Chapter 14

Knowledge Capture Systems:
Systems that Preserve and Formalize Knowledge
Chapter Objectives

- To describe what are knowledge capture systems
- To explain how to elicit and store organizational and individual knowledge
- To discuss the value of organizational storytelling for knowledge capture
- To explain the two types of knowledge capture systems
  - To capture knowledge in educational settings
  - To capture tactical knowledge
What are Knowledge Capture Systems?

- Knowledge capture systems support the process of eliciting explicit or tacit knowledge from people, artifacts, or organizational entities.
- They rely on mechanisms and technologies to support externalization and internalization.
Organizational stories:

- “a detailed narrative of past management actions, employee interactions, or other intra- or extra-organizational events that are communicated informally within organizations”

- include a plot, major characters, an outcome, and an implied moral

- play a significant role in organizations characterized by a strong need for collaboration
Using Stories for Capturing Organizational Knowledge

• Guidelines for organizational storytelling:
  - Stimulate the natural telling and writing of stories
  - Rooted in anecdotal material reflective of the community in question
  - Should not represent idealized behavior
  - An organizational program to support storytelling should not depend on external experts for its sustenance
  - Organizational stories are about achieving a purpose, not entertainment
  - Be cautious of over-generalizing and forgetting the particulars
  - Adhere to the highest ethical standards and rules
Using Stories for Capturing Organizational Knowledge

• Important considerations:
  ✷ Effective means of capturing and transferring tacit organizational knowledge
  ✷ Identify people in the organization willing to share how they learned from others
  ✷ Use metaphors to confront difficult organizational issues
• Storytelling provides a natural methodology for nurturing communities because it:
  ✷ builds trust
  ✷ unlocks passion
  ✷ is non-hierarchical
Where can storytelling be effective?

- Igniting action in knowledge-era organizations
- Bridging the knowing-doing gap
- Capturing tacit knowledge
- To embody and transfer knowledge
- To foster innovation
- Enhancing technology
- Individual growth
- Launching/Nurturing communities of practice
  - thematic groups (World Bank)
  - learning communities or learning networks (HP)
  - best practice teams (Chevron)
  - family groups (Xerox)
Techniques for Organizing and Using Stories in the Organization

• Anthropological observation
  - naïve interviewers
  - asked *innocent* and unexpected questions
  - caused the subjects to naturally volunteer their anecdotes
  - *curiosity* resulted in a higher level of knowledge elicitation
Techniques for Organizing and Using Stories in the Organization

• Story-telling circles
  - formed by groups having a certain degree of coherence and identity

• Methods for eliciting anecdotes:
  - Dit spinning (fish tales)
  - Alternative histories
  - Shifting character or context
  - Indirect stories
  - Metaphor
Knowledge Representation through the use of Concept Maps

- Based on Ausubel’s learning psychology theory
- Concepts, enclosed in circles or boxes, are perceived regularities in events or objects designated by a label
- Two concepts connected by a linking word to form a proposition, semantic unit or unit of meaning
- Vertical axis expresses a hierarchical framework for organizing the concepts
- Inclusive concepts are found at the top, progressively more specific, less inclusive concepts arranged below
- Relationships between propositions in different domains are cross-links
Concept Map about Concept Maps

- Concept Maps
  - Organized Knowledge
    - Concepts
      - Perceived Regularities
        - Events (Happenings)
        - Objects (Things)
      - Labeled
      - Hierarchically Structured
        - Symbols
        - Words
        - Creativity
      - Infants
    - Propositions
      - Context Dependent
        - Associated Feelings or Affect
      - Effective Teaching
      - Effective Learning
      - Crosslinks
        - Interrelationships
        - Different Map Segments

represents
A Concept Map Segment from Nuclear Cardiology Domain

- Generalized Abnormalities
  - Heart Wall Motion
    - Normal Wall Motion
  - Differentiation Ability
  - Severe Left Ventricle Dysfunction
- Normal Global Function
- Abnormal Global Function
  - which exhibits
  - 50% with
  - 'BULLSEYES' 'DIFFUSE BLUE'
- Cardiomyopathy
  - small inferior
- Valve Disease
  - Mitral Valve Prolapse
  - 'ASSYMETRIC ZONES'
  - 'BLUE FINGERS'
- First Pass Radionuclide Ventriculogram
  - displays a statistical representation of velocity in terms of counts
- bolus ejection rate images
- Prognostically Significant
  - 'LOW'
  - 'HIGH'
  - Diagnostic Significant
  - may indicate
  - when below
  - which exhibits
  - Normal LV Function
Knowledge Capture Systems: CmapTools

- To capture and formalize knowledge resulting in context rich knowledge representation models to be viewed and shared through the Internet
- Alleviates navigation problem with concept maps
- Serve as the browsing interface to a domain of knowledge
- Icons below the concept nodes provide access to auxiliary information
- Linked media resources and concept maps can be located anywhere on the Internet
- Browser provides a window showing the hierarchical ordering of maps
Segment from Nuclear Cardiology using CmapTools
Explanation Subsystem using CmapTools
• Tactical knowledge
  ▪ human ability that enables domain experts to assess the situation at hand (therefore short-term)
  ▪ myriad of inputs, select a plan that best fits current situation, and executing plan
  ▪ recognize and treat only the salient features of the situation
  ▪ gain a small, but important portion of the available inputs for general knowledge
Knowledge representation through CxBR

- **Context** - set of actions and procedures that properly address the current situation
- As mission evolves, transition to other context may be required to address the new situation
- What is likely to happen in a context is limited by the context itself
Knowledge representation through CxBR

- **Mission Context** - defines the scope of the mission, its goals, the plan, and the constraints imposed
- **Main Context** - contains functions, rules and a list of compatible subsequent Main Contexts
- **Sub-Contexts** - abstractions of functions performed by the Main Context which may be too complex for one function
Knowledge representation through CxBR

Mission Context: Drive to Work

Main Context1: City Driving

Sub-Context1: Traffic Light Actions

Main Context2: Interstate Driving

Sub-Context2: Engage Cruise Control
• *Context-based Intelligent Tactical Knowledge Acquisition (CITKA)*
  - uses its own knowledge base to compose a set of intelligent queries to elicit the tactical knowledge of the expert
  - composes questions and presents them to the expert
  - result is a nearly complete context base can be used to control someone performing the mission of interest in a typical environment
CITKA consists of four modules of independent subsystems:
- Knowledge engineering database back-end (KEDB)
- Knowledge engineering interface (KEI)
- Query rule-base back-end (QRB)
- Subject matter expert interface (SMEI)
Barriers to the use of knowledge capture systems

- Barriers to the deployment of knowledge capture systems from two perspectives:
  - the knowledge engineer who seeks to build such systems
  - the subject matter expert, who would interact with an automated knowledge capture system to preserve his knowledge
Barriers to the use of knowledge capture systems

- Knowledge Engineer requires developing some idea of the nature and structure of the knowledge very early in the process
  - must attempt to become versed in the subject matter, or the nature of knowledge
- An automated system for knowledge capture, without a-priori knowledge of the nature, is essentially not possible
Barriers to the use of knowledge capture systems

- From the point-of-view of the expert:
  - need to take the initiative of learning how to interact with the system
  - some people may be resistant to trying new things
  - can be overcome, with adequate training and the utilization of user-friendly interfaces
Using learning by observation capture knowledge

- Research on how humans and animals learn through observation
- Use of learning through observation to automate the knowledge acquisition task
- Learning by observation shows promise as a technique for automatic capture of expert’s knowledge, and enable computers to automatically “learn”
Conclusions

In this chapter we:

• Described knowledge capture systems
  ♦ design considerations
  ♦ specific types of such systems
• Discussed different methodologies and intelligent technologies used to capture knowledge
  ♦ concept maps as a knowledge-modeling tool
  ♦ context-based reasoning to simulate human behavior
• Explained how stories are used in organizational settings to support knowledge capture
Chapter 14

Knowledge Capture Systems:
Systems that Preserve and Formalize Knowledge