. Everything from the broader structure of the stories to particular

scenes are drawn from this general form. In her study of the scientific debates that went on in the early development of evolutionary theory, Landau (Landau 1991) argues that all the various models of evolution adhered broadly to a hero story form with our ancestors as heroes of the story, but differed in such particulars as the evolutionary "gift" that started them on their "journey." This narrative organization of evolutionary theories persists in modern discussions.

Examples of the role of stories in design can be found in an information management system my colleagues and I designed for a technology development group at Sandia Labs (Stubblefield and others 2003). Our customers were a research and development group that had brought a wide variety of scientific disciplines together to develop a micro-mechanical fabrication technology known as LIGA. Our system, called the LIGA Traveler, was an information management tool to support work in their laboratory.

A common story our users told us during our field work emphasized their own difficulties in perfecting the technology. Although the particulars of these stories differed greatly, the form was always the same: the teller had to struggle both to obtain needed information from other researchers in the lab, and to effectively communicate their own results. In a sense, each person was the hero in their own scientific journey.

This general structure led to three essential features of our design:

1) Since each person approached work from the point of view of their own technical specialty, we had to accommodate the different technical languages of the laboratory's various specialties (manufacturing, materials science, physics, electroplating, etc.);

2) We had to modularize information so each specialty had clear ownership of its data; and

3) In order to support sharing and communication, we had to allow access to all data in the lab through a common interface.

Although not an example of long-term KM, the resulting system has endured through significant changes in the user community. In particular, it has remained useful and

usable and the user community has progressed from more classic R&D into more focused prototype development. It has also remained useful as the lab emerged from its early "growing pains" and coalesced into a unified, focused community of practice.

Conclusion

The story of the LIGA Traveler underscores the two themes that constitute my position: 1) Long-term knowledge management systems must build on social invariants in the user community; and 2) the general form of stories people tell about their work are a valuable clue to these invariants.

Finding these abstract structures is a matter of interpreting user stories in light of both broader ethnographic data, and the theoretical ideas we bring to that interpretation. Consequently, much of my current work focuses on developing an understanding of socially shared narratives that can help me to find those underlying invariants.

References

Brown, J. S. and P. Duguid. The Social Life of Information. Boston: Harvard Business School Press, 2000.

Bruner, Jerome. Acts of Meaning. Cambridge, Mass: Harvard University Press, 1990.

Bruner, Jerome. "The narrative construction of reality." Critical Inquiry 18 (1 1991): 1-12.

Carroll, John M. Making Use: Scenario-based design of human-computer interactions. Cambridge, Mass: MIT Press, 2000.

Coyne, Richard. Designing Information Technology in the Postmodern Age. Cambridge, Mass: MIT Press, 1995.

Damasio, Antonio R. Descartes Error: Emotion, Reason, and the Human Brain. New York: Grosset/Putnam, 1994.

Deacon, Terrence. The Symbolic Species. New York: Norton, 1997.

Hutchins, Edwin. Cognition in the Wild. Cambridge, Mass.: MIT Press, 1995a.

Hutchins, Edwin. Cognition in the Wild. Cambridge, Mass.: MIT Press, 1995b.

Kuniavsky, M. Observing the User Experience: A Practitioner's Guide to User Research. San Francisco: Morgan Kaufmann Publishers, 2003.

Lakoff, George. Women, Fire and Dangerous Things. Chicago: University of Chicago Press, 1987.

Lakoff, George and Mark Johnson. Philosophy in the Flesh: The Embodied Mind and Its Challenge to Western Thought. New York: Basic Books, 1999.

Landau, Misia. Narratives of Human Evolution. New Haven: Yale University Press, 1991.

Laurel, B. Design Research: Methods and Perspectives. Cambridge, Mass: MIT Press, 2003.

Lave, Jean and Etienne Wenger. Situated Learning: Legitimate Peripheral Participation. Cambridge: Cambridge University Press, 1991.

LeDoux, Joseph. The Emotional Brain. New York: Simon & Schuster, 1996.

Nardi, Bonnie A. Context and Consciousness: Activity Theory and Human-Computer Interaction. Cambridge, Mass.: MIT Press, 1996.

Preece, Jenny, Yvonne Rogers, and Helen Sharp. Interaction Design. Chichester, England: John Wiley & Sons, 2002.

Schuler, Douglas and Aki Namioka. Participatory Design: Principles and Practices. Hillsdale, NJ: Lawrence Erlbaum Associates, 1993.

Stubblefield, William A. "The Social Life of Engineering Authorizations." In Designing Interactive Systems (DIS-2000) in Brooklyn, New York, Year.

Stubblefield, W. A., K. S. Rogers, and D. S. Ingram. "The LIGA Traveler: Social and Technical Invariants in Interactive System Design." In DUX 2003: Designing User Experiences in San Francisco, Year.

Suchman, Lucy A. Plans and Situated Actions: The Problem of Human Machine Communication. Cambridge: Cambridge University Press, 1987.

Varela, Francisco, Eleanor Rosch, and Francisco Varela J. The Embodied Mind: Cognitive Science and Human Experience. Boston: MIT Press, 1993.

Wenger, Etienne. Communities of Practice: Learning, Meaning and Identity. Cambridge: Cambridge University Press, 1999.

Winograd, T., ed. Bringing Design to Software. Boston: Addison-Wesley, 1996.