Weakly-structured Workflows for Knowledge-intensive Tasks: An Experimental Evaluation

L. van Elst, F.-R. Aschoff,
A. Bernardi, H. Maus, S. Schwarz

German Research Center for Artificial Intelligence (DFKI)

- Knowledge Management Department -

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Agenda

- Concept: Weakly-structured workflows for BPOKM
- Design of experimental evaluation
- Experimental results

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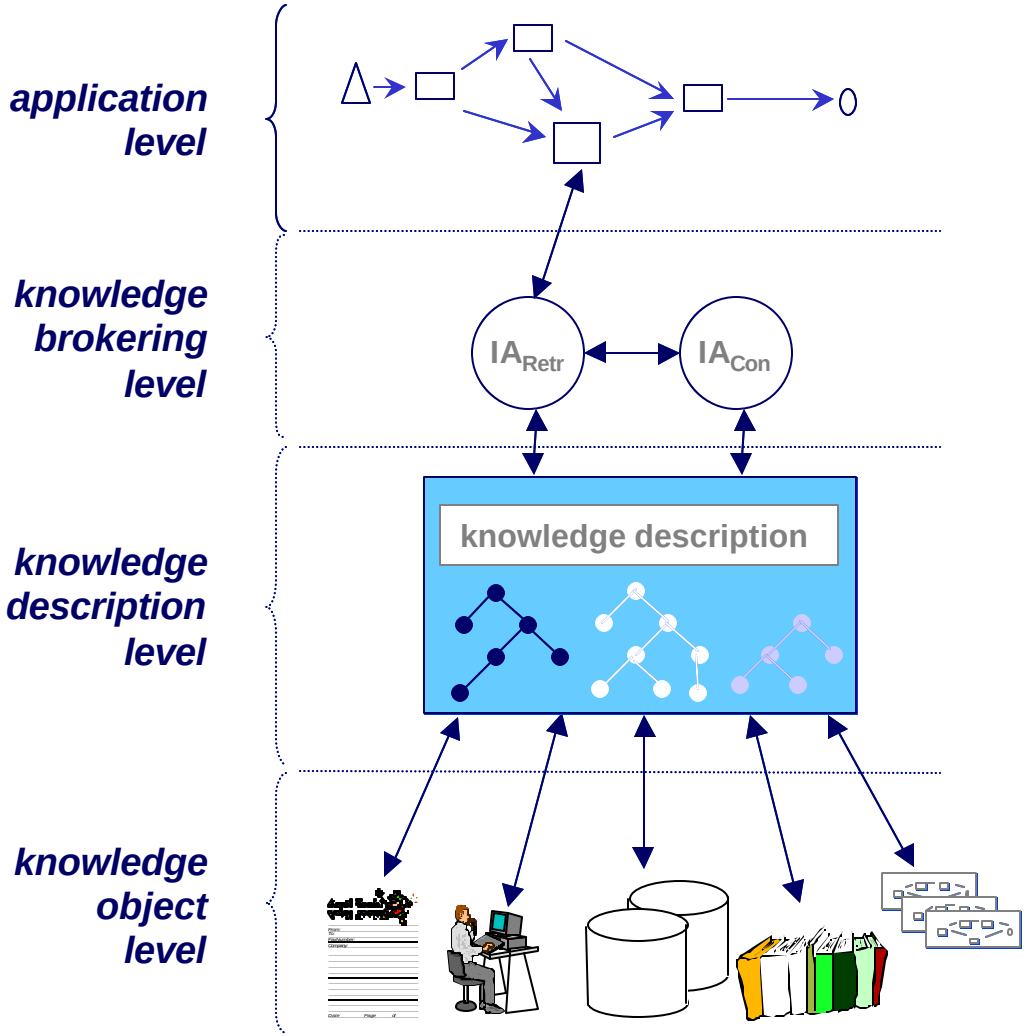
Background/History: KnowMore (Abecker et al., 1998) Framework for Organizational Memory Information Systems



- Knowledge workers are involved in complex processes
- Process models and their enactment provide context information and facilitate proactivity
- Ontologies are the explicit basis for the knowledge-level description
- Access to various information sources relies on formal knowledge-item descriptions

Knowledge management addresses context-specific, proactive delivery of information

FRODO creates a conceptual and technical framework to build a distributed OM for knowledge-intensive work

- From **central** to **distributed** Organizational Memories
  - A monolithic, central OM is *seldom feasible*
  - Central OMs neglect the reality (and opportunities) of the *distributed nature of knowledge* in companies

  ➔ The FRODO framework facilitates *societies of cooperating agents* as a basis for distributed organizational memories, especially
    - distributed ontology management and
    - cooperative specialists for information retrieval

- From **strict** process models to **weakly-structured** workflows
  - Traditional models for business processes are ill-suited for knowledge-intensive work
  - Users are ignored as source for process knowledge

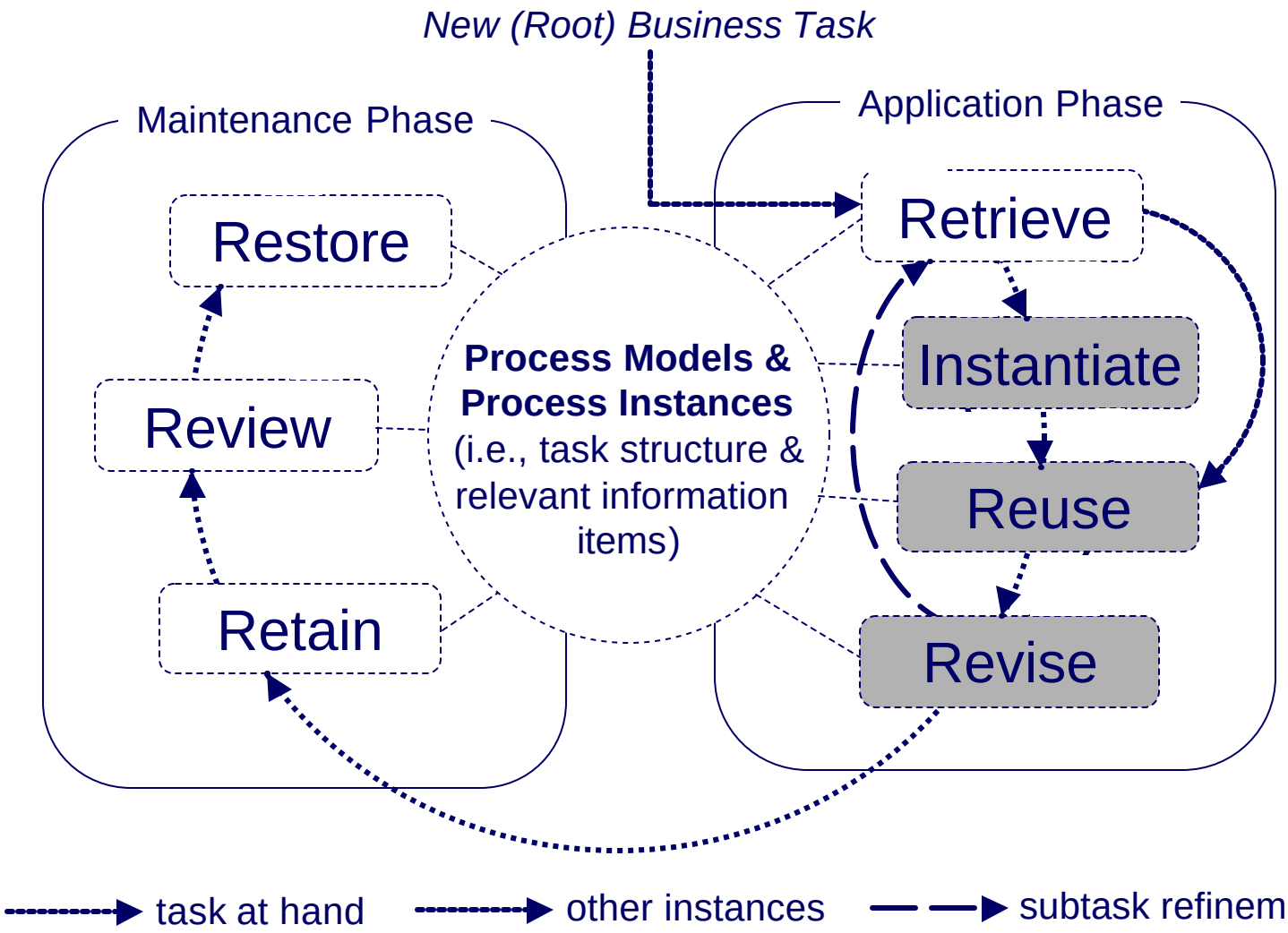
  ➔ FRODO supports complex, dynamically configured processes

Knowledge-intensive work processes are modelled by weakly-structured workflows

- **A weakly-structured workflow consists of knowledge-intensive tasks**
  - which are not necessarily defined a-priori
  - but abstract structures are usually known
- **Weakly-structured workflows evolve over lifetime**
  - they can - but need not to - follow the structure of underlying models
  - exact structural repetitions are seldom, but there is a multitude of 'similar' tasks
  - workflow instances can be modeled and refined during runtime
    i.e., lazy modeling, late modeling
  - hierarchical refinement of tasks leads to structured workflow instances
- **Workflow instances represent valuable process knowledge**
  - tasks are worth to be supported and preserved (e.g., for best/worst practices)
  - typical instances are generalised to 'templates', i.e., task models

FRODO TaskMan exhibits the core functionalities needed to support knowledge-intensive work

Life- and use cycle of process models can be described as variant of a standard case-based reasoning cycle



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Of course, there are a lot of questions to such an approach

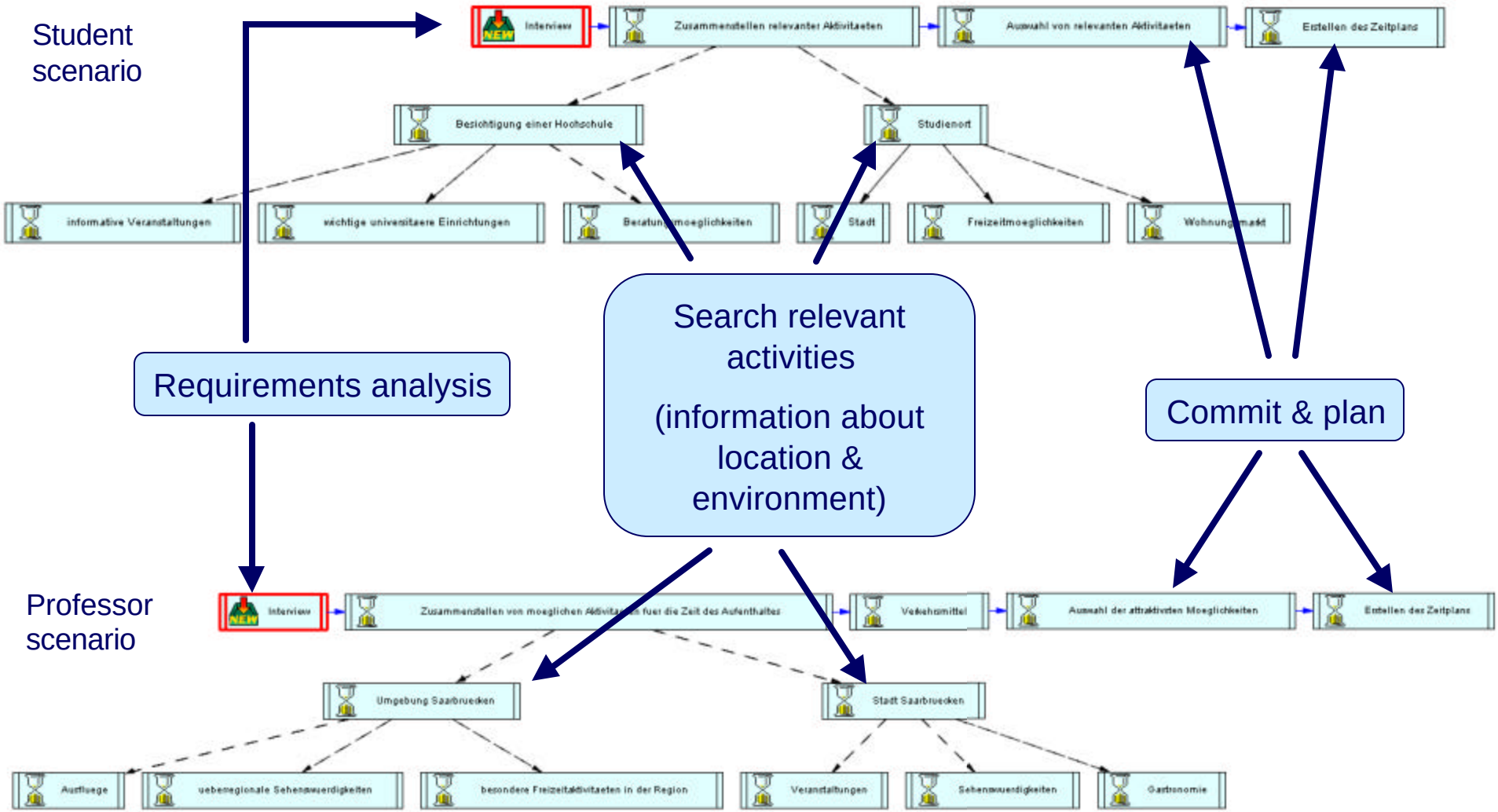
- Are weakly-structured workflows a useful basis for support of knowledge-intensive activities?
- Is integration of process execution and information support accepted and considered of benefit?
- Is process-embedded information a means of knowledge sharing and transfer?

We chose visit planning as the knowledge-intensive activity to be supported

- **Scenario 1:** Prepare a visit for a prospective *student* to get familiar with the future work/living environment
- **Scenario 2:** Prepare a visit for a guest *professor* at the university, including tourism aspects

- Characteristics of the scenarios:
  - They include room for flexible interpretation
  - Ultimately, a time schedule needs to be produced
  - They can be understood and processed in reasonably short time
  - There is plenty of relevant information in the web
  - Both scenarios are “structurally equivalent”

Both scenarios lead to structurally similar initial workflows

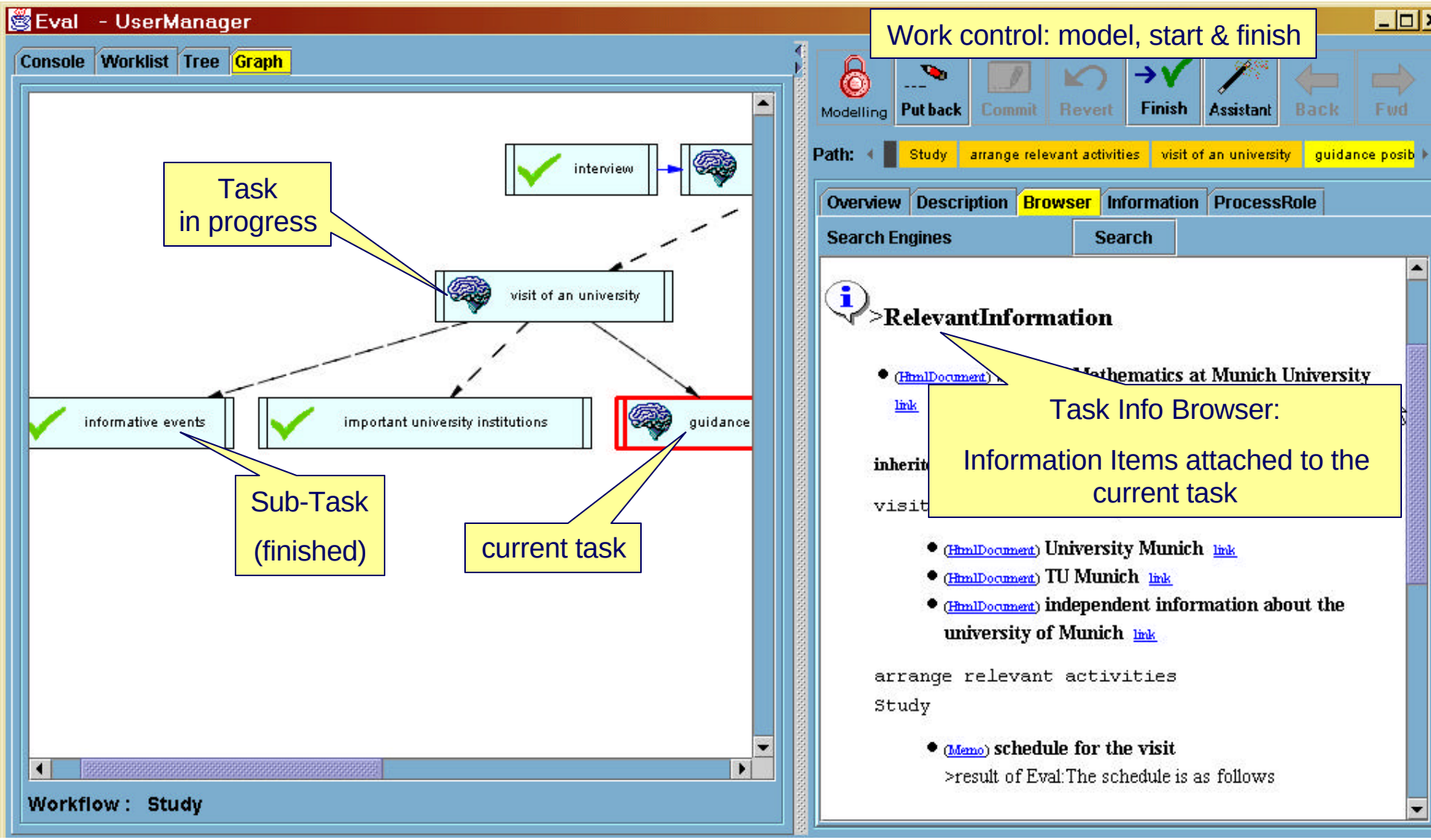


In the evaluation, subjects used a restricted version of the FRODO TaskMan

- Expressive power of the workflow language:
  - hierarchical decomposition
  - sequential dependency
- Dynamic refinement of workflows at execution time
  - integration of modeling & enactment
- Enriching workflow tasks with information needs
  - dynamic & static
- Support of task execution by linked information items
  - context-specific information support

The user can add and use relevant information items in the workflow context

- choosing **concepts from domain ontologies**
  - study and tourism ontologies
  - used as task annotation and for searching the web
  - also adding keywords
  - search the web with given concepts/keywords
- adding **relevant web pages**
  - explicitly and by surfing the web
- adding **memos**
  - resemble notes, remarks, results for a specific task
- investigate task information
  - provided in a browser
  - also inherited (i.e. from the task hierarchy) information is shown



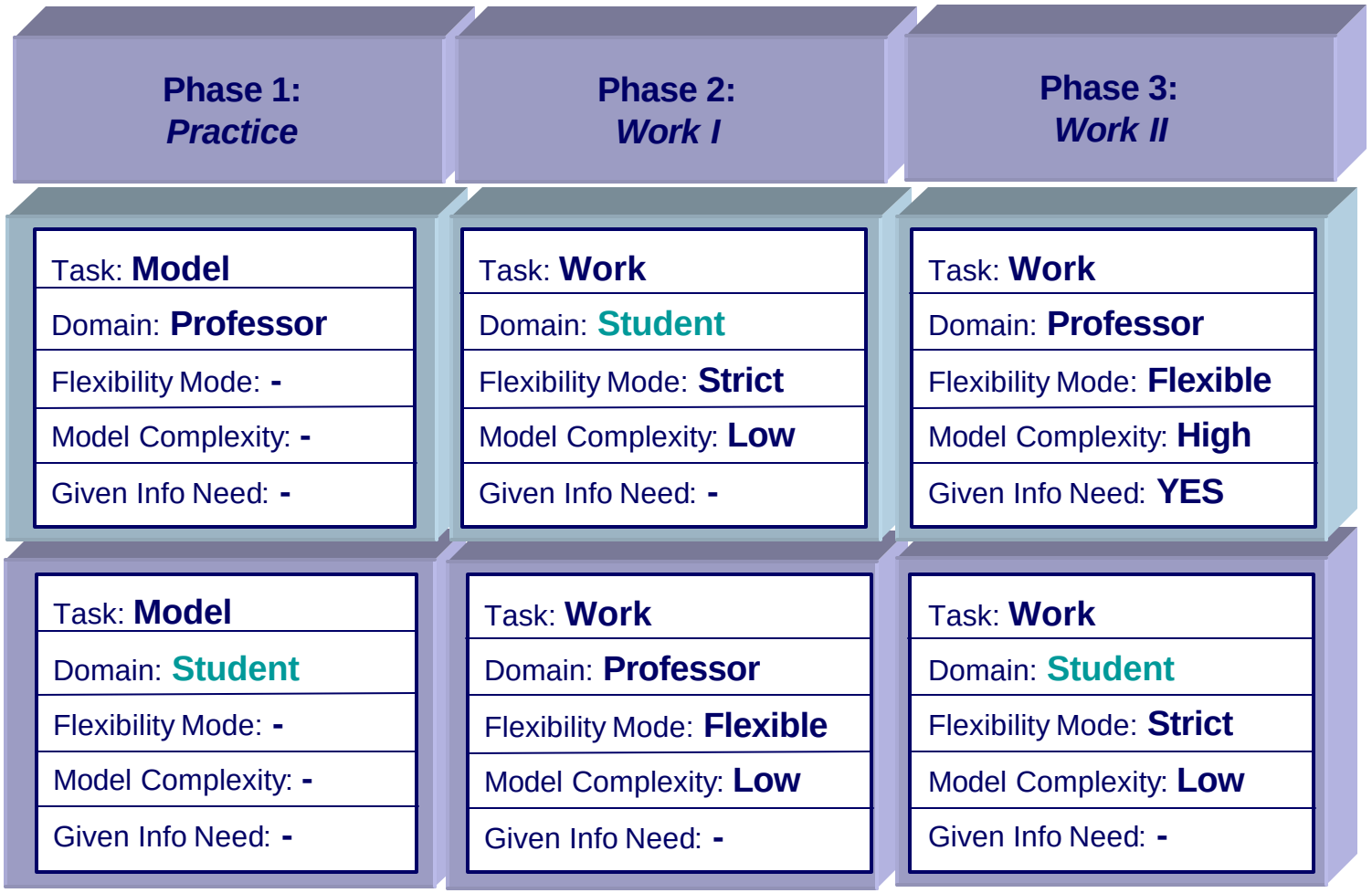
The Experimental Design Comprised Four Factors

- Domain: Preparing a schedule for a professor in Saarbrücken
  vs. for a student in Munich
- Flexibility mode of the workflow: Strict vs. weakly-structured
- Complexity of given workflows: “small” vs. “big” model
- Re-use of information: With/Without Given Information Items

A full (2x2x2x2)-factorial design was not feasible.
This led to a restricted design with two experimental groups and the following features:

- Both groups process both domains and both flexibility modes.
- Complexity and re-use of information is tested only in one domain and with flexible workflows (between groups).

The experiment comprises the model-work-refine phases of the workflow lifecycle



Four hypotheses are investigated in the experiment

- Knowledge workers feel better supported with late/lazy modeling facilities
- Lazy/late modeling in weakly-structured workflows leads to a more precise classification of information items than strict workflows
- Proactive information support is (demonstrably) useful
- Weakly-structured workflows are better suited than strict ones to deal with unexpected task situations

The evaluation trials gathered direct and indirect measurements

- **direct measurements:** The test persons were asked for subjective assessments via questionnaires
- **indirect measurements:** data collected during the experiment were evaluated
  - modified workflow models
  - attached information items
  - web logs, representing search activities

We performed 5 trial runs with 25 students in total.
The first run was considered a pre-study.

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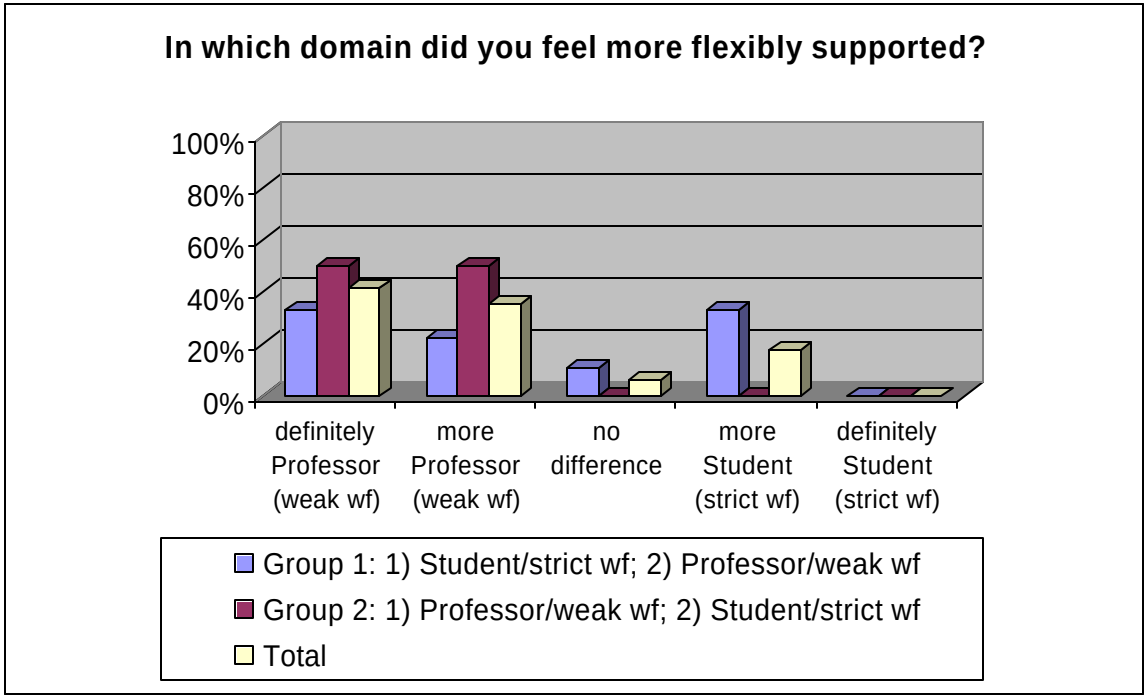
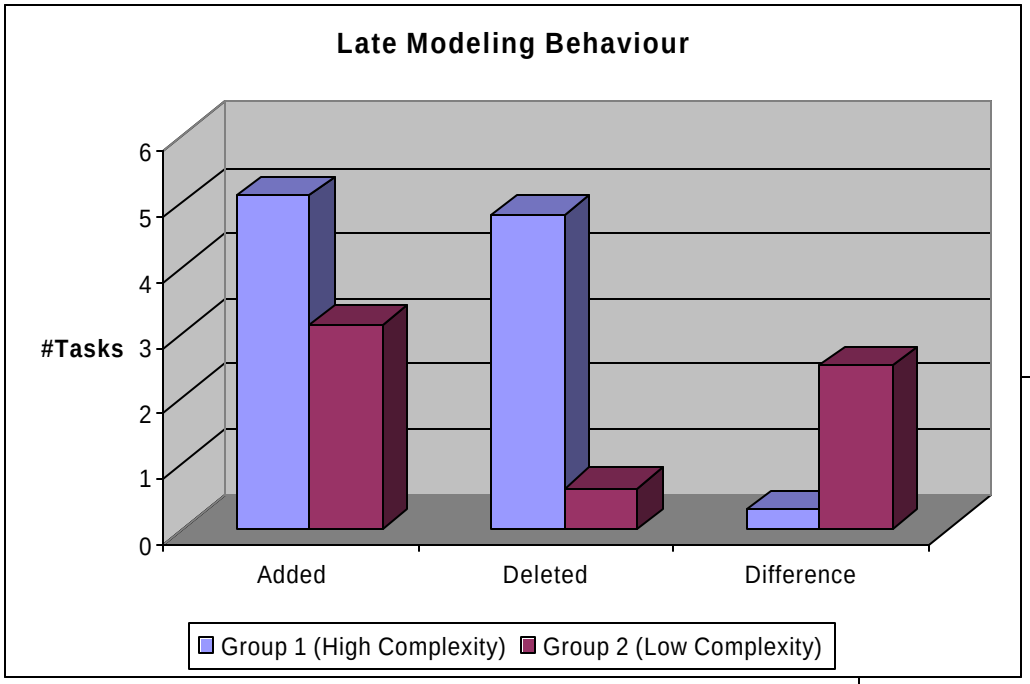
Evaluation of the questionnaires proves: Knowledge workers feel better supported with late/lazy modeling facilities

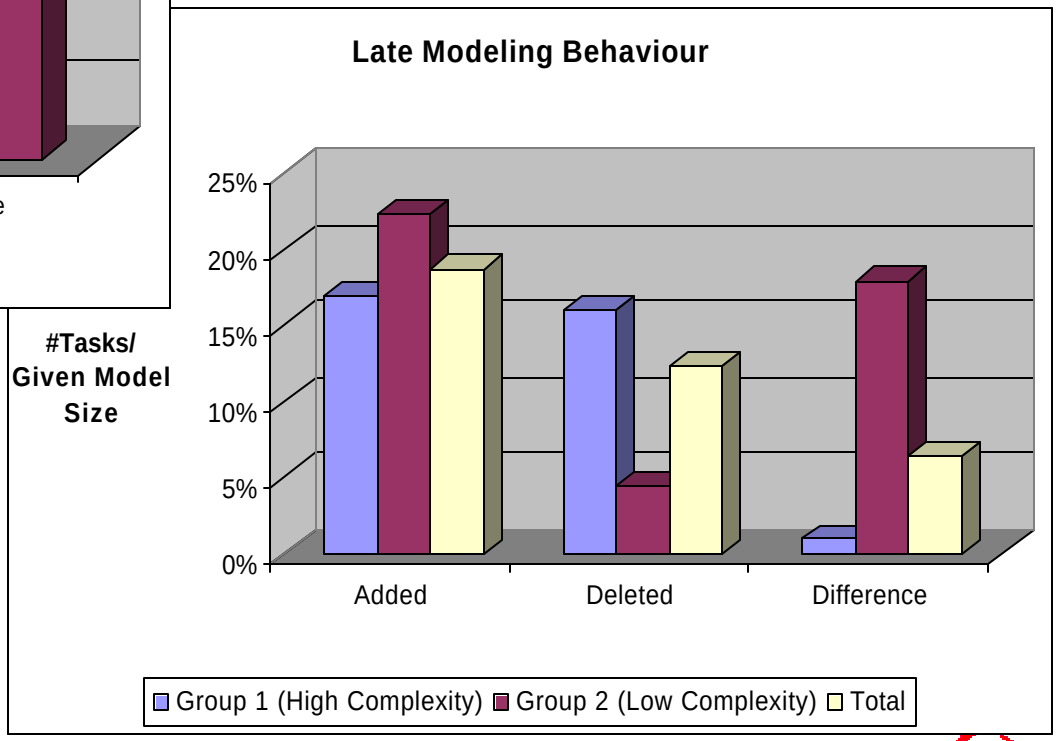


- All groups appreciate the flexibility of weakly-structured workflows
- Appreciation is significantly higher in the groups who started with the weak workflows
  - people appreciate the benefits after they lose them

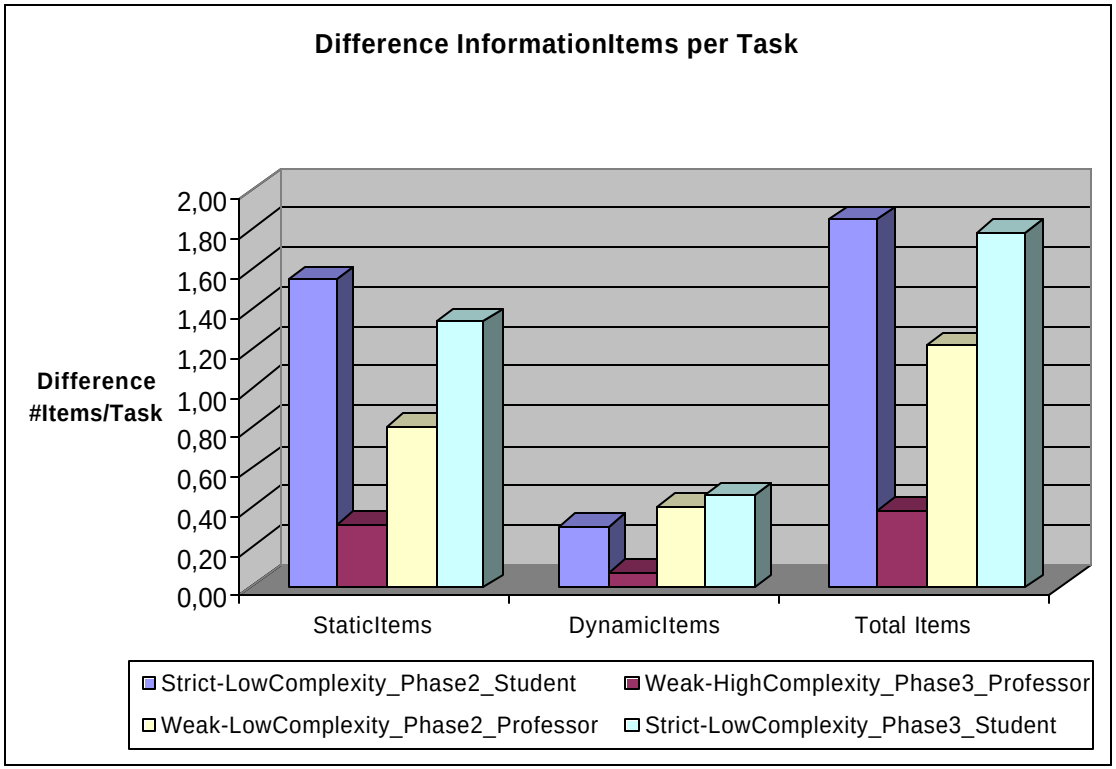
The inverse question gave an identical result.

Analysis of the modified workflow models shows: Dynamic modeling is used intensively.



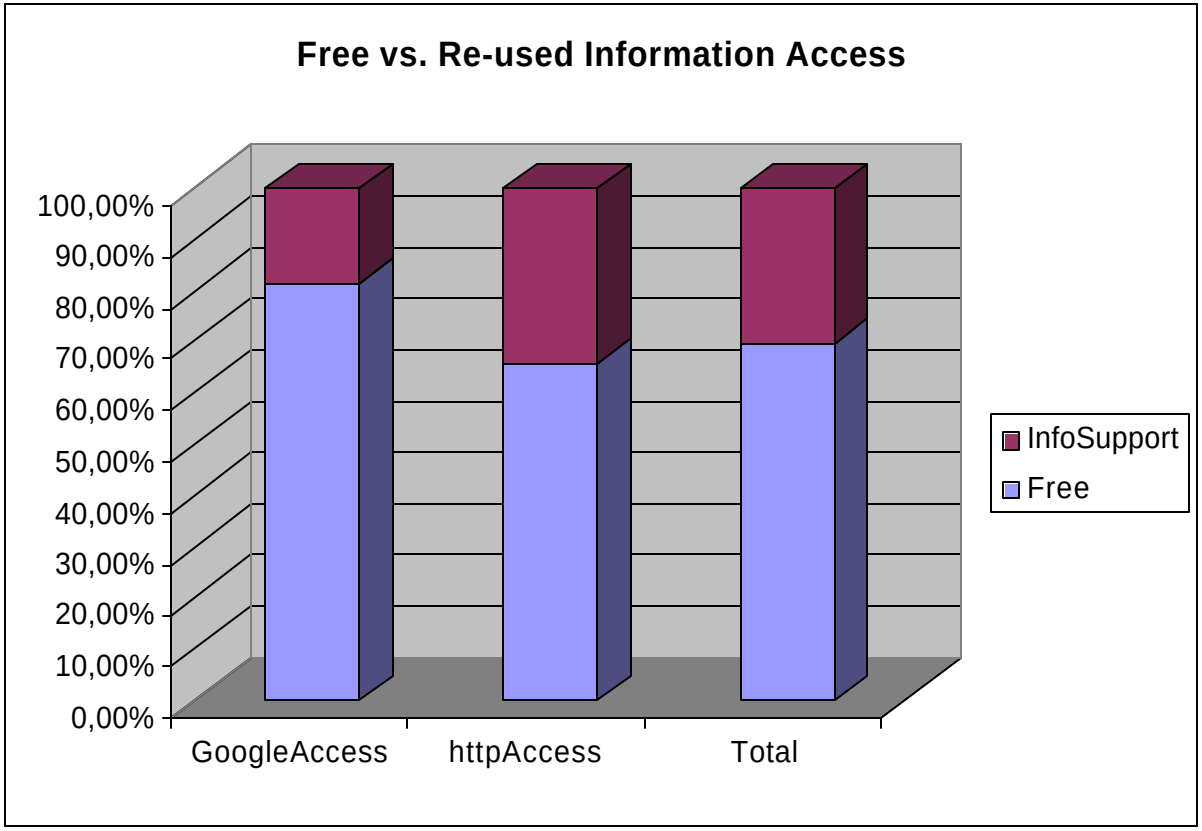


Analysis of enriched workflow models demonstrates: Lazy/late modeling in weakly-structured workflows leads to a more precise classification of information items than strict workflows



- Weak workflows result in less information items per task
- this is interpreted as a more precise classification

Proactive information support is (demonstrably) useful



Evaluation of web access logs shows:

- About 30% of all information access result from pre-given information

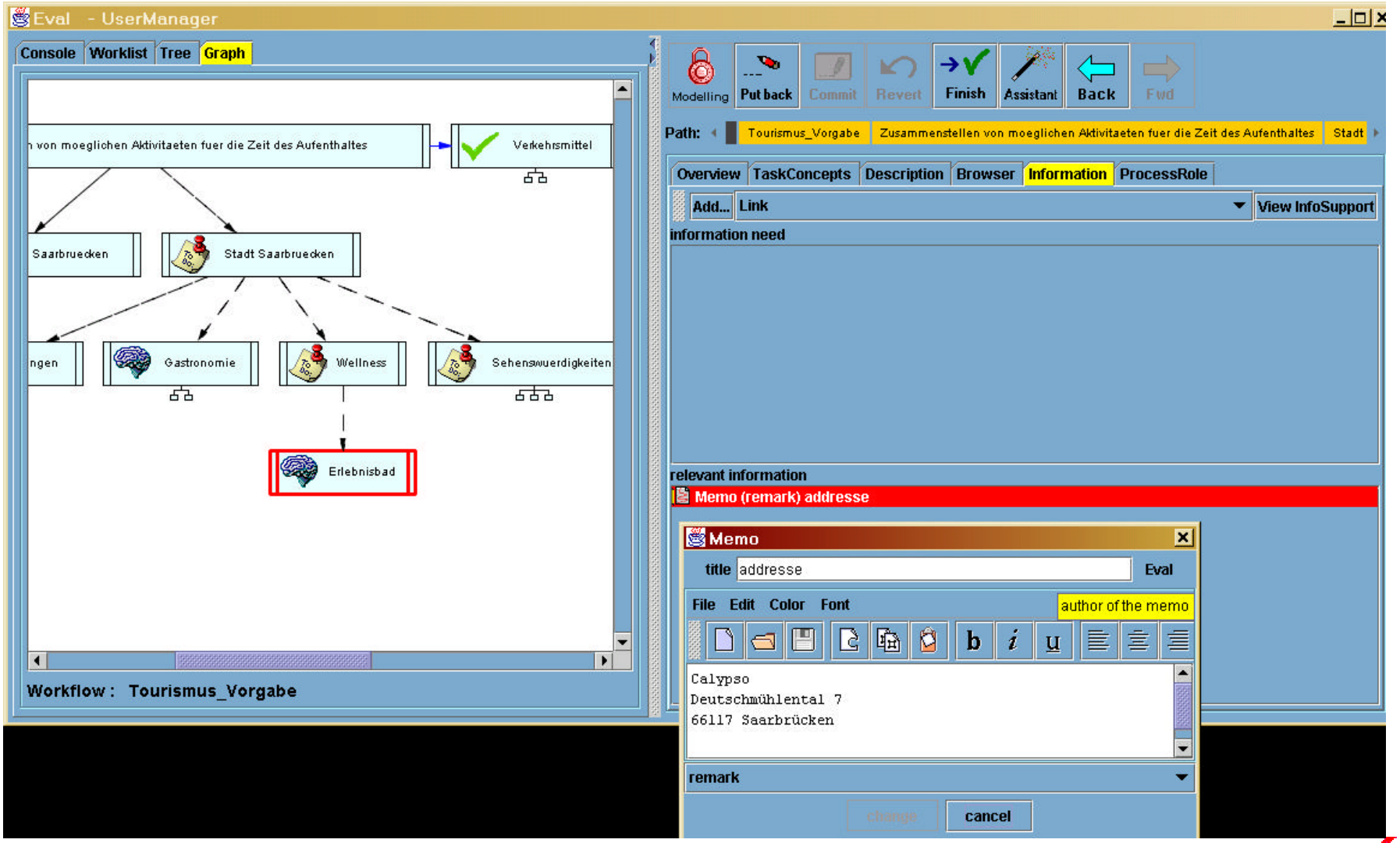
➲ User profit from pre-given information elements

➲ Nevertheless, additional information sources are visited

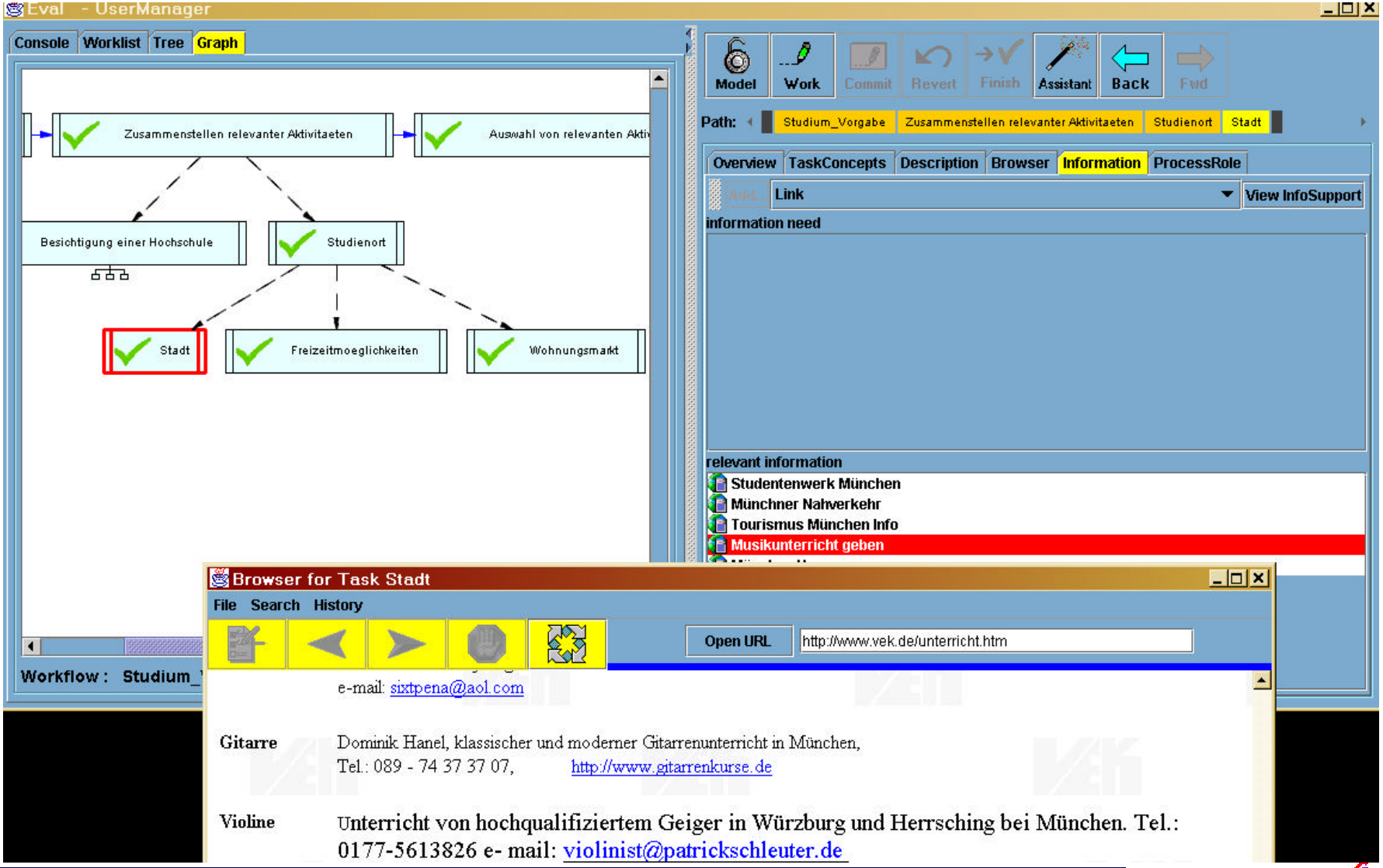
Weakly-structured workflows are better suited than strict ones to deal with unexpected task situations

- After 1 hour's work, an additional task was introduced in each condition:
  - Weakly-structured workflow: "The professor indicates that his wife intends to do sightseeing & wellness. Check possibilities and make relevant suggestions"
  - strict workflow: "The student intends to earn money by giving music instructions. Check possibilities and contacts"
- The analysis of the work results shows the advantage of weakly-structured workflows:
  - Weakly-structured workflow: The task is integrated into the process
  - Strict workflow: The task is
    - partially ignored
    - wrongly classified

Unexpected task in a weakly-structured workflow: Sound integration of the additional task and information related to it.



Unexpected task in a strict workflow: Relevant information is (inadequately) linked to ‘town’



Summary & Conclusion

- **Concept of weakly-structured workflows for information support for knowledge-intensive work**
  - Late/lazy modeling deal with the need for flexibility of knowledge workers
  - Attached information needs provide the context for precise information delivery (what & when)
- **Experimental evaluation**
  - sound experimental design was difficult
  - sound example was hard to construct
  - design, performance and evaluation were time-consuming
  - first experiment runs discovered previously unknown deficiencies in various tool implementations
  - But:
    - approach was supported by data (wrt. original hypotheses)
    - interesting additional insights and aspects
    - software was consolidated
- **Hope: More “comparable” work in KM community**

IR like evaluations
(high inner, low external validity)

this work

Real-life case studies
(high inner, low external validity)

Thank you for your attention!

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