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Situated Documents in Personal Information Spaces

L. van Elst, M. Kiesel, S. Schwarz,
G. Buscher, A. Lauer, A. Dengel

*Deutsches Forschungszentrum für Künstliche Intelligenz (DFKI)
Forschungsbereich Wissensmanagement*

HS Furtwangen, November 26th, 2008

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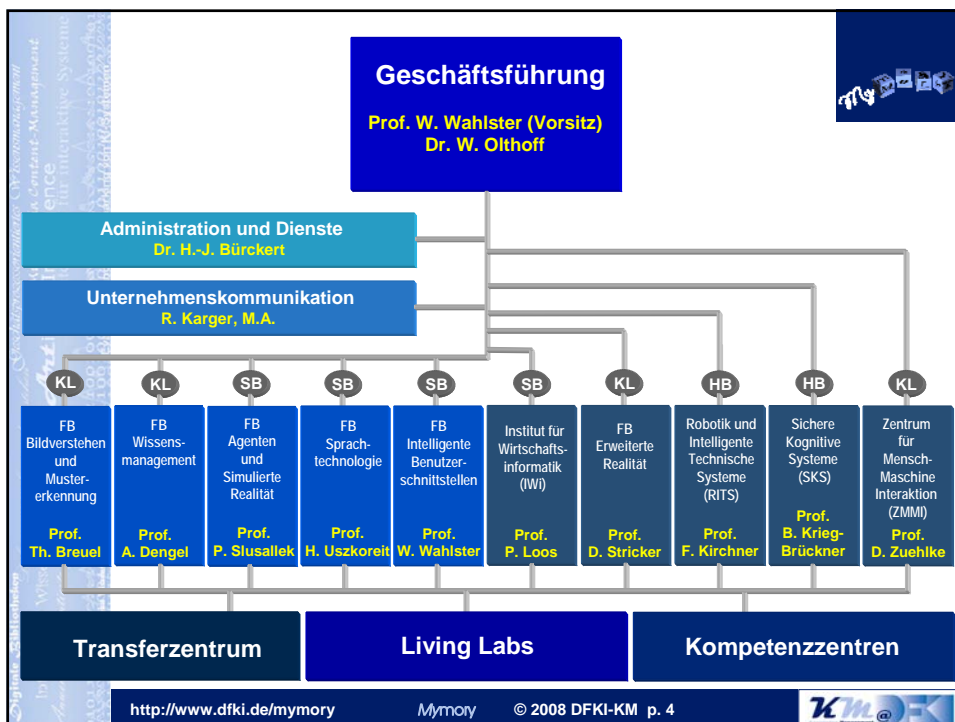
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Jetzt aber ...

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<http://www.dfki.de/mymory>

Mymory

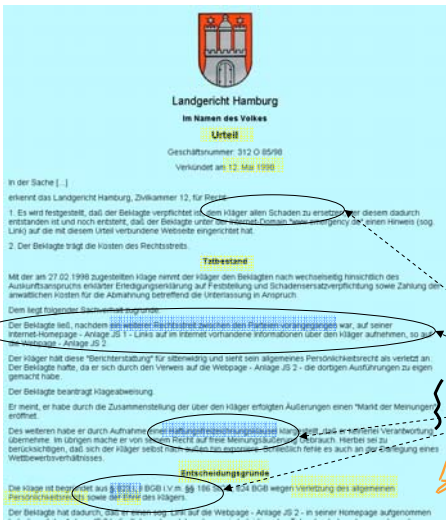
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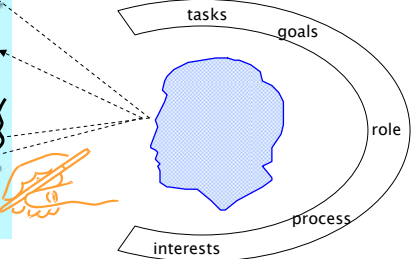
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The meaning of documents is constructed in the interaction of content and comprehension




- ▶ **Ontological annotation**
 - D₁ IS-A VerdictDocument
 - Verdict312085/98
 - **PRONOUNCED** 05/12/1998
 - Paragraph2 DESCRIBES CaseFacts
 - Paragraph3 DESCRIBES DecisiveFactors
- ▶ **A lawyer's perception & annotation**



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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.

Knowledge workers might (also/to some extent) become knowledge engineers...

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In Mymory, the user's attention is complemented by „attentive“ documents

Model Level

Models
reflecting the knowledge worker's mental models

+

Models
reflecting the document's content & context

Drive

Application Level

Generate

Virtual Document

- Highlighting
- Extraction
- Context Embedding


Work Process Level

Enhance

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A document work study reveals more detailed insights into document-centered knowledge work



- ▶ **Reading activities within real world settings are poorly understood**
- ▶ **Method: Diary study** in the spirit of Sellen's¹ work
 - Questionnaire for capturing document reading & generation activities
 - document type
 - reading volume & activity
 - purpose
 - editing activities
 - medium & location
 - duration
 - sequences of activities
 - Pilot study + 26 knowledge workers in the KM lab (1 week), completed by 15 test persons (4 or 5 days of documentation)


¹Adler, A., Gujar, A., Harrison, B., O'Hara, K., & Sellen, A.J. (1998). *A diary study of work-related reading: Design implications for digital reading devices.*

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Some results from the study

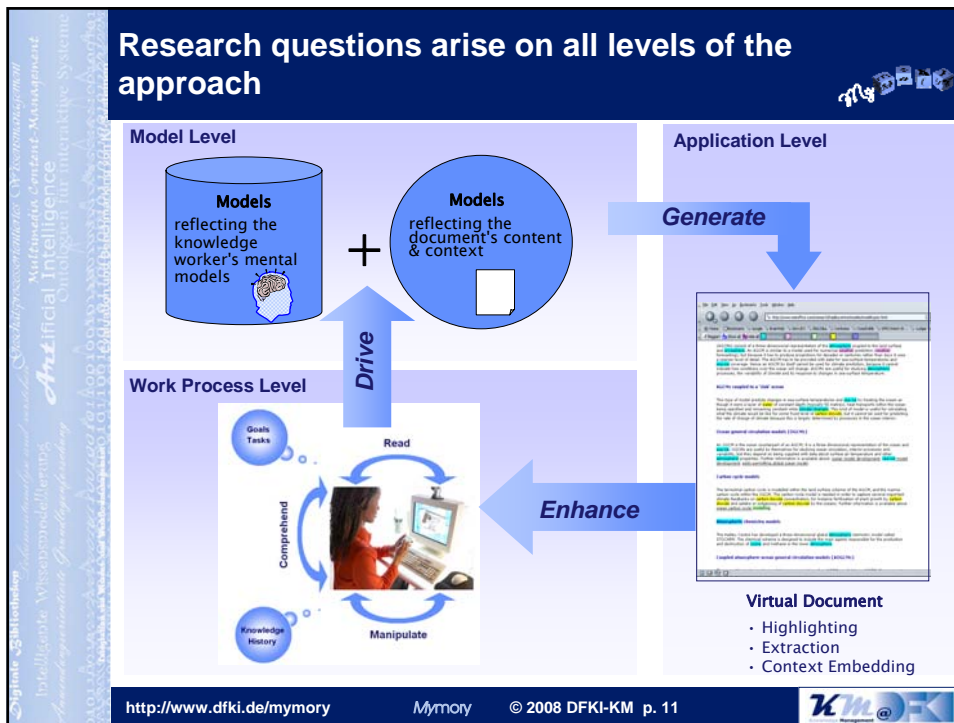


- ▶ **General characteristics**
 - About 80% of work is knowledge work
 - More than 50% of knowledge work is document-centered (10-90%)
 - Test persons estimate that 80% of their document work was captured by the questionnaire
- ▶ **Subgroup analysis**
 - >80% of the actions have been performed online at PC
 - ~33% of paper actions led to annotations vs. 11% with PC actions
 - ~36% of actions are single/isolated; most of the chained actions contain 2-3 "atoms", some up to 19.

Take the individual working style into consideration!

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Challenges for mixed textual and formal environments

- ▶ How can the *acquisition of (formal) knowledge* in such an environment be facilitated?
- ▶ How can the potential *complexity of formal annotations* during a document's life and use cycle be adequately handled?

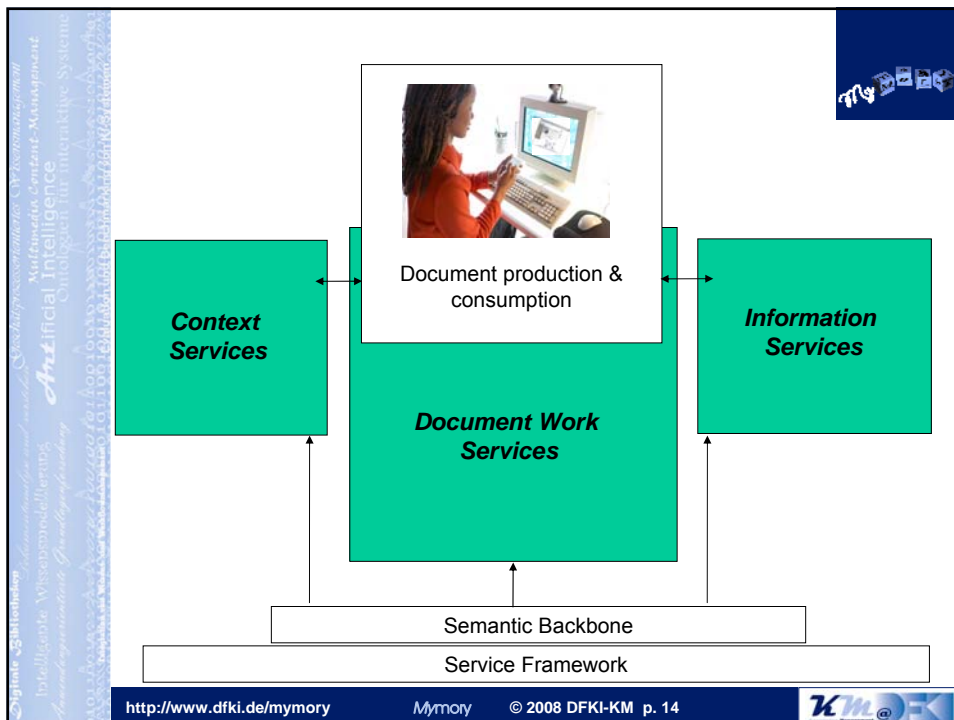
Information about a *user's work context*, her *attention* and *interaction with documents* may be a good guideline to find out which relations are worth being established and how they can be utilized for improved information handling.

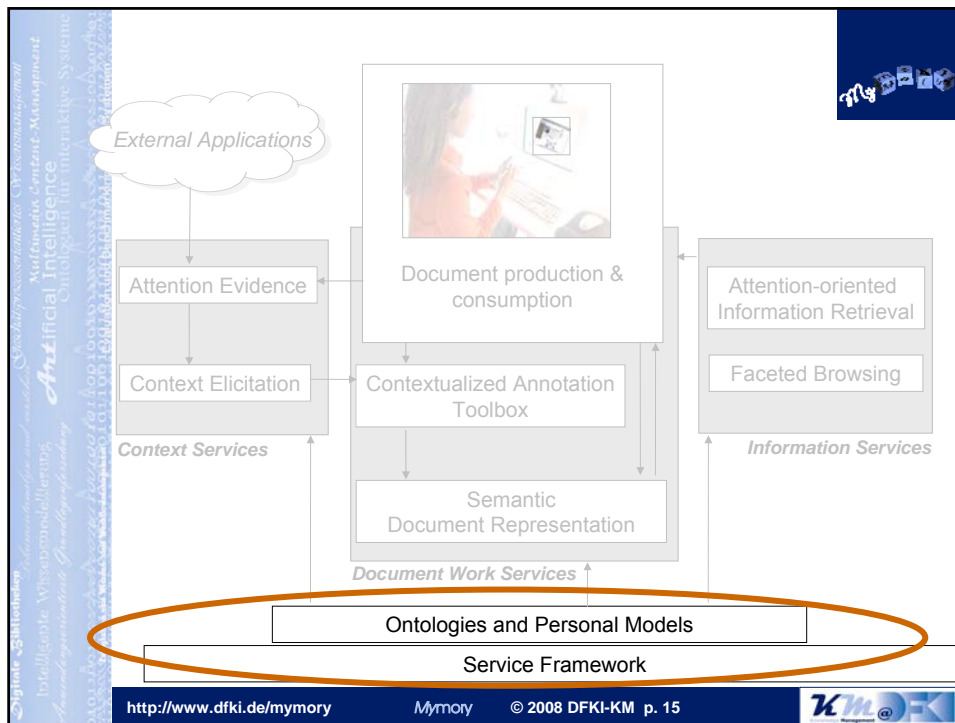
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Systems for *knowledge engineering* *knowledge workers*: Design principles



- ▶ **Tight coupling between business tasks and knowledge acquisition**
 - Separated knowledge maintenance processes tend to be omitted
 - User is in the right domain context
 - Subtle balancing necessary
- ▶ **As many automation as possible, as unobtrusive as possible**
 - while maintaining trust and control!
- ▶ **Multiple levels of formalization, user driven transitions between levels**
 - level of formalization normally constrains the potential services that can exploit the knowledge





Short remarks to infrastructure

- ▶ **Service Service Framework**
 - A middleware platform that enables loose and tight coupling of components (mainly on one user's desktop).
 - Supports multiple styles of (RDF/S-)model-driven implementation
 - <http://servicia.opendfki.de>
- ▶ **Personal Information Models (PIMo)**
 - Vocabulary for describing information elements on an individual desktop (persons, projects, locations, ...)
 - From tags and topic map expressivity to RDF/S
 - Intended applications: Instances, exploitation of relations, mappings to first order citizens of file systems and applications

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Personal Information Model *PIMO*

- ▶ documents, e-mails, websites are **"tagged"** with concepts
- ▶ represents **personal mental model**
- ▶ formal: **classes, concepts, relations** in RDFS
- ▶ basic classes **predefined**
- ▶ **user generated** classes, concepts, relations
- ▶ extensible with
 - organizational knowledge
 - ontologies
 - extracted data

The diagram illustrates a person (Claudia) interacting with a system. On the left, a 'Person' node is connected to 'The CID Project' (Topic), 'Management', 'Claudia', and 'Dirk'. 'The CID Project' is linked to 'Topic', 'Project', and 'Document'. 'Management' is linked to 'CID', 'CID slides', and 'Karlsruhe'. 'Claudia' is linked to 'Person' and 'Dirk'. 'Dirk' is linked to 'Person' and 'Location'. 'Project' is linked to 'Document'. 'Document' is linked to 'CID slides'. 'CID slides' is linked to 'Karlsruhe'. 'Karlsruhe' is linked to 'Location'. Below the person, there are three data sources: 'Files' (Documents, Papers, Projects, CID, Research), 'E-Mails' (Inbox, Todo, SAP, CID-proj, Karlsruhe), and 'Contacts' (Claudia Stern, Dirk Hagemann, Klaus Nord). A 'Data' section is also shown. A legend indicates: dashed blue arrow = 'is a', solid blue arrow = 'Relation', orange arrow = 'Annotation'.

PIMO - a Framework for Representing Personal Information Models
 Sauermann, van Elst, Dengel (2007)
<http://www.dfki.uni-kl.de/~sauermann/papers/sauermann+2007b.pdf>

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The architecture diagram shows the following layers and components:

- External Applications** (cloud icon) connects to **Attention Evidence**.
- Attention Evidence** and **Context Elicitation** are part of **Context Services**.
- Context Services** interacts with **Document production & consumption**.
- Document production & consumption** (with a person at a computer) feeds into the **Contextualized Annotation Toolbox**.
- The **Contextualized Annotation Toolbox** and **Semantic Document Representation** are part of **Document Work Services**.
- Document Work Services** interacts with **Context Switching**, **Attention-oriented Information Retrieval**, and **Faceted Browsing**, which are part of **Information Services**.
- Information Services** interacts with **Ontologies and Personal Models**.
- Ontologies and Personal Models** and **Service Framework** form the base of the system.

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A Wiki system narrows the gap between document consumption and generation

- ▶ **Wiki as a Personal Knowledge Tool**
- ▶ **Extension of Wiki System with Semantic Representation Capabilities**
 - allows for massive document annotation
- ▶ **Templates vs. flexible granularity:**
 - Arbitrary annotations can be added to any wiki page, paragraph, or individual words.
 - Context- and attention-oriented annotations need flexibility!

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Semantic Wikis enrich standard Wikis with machine-readable information

Semantic Web

navigation

- Main Page
- Tools
- Ontologies
- People
- Events

services

- Editing help
- Browse
- OWL/RDF feeds
- Recent changes

search

Go Search

toolbox

- What links here
- Related changes
- Upload file
- Special pages
- Printable version
- Permanent link
- Browse properties

page discussion edit history

Germany

Federal Republic of Germany is a country in Europe, that has Berlin as its capital. Further background information can be found in the [Wikipedia article about Germany](#).

Germany is bordered to the north by the North Sea, Denmark, and the Baltic Sea, to the east by Poland and the Czech Republic, to the south by Austria and Switzerland, and to the west by France, Luxembourg, Belgium and the Netherlands. Germany has 82,411,000 inhabitants and an area of 357,050km². Germany is a member of the European Union, the UN and the NATO.

City	Population
Berlin	3,391,407
Buxtehude	
Celle	72,000
Dresden	508,351
Freiburg	217,547
Halle (Saale)	240,000
Hamburg	1,769,117
Hannover	522,944
Karlsruhe	285,812
Koblenz	105,888
Leipzig	510,274
Marburg	79,139
Munich	1,300,000
Wiesbaden	300,427
Worms	85,829

page discussion edit history

Editing Germany

Warning: You are not logged in. Your IP address will be recorded in this page's edit history.

```

'''Federal Republic of Germany''' is a country in [[located in:Europe]],
that has [[has capital:Berlin]] as its capital. ({{Wikipedia pointer}})

Germany is bordered to the north by the [[borders:North Sea]],
[[borders:Denmark]], and the [[borders:Baltic Sea]], to the east by
[[borders:Poland]] and the [[borders:Czech Republic]], to the south by
[[borders:Austria]] and [[borders:Switzerland]], and to the west by
[[borders:France]], [[borders:Luxembourg]], [[borders:Belgium]] and the
[[borders:Netherlands]]. Germany has [[population:82,411,000]]
inhabitants and an area of [[area:357,050km²]]. Germany is a member of
the [[member of:European Union]], the [[member of:United Nations|UN]]
and the [[member of:NATO]].

{{#ask: [[Category:City]] [[located in:Germany]] | ?Population}}

{{location data}}

[[uses currency:Euro| ]]

{{ask}}

[[Category:Country]]
          
```

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"Massive annotation" scenarios have special demands



► Storage questions

- Annotations are stored separately from the text as the amount of expected data (eyetracker, context) is expected to make in-document storage impractical.
- Annotations consist of a starting and ending character position and the annotation data itself.
- Challenge: Keeping annotation data in sync with documents.

license1	General Public License 2.0	
label "GPL 2.0"	Preamble	preamble1
has_preamble	...	
preamble1	Terms and Conditions	
terms_cond	0. ...The "Program", below, refers to any...	definition1
definition1,	1. You may copy and distribute...	permission1
permission1	provided that you...keep intact all notices...	activity activity1
activity1 		requirement requirement1
requirement1 		

- The semantic wiki system **Kaukolu** has been developed open source as an extension of JSPWiki.



Annotations can origin from manual and automatic processes



► Manual annotations

- can use concepts from the user's Personal Information Model or arbitrary RDF/S ontologies and associate them with text passages, e.g.,
 - Permissions can be parts-of a license
 - A Permission consists-of requirements and an activity.
- graphical annotations/freehand drawings are supported (Tablet PC)
- also meta-data like ratings, e.g.
 - "I like the GPL license very much."

► Automated annotations

- From context services
 - Grouping of annotations
 - Attention annotations

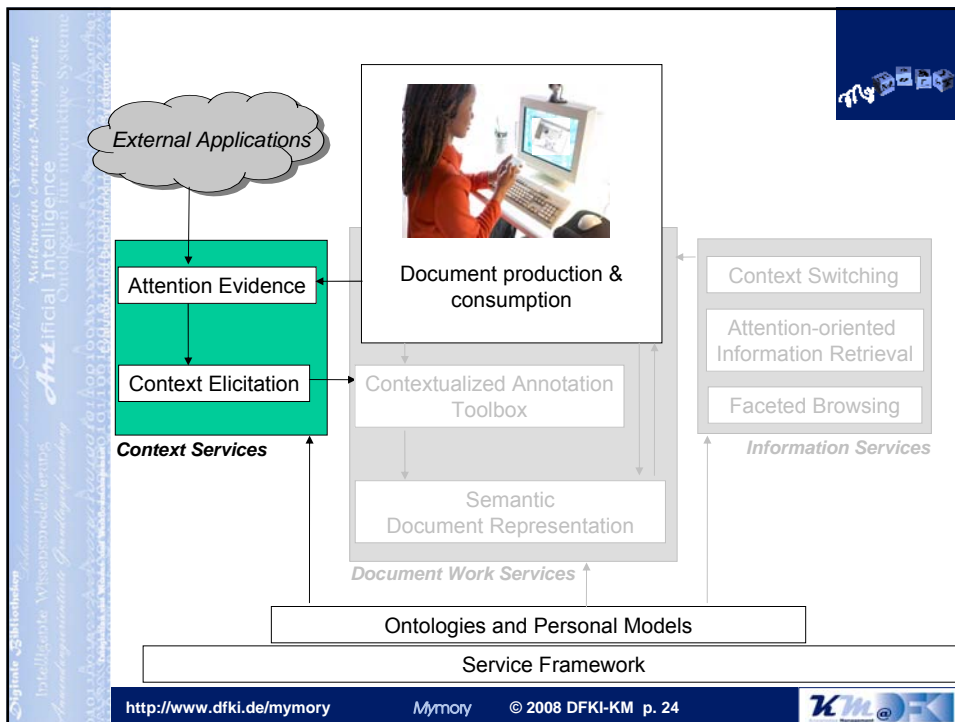


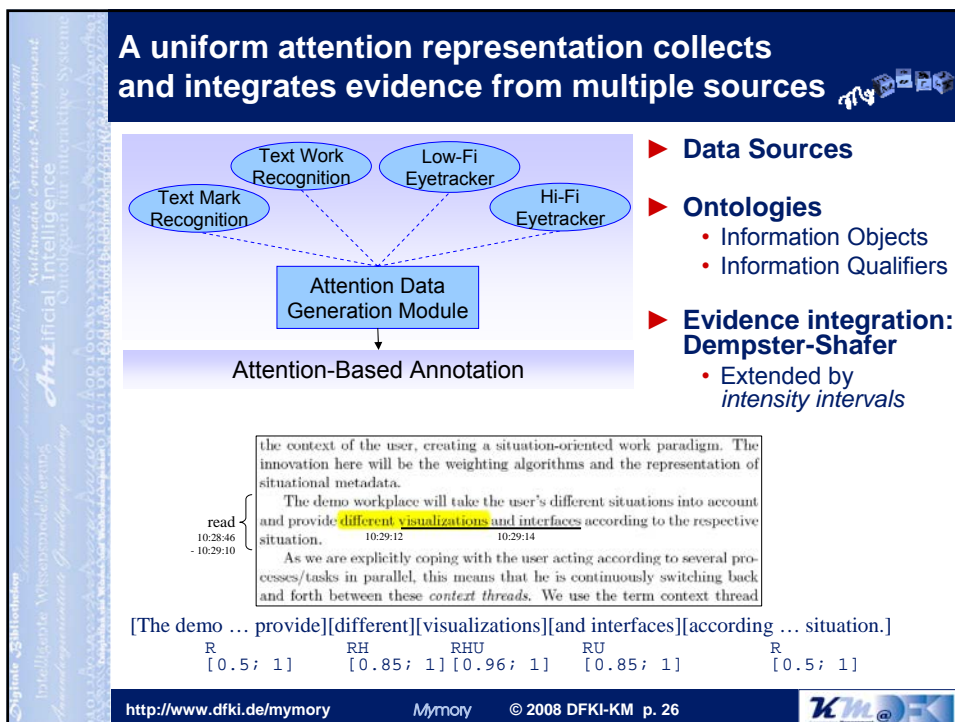
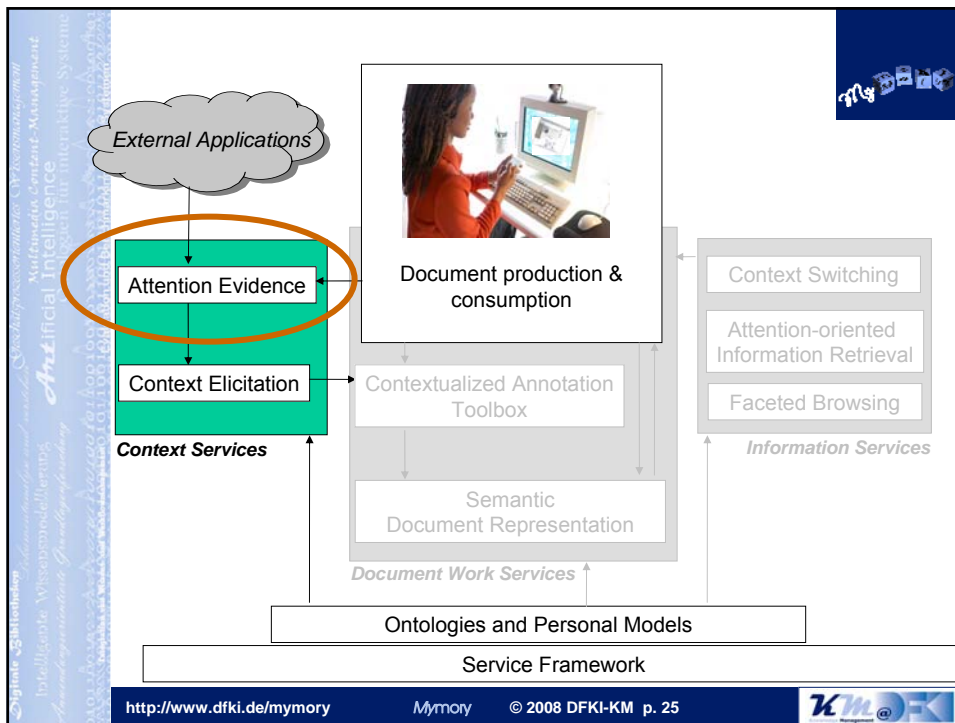
Manual annotations can be added via a faceted interface

The screenshot shows the Kaulowiki web interface. At the top, there is a search bar and a 'Find!' button. Below the search bar is a navigation menu with options like 'Main page', 'About', 'Recent Changes', 'Wiki Etiquette', 'Find pages', 'Unused pages', 'Underlined pages', and 'Page Index'. The main content area displays the 'GNU General Public License 2.0' document. On the right side, there is an 'Add New Annotation' form with a dropdown menu for 'Select the annotation's target URI' and a text input field for 'Select the annotation's target URI:'. The form also includes a 'Your selection was:' section and a 'license.Permission_to_copy_Source_Form' dropdown.

General or domain specific heuristics can ease facet selection.

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Artificial Intelligence

Mathematisches Content-Management


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State-of-the-art eye tracking device serves as high precision source for attention evidence



- ▶ **Tobii 1750 eye tracker has an accuracy of around ± 20 pixel**
- Allows the detection of fixations and detailed eye movements




→ DEMO

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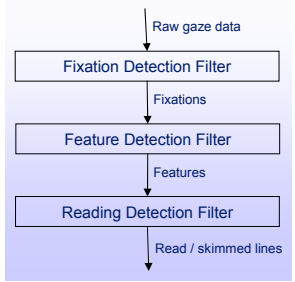
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State-of-the-art eye tracking device serves as high precision source for attention evidence



- ▶ **Tobii 1750 eye tracker has an accuracy of around ± 20 pixel**
- Allows the detection of fixations and detailed eye movements
- ▶ **Filter chain mechanism to accumulate and process the raw gaze data and come to more abstract gaze representations**






```

graph TD
    A[Raw gaze data] --> B[Fixation Detection Filter]
    B --> C[Fixations]
    C --> D[Feature Detection Filter]
    D --> E[Features]
    E --> F[Reading Detection Filter]
    F --> G[Read / skimmed lines]
    
```

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Mymory

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From eye movements to document work: Detecting the reading mode

▶ **Main Question:**

How can we come from raw data to "meaningful" models of cognitive processes during knowledge work?

▶ **Reading behavior consists of very characteristic eye movements:**

- Fixations
- Forward saccades
- Regressions

Four major brain waves exist: alpha has a frequency that ranges from 8 to 14 cycles per second (cps).

▶ **First step: Algorithm for detecting reading vs. skimming**

- Detect fixations
- Classify the transition from one fixation to another (→ feature)
- Apply scores to the detected features
- Classify a list of successive features as "read" or "skimmed" (based on score thresholds)

See: G. Buscher, A. Dengel, L. van Elst, F. Miffag.
 Generating and Using Gaze-Based Document Annotations ,
 In: CHI '08 extended abstracts on Human factors in computing systems.

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From saccades to gaze-based document annotations

1. **Reading detection algorithm detects reading or skimming behavior**

Four major brain waves exist: alpha has a frequency that ranges from 8 to 14 cycles per second (cps) and is found in the occipital part of the brain. Beta covers 14 to 30 cps. Delta wave includes frequencies that are below 5 cps. Theta wave covers the range between 5 and 8 cps. Alpha waves are more active during relaxation and light sleep. Nonetheless, their function is altered by deep mental activities. Beta waves, on the other hand, appear during mental concentration periods.
2. **Due to eye tracker inaccuracies the lines detected as read or skimmed often differ from the actual text rows**

Four major brain waves exist: alpha has a frequency that ranges from 8 to 14 cycles per second (cps) and is found in the occipital part of the brain. Beta covers 14 to 30 cps. Delta wave includes frequencies that are below 5 cps. Theta wave covers the range between 5 and 8 cps. Alpha waves are more active during relaxation and light sleep. Nonetheless, their function is altered by deep mental activities. Beta waves, on the other hand, appear during mental concentration periods.
3. **Application of OCRopus for online recalibration and line matching**


Four major brain waves exist: alpha has a frequency that ranges from 8 to 14 cycles per second (cps) and is found in the occipital part of the brain. Beta covers 14 to 30 cps. Delta wave includes frequencies that are below 5 cps. Theta wave covers the range between 5 and 8 cps. Alpha waves are more active during relaxation and light sleep. Nonetheless, their function is altered by deep mental activities. Beta waves, on the other hand, appear during mental concentration periods.
4. **Gaze-annotation generation and storage in Kaukolu**


Annotation (Read) Delete author: Georg start date: 06.01.2008 15:25:06 end date: 06.01.2008 15:25:21 read: 75.2% skimmed: 24.8%	Four major brain waves exist: alpha has a frequency that ranges from 8 to 14 cycles per second (cps) and is found in the occipital part of the brain. Beta covers 14 to 30 cps. Delta wave includes frequencies that are below 5 cps. Theta wave covers the range between 5 and 8 cps. Alpha waves are more active during relaxation and light sleep. Nonetheless, their function is altered by deep mental activities. Beta waves, on the other hand, appear during mental concentration periods.
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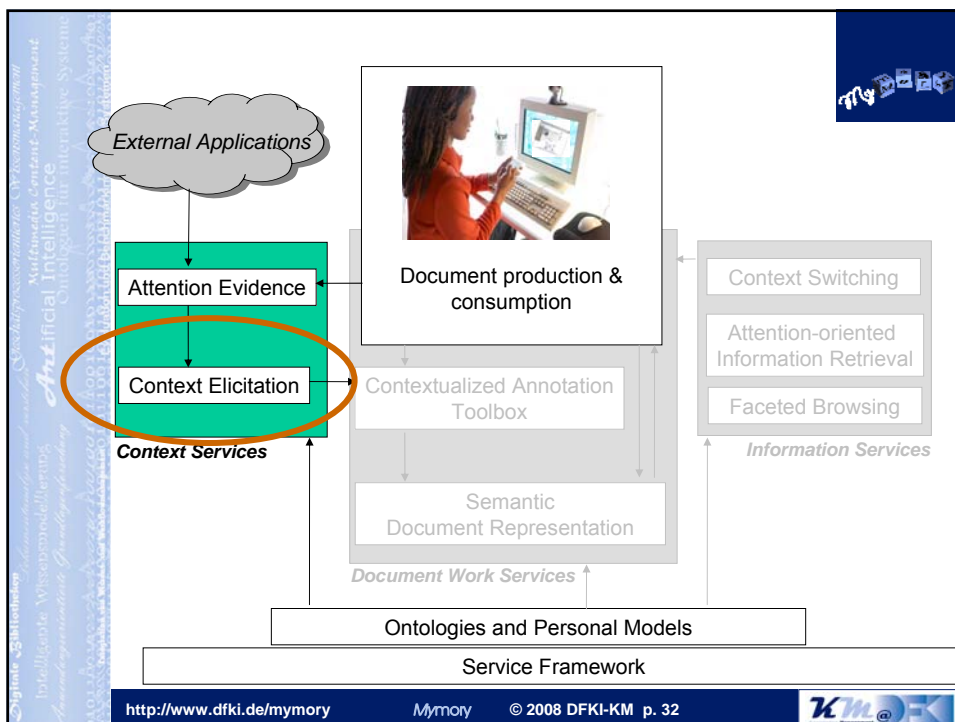
Demo





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Context models reflect today's working style



- ▶ **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 user observation component monitors the user's activities and feeds a representation of his/her context.**
- ▶ **Context services**
 - Identify the current context, and
 - Detect context switches

The user's current work context model frames corresponding annotations.



The attention pipeline is with fed with additional sources of evidence



- ▶ **User observation monitors handling of information objects.**
 - **userobservation.opendfki.de** as open-source platform with shared user action ontology
 - Mozilla plugins observe email + web browsing
 - Filesystem observer
 - PAS logger (L3S): observe window management
 - Camera-based document recognition (from Prof. Kise, Osaka Prefecture University) was integrated as real-time bridge to Gutenberg's world.
- ▶ **Explicit attention indicators (e.g., highlighting) are captured within the document workbench.**



NEPOMUK



大阪府立大学
Osaka Prefecture University



A Personal Information Model (PIMO) provides the basic vocabulary for context modeling

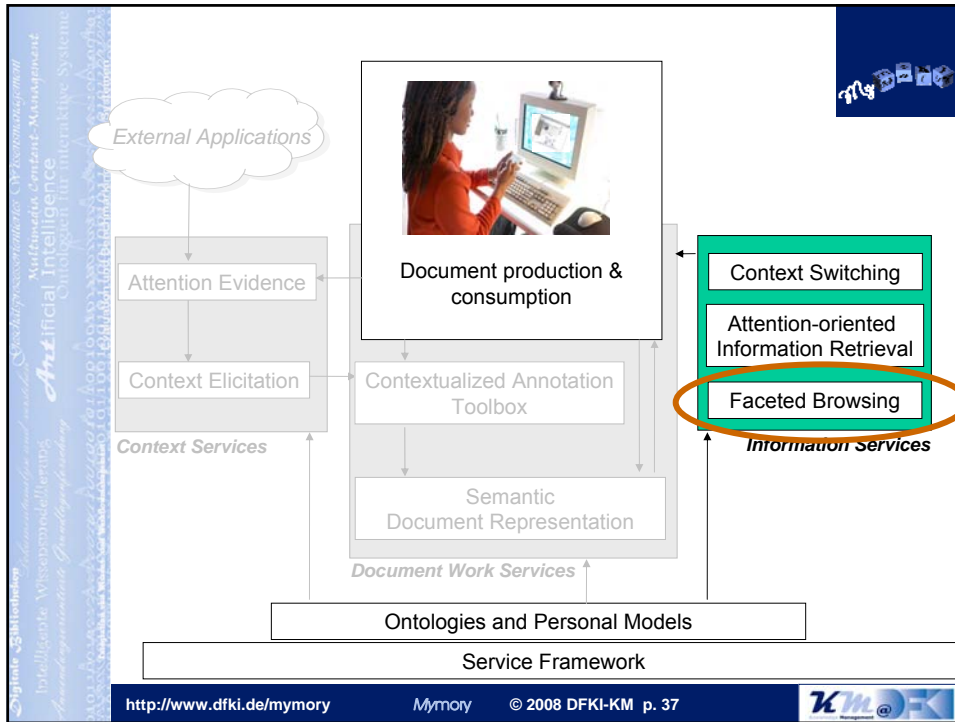
The diagram illustrates the PIMO architecture. On the left, a **User** interacts with a **User Observation Hub**, which feeds into a **NOP** (Non-Overlapping) component. This leads to a **hop2ce** component, which outputs **relevant PIMO Concept(s) = CE(s)**. These concepts, along with a **stimulus**, are processed by an **entailment spreading** component. The output of this process is fed into an **attention pipeline**, which is divided into **short-term**, **medium-term**, and **long-term** memory stages. The PIMO itself is shown as a central hub containing **Ontologies** (The CD Project, Topic, Project, Management, Document, Check, CD tasks, Person) and **Data** (Files, E-Mails, Contacts, Documents, Papers, Projects, Research, Inbox, Todo, SAP, CD Project, Website, Claudia Stamm, Dirk Hagemann, Klaus Nord).

Attention data is used to build a **model** of the user's current **work context** by weighting the concepts in her Personal Information Model.

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The diagram shows a layered service architecture. At the base is the **Service Framework**, which supports **Ontologies and Personal Models**. Above this is **Document Work Services**, which includes **Semantic Document Representation** and **Contextualized Annotation Toolbox**. **Context Services** (including **Attention Evidence** and **Context Elicitation**) interact with **External Applications** and **Document production & consumption**. **Information Services** (including **Context Switching**, **Attention-oriented Information Retrieval**, and **Faceted Browsing**) also interact with **Document production & consumption**.

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Filters support search in the personal semantic wiki

- ▶ **Page Filters**
 - standard wiki search (full text page content search, search by author, search by modification date)
- ▶ **Annotation Filters**
 - searching for paragraphs with a matching Kaukolu annotation. Annotations can be filtered using facets derived directly from their RDF representation which is useful when handling annotations based on arbitrary ontologies.
- ▶ **Context Filters**
 - filtering by an annotation's context, either searching for a specific context, or an activated PIMO concept within the context.
- ▶ **Combinations of Simple Filters**
 - AND, OR

Vertical text on the left side of the slide reads: "Digitale Bibliothek, Künstliche Intelligenz, Informationsmanagement, Ontologien für interaktive Systeme".

Footer: <http://www.dfki.de/mymory> MyMory © 2008 DFKI-KM p. 38

Filter example: Ontological annotations



Advanced Search


Find Documents
Create New Document

Active Constraints	Facets	Restriction Values
<p>Annotation Filter</p> <p><input type="checkbox"/> Type: some Permission having:</p> <div style="display: flex; justify-content: space-between; margin-top: 10px;"> Filter Operator Shortcut </div>	<p>rdf:type creator author created created comment createdInContext activePIMOConcept activity condition</p>	<p>CopyAnnotation 7513a800-6391-4631-8...</p> <div style="display: flex; justify-content: space-between; margin-top: 10px;"> Apply Wildcard Range </div>


Search Results

GNU_General_Public_License_2_0_Text Top

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Filter example: Attention annotations



Filter Annotations

Author: All | All

Filter Annotations

Author: All | Created: All | Context: Active-Licensing | Pimo: All | Eyetracker Annotations: Show unred as gray

Icon Mode: on Mode

BertsBlog

Bert's personal EPOS project history

Bert's personal EF

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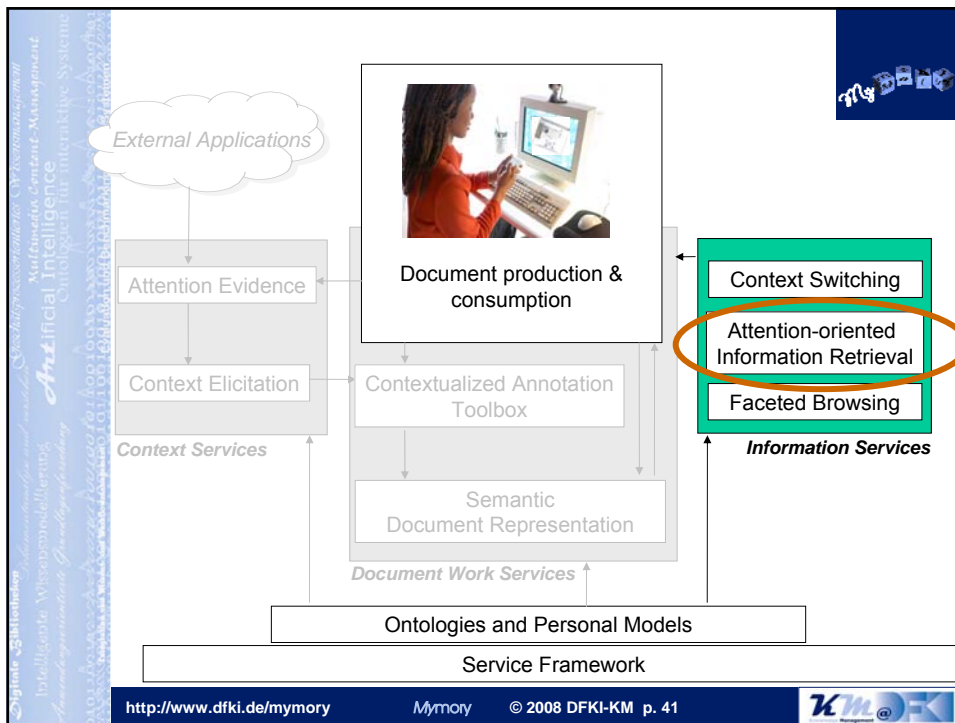
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Search results can be fused into report documents, maintaining *provenance* relations.

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Attention-based document index

- ▶ Attention-based desktop index to search for attention-enhanced documents
 - Improves re-finding of known material
 - Even if main topic of a document and topic of interest are different

1. Reading a document

Whales

Paragraph about Ultrasound

2. Searching for: Ultrasound

Common search	Attention-enhanced search
1. Ultrasound	1. Ultrasound
2. Sound Frequencies	2. Sound Frequencies
3. Car parking aids	3. Whales
4. Medical Sonography	4. Car parking aids
...	5. Medical Sonography
61. Whales	...

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Attention-based IR evaluation (1): Gaze-based query expansion and re-ranking

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- ▶ **Assumption:** The user's visual attention is valuable information for estimating the thematic context more precisely.
- ▶ **Study (21 subjects)** for analyzing the effect of gaze-based annotations on web search using query expansion and re-ranking.

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Three Implicit Feedback Methods to Evaluate

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Input: viewed documents 	Gaze-Filter		TF x IDF based on read or skimmed passages
	Gaze-Length-Filter		Interest(t) x TF x IDF based on length of coherently read text
	Reading Speed		ReadingScore(t) x TF x IDF based on read vs. skimmed passages containing term t
	Baseline		TF x IDF based on opened entire documents

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Study Design

1. Informational task given
 - 2 different tasks
 - Task description in simulated email
 - Participants had to imagine being journalists
2. Read pre-selected documents
 - Email attachments
 - Document structure carefully chosen
3. Search for more information on Wikipedia
 - 3 different queries:
 - main topic, sub-topic, related topic
4. Give relevance feedback for the first 20 result entries per query

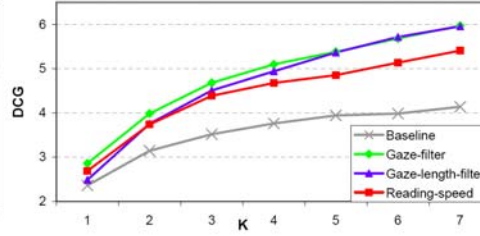
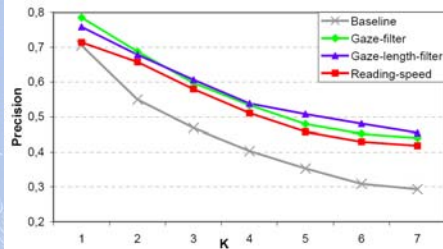
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Task Example

- ▶ Topic: perceptual organs of animals
- ▶ Pre-selected documents: 4 Wikipedia articles about cats, sharks, dogs, bats
 - The articles described all facets of the species.
 - Each article contained several paragraphs dealing with perception-related issues.
- ▶ 3 different queries
 - Main topic query: more material about perception
 - Sub-topic query: more material about visual perception
 - Related-topic query: perceptual organs for the earth's magnetic field

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Precision and Discounted Cumulative Gain (DCG)



$$\text{precision} = \frac{|\{\text{relevant documents}\} \cap \{\text{retrieved documents}\}|}{|\{\text{retrieved documents}\}|}$$

$$\text{DCG}_p = \sum_{i=1}^p \frac{2^{\text{rel}_i} - 1}{\log_2(1 + i)}$$

- ▶ Result: considering gaze-based annotations for query expansion can **enhance the precision** of the search result ranking by **20% on average**.

See: G. Buscher, A. Dengel, L. van Elst.
Query Expansion Using Gaze-Based Feedback on the Subdocument Level, SIGIR '08.



Attention-based IR evaluation (2): Predicting relevance from eye movements

- ▶ Explicit relevance feedback is an important method for enhancing the ranking of search results. However, it is rarely used: too much decision effort.
- ▶ *Assumption:* Eye movements partly reflect cognitive processes → study to predict relevance from eye movements (19 participants, 266 relevance ratings)
- ▶ Application of our reading detection method to find expressive eye movement measures, e.g.:
 - Simple measures like fixation duration and saccade length
 - Sophisticated measures like the ratio of read lines to skimmed lines

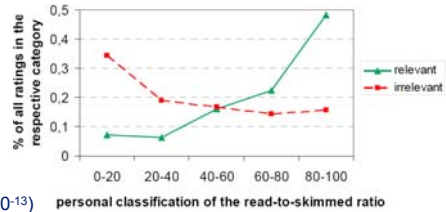


Attention-based IR evaluation (3): Predicting relevance from eye movements

- ▶ Read/Skimmed Lines Ratio Can be Used to Predict Relevance

- ▶ **Relevance prediction test based on the eye movement measures:**

- Positive prediction value: **85%**
- Sensitivity: **75%**
- Specificity: **73%**
- Significance: **high ($< 10^{-13}$)**



$$PPV = \frac{\text{number of True Positives}}{\text{number of True Positives} + \text{number of False Positives}}$$

$$\text{sensitivity} = \frac{\text{number of True Positives}}{\text{number of True Positives} + \text{number of False Negatives}}$$

Previous studies reported values up to:

- Positive prediction value: ca. **70%**
- Sensitivity: ca. **35%**

$$\text{specificity} = \frac{\text{number of True Negatives}}{\text{number of True Negatives} + \text{number of False Positives}}$$

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External Applications

Attention Evidence

Context Elicitation

Context Services



Document production & consumption

Contextualized Annotation Toolbox

Semantic Document Representation

Document Work Services

Context Switching

Attention-oriented Information Retrieval

Faceted Browsing

Information Services

Ontologies and Personal Models

Service Framework


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Knowledge worker's (digital) work

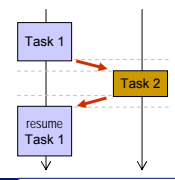
- ▶ Basically, knowledge workers
 - work with documents
 - use office applications

- ▶ Particularly, knowledge workers
 - have to deal with multiple tasks "in parallel"
 - are often interrupted during work

- ▶ Task switching force workers to
 - stop current task
 - close current documents/applications
 - start/resume another task
 - open new/former documents/applications









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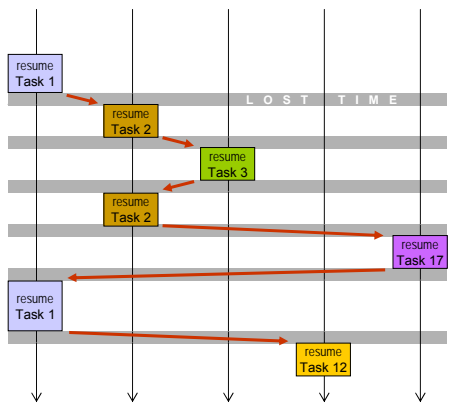
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Multi-tasking is expensive

- ▶ Tasks in parallel
 - tasks *never* finished
 - interleaved task execution
 - => halt + resume tasks

- ▶ Task switching overhead
 - halt + store current state:
close windows, write note about state
 - remember/recall other task's state:
find folders, URLs
 - recover other state:
open docs
 - resume other state




Goal: Reduce task switching overhead !

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Multi-desktop paradigm is a good start

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Multiple desktops can be used to organize daily work in alternative ways

- ▶ **tool oriented:**
each desktops provides a special set of applications to suite a special class of tasks
 - communication desktop: mail + chat
 - hacking desktop: eclipse, javadoc
 - music desktop: iTunes, ...
 - news and web desktop: firefox
- ▶ **task oriented:**
each desktop contains the material and information needed to accomplish one specific task
 - organizing trip to HS Furtwangen
 - preparing slides for Furtwangen talk
 - discussing colleagues attention experiment
 - supervising diploma thesis Jan Haas

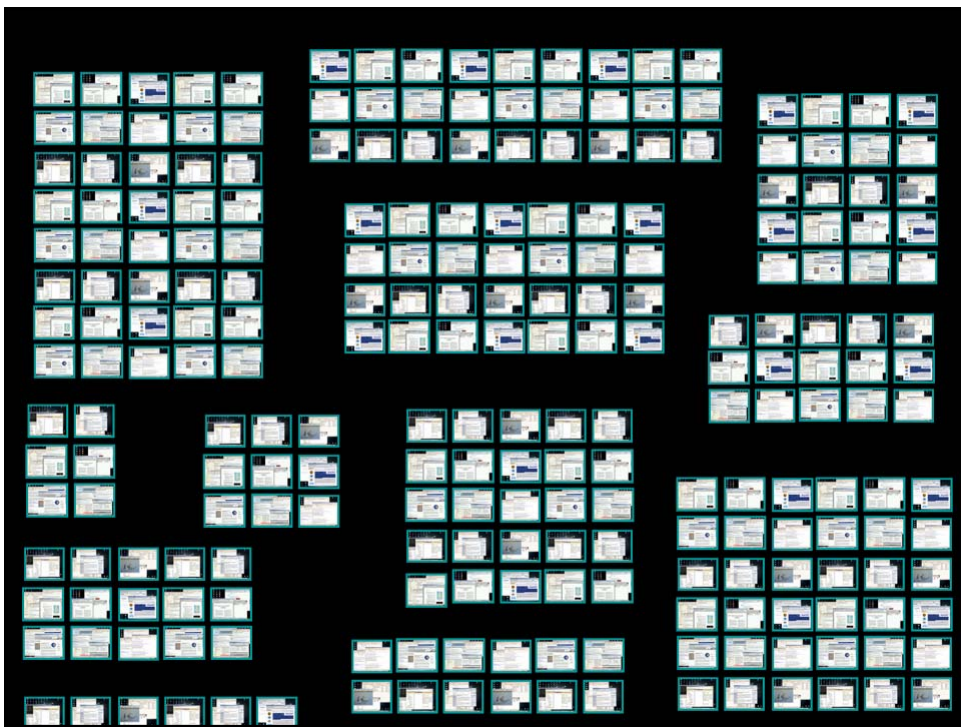
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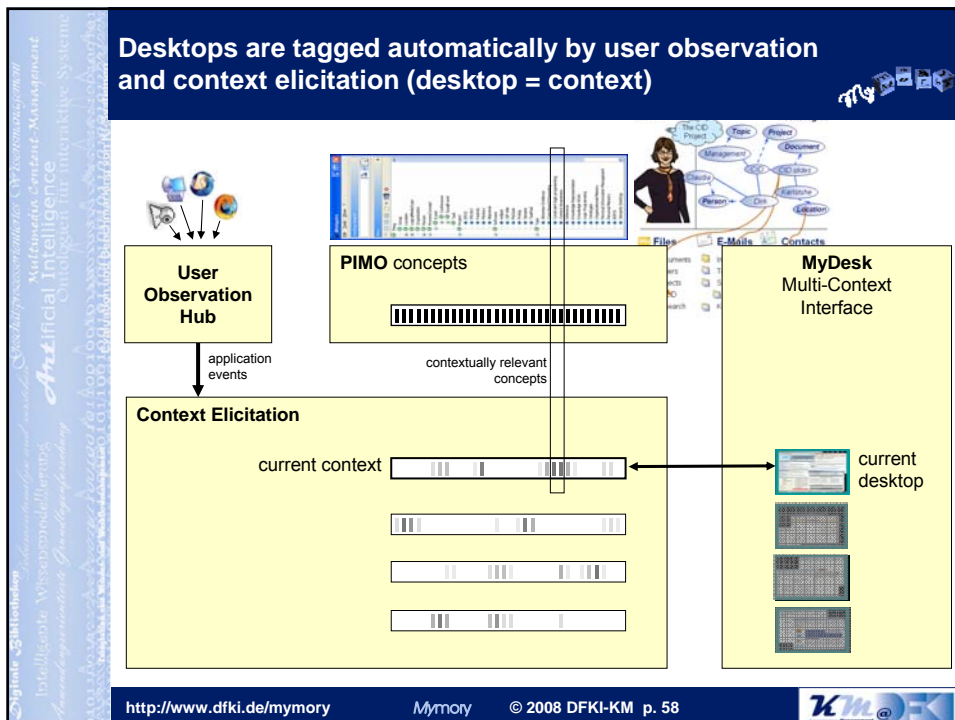
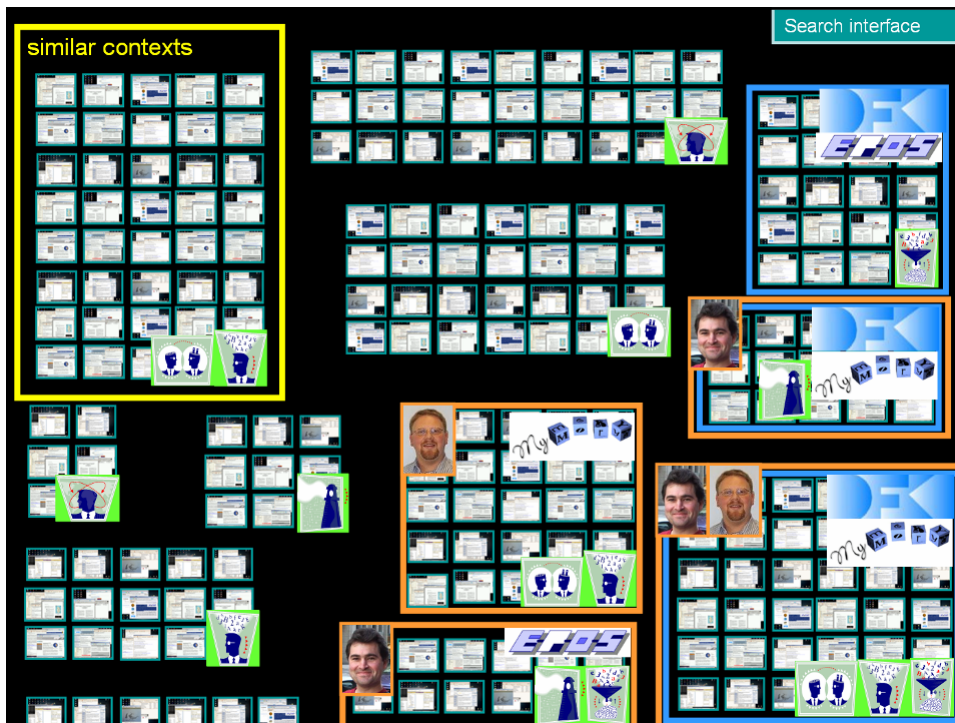
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Extensions to traditional Multi-Desktop

- ▶ Arbitrary, increasing amount of desktops
 - One (new) desktop for each (new) task => many desktops
- ▶ Meta-data for desktops
 - Annotate desktops with context information (automatically)
- ▶ Sophisticated user interfaces
 - Visualize / cluster / search / filter / switch desktops
- ▶ Persistent storage of desktop state
 - Store / restore application windows + open documents

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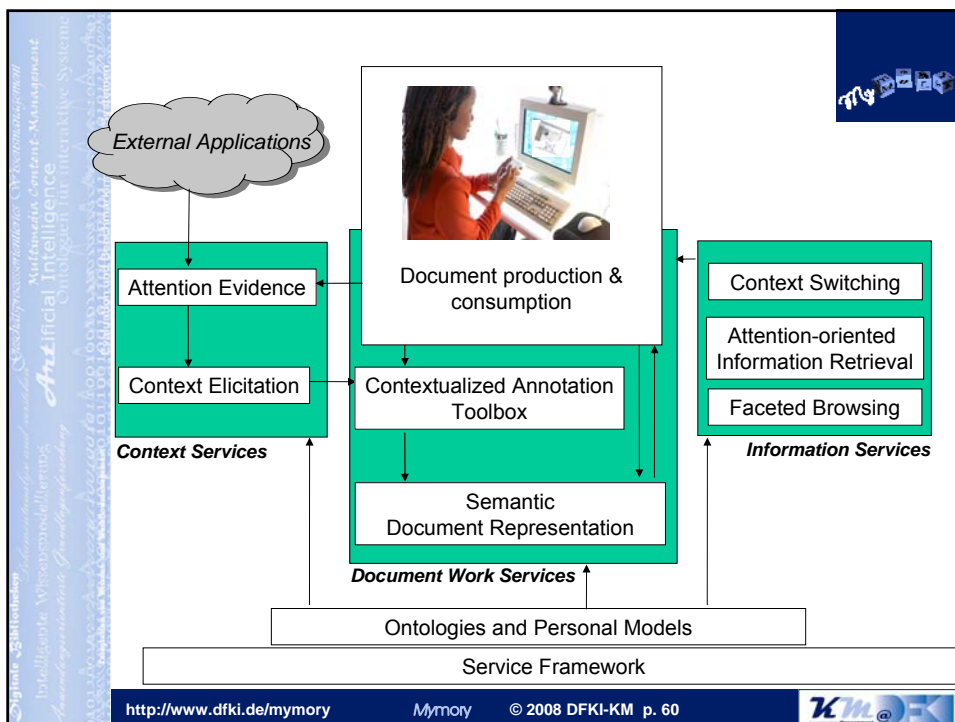
“MyDesk“ adapts the multi-desktop paradigm and realizes a context switching interface

my

<http://mydesk.opendfki.de>


- Desktop switching (Windows, C#)
→ Visibility-Trick (Hide/Show)
- Timeline of desktops (like ALT+TAB)
- Manual 2-dim. layout of desktop
- Manual/autom. tagging of desktops
- Searching/filtering desktops
- Persistency of desktop state
→ Store/restore open windows

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Summary: Key features and principles



- ▶ **Semantic Wiki**
 - Document generation, consumption, and annotation integrated
- ▶ **Automated Annotation**
 - Attention estimation
 - Context elicitation
- ▶ **Exploitation of Added Knowledge**
 - Manually by filters
 - Attention valuable within extended IR
- ▶ **Level of Formalization is Driven by User**

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Physical workplace(s)





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Living Lab
Virtual Office

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Some Mymory Publications



▶ Eye Tracking & Information Retrieval

- G. Buscher, A. Dengel, L. van Elst. [Query expansion using gaze-based feedback on the subdocument level](#), In: *SIGIR '08: Proceedings of the 31st annual international ACM SIGIR conference on Research and development in information retrieval*, Singapore, pp. 387-394, 2008.
- G. Buscher, A. Dengel, L. van Elst. [Eye Movements as Implicit Relevance Feedback](#), In: *CHI '08 extended abstracts on Human factors in computing systems*, pp. 2991-2996, April 2008.
- G. Buscher, A. Dengel, L. van Elst, F. Mittag. [Generating and Using Gaze-Based Document Annotations](#), In: *CHI '08 extended abstracts on Human factors in computing systems*, pp. 3045-3050, April 2008.

▶ Context Elicitation and Switch Support

- S. Schwarz, M. Kiesel, L. van Elst. [Adapting the Multi-Desktop Paradigm Towards a Multi-Context Interface](#). In: *Fifth International Workshop Modeling and Reasoning in Context at Human Centered Processes (HCP-2008)*.
- S. Schwarz. [A Context Model for Personal Knowledge Management Applications](#), In: T. Roth-Berghofer, S. Schulz, and D.B. Leake (Eds.), *Modeling and Retrieval of Context*, pp. 18-33, LNCS 3946, Springer, 2006.

▶ Semantic Wiki & Mymory Roundtrips

- L. van Elst, M. Kiesel, S. Schwarz, G. Buscher, A. Lauer. [Contextualized Knowledge Acquisition in a Personal Semantic Wiki](#). In: A. Gangemini, J. Euzenat (Eds.) *Proceedings of 16th International Conference on Knowledge Engineering and Knowledge Management (EKAW 2008)*, Springer LNCS 5268, pp. 172-187, 2008.
- M. Kiesel, S. Schwarz, L. van Elst, G. Buscher. [Using Attention and Context Information for Annotations in a Semantic Wiki](#), In C. Lange, S. Schaffert, H. Skaf-Molli, M. Völkel (Eds.) *Proceedings of the 3rd Semantic Wiki Workshop (SemWiki 2008) at the 5th European Semantic Web Conference (ESWC 2008)*, Tenerife, Spain, June 2nd, 2008, CEUR-WS 360.
- M. Kiesel, S. Schwarz, L. van Elst, G. Buscher. [Mymory: Enhancing a Semantic Wiki with Context Annotations. Demonstration](#), System Demonstration at the 5th European Semantic Web Conference (ESWC) (Demo Paper).



Thank you for your attention!

Questions, Suggestions, and Discussions

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