

Web-based Collaboration & Knowledge Management

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Image 1

User-centered design-- what is at stake?

- Productivity paradox
 - Efficiency gains from textile or agricultural machinery 100% or 1000%
 - Computer efficiency gain is well under 50 percent, despite \$1 trillion/yr. investment
 - Return on investment is about zero (recent numbers somewhat better)
- Landauer “The trouble with computers”
 - Attributes paradox to poor design
 - Average UI has 40 flaws. Correcting the easiest 20 of these yields an average improvement in usability of 50%.
 - Early UCD can yield efficiency improvements of over 700%.

Image 2

Additional needs of R&D

- Knowledge creation and application
- Open collaboration in an active “thinking space”
- Create in-house concepts and taxonomies
- Break those concepts and taxonomies
 - what-if analysis
- Empowerment and buy-in from staff

Image 3

MAGIC

- Media And Graphics Interdisciplinary Centre
- Cognitive Science of human interaction with technological tools, media, & environments
- Human-centred design of new technologies
- Iterative development cycle
 - Observation, interviews, focus groups
 - Theory-based analysis
 - Prototype
 - Experimental test of prototype in use
 - Field test
- Co-evolution of institution and technology

Image 4

Stimulating knowledge sharing

- Support knowledge creation and capture
 - User friendly technology and environment
 - Questioning assumptions, breaking rules
 - Supporting the process of innovation
 - Capturing the results
- Support communication in collaboration
 - Natural patterns of communication
 - Metacognition support
- Reduce social and institutional barriers
 - Support informal collaboration, COP
 - Maintain authorship and citations
 - Integrate with corporation's reward policy
 - Make successes highly visible

Image 5

Orlikowski Lotus Notes study

- Conflicts between mental model of system
(tool/task) & groupware functions
- Conflicts between individual and institutional goals
- Use levels poor, despite high use of email

Image 6

Reasons for Failure

- Pure organizational issues with rollout
 - No training provided
 - Learning time not billable
 - Groupware concept unclear
- Deeper issues with structure of organization
 - Competition between consultants rewards information hoarding

Image 7

Applied Cognitive Science

- Fields of inquiry
 - Perceptual/Cognitive/Social Psychology
 - Psycholinguistics, Communication theory
 - Computer Science (AI)
 - Neuroscience
 - Anthropology, Sociology
- Methods
 - Experiments
 - Observation (video, keystroke, weblog)
 - Math & Computational Modeling

Image 8

Should KM **just** manage K?

- KM designed to store and transfer information
 - **Document management tools:** DBs, document repositories.
 - **Authoring tools:** e.g text processors, html editors.
 - **Search and retrieval tools:** search engines
- Knowledge creation, collaboration are left as an exercise for the student...
- Innovation & collaboration **are** the design goals

Image 9

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Image 10

Perceptual Cognition

- Theoretical analysis of perception, action, and problem solving
- “Things that make us smart” Thinking tools and artifacts
 - Physical & virtual models
 - Notation systems, sketches
 - Whiteboards
 - Kitchen tables

Image 11

KM tools and processes, pro & con

“ We shape our tools, and then our tools shape us”

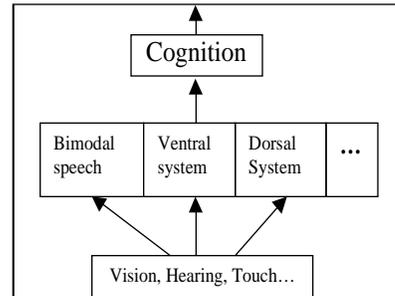
- Structure process and information
 - Categories, hierarchies, & sequences
 - Lock-step processes and rigid categories
 - Hidden information may be mission critical
- Reinforcing structures and processes make it hard to “think outside the box”
- Changing processes just shifts the problem

Image 12

Neuroscience: One input, many processes

- Neural Architecture

- Multiple brain areas
- Highly interconnected
- Informationally encapsulated
- Multimodal inputs, parsed from scene and fused



- Evidence from lesion studies

Image 13

“FINSTs... make thoughts true”

- Perception

- “Hotlink” tokens
- Drawn to salient events
- Object-centred, “sticky”
- Visual routines
- Finite number ~ 4

- Cognition

- Maintain object history
- Implicit memory of object associations
- Sparse cognitive representation
- Just-in-time delivery of information

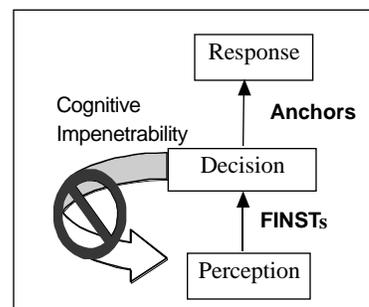


Image 14

Indexical cognition

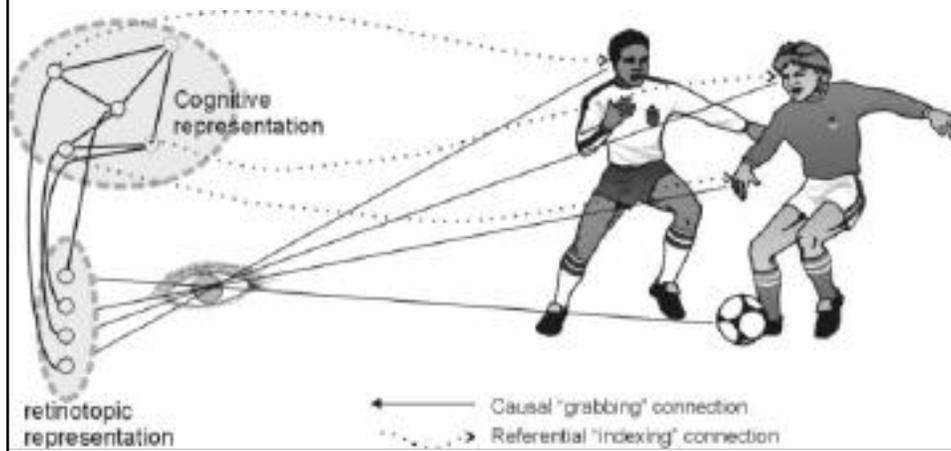


Image 15

FINST demo

<< 3 Change blindness movies >>

Image 16

CogScience of KM: Cognition

- Thinking tools
 - **Format-independent** visual placeholders for knowledge
 - **Anchoring** concepts in data (e.g. URLs link to underlying evidence)
- Manipulation of placeholders reflects
 - **Information acquisition**-- Web, local sources, experts
 - **Transformation into knowledge**-- Spatial (re)arrangements:
- Gestalt groupings = visual analog of thought
- Pattern discovery, concept clustering and chunking builds and reflects expertise

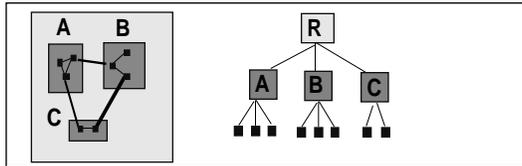
Image 17

CZWeb project

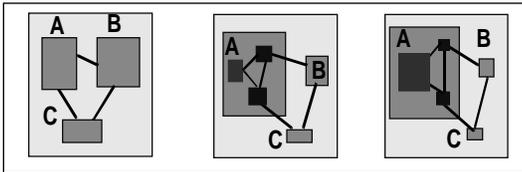
A software prototype developed at Simon Fraser University to support the evolution of users' understanding through the manipulation of information in the form of graphical placeholders that represent particular information clusters because they point to them, and can display them on demand in a browser window.

Image 18

Aspects of the CZ Display



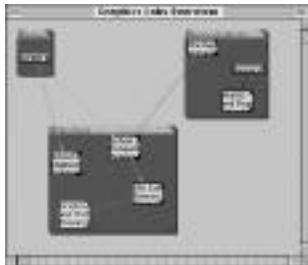
- Hierarchy of items and clusters
- Multiple levels are viewable



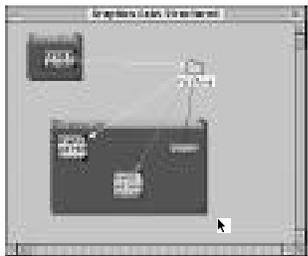
- Continuous zoom
- Layout algorithm

Image 19

CZWeb for Web-based knowledge work



CZWeb creates a clickable index for each Web page visited at an open location.



If space is at a premium, CZWeb allows items to change size and location to make room for new or expanded items.

The result is an environment for decision evolution through flexible, spatial organization of information.

Image 20

User Test results

User tests showed it aided users to perform tasks combining information from different areas of the Web (HCI International 1997)

Image 21

PlanBee



Image 22

Stimulating knowledge sharing

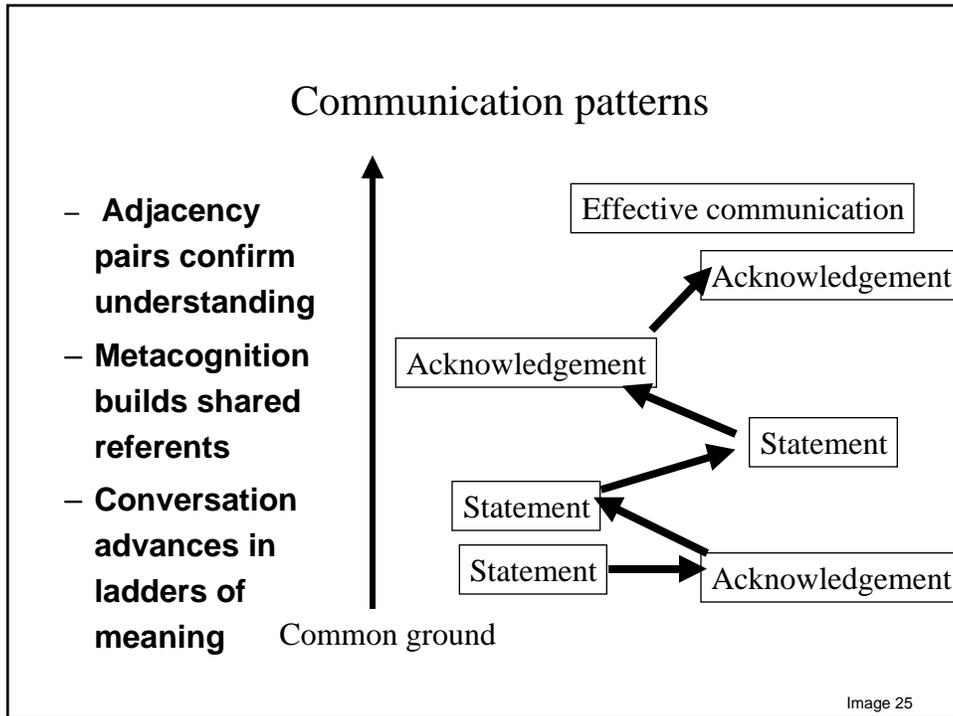
- Support knowledge creation and capture
 - Easy-to-use environment
 - Focuses on innovation, breaking the rules
 - Supports the thinking process
 - Captures the results
- Support communication in collaboration
 - Natural patterns of communication
 - Metacognition support
- Reduce social and institutional barriers
 - Maintain authorship and citations
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Image 23

CogSci of KM: Distributed Cognition

- Communication as a **Joint action**
- First goal is building metarepresentation: **Grounding**
- Theory of Mind Module (ToMM)
 - Neural structure
 - Matures ~4-5 years
 - Allows meta-representation
 - Impaired in autism

Image 24



- ### Groupware design goals
- Group actions of a participant in different environments and over time
 - Support awareness of participants and their roles
 - Support “grounding” patterns
 - Sequences of information and participants
 - Confirmation of understanding
 - Advancement
 - Annotation
- Image 26

Threaded discussions

- Top-down structure
- Only start a thread or respond to a message
- No UI support for summarize and advance
- Isolated conferences & environments
- No visual cues to who is present and what roles they have



Image 27

Findings from research on CSCL/CSCW

- Threaded discussions are typically dialogs
- Patterns of argument do not follow threads
- Nobody uses keywords
- Claims for better participation and enjoyment by less assertive participants
- “Weaving messages” key to success

Image 28

Focused designs

- Three mockups that implement the recommendations for different user populations
 - Conferencing in online classroom
 - Instructor's view
 - Consultant or "helpdesk"

Image 29

Telelearning application

- Production
 - Provide topic flow flexibility
 - Support grounding interactions
- Interpretation
 - Support integration of information across activities
 - Scaffold meta-representations
 - Create knowledge space for post-hoc analysis

Image 30

CZ approach to Groupware

- Personal icon gives visual cues as to who is present
- Icon highlights all productions of that user
- Multiple referents/message
- CZ "springs" move most referenced messages inward
- Messages evolve into concept map
- Drill down from concept map to find authors

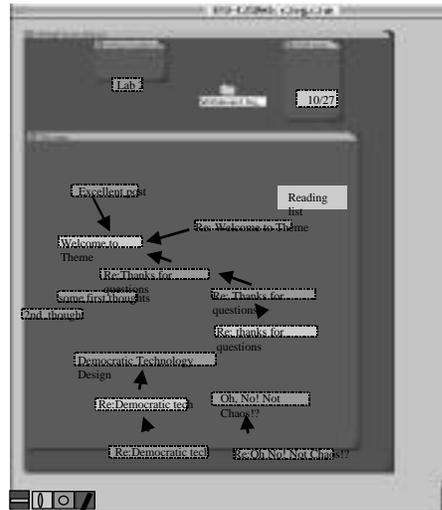


Image 31

Visualization of communication patterns

- Multiple referents/message
- Argument level x time at a glance
- Time sliders, level of argument, icons for message types etc.

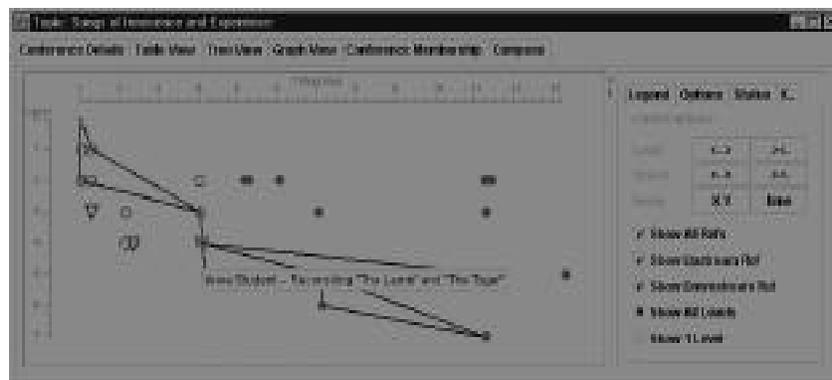


Image 32

Sequencing for executive overview

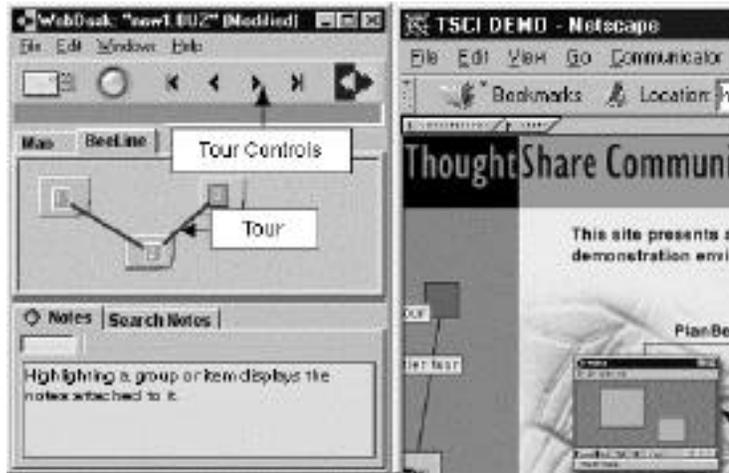


Image 33

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Image 34

Motivation, roles and rewards

- Why collaborate?
- Why give away knowledge?
- References, authorship
- Status in community
- Translates to individual success

Image 35

Controversies...

- Social issues & technology in the workplace
 - Control of workers
 - Job classifications, status & demographics
 - Telecommuting, “open office” e.g. Chiat/Day
- Infrastructure issues
 - Training
 - Hidden costs
 - “Informating” makes process visible & transforms work
- New approaches
 - Social Psych/Anthropological methods

Image 36

Approaches

- **Methods for seeking information**
 - Management: procedures, forms, training manuals etc.
 - Interviews and Participatory design methods (Conscious knowledge and processes)
 - Observational studies (Tacit knowledge)
- **Structures for interpretation**
 - Organizational Psychology
 - Communication theory (e.g psycholinguistics)
 - Distributed/situated cognition theories

Image 37

CogSci of R&D: Social Cognition

- **Newer area, so fewer results**
- **Social and cross cultural cognition**
 - Cognitive structure/dissonance theory
 - Fundamental attribution error
 - Cultures and microcultures
 - Ethnomethodology approaches

Image 38

Julian Orr's Study of Xerox Field Techs

- Techs thought of as independent, well trained
- Orr found that they got together on their own
- Stories transferred knowledge, built a common approach "how we do things"
- Especially how to subvert company procedure
- Recommendation to issue 2 way radios

Image 39

Communities of Practice

- Groups, usually informal, characterized by
 - Mutual engagement
 - Joint enterprise
 - Shared repertoire
 - Often create unique group concepts: reification
- Communities of interest, purpose, passion

Image 40

Example: SV in “Regional Advantage”

- SV vs. Boston
- Distribution of firms and bars
- Knowledge ecology
- Sand Hill address runs > \$200 USD/ft
- Even MS opened SV office

Image 41

Conclusions

- Don't settle for **just** Knowledge Management
- Solutions have to be driven by your needs
 - R&D is special case
 - Don't build in false assumptions, errors, and institutional inertia
 - Design for humans: perception, cognition, social interaction
 - Customize design for tasks, goals, work processes, social and organizational context of institution
 - Purchaser must directly benefit, e.g. visibility and responsiveness to upper management

Image 42

More information at www.ubc.ca/~fisher

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John Dill
Jerry Fodor
Zenon Pylyshyn
Brian Scholl

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Image 43

Application to CME: Educating the Reflective Practitioner

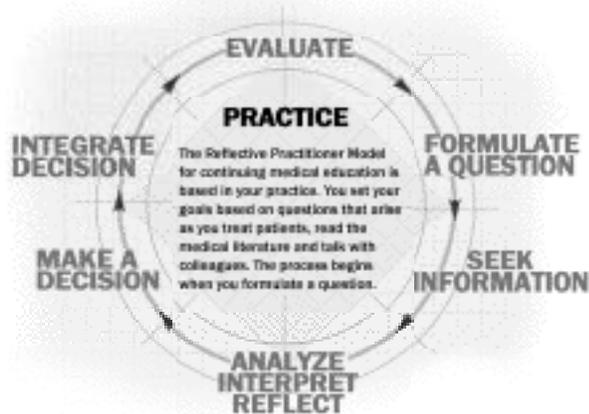


Image 44