The meaning of documents is constructed in the interaction of content and comprehension

- Ontological annotation
  - D1 IS-A VerdictDocument
  - Verdict312085/98 PRONOUNCED 05/12/1998
  - Paragraph2 DESCRIBES CaseFacts
  - Paragraph3 DESCRIBES DecisiveFactors

- A lawyer's perception & annotation

- Situated Documents in Personal Information Spaces
- Project Overview –

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Getting "in tune" with our documents can be an amplifier for the quality knowledge work

- Business documents contain information which is related to our tasks, our experience, our attitude, or expectations addressing persons, things, events, topics, etc.
- Exploitation of these relations in personal information webs is still restricted as they are
  - rarely explicated during document generation,
  - hardly ever captured during document consumption,
  - to a large extend context-dependant.
- Information about a user’s attention and interaction with documents may be a good guideline to find out which relations are worth being established and how they can be utilized for improved information handling.

MyMory approach: User attention as a central trigger for people-focused KM

- Employ technologies for unobtrusive user observation in order to create meaningful, context-oriented relations between information items
- Use attention evidence for precise information delivery
- Provide mechanisms of meaning coordination to facilitate reusability of knowledge among different contexts

MyMory aims at assistance for knowledge capturing during document creation and comprehension for individual benefit in organizational environments.
In **Mymory**, the user's attention is complemented by „attentive“ documents

![Diagram](http://www.dfki.uni-kl.de/mymory)

#### Models reflecting the knowledge worker's mental models

#### Situation-Oriented Viewer

- **Virtual Document**
  - Highlighting
  - Extraction
  - Context Embedding

**Mymory** is organized in four central research threads

- **Generation of multi-modal attention evidence**
  - How can state-of-the-art technology be used to assess a user’s attention during knowledge work?

- **Rich multi-modal context modeling and identification**
  - How can these observations in today's increasingly fragmented work processes be interpreted as a coherent whole?

- **Attention-oriented filing and retrieval of documents**
  - How can attention data be exploited for improved information delivery services?

- **Sensemaking for knowledge workers**
  - How can context and attention models be used to support knowledge workers with constructing meaning from information?

A prototypical application will show how the research results may be embedded in an enriched physical workplace environment.
Research thread 1: Generation of multi-modal attention evidence

► **Text comprehension** is a central aspect of document-centered knowledge work
► **User attention** is a basis for subsequent comprehension processes
► **Explicit measurement** of attention is out of reach
► State-of-the-art technology allows for **unobtrusive evidence generation** for user attention

MyMory will exploit multiple sources of evidence for assessing user attention

A uniform attention representation collects and integrates evidence from multiple sources

► The user’s **attentional state & focus** is estimated
  - using webcam and eye tracking technology.
► The **text work recognition** module
  - uses eye tracking + visible text area + scroll + mouse events.
  - classifies visible text passages: read / skimmed / unread / …
► **Interaction devices** explicitly provide attention data
  - e.g., usage of a digital stylus to highlight interesting text passages
► **Connections to the physical environment** come into reach
  - e.g., recognition of bar codes / RFID tags on books

Multi-modal user interaction provides valuable evidence for the user’s context.
Research thread 2: Rich multi-modal context modeling and identification

► Knowledge work requires "multi-tasking capabilities"
- The user is embedded in a multitude of processes.
- Many processes are emerging and changing at a rapid pace.
- Processes are often intersecting: Tasks run in parallel.
- The user has to keep track of and switch between processes / tasks.

► The representation of the user context model has to incorporate this multi-tasking aspect
- Multiple context threads divide the user’s context and separate the contextual elements (CEs) in the user’s context.
- The CEs contribute to different, maybe multiple, context threads. However: For the user only one context thread is “active” at a time.

MyMory will recognize context threads based on attention-enhanced context models

Users have to serialize in spite of parallel demands and dynamic fanning

► Multi-modal extensions to the EPOS context model
- Integration of attention data
- Interpretation of attention data in terms of document work

► Multi-tasking extensions to the context model
- Representation of multiple context threads

► Context switches
- Similarity measures on contextual elements (to estimate best-fitting context thread(s) for an observed user action)
- Detect switches, potentially “near” context threads

► User assistance
- Context as input for document markup & retrieval
- How can attention data be exploited
  - for the same user in the same context/in a different context?
  - for another user?
- Reflecting context switches and information transitions in the workplace
Research thread 3: Attention-oriented filing and retrieval of documents

► Widespread desktop search engines neglect local retrieval knowledge
  - Relevancy is determined by standard similarity measures.
  - Personalization is a weakly-integrated add-on (query expansion, presentation tailoring).

► Deep integration of context knowledge adapts information retrieval to the user’s needs and views
  - Informed local search realizes user-perspective similarity measures.
  - This is the basis for more precise situation-specific relevance assessments.

► Attention data provides valuable knowledge for improved retrieval services
  - as heuristics to partition documents
  - as implicit and context-sensitive query extension and relevance feedback
  - as additional information with retrieved documents (re-finding and re-presenting)

Mymory will deliver a retrieval model that integrates vector space models with fuzzy attention data.

Fuzzy attention evidence has to be integrated into vector space-based retrieval models
Research thread 4: Sensemaking for knowledge workers

Sensemaking is at the heart of interdisciplinary KM research
- Cognitive & social psychology (e.g., Dervin)
- Organizational sciences (e.g., Weick, Wiig)
- Information sciences (cf. Case)
- Artificial Intelligence (e.g., Furnas, Russell, Stefik, Card)

Construction of meaning from complex information is
- situation-oriented
- goal-oriented
- knowledge-driven

Attentive documents carry valuable knowledge for their context-oriented interpretation

Mymory will provide coordination mechanisms between attentive documents and user models.

Multiple work contexts require situated document (re-)presentations

Today
- Context-aware
  - Information need
  - Query interpretation
  - Information presentation time

but...
- One-size-fits-all
  - Representational Space
  - Document representation
  - Document presentation

Goals
- Tasks
  - Read
  - Comprehend
    - Associate
    - Categorize
    - Rate relevance
  - Manipulate
    - Delete, Generate
    - Access, Retrieve
    - Scroll, Highlight

Knowledge History
Models of the knowledge worker’s mental models are complemented by attentive documents

- Attentive documents maintain relations to their environment
  - to their creation context
  - to the way they have been perceived (e.g., which parts have been skimmed over, carefully read, not been perceived)

- Mental model representations reflect a user’s
  - knowledge
  - tasks, goals

- Meaning is constructed as a result of coordination processes between these models

MyMory investigates IT support for sensemaking in KM environments

Roles
- Tasks
- Goals
- Knowledge

Processes
- Coordination

Models reflecting knowledge worker’s mental models on
- Tasks
- Goals
- Knowledge

Sensemaking through Mapping

Situation-oriented views

Attention and context

Solution-oriented view

Models
- Reflecting the document’s background
- Creation
- Use
- Perception
Mymory focuses on central areas in the sensemaking triangle

- **Situation-oriented annotations** using and extending Semantic Web formalisms
  - Starting point: Contextualized ontologies, named graphs

- **Ad hoc mappings** between mental model representations and attentive documents
  - Starting point: Context & ontology mapping techniques

- **Update** of mental model representations triggered by mappings to attentive documents
  - Starting point: Ontology learning techniques

Attention evidence guides establishing, mapping, and evolution of models.

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**Situatedness** vs. **Complexity of Models**

- **Semantic Web Technology 2005**: OWL Models, EPOS, Mymory
  - Single Classification
  - Multiple Classifications
  - Info Extraction
  - Dublin Core

- **Humans**

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Integrative application: The Connected, Context-aware, Creative Document Workspace (C³DW)

Integration of the various research threads into a comprehensive application environment

- provides a basis for jointly discussing the core scientific assumptions,
- allows for investigating the interplay between abstract concepts in IT support for people-focused Knowledge Management, their reflection in the virtual interfaces and the physical environment,
- helps in communicating the Mymory approach to potential exploitation partners.

Mymory will provide a semantic text processing prototype that supports creative document work by exploiting user attention for annotation, information delivery services, and sensemaking.

An enriched knowledge workspace frames the environment for people-focused KM
Mymory in a nutshell: Application-oriented basic research for knowledge management

Validation & Evaluation

Demo
Creative
Connected
Context-aware
Document Workspace (C3DW)

Research
Multi-modal context
Attention-oriented IR
Sensemaking
Attention Evidence

Partners
... (Law)
... (IT)
... (Pharma)

People-focused Enterprise Knowledge Management

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