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The Reality of Knowledge Sharing & Collaboration: Web-based Workspaces

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MAGIC

UBC Media And Graphics Interdisciplinary Centre

- Cognitive Science of interaction with technological tools, media, & environments
- Design & test technologies from collaborative learning to air traffic control
- Industry, government, other research groups e.g. Simon Fraser U., HRL, Sun

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I'm not a ThoughtShare employee, rather I work at UBC MAGIC. MAGIC collaborates with a number of private sector and academic institutions on development projects.

The research I will describe here was done at Simon Fraser university in a group headed by John Dill. I participated in this project as an SFU employee and later at MAGIC



Limitations of KM Tools

- Many applications for authoring
 - Text processors, html editors, concept mapping tools, etc.
- Innovative applications for storing and retrieving
 - Document management, data mining, etc.
- What about knowledge creation?

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Current software is limited by its emphasis on the end product--the document or service. It does not support the process of creative thought and collaboration.

KM products have made excellent progress towards document management solutions, but have neglected the basic process of knowledge creation



Managing Useful Knowledge

- Knowing-how
- Evidence-based
- Focused on problem area
- Relevant to current & predicted needs
- Captured as an artifact
- Ability to update and modify
- Lead to specific actions

The type of knowledge that is captured should include tacit knowledge, not simply theoretical knowledge.



Dynamics of KM

- **Building knowledge**
 - Acquisition-- Web, local sources, and experts
 - Transformation-- Understanding and innovation
 - Collaboration-- Thinking teams
- **Capturing knowledge--** Documents and artifacts
- **Dissemination--** Organizations & communities

Here is one version of the cycle of knowledge work. While most KM concentrates on the last two stages we will examine the initial creative process by which knowledge is produced and captured in an artifact.



Cognitive Science of Problem Solving

- Laboratory models of info processing
 - Perception \Rightarrow Cognition \Rightarrow Action
- Indexical Cognition: Things that make us smart
 - Physical & virtual models
 - Notation systems
 - Whiteboards
 - Kitchen tables

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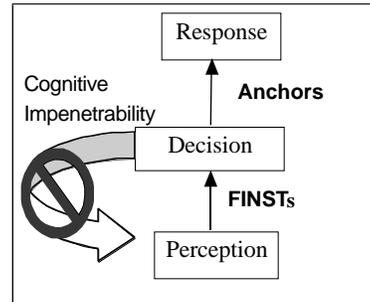
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Much of the research draws upon models of human Cognitive Science. In particular a new set of theories developed by Zenon Pylyshyn and colleagues.



“FINSTs Make Thoughts True”

- Perception
 - “Hotlink” tokens
 - Object-centred
 - Visual routines
- Cognition
 - Maintain object history
 - Sparse mental representation
 - Just-in-time delivery of sensory information



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In recent years there has been a great deal of interest in Indexical, situated, embodied, deictic cognition: Minimal mental model. Leave as much of the representation in the world as possible, retrieve information as needed

Pylyshyn's FINST hypothesis describes a minimal mechanism that can support this high level of interaction of perception and cognition. At the perceptual level, there is evidence for a small number (~4) of attentional tokens that index perceptual primitives as originating from a given object or event in the world. When information about aspects of an object are needed, they are recalled by reference to the token.

Among other things, FINSTs enable you to track a subset of identical moving targets, subitize a small number of items and perform simple visual routines such as collinearity quickly. They are drawn by new display items and provide potentially parallel access to a small number of them.

At the cognitive level, FINSTs provides the underlying atom of semantics-- the token that enables you to believe something about a specific object or event

Philosopher Jerry Fodor says FINSTs are the things that "make thoughts true"



Thinking Tools

Evolve understanding by using analogs to mental operations on the workspace

- Accumulation (e.g. Web, document repository)
- Annotation
- Containment, co-location
- Gestalt groupings-- collinearity, proximity
- Culling
- Sequencing for communication

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Indexical cognition models help us to develop tools that facilitate creative intelligence, collaboration, and the capture of tacit as well as explicit knowledge.



Technology Barriers

- Organization of found information:
 - Categories, hierarchies, sequences, links
- Forcing decisions before concepts evolve
- Categorization is too rigid
- Formality, generality, & persistence
- End result: your collaborators end up where you started

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In order to create a new solution, a user must be able to understand information in a new way. This requires them to restructure the information in a fluid way, overcoming the information structure that they find in Web and intranet systems. This structure was based on and supports old ways of thinking about the information.

By forcing users to think about the format and structure of the final document at early stages of the creative process, document-based KM software packages do not allow users the flexibility that they need to think on the screen.

Even if users are successful, the document that they produce is hard to change, and so they unintentionally force their collaborators to overcome that organization in order to add their knowledge and insight.



Design Goal

A collaboration environment that supports 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.

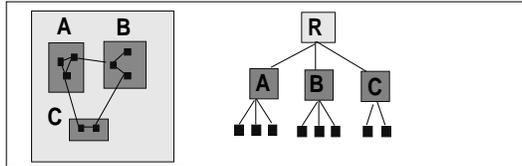
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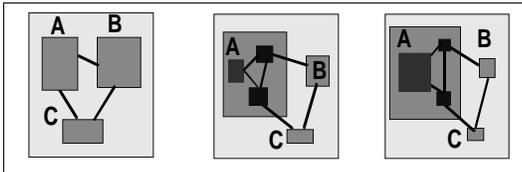
The CZWeb project at SFU was part of a comprehensive research effort to understand and manage large information spaces. This began with the PRECARN IGI project, begun by John Dill and headed by Tom Calvert , and continued as CZWeb



Aspects of the CZ Display



- Hierarchy of items and clusters
- Multiple levels are viewable
- Continuous zoom
- Layout algorithm



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CZWeb uses a hierarchical graph representation and a continuous zoom to use screen real estate efficiently.

The inset zoom technique maintains the visibility of the base page while allowing simultaneous views of multiple levels of the hierarchy

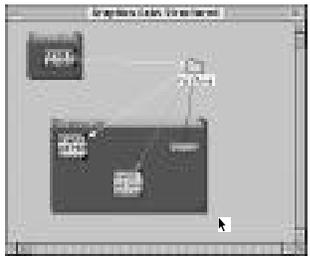
Layout algorithm responds to new items or removal of items by re-arranging the display for optimal visibility.



CZWeb Prototype



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.

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Web exploration is a dynamic and evolving process. It is impossible to predict how many pages will be visited in a session. No static layout would be optimal for all sessions.

As the user visits sites, CZWeb watches browser events and displays new Web locations in open spaces, with a visible link to the previously visited page. These links are springs that can reposition the nodes they connect so as to keep the spring length short.

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

CZWeb's communication with the browser is 2-way. Clicking on a node opens the Web page it points to in the browser window

Question: How will users respond to the display transformations?



User Test results

- CZWeb prototype implements
 - Accumulation
 - Containment, co-location
 - Gestalt groupings-- collinearity, proximity
 - Culling
- User tests showed it aided users to perform tasks combining information from different areas of the Web (HCI International 1997)

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User results were positive, and supported our claims that this approach was more effective than browser-based interaction alone.



Plan Bee Freeware



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In 1998 CZWeb technology was licensed to ThoughtShare communications for commercial development. John Dill and myself worked with the ThoughtShare team on the design of an industrial-strength KM application based on that technology.



Collaboration Features

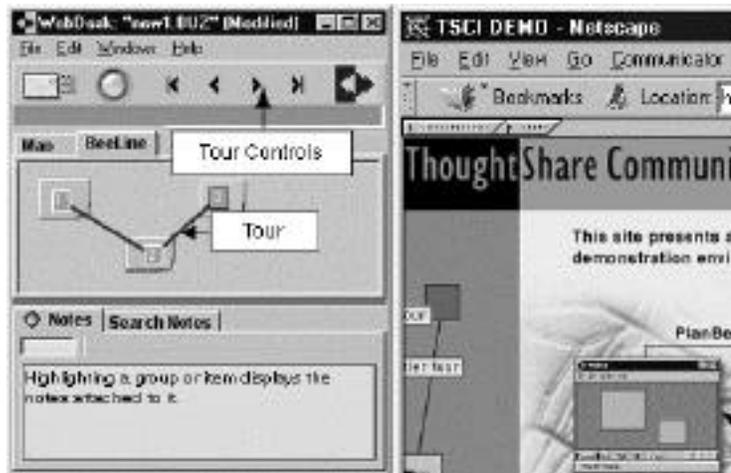
- CZWeb development continuing at SFU
- ThoughtShare adding collaboration functionality
 - Annotation
 - Sequencing for communication
 - Mail and post to Web capability

CZWeb development is a continuing effort at SFU. New features and functions will continue to emerge from this project.

ThoughtShare added collaborative functions to round out the product design and make it more applicable to collaborative uses. We will examine a few of the ways in which the product line is being developed in those areas



Sequencing for collaboration



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The Web tour is a particularly useful function. This enables someone receiving a BuzzPack, as the documents are called, to follow the creator's sequence of thought.



Things that make us smart

- Initially, concept mapping tools
- Applied Cogsci for new approach
 - CZWeb
 - ThoughtShare
- Support rather than replace other KM tools
- Applications? CME, New Ventures...

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If we look at the tools that are out there, with the exception of concept mapping tools there has been little effort placed on supporting the key processes of knowledge creation and capture.

CZWeb was the first application to do so, and ThoughtShare continues the effort. ThoughtShare can be thought of an application that does not replace KM products, but rather complements them with added functionality.



Information & Downloads

- CZWeb prototype information
 - www.cs.ubc.ca/~fisher
- PlanBee Freeware
 - www.thoughtshare.com
- ThoughtShare Server Suite for KM
 - Exhibit hall, booth 1228

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Thanks to:

Colleagues

Kelly Booth
John Dill
Jerry Fodor
Zenon Pylyshyn
Brian Scholl

Funding agencies

PRECARN
IRIS NCE
Telelearning NCE



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The research I describe here has been developed in a wide ranging collaboration between researchers across Canada and in the US. In addition to John Dill and Zenon Pylyshyn who I mentioned earlier, I would like to acknowledge the contribution of MAGIC Director Kelly Booth and FINST researchers Jerry Fodor and Brian Scholl and our funding agencies PRECARN, IRIS, and Telelearning.