

Applying Knowledge Management *techniques for building corporate memories*

Ian Watson
AI-CBR
Computer Science Dept.
University of Auckland
New Zealand



...the relationship between case-based reasoning and knowledge management...

...coincidentally I've just written a book about this...

...plug the book!!!

Outline

- Talk about
 - Knowledge
 - Knowledge management
 - Why CBR is appropriate for KM
 - CBR is a methodology for KM
 - Some KM/CBR applications
 - Future research directions
 - A CBR/KM tool

Knowledge

- The knowledge economy
- Knowledge workers
- Knowledge assets
- Entrepreneurs are no longer seen as the owners of capital, but rather as individuals who express their tacit knowledge by "knowing how to do things" (Casson, 1997)

Knowledge

- The *active* management of a organisation's knowledge assets is now widely recognised as good practice
- Typically this involves some technological innovation
 - intranets, extranets
 - document management
 - information retrieval
 - knowledge-based systems
- And organisational change

A Knowledge Framework

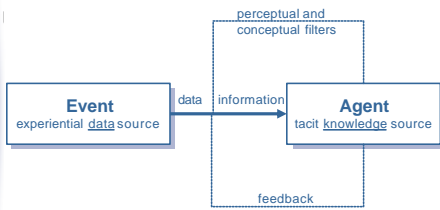
- To manage knowledge we must:
 - understand what knowledge is
- The idea that knowledge can be slotted into a data-wisdom hierarchy is bogus, for the simple reason that one man's knowledge is another man's data.* (Stewart 1997)

data → information → ~~knowledge~~ → wisdom

A Knowledge Framework

- Some observations
 - Knowledge is not static
 - Knowledge has a life cycle
 - (i.e. it has a *relevancy* period)
 - Knowledge needs to be applied
 - Knowledge is dynamic
- A KM system must therefore reflect this

A Knowledge Framework



Adapted from Boisot [1998]

A Knowledge Framework

- Different researchers have recognised the task requirements of a KM system
- Their separate characterisations show a very similar pattern

KM Task Requirements

- Van der Spek, R. & Spijkervet, A. (1997). Knowledge Management Dealing Intelligently with knowledge, in Knowledge Management and its integrative elements, edited by J. Liebowitz and L.C. Wilcox, CRC Press.
 1. Developing new knowledge
 2. Securing new and existing knowledge
 3. Distributing knowledge
 4. Combining available knowledge

KM Task Requirements

- Ruggles, R. (1998). The State of the Notion: knowledge management in practice. California Management Review, Vol. 40, No. 3.
 1. Knowledge Generation consisting of:
 - creation
 - acquisition
 - synthesis
 - fusion
 - adaptation
 2. Knowledge Codification consisting of:
 - capture
 - representation
 3. Transfer



KM Task Requirements

- Karl Wiig (1999). Knowledge Management: An Emerging Discipline Rooted in a Long History. In, Knowledge Management. Daniele Chauvel & Charles Despres (Eds).
 1. Creation and sourcing
 2. Compilation and transformation
 3. Dissemination
 4. Application and value realization



KM Task Requirements

- Watson, I. (2000). Report on Expert Systems 99 Workshop: Using AI to Enable Knowledge Management. In, Expert Update Vol. 3 No. 2,
 1. Acquire
 2. Analyse
 3. Preserve
 4. Use



KM Task Requirements

- S. Staab, R. Studer, H.P. Schnurr & Y. Sure (2001). Knowledge Processes and Ontologies, IEEE Intelligent Systems Vol. 16, No. 1.
 1. Creation and import
 2. Capture
 3. Retrieve / Access
 4. Use



KM Task Requirements

- Rosina Weber, David Aha, & Irma Becerra-Fernandez (2001). Intelligent lessons learned systems. International Journal of Expert Systems Research & Applications, Vol. 20, No. 1.
 1. Collect
 2. Verify
 3. Store
 4. Disseminate
 5. Reuse



KM Task Requirements

- Jay Liebowitz. (2001). Knowledge Management: Learning from Knowledge Engineering. CRC Press.
 1. Transform information to knowledge
 2. Identify and verify knowledge
 3. Capture and secure knowledge
 4. Organize knowledge
 5. Retrieve and apply knowledge
 6. Combine knowledge
 7. Create knowledge
 8. Distribute/sell knowledge



KM Task Requirements

- Clear that there is a common set of tasks a KM system requires
- But what knowledge should be
 1. Collected
 2. Verified
 3. Stored
 4. Disseminated
 5. Reused



Experience

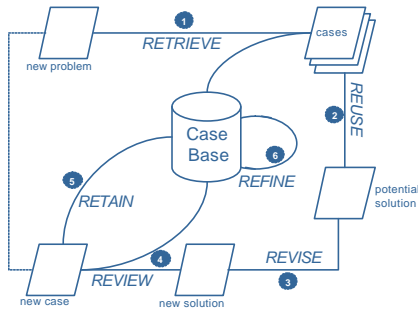
- Experience is a good source of knowledge
- Experts have experience
- Experience can be stored as cases
- Hence CBR seems appropriate for KM
- *Experience management*

CBR is a methodology

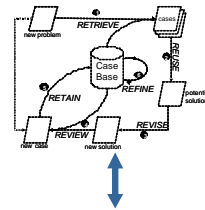
- It was common to think of CBR as a AI technique
 - Like genetic algorithms, neural networks, rule induction,...
- But CBR is a methodology for problem solving
- Involves a set of tasks that can be implemented in a variety of ways

Watson, I., (1999). CBR is a methodology not a technology. In, the Knowledge Based Systems Journal, Vol. 12. no.5-6,

CBR is a methodology

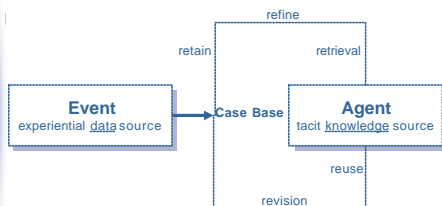


CBR is a methodology



A methodology is an organised set of principles which guide action in trying to manage real-world problem situations" (Checkland & Scholes 1990)

CBR for KM



Applying Knowledge Management: techniques for building corporate memories

- Published by Morgan Kaufmann in November 2002
- Intended audience:
 - Knowledge managers
 - MSIS...
 - ...anyone implementing KM solutions



Applying Knowledge Management: *techniques for building corporate memories*

- Outline
 - Introduction to KM
 - Introduction to CBR
 - Case studies of CBR KM systems
 - Lessons Learned
 - Resources



Applying Knowledge Management: *techniques for building corporate memories*

- Case Studies (familiar ones)
 1. **National Semiconductor** – managing product quality
 2. General Electric – colour matching
 3. **Wilson & Roysten** – process improvement in aluminium foundries
 4. **Deloitte Touche** – benchmarking best practice for internal financial control
 5. Analog Devices – online product selection
 6. Western Air – online engineering sales support
 7. ChangingWorlds – intelligent TV guides



Applying Knowledge Management: *techniques for building corporate memories*

- Lessons learned
 - Half the case studies used commercial CBR tools
 - All were developed using rapid prototyping
 - Half replaced manual CBR processes
 - Existing cases were present in the majority
 - Case numbers varied from 200 to 20,000+
 - Only one used multiple case-bases
 - All used nearest neighbour
 - Only one used automatic case revision
 - Two involved significant organisational change



All good news?

- Yes and No
 - Good to see successful KM applications of CBR
- But
 - Preponderance of engineering domains
 - Contained (small) problems
 - Some KM people would argue these are just “expert systems” that use CBR



Reasons

- CBR research has concentrated on solving engineering problems
 - from CLAVIER to INRECA
- CBR tools were developed for engineering problems
 - ReMind
 - Kate
 - CBR-Works
 - Eclipse
 - Spotlight



Solution


- We need to develop a CBR tool for organisational KM
- BIG project (like INREKA)
- One company did have such a vision
- Inference
 - Had two CBR products
 - CBR-Express
 - ART-IM

 The University of Auckland

Organisational KM tool

- Ralph Barletta (developer of ReMind) had a vision for Inference's tool
- A CBR tool that could
 - take a knowledge requirement (query)
 - return useful results
 - with a confidence measure
 - if necessary search all the company's knowledge repositories
 - and beyond...
- His ideas were never fully realised


www.aicbr.org

 The University of Auckland

Knowledge, Structure & Search

- Basic Assumptions:
 - Useful knowledge comes in a variety of forms
 - People don't like to have to add structure to their content (i.e., creating cases)
 - People have a hard time building good queries
 - People would rather be guided to useful content than go fishing
 - People expect high precision and recall in their searches
 - People need to trust results


www.aicbr.org

 The University of Auckland

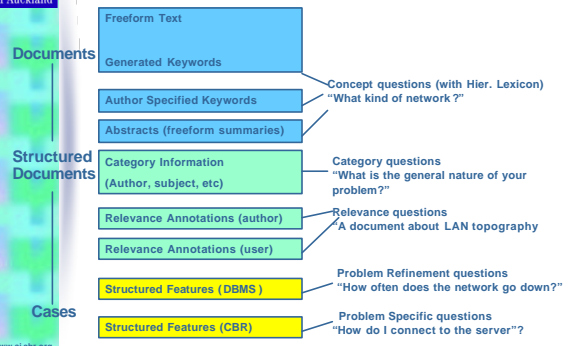
Knowledge, Structure & Search

- Structure & Search
 - As more structure is added to knowledge
 - Query building is easier
 - Precision and recall go up
- The Solution
 - Provide a **multi-content** knowledge search architecture that tangibly rewards the addition of structure to knowledge without explicitly requiring it.

www.aicbr.org

 The University of Auckland

From Documents to Cases: The Structure Continuum



The diagram illustrates the Structure Continuum with three main stages: Documents, Structured Documents, and Cases. Each stage is associated with specific content types and associated questions.

- Documents:**
 - Freeform Text
 - Generated Keywords
 - Author Specified Keywords
 - Abstracts (freeform summaries)

Concept questions (with Hier. Lexicon)
"What kind of network?"
- Structured Documents:**
 - Category Information (Author, subject, etc)
 - Relevance Annotations (author)
 - Relevance Annotations (user)


Category questions
"What is the general nature of your problem?"

Relevance questions
"A document about LAN topography"
- Cases:**
 - Structured Features (DBMS)
 - Structured Features (CBR)

Problem Refinement questions
"How often does the network go down?"

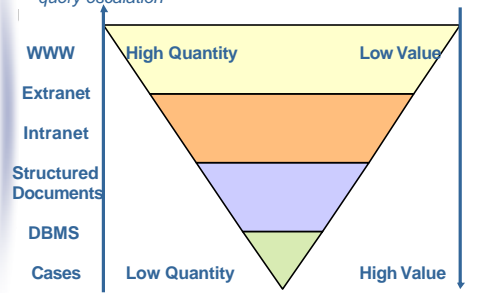
Problem Specific questions
"How do I connect to the server?"

www.aicbr.org

 The University of Auckland

From Documents to Cases: The Value Continuum


query escalation



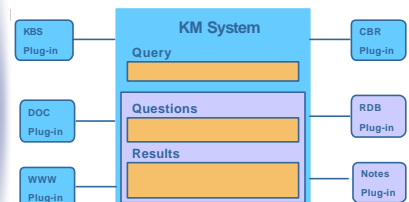
The diagram illustrates the Value Continuum as an inverted triangle. The left side represents 'query escalation' and the right side represents 'High Value'. The bottom-left corner is 'Low Quantity' and the bottom-right corner is 'High Value'.

- WWW:** High Quantity, Low Value
- Extranet:** (Transition from High Quantity to Low Value)
- Intranet:** (Transition from High Quantity to Low Value)
- Structured Documents:** (Transition from High Quantity to Low Value)
- DBMS:** (Transition from High Quantity to Low Value)
- Cases:** Low Quantity, High Value

www.aicbr.org

 The University of Auckland

KM Architecture



The diagram shows the KM Architecture with a central 'KM System' box containing 'Query', 'Questions', and 'Results' components. This system is supported by various plug-ins:

- Left Side Plug-ins:** KBS Plug-in, DOC Plug-in, WWW Plug-in
- Right Side Plug-ins:** CBR Plug-in, RDB Plug-in, Notes Plug-in

www.aicbr.org

Conclusion

- CBR closely matches the task/process requirements of a KM system
- Explains why CBR has been used so successfully in KM systems
- Not a one-way street
- KM has a lot to offer CBR
- Recognized by the Germans merging their CBR & KM communities



Questions ???