The human and social nature of knowledge

University of the Free State
Bloemfontein, South Africa

Vince Kellen
Vice President, Information Systems
DePaul University

Instructor
College of Computer Science, Telecommunications and Information System

My background

- Plenty of practical experience with 20 years in various areas of managing knowledge
  - First degree was in studio art
  - Journalist (trade magazine editor and newspaper reporter)
  - Financial management of small businesses
  - 9 years working with Exxon on a safety engineering/knowledge management tool
  - 11 years of data warehousing and CRM experience, practice leader for large consulting firms
  - VP of IS at DePaul where we have data warehousing, content management and performance measurement initiatives at various stages of development
- Still a student of knowledge management
  - Continuing education and academic research at DePaul

Three main sources for this discussion

1. "The knowledge management puzzle: Human and social factors in knowledge management," J.C. Thomas, W.A. Kellogg, and T. Erickson; IBM Systems Journal, Vol. 40, No. 4, 2001.
2. "The emergence of knowledge in organizations," Ralph Stacey, Emergence, 2(4), 2000.
3. The writings of Chris Argyris on organizational learning

Agenda

- Dominant view of knowledge management
  - Tacit knowledge; conversion to explicit; storage, retrieval and diffusion of explicit knowledge
  - Focus on the production versus consumption of knowledge
  - How is knowledge produced? (innovation)
  - Knowledge can be managed
- Some reactions to the dominant view
  - Knowledge grows via a series of unplanned, indeterminate interactions between people
  - Knowledge is acted upon in tacit form without full awareness or validity
  - Learning is fraught with difficulties
    - Cognitive biases, organizational and individual defensiveness
  - Knowledge can’t be managed

The technologist's view of knowledge management

- Catalog
  - Identify data, documents, build a taxonomy (by hand or driven from the data)
  - Collect documents and maintain a collection scheme
  - Convert documents, add metadata
- Store and search
  - Data warehousing, data movement (ETL, MOM)
  - Knowledge bases (Verity, Autonomy, etc.) with advanced searching algorithms
  - Index services for simpler searching
  - Search engine aggregation (Copernic.com)
- Disseminate
  - Create an intranet site or a portal and personalize it
  - Sit back and wait

The manager's view of tacit knowledge

- Knowledge and skill, inside people's heads, can generate results
  - Knowledge
    - Geniuses convert their knowledge to written form, often using the language of math for reliable diffusion of knowledge
  - Skill
    - Geniuses often do not know how they do what they do, nor can they reliably teach others how they themselves excel
- To gather knowledge
  - Interview, work alongside of, or observe the domain experts
  - Use data mining to glean knowledge from data
  - Meta-studies
- To improve skill
  - Apprenticeship programs, training, planned work experiences

Knowledge and behavior

- Can you see someone acquire knowledge when it occurs?
  - Knowledge must lead to observable behavior change that can be linked to business success.
  - Learning occurs when people produce what they say they know (C. Argyis)
- Two forms of behavior change: intrinsic and coerced
  - Coerced behavior change
    - "We will pay you more if you do X"
    - "We will accept you in the group if you behave in following X ways"
  - Intrinsic behavior change
    - "I want to earn more money, so I will do X"
    - "In the name of my religious beliefs, I will do X"
    - "I want to rule the earth and coerce others, so I will do X"
  - Questions
    - Is it easier to acquire knowledge or get knowledge acted upon with coercion?
    - Is intrinsically motivated behavior better? Is it harder to get the behavior started or stopped?

In the conventional view of knowledge management, the emphasis is on planning, documenting, repeating, controlling, predicting

Isn't this what management is supposed to do?

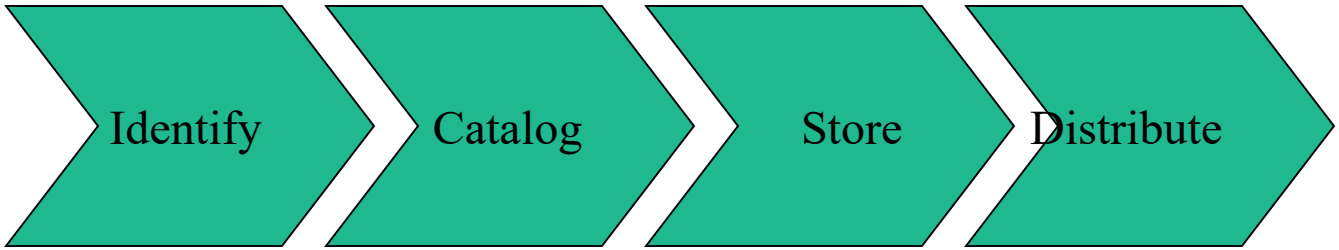
Definition of management

- Management is responsible for generating the results the organization requires (P. Drucker)
  - Today, generating results requires new knowledge
- How does management do this?
  - The direct approach
    - By planning, predicting, controlling, repeating
  - The indirect approach
    - By fostering, enabling, signaling, shaping culture
  - No approach
    - Stacey calls knowledge intractable
- The central question:
  - Is knowledge best managed with a direct or indirect approach?

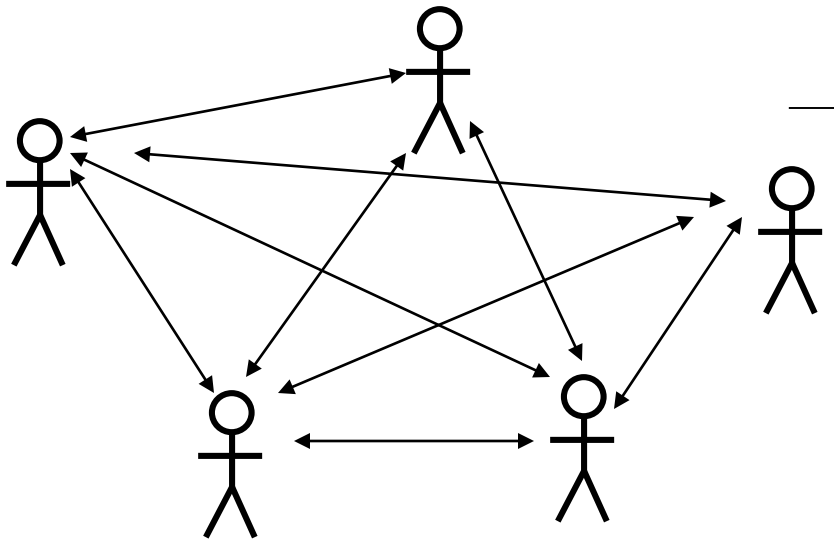
Some thoughts (from the two papers)

- Knowledge is intertwined with human cognition and social context
- Knowledge is created through a complex, emergent system of richly interconnected processes
- The production line metaphor of knowledge being created, then captured, then disseminated, and then internalized can be quite misleading as an overall scheme for knowledge management
- Systems, databases, recorded and written artifacts are usually thought of as stores of knowledge. They are simply records that can only become knowledge when people use them as tools in their processes of gesturing and responding to each other. What is captured in these artifacts is inevitably something about the meanings of social acts already performed. Since a social act is ephemeral and since knowledge is social acts, it can never be stored or captured.
- Knowledge is the act of conversing and new knowledge is created when ways of talking, and therefore patterns of relationship, change. Knowledge, in this sense, cannot be stored, and attempts to store it in artifacts of some kind will capture only its more trivial aspects.
- Organizational change, learning, and knowledge creation are the same as change in communicative interaction, whether people are conscious of it or not.

Knowledge chain or knowledge network?



Or



What is the precise sequence of interactions that produces the knowledge needed by the organization? What comprises the interactions? Can you repeat the sequence each time? What rules govern the sequence?

Stacey's criticisms

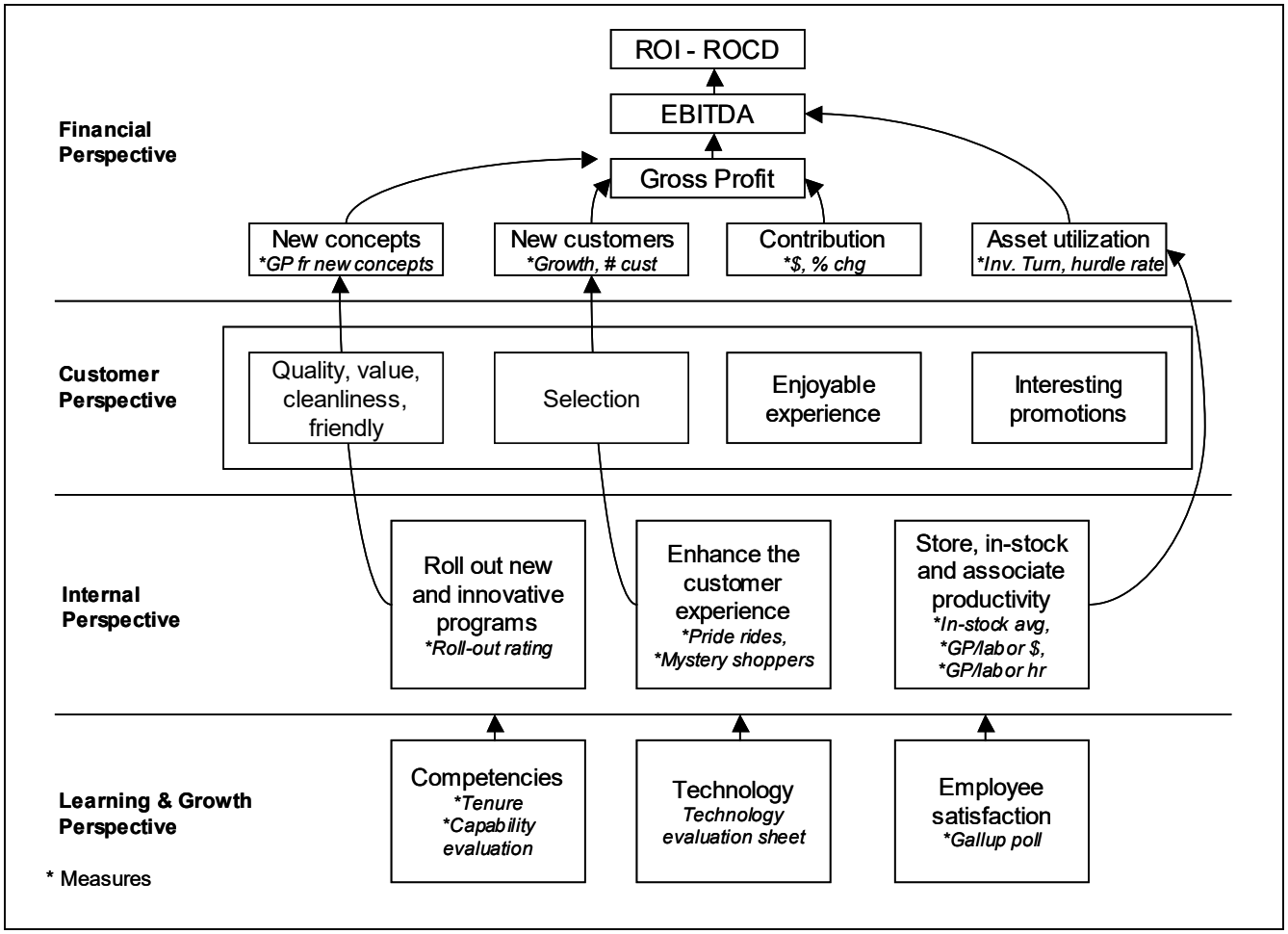
- Systems thinking does not sufficiently explaining how knowledge emerges as tacit knowledge (which is the basis for skill). All major writers assume that something can be reliably done to create knowledge; that there is a "designer" to the system, that a method can be followed
- Knowledge does emerge, unpredictably, from a collection of diverse, richly connected agents that engage in interactions, without the aid of a "designer" or a "blueprint"
- Gesture, social structure and culture, play the significant role
- The individual, the group, the organization, and the society are at the same ontological level: they are the same "thing." They engage in a circular, unplanned series of interactions that create knowledge
- Knowledge cannot be stored. It is alive in these interactions. It also cannot be engineered or planned. It emerges…

Explain *that* to your boss!

Knowledge management and performance measurement

- Business performance measurement (BPM) is a curious subset of knowledge management
- Some examples include:
  - Balanced scorecards (BSC)
  - Economic Value Add (EVA), Activity-Based Costing
  - TQM, ISO, Baldridge and other Quality Programs rely on process measurement, which can be included in BPM
- Since it is usually closely tied with behavior and learning agendas via compensation and performance reviews, perhaps this is the real knowledge that needs to be managed
- BPM is still relatively new, with some strong support in the market (e.g., BSC), only a little bit of supporting empirical evidence, and plenty of issues

Sample BSC



Kaplan, R. S. & Norton, D. P. (2001). The Strategy-Focused Organization. Harvard Business School Press

Problems with BPM

- Adoption rates, while heavy in the Fortune 1000 (40% use BSC), drop sharply in small and medium-sized businesses
- Data quality is often poor. Endemic to data warehouses and many ERP systems, bad data undermines trust and use in a BPM system
- Not all measures are good ones. Two things are needed: a *proper* strategy and the metrics linked to the strategy
- Metrics need switching out. About 33% of metrics change each year. Reasons: changes in strategy, metrics being "run down" due to optimization or circumventing the system (changing metrics without improving performance, suppressing data when differences persist)
- Key external (customer) metrics may be difficult to acquire or validate
- Coherence issues: metrics must align laterally across functional units and vertically from executive management to front-line employees
- Decisions based on data problems may be faulty (prospect theory) due to limits of human cognition
- Defensive reasoning can deny any explicit knowledge

Some solutions to BPM problems

- Some companies actually violate accepted BPM principals for success.
  - Performance must be defined, accurately measured, and rewards based on performance
  - Some firms relied on ambiguity and intrinsic motivation, forcing higher data quality, increasing dialog, and eliminating the “fear” factor
- Problems that trigger cognitive errors can be recast to avoid error
  - From a probability representation to frequency one (Gigerenzer)
  - Data visualization can circumvent some of the faulty cognitive “wiring”
- Breaking through defensiveness, while difficult can be done
  - Action-theory, Bohm Dialogue, etc.

Knowledge management and metaphor

- The conversion of data into personal knowledge can be aided greatly using metaphor and visualization
- Is all cognition grounded in perceptual and performance (kinesthetic) schemas rather than arbitrary symbolic code?
  - Some neuroscientists would say yes

Metaphor	***Abstract Schema***	***Concrete Schema***
Important is big	Significance in situation	Seen/felt size
Difficulties are burdens	Obstacle to intention	Felt weight
More is up	Quantity or degree	Seen or felt elevation
Categories are containers	Classification	Seen or felt containment
Similarity is closeness	Diagnostic/predictive similarity	Seen or felt proximity
Help is support	Assistance toward intention	Felt firmness underneath
Time is motion	Passage of time	Seen/felt movement
States are locations	Situational equivalence	Seen/felt place
Change is motion	Variation over time	Seen/felt movement
Action is self-propulsion	Autonomous activity	Intentional movement
Purposes are desired objects	Intention	Reinforcing object
Causes are physical forces	Causes and origins	Felt pressure and weight
Relationships are enclosures	Relational dependency	Seen/felt enclosure
Controlling is being above	Causal dependency	Vertical alignment
Seeing is understanding	Knowledge	Objects seen
Understanding is grasping	Knowledge and comprehension	Objects actively felt

Lakoff, Mark & Johnson, George. (1999) Philosophy in the Flesh: The Embodied Mind and its Challenges to Western Thought. Basic Books.

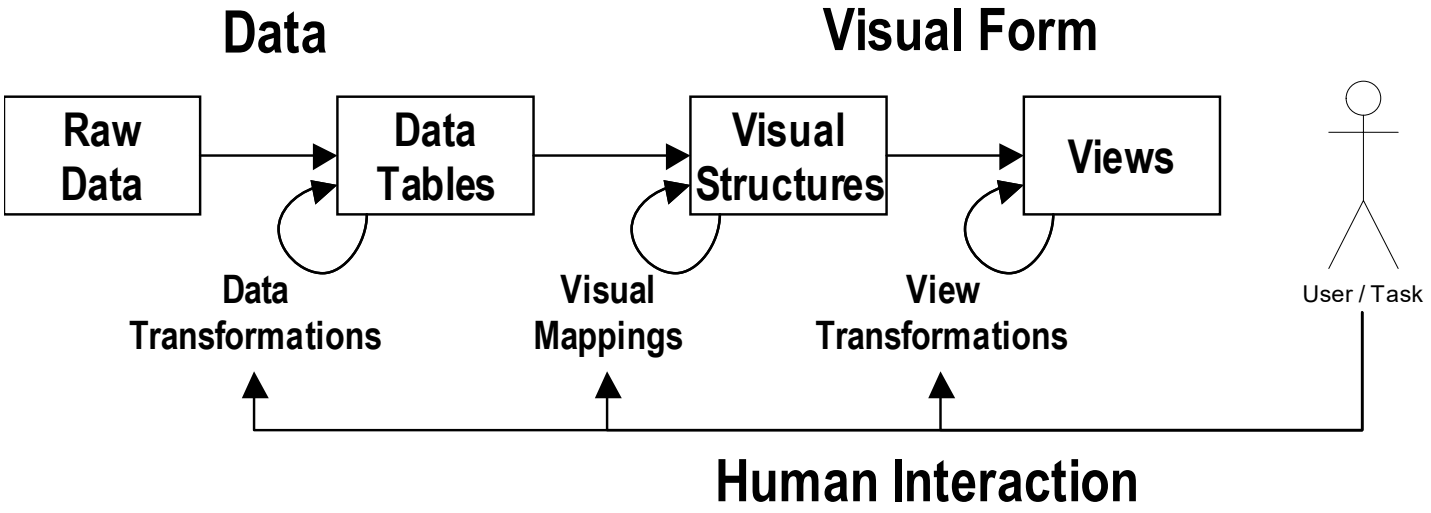
Factors where visualization aids in processing data

Parallel perceptual processing	Some attributes of visualizations can be processed in parallel compared to text.
Offload work from cognitive to perceptual system	Some cognitive inferences done symbolically can be recoded into inferences done with simple perceptual operations.
Expanded working memory	Visualizations can expand the working memory available for solving a problem.
Expanded storage of information	Visualizations can be used to store massive amounts of information in a quickly accessible form (e.g., maps).
Locality of processing	Visualizations group information used together, reducing searching.
High data intensity	Visualizations can often present a large amount of data in a small space.
Spatially indexed addressing	By grouping data about an object, visualizations can avoid symbolic labels.
Recognition instead of recall	Recognizing information generated by a visualization is easier than recalling that information by that user.
Abstraction and aggregation	Visualizations simplify and organize information, supplying higher centers with aggregated forms of information through abstraction and selective omission.
Visual representations make some problem obvious	Visualizations can support a large number of perceptual inferences that are extremely easy for humans.
Perceptual monitoring	Visualizations can allow for the monitoring of a large number of potential events if the display is organized so that these stand out by appearance or motion.
Manipulable medium	Unlike static diagrams, visualizations can allow exploration of a space of parameter values and can amplify user operations.

Card, Stuart K., Mackinlay, Jock D. & Shniederman, Ben. (1999). Readings in Information Visualization: Using Vision to Think. Academic Press.

A process for visualization?

Knowledge management processes should routinely incorporate HCI expertise



Raw data: idiosyncratic formats
Data tables: relations (cases by variables) + metadata
Visual structures: spatial substrates + marks + graphical properties
Views: graphical parameters (position, scaling, clipping, …)

Card, Stuart K., Mackinlay, Jock D. & Shniederman, Ben. (1999). Readings in Information Visualization: Using Vision to Think. Academic Press.

Organizational defensiveness (following Argyris)

- Reasoning is the process people use to move from thought to action. Two forms of reasoning: defensive, productive
- Defensive reasoning
  - Premises for causal reasoning are tacit, not made explicit
  - Inference process that takes people from premise to conclusion are tacit
  - Data used to generate premises, conclusions are not subject to verification
  - The logic used to test conclusions is same as that used to produce them
  - Defensive reasoning is practiced and skilled. People practice it without thinking. It is a form of tacit knowledge. Positive values are ascribed to defensive reasoning
  - *Defensive reasoning is self-serving, anti-learning and overprotective*
- Productive reasoning
  - Reasoning is a key activity in designing and implementing action
  - Learning to make inferences explicit and test validity in practice is important to effective action
  - Designing activity to help others, self understand is central to initiating and sustaining action or change

Model I and Model II theories in use

Model I

1	Define goals and try to achieve them	Design and manage the environment unilaterally (be persuasive, appeal to larger goals.
2	Maximize winning and minimize losing	Own and control the task (claim ownership of the task, be guardian of the definition and execution of the task).
3	Minimize generating or expressing negative feelings	Unilaterally protect yourself (speak in inferred categories with little or no directly observable data, be blind to impact on others and to incongruity; use defensive actions such as blaming, stereotyping, suppressing feelings, intellectualizing)
4	Be rational	Unilaterally protect others from being hurt (withhold information, create rules to censor information and behavior, hold private meetings)

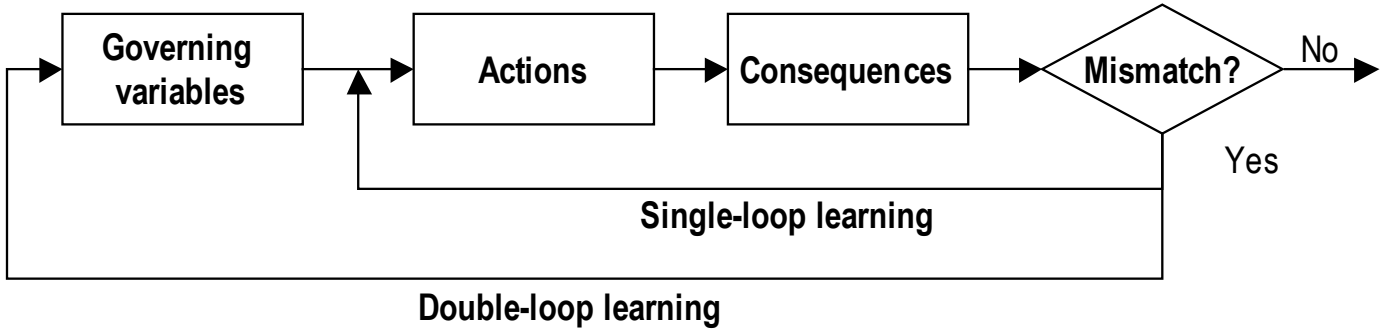
Model II

1	Valid information	Design situations where participants can be origins of action and experience high personal causation.
2	Free and informed choice	Task is jointly controlled
3	Internal commitment to the choice and constant monitoring of its implementation	Protection of self is a joint enterprise and oriented toward growth (speak in directly observable categories, seek to reduce blindness about own inconsistency and incongruity). Bilateral protection of others

Complex and important problems solved with Model I creates counterproductive consequences. Model I is learned early in life, according to Argyris and Schön.

Deterministic, probabilistic reasoning

- Management relies too much on deterministic causality
- In an environment of uncertainty and change, probabilistic reasoning is needed.
  - Probabilistic causality implies seeking of disconfirming evidence, which is hard for people to do, hence the attachment to deterministic reasoning, which needs no disconfirming evidence (because the deterministic reasoning says there is none!).
- Discovering error is the first step toward learning



OK. Where are we?

- Enterprises need to manage knowledge so that they can make and act on decisions within time frames dictated by the competitive environment. *Knowledge is intertwined with action.* In fact, I view knowledge and action as two sides of the same coin.
- Knowledge management is clearly getting a handle on how to catalog, store, search and distribute information. This is *production* of knowledge
- Knowledge management has had plenty problems with getting knowledge turned into action. This is *consumption* of knowledge.
- Consumption of knowledge is the scarce capability, not production
- Therefore, knowledge management needs to focus hard on the social and human issues of *knowledge consumption*

Perfect decisions

- Have valid data
- Have valid assumptions
- Have valid reasoning process
- Have people who discuss the validity of data, assumptions and reasoning
- Use visual aids and metaphor to avoid representation and cognition problems
- Handle and weed out defensive processes correctly
- Are coherent with other decisions being made, both horizontally and vertically within the organization
- Are appropriate given the environmental challenges
- Engage the right motivational forces within the enterprise
- Engage both coerced and intrinsic behavior to advantage
- Require perfect managers

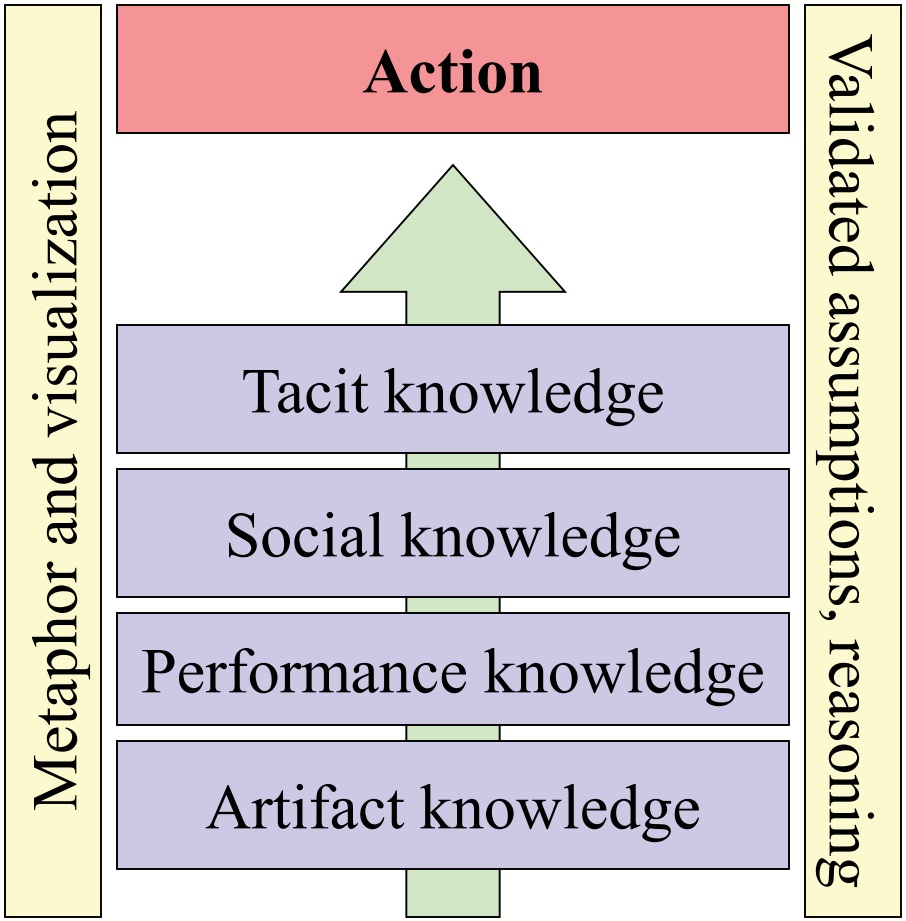
Knowledge layers

Artifact knowledge consists of all the myriads of documents and data that populate company computers and file cabinets.

Performance knowledge consists of the computer systems and documents that convey specific business performance information. This information is often tied to employee compensation and review programs.

Social knowledge consists of all the methods people use communicate outside of artifacts including gestures, symbols, language, culture, group norms. Social knowledge can involve unplanned activities and nonconscious learning.

Tacit knowledge consists of knowledge that resides private to individuals, not codified in an artifact and often not directly communicated as social knowledge.



Techniques for the social nature of knowledge

- **Bohm dialogues.** Inquiry is balanced with striving for an answer. People ask questions, make observations, but "suspend" thought. More…
- **Systematic use of metaphor.** A creative process that uses language from a variety of domains within the design process. The creative agency world has done this regularly.
- **Stories and story telling**. Find stories in literature or elsewhere that relate to the problem at hand.
- **Expressive communication.** Teams are motivated by personal or social aims; occurs in informal settings, on notes, in stories; contains humor or personal appeals; is designed to build trust.
- **Conversation.** Through conversation we create, develop, validate and share knowledge. More than intellectual endeavor, it is a social process too.

From "The knowledge management puzzle: Human and social factors in knowledge management," J.C. Thomas, W.A. Kellogg, and T. Erickson; IBM Systems Journal, Vol. 40, No. 4, 2001

Safety engineering case study

- As a result of the Valdez incident, Exxon realized that the company was not sharing safety information for advantage
- Powerful disincentives to sharing information
  - Highly charged information
  - Significant legal and liability repercussions
  - Strong local opinions on the best way to manage safety data
- Powerful incentives for sharing information
  - Accumulated statistics can help identify systemic causes
  - Sharing details on the safety incident can help other facilities prevent problems

What Exxon did

- Designed a way of cataloging, collecting and distributed safety information
  - Data was highly codified into a series of hierarchical lists. 90% of data entry was reduced to selecting items from a list
  - Data was collected in a distributed system at all Exxon locations world-wide. A GUID approach as designed to number records uniquely.
  - Data was allowed to be exported and important between any installation of the software. This allowed rolling-up and sharing sideways
- Codification took lots of time
  - About 2 years of effort was required to codify the pick lists, getting buy-in from key constituents
  - Usability was a top concern in the application development

The human side

- Exxon spent considerable time discussing assumptions and reasoning processes that went into the design of the system
- Exxon spent considerable time listening to users and developing a system that really worked for the users
- Exxon had a decision making process that distributed votes across business units according to headcount. Decisions could be made. Compromises could be had.
- Exxon had a significant training investment that went well beyond the system itself and included legal and management issues
- Significant debate concerning the deep philosophies embedded in the system was openly engaged in for years, resulting in changes
- *The result: successful deployment and use over a 9-year period.*

Another approach…

Martial arts approach learning and knowledge differently

- All action begins with thought. Understanding all assumptions in thought is necessary for proper action. Weaknesses in understanding your assumptions that provide the basis for thought prevents learning. Insufficient learning can be fatal.
- Learning is inhibited by defensive routines, and primarily around definitions of the self held by the individual. In order to learn, one must redefine one's self. There is no "painless" learning that is significant.
- Defensiveness must be discussed in a challenging but supportive manner between instructor and student. Failure to do this can be fatal.
- If the student has the courage to regularly face disconfirming evidence and regularly address defensive behavior, skill can be *greatly* enhanced. In fact, this is a key differentiator between the novice and the master.
- Emotion is not ignored, it is mastered. Action must be without emotion to avoid error. A specific kind of emotion or intensity, based on apparent conflicting goals of self-knowledge and self preservation, is recruited. Effective actual combat is actually emotionless, trained and reflexive.
- Experts will quickly recognize personal weaknesses in competitors and exploit them in matches

KM and the 21st century business

- The modernist society is fading away. Power in society is not in production, but in consumption. Consumers hold the ultimate power. Understanding and responding to consumers within competitive timeframes is key.
- Traditional, industrial-age hierarchical means won't work in the post-modern world
  - In a modernist company, specialization of skill, reduction in improvisation (and knowledge) and rote interaction with machinery creates productivity gains
  - In a post-modern company, fuzzy boundaries between skills, increase of interaction flexibility, improved flow of knowledge across functional units and highly interactive, non-repeatable interactions with information creates new profits
- Is the modernist approach useful at all?

My views

- Knowledge is slippery. To one who has it, it is easy to see. To those who don't, it can be mysterious. Using conventional approaches to knowledge management makes perfect sense for those who already posses the knowledge.
- Knowledge is personal
  - We know what it is our nonconscious brain system wishes us to know. In the presence of strong emotions, learning is enhanced. We know in a way that preserves our sense of self. We exclude that which is inconsistent with our sense of self
  - How we learn varies. People respond differently to reading, writing, speaking, hearing, visualization, narrative, role-playing, experimentation, etc.
  - Learning and stress co-occur. Learning involves emotion and a change in our sense of self which creates stress. We usually avoid learning (hence we avoid change) in proportion to the stress it creates. Some knowledge, to be acquired, will cause enormous stress.
- Knowledge is tied to culture
  - We tend to engage in communication habits formed by group norms. These group norms shape the frequency, tone and structure of these habits
- The technology issues are DWARFED by the human ones

Thank you!

What assumptions are invalid?