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 process of eliciting explicit or tacit knowledge from people, artifacts, or organizational entities
- Rely on mechanisms and technologies to support externalization and internalization

Using Stories for Capturing Organizational Knowledge

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

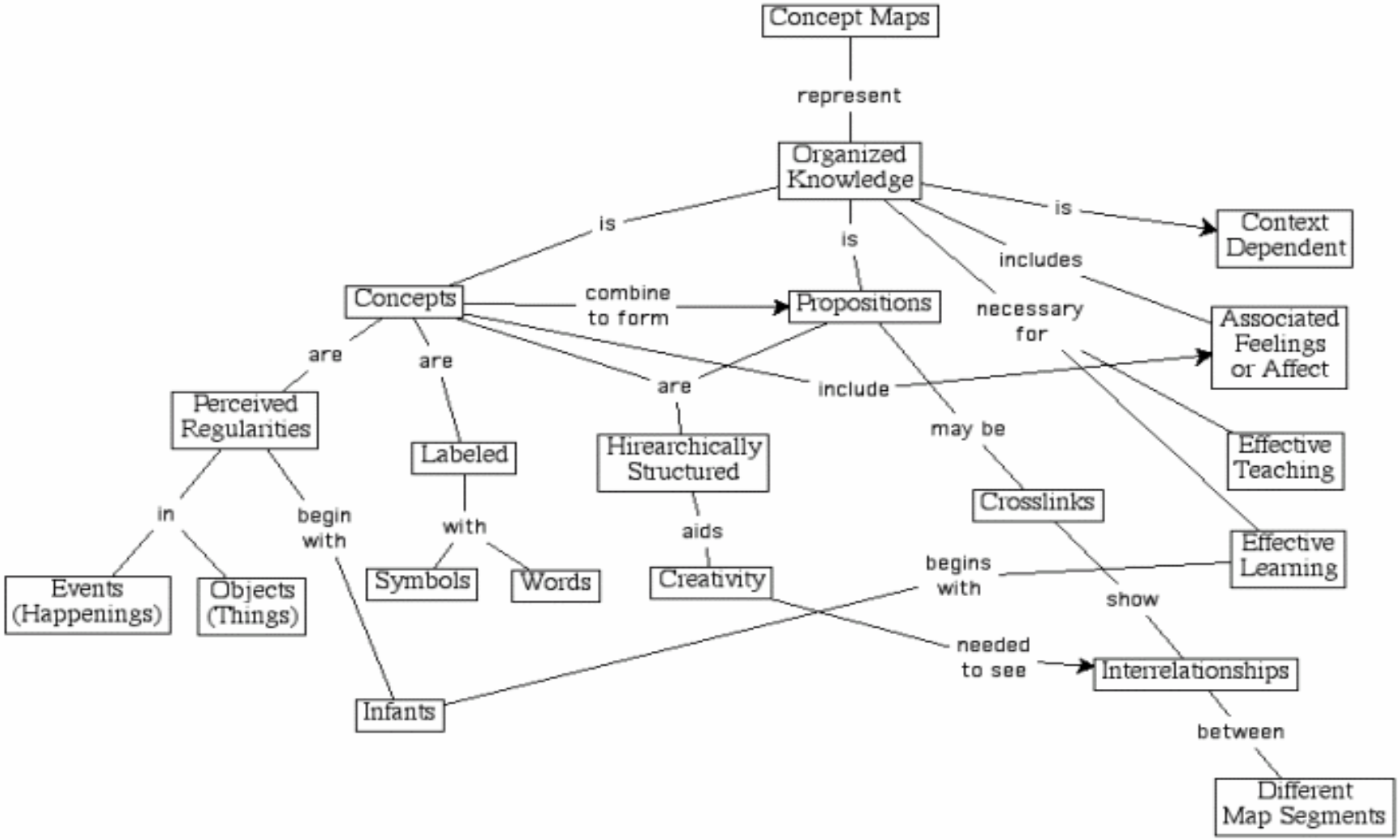
Techniques for Organizing and Using Stories in the Organization

- *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*

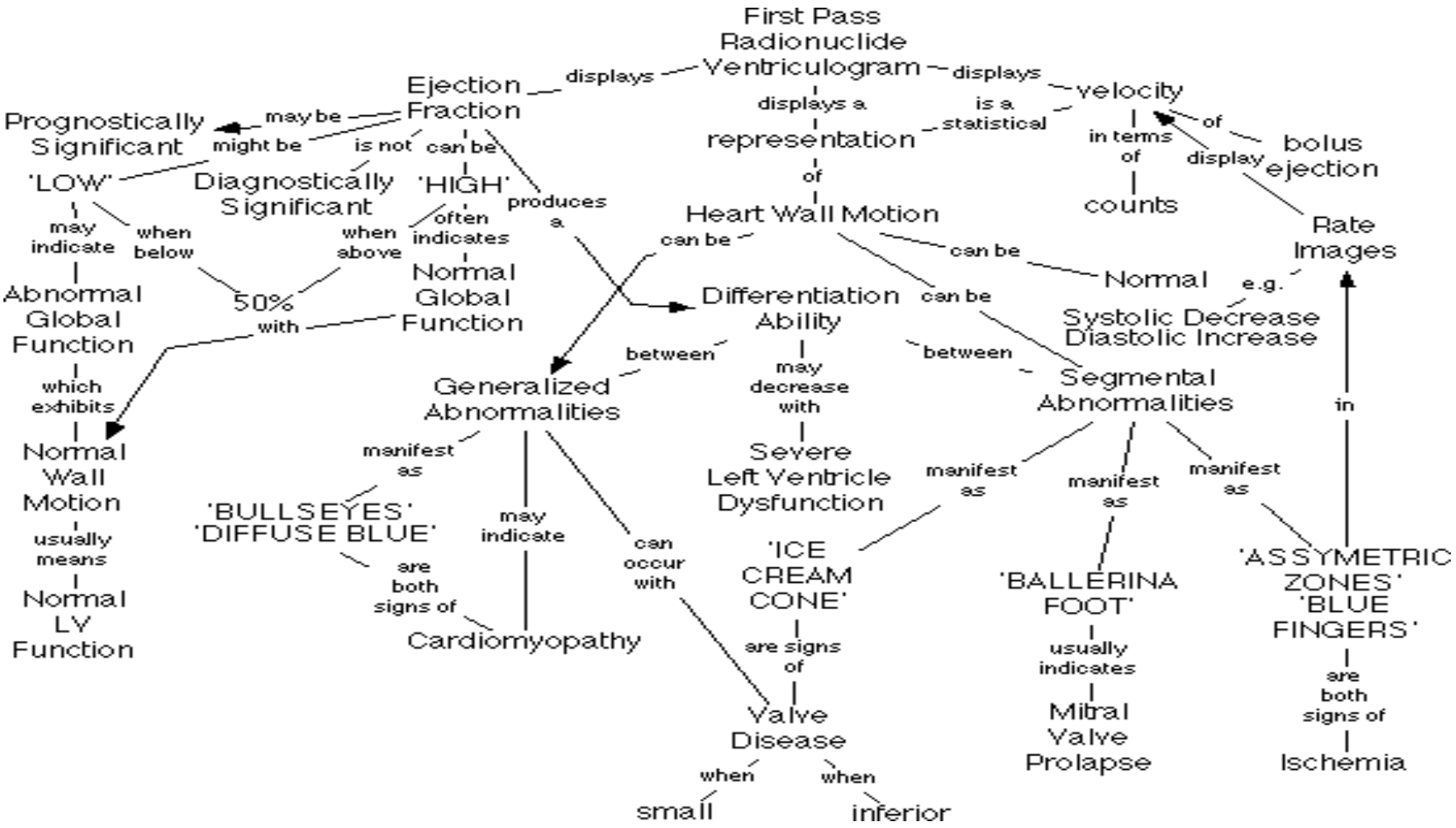
Knowledge Representation through the use of Concept Maps

- 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



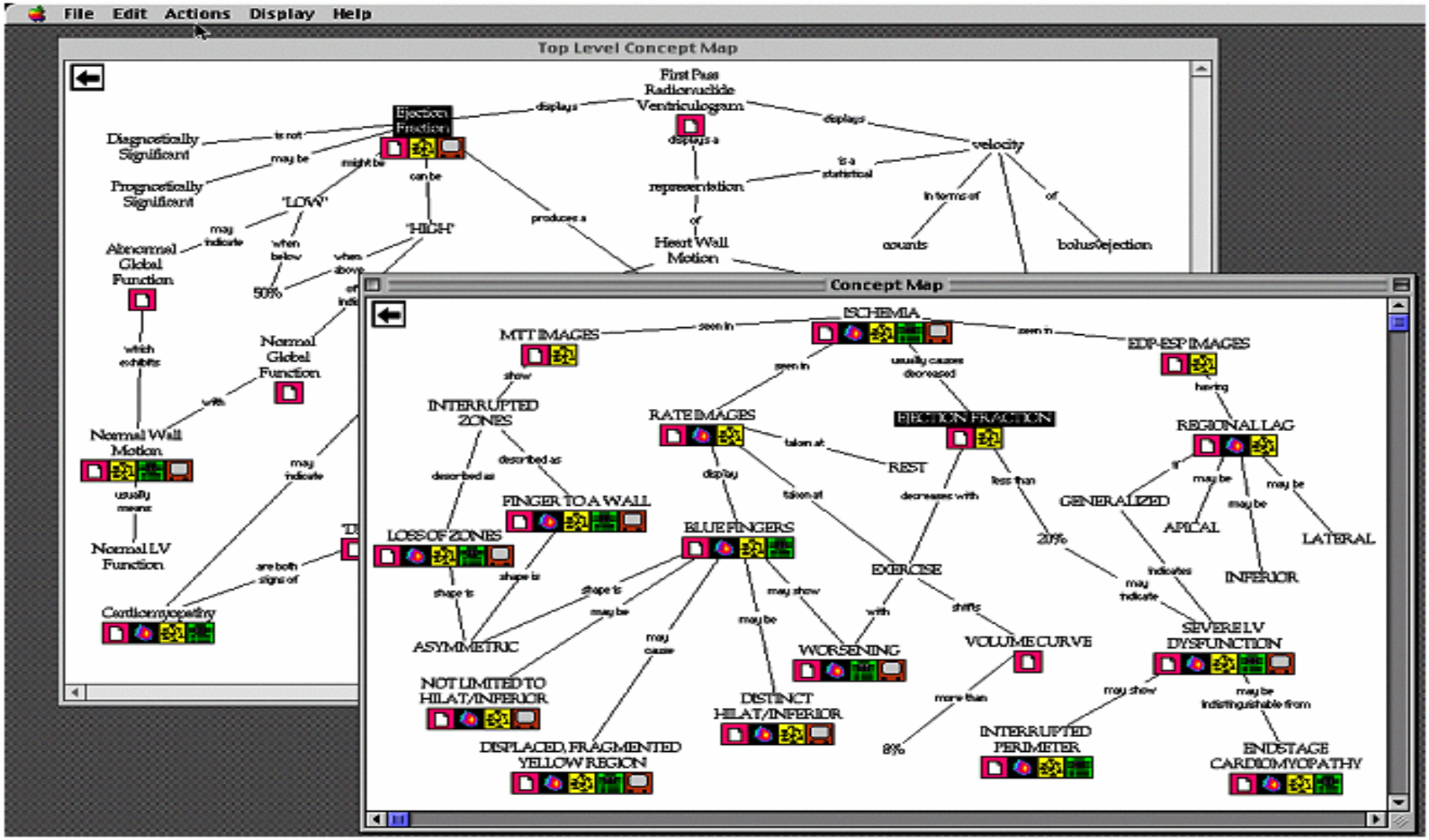
A Concept Map Segment from Nuclear Cardiology Domain



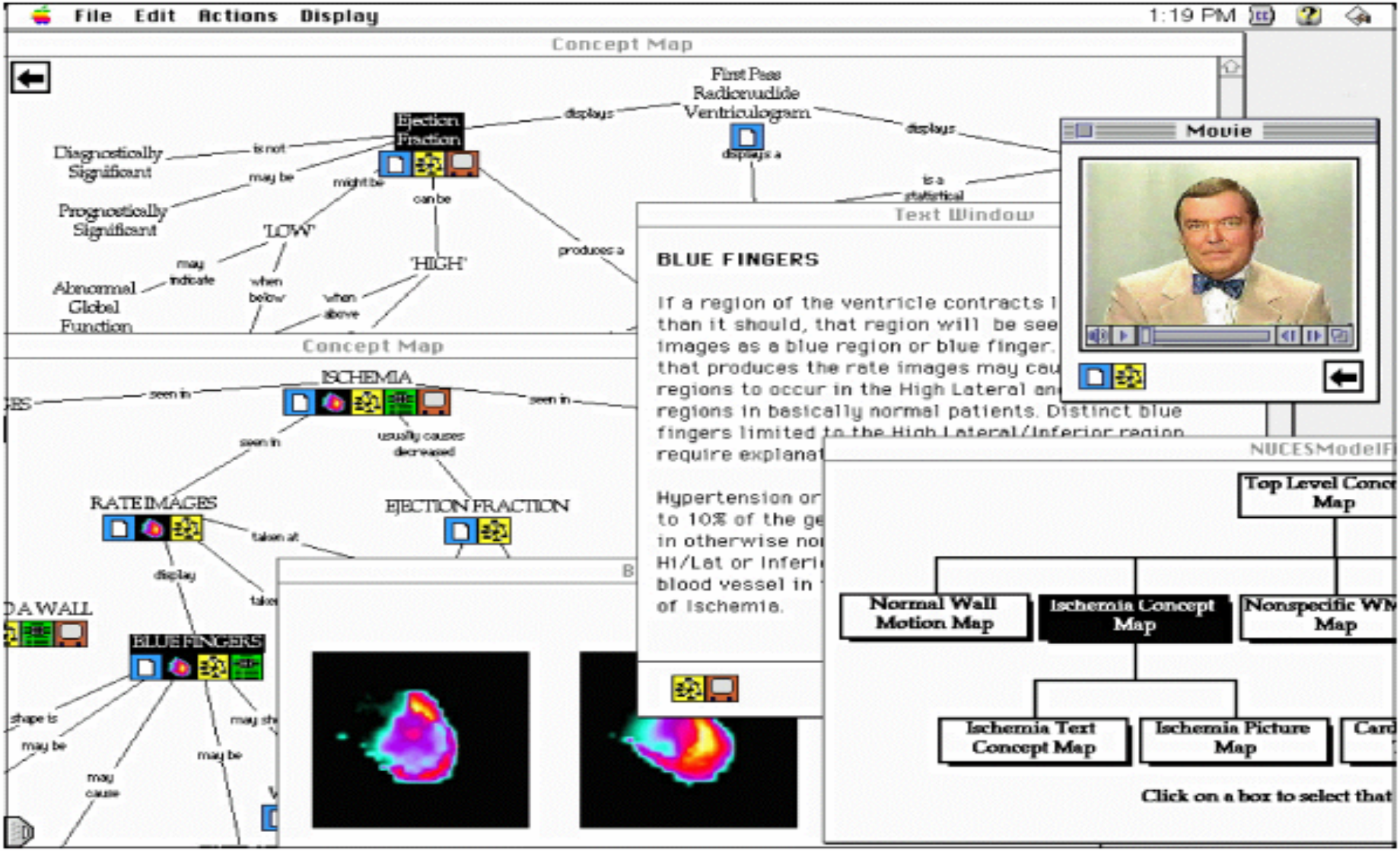
Knowledge Capture Systems: CmapTools

- 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



Knowledge representation through context-based reasoning

- 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

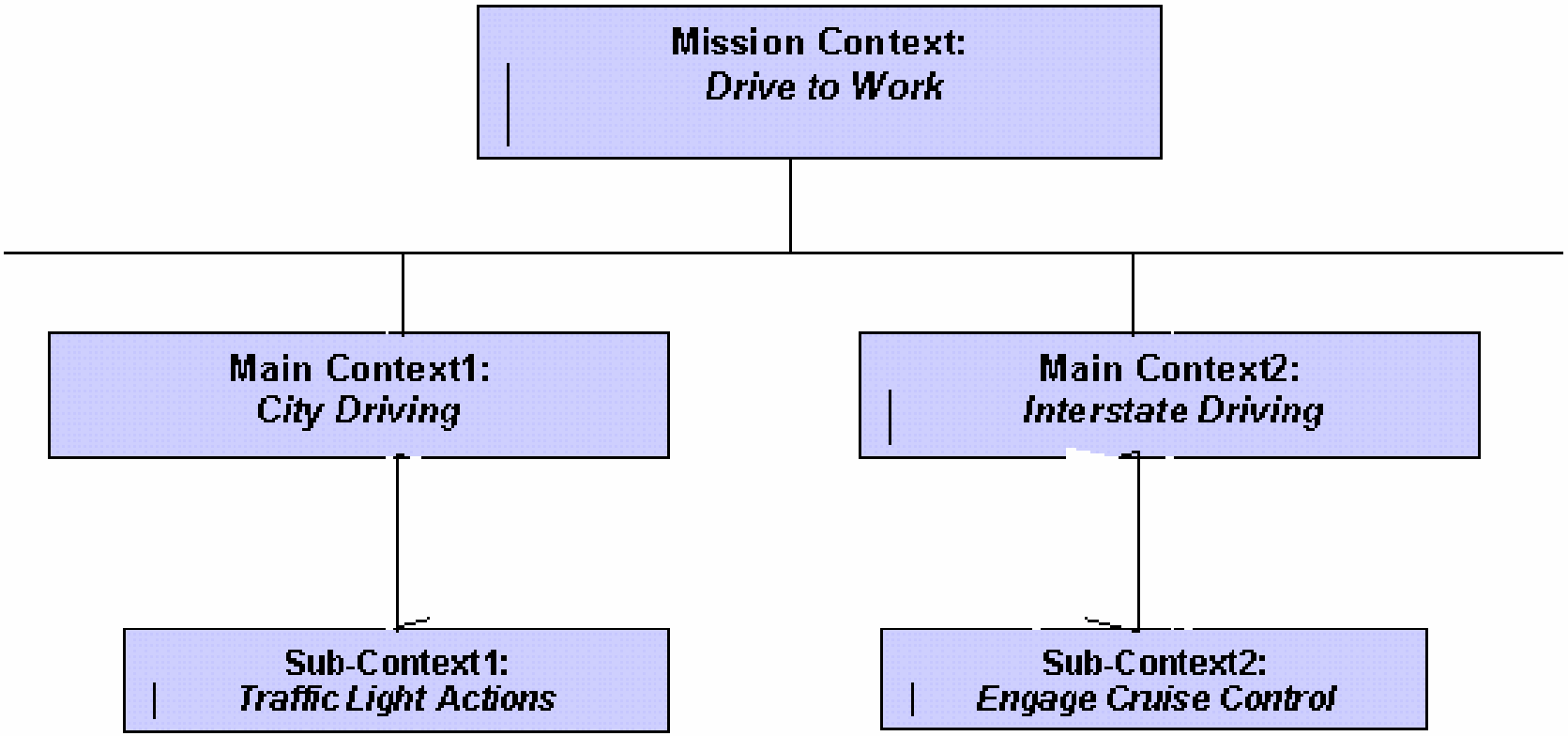
Knowledge representation through CxBR

- *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



Knowledge Capture Systems based on CxBR

- *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

Knowledge Capture Systems based on CxBR

- 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

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