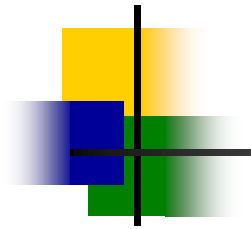

Creative Environments and one Selected Subsystem for Scientific Research

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Outline

1. Analysis: User Requirements and Functional Requirements
2. Design: a Creative Environment (CE)
3. Implementation: one Selected Subsystem
4. Conclusions

Analysis: User Requirements Analysis

A collaboration work with Dr. Tian on User Requirement Analysis:

- Conducted a **survey** for investigating **"What aspects of knowledge creation processes should be supported"** at JAIST.
- Developed a **Survey On-line Analysis System** for transforming the **survey results** to the **user requirements.**

Analysis: Analysis Method

A family of achievement functions and the reference profile approach (Wierzbicki et al, 2000)

- The system user specifies a **reference distribution** of the results;
- The system computes the values of the **achievement functions**;
- The system orders the questions and prepares **a ranking list.**

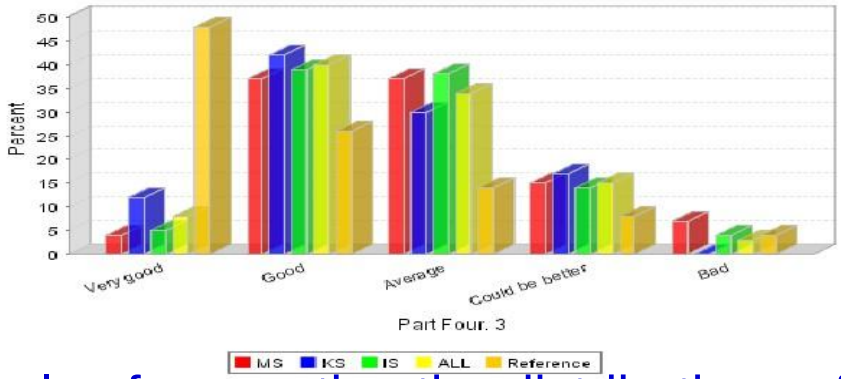
Analysis: User Requirements Analysis System (1)

Part Four. 3:Do you feel you are efficient in generating new ideas and research concepts?
A:Very good
B:Good
C:Average
D:Could be better
E:Bad

Percent	A	B	C	D	E
MS	4%	37%	37%	15%	7%
KS	12%	42%	30%	17%	0%
IS	5%	39%	38%	14%	4%
ALL	8%	40%	34%	15%	3%
reference	48	26	14	8	4

school | status | Nationality | calculate | view chart

Types	A (yjk−r)	B (yjk−r)	C (yjk−r)	D (yjk−r)	E (yjk−r)	miniel sigri (yijk−ri)	∑iel sigri (yjk−ri)	σ1(yjk, r, ε)
MS	−44	11	−23	−7	−3	−44	−66	−77.0
KS	−36	16	−16	−9	4	−36	−41	−56.5
IS	−43	13	−24	−6	0	−43	−60	−73.0
ALL	−40	14	−20	−7	1	−40	−52	−66.0



An example of computing the distributions of answers and the value of function σ_1 for a selected question

Analysis: User Requirements Analysis System (2)

The worst top 10 in ranking list			
question index	questions	Types	score
Part Three. 1(9)	Because of language reason, it is difficult to discuss research issues with the colleagues from other countries.	ALL	−58.8
Part Three. 1(17)	I easily and readily share tacit knowledge (highly personal and unformulated knowledge and experience).	ALL	−57.8
Part Three. 1(7)	I am efficient in preparing presentations and speaking at seminars.	ALL	−55.0
Part Three. 1(8)	I have good feed back, enough critical questions and suggestions from my group in discussing.	ALL	−54.0
Part Five. 3	You know enough to plan and organize your research efficiently. There are short−term and long−term research goals and you know how to achieve them step by step.	ALL	−54.0
Part Two. 4	You are efficient in designing and planning experiments?	ALL	−51.2
Part Four. 3	Do you feel you are efficient in generating new ideas and research concepts?	ALL	−50.4
Part Five. 1	It is difficult for you to decide research topic.	ALL	−49.4
Part Four. 6	Do you feel you have good enough proportion of relaxation after your normal work to get new ideas?	ALL	−48.6
Part Five. 6	Do you feel you have well enough technical support for planning and organizing your research?	ALL	−46.8
The best 10 in ranking list			
question index	questions	Types	score
Part Two. 1 (1)	Learning and training on how to do experiment (including theory, method and skill)	ALL	6.8
Part Two. 1 (2)	Help and Guidance from the supervisor or colleagues	ALL	−1.6
Part One. 1 (4)	How often do you use following information and resources to search the scientific literature? (Search engine, for example Google, Yahoo and so on)	ALL	−2.8
Part Three. 1 (11)	Because of research competition, we can not exchange our ideas and results adequately with the colleagues.	ALL	−4.4
Part Three. 1 (6)	I am too shy to discuss my ideas openly and freely with the colleagues.	ALL	−5.0
Part One. 1 (3)	How often do you use following information and resources to search the scientific literature? (Scientific Website related to your research)	ALL	−14.2
Part Two. 1 (5)	Good managements of experimental equipments, operational manuals and material	ALL	−23.4
Part Three. 1 (12)	My supervisor encourages us to discuss and exchange our idea in the group.	ALL	−23.4

An example of the ranking lists of the worse evaluated questions and the best evaluated questions

Analysis: Results of User Requirements

The most critical issues (by the System):

c1)Difficulty in discussing research questions with colleagues from other countries; (Debate)

c2)Easiness of sharing tacit knowledge; (Debate)

c3)Critical feedback, questions and suggestions in group discussions; (Debate)

c4)Organizing and planning research activities; (Roadmapping)

c5)Preparing presentations for seminars and conferences; (Debate)

c6)Designing and planning experiments; (Implementation)

c7)Generating new ideas and research concepts. (Hermeneutic)

The most important issues (by the System):

i1)Learning and training how to do experiments; (Implementation)

i2)Help and guidance from the supervisor and colleagues; (Hermeneutic)

i3)Frequent communication of the group. (Debate)

Suggestions and comments (by the respondents):

s1) Plentiful information and knowledge source; (Hermeneutic)

s2) Communication and discussion with other researchers either from the same lab or from different labs, different subjects, or other institutes. (Debate)

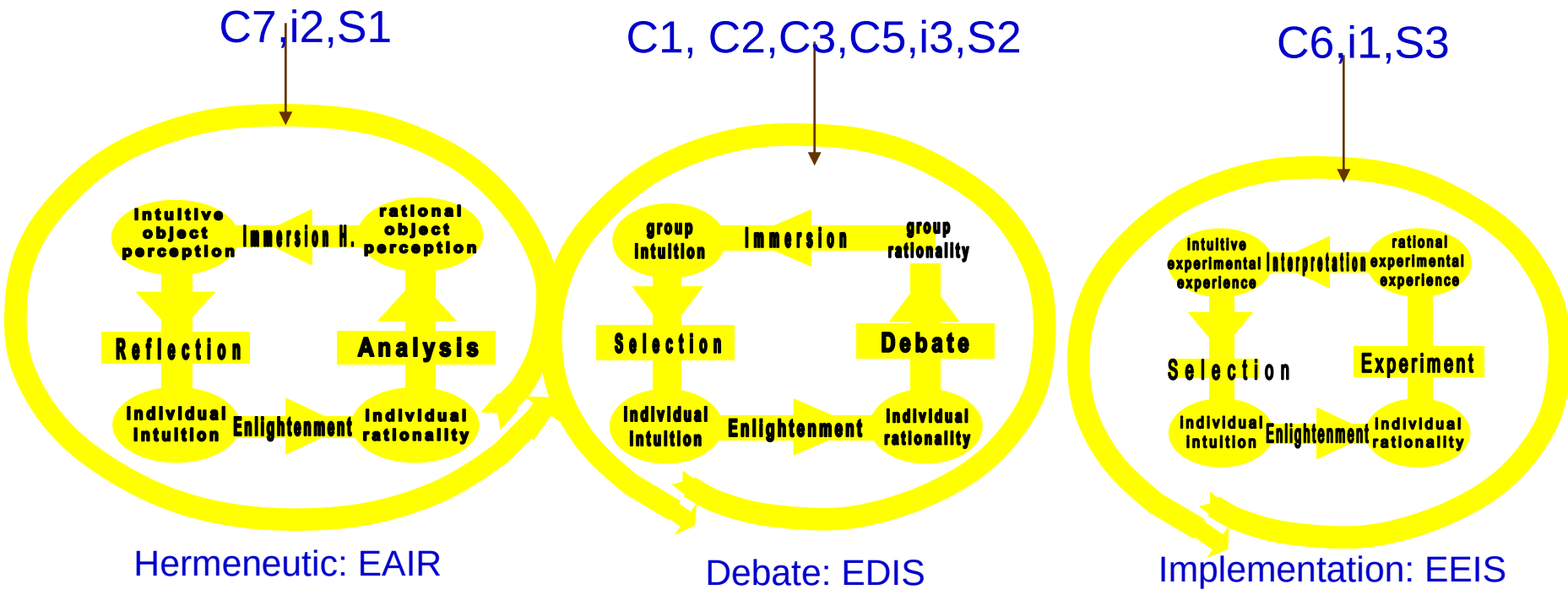
s3) Training and guiding on research method and experiment skill; (Implementation)

All the requirements were considered into the Creative Environment (CE):

Solved by the prototype CE

On-going work in the CE

Analysis: Three Creative Processes Models



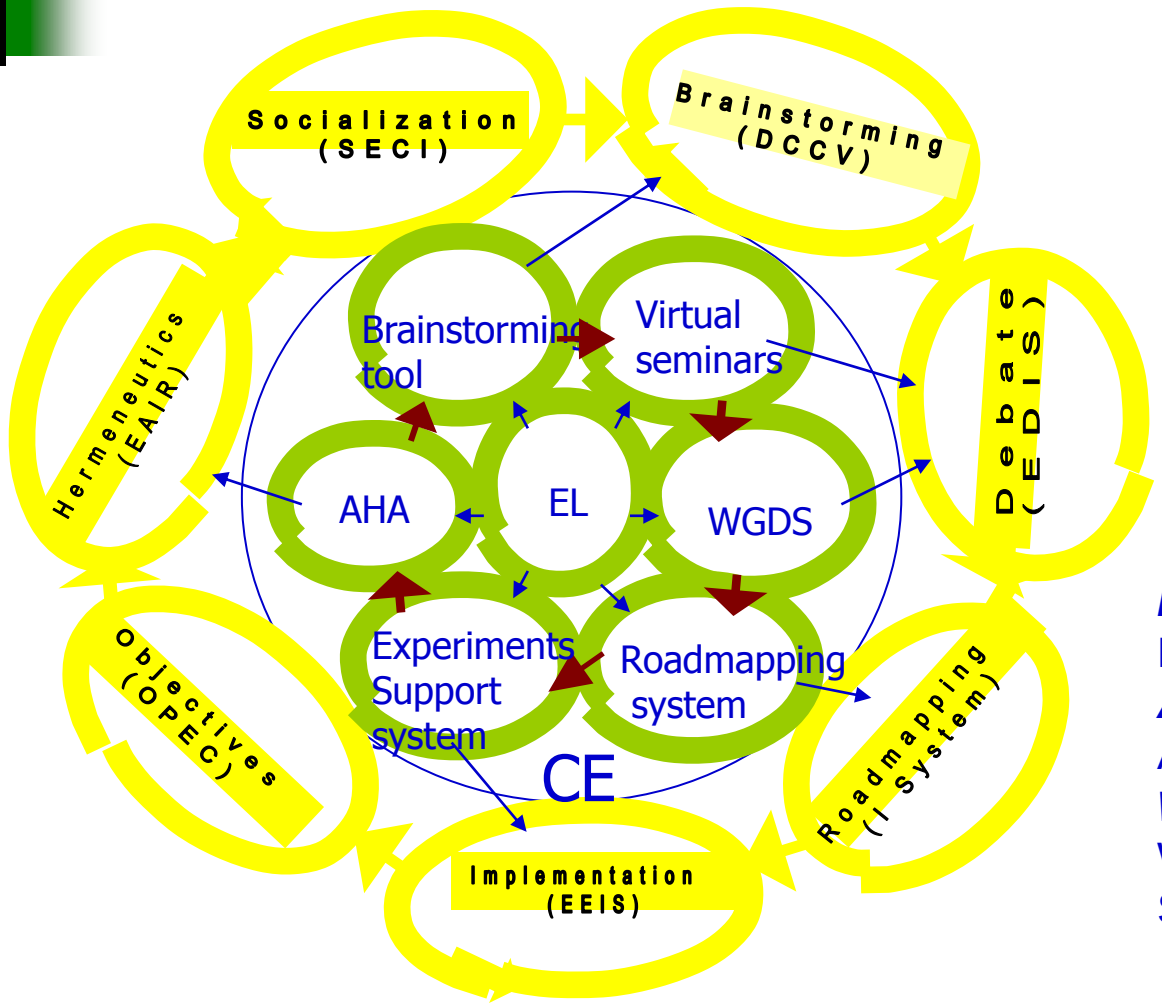
Hermeneutic: EAIR

Debate: EDIS

Implementation: EEIS

Source: Wierzbicki and Nakamori, 2006

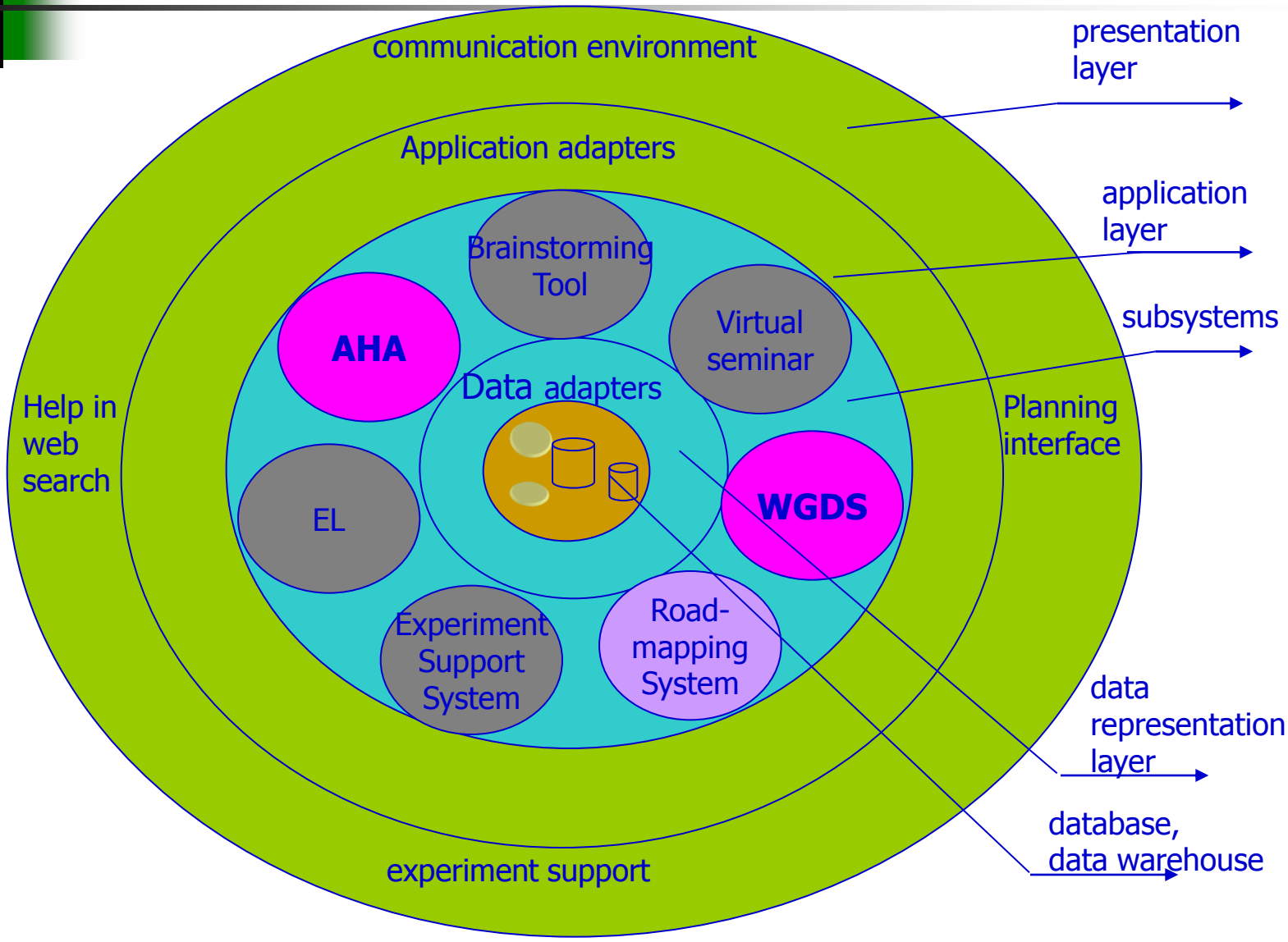
Design: Conceptual Structure of the CE (1)



CE for JAIST Nanatsudaki Model

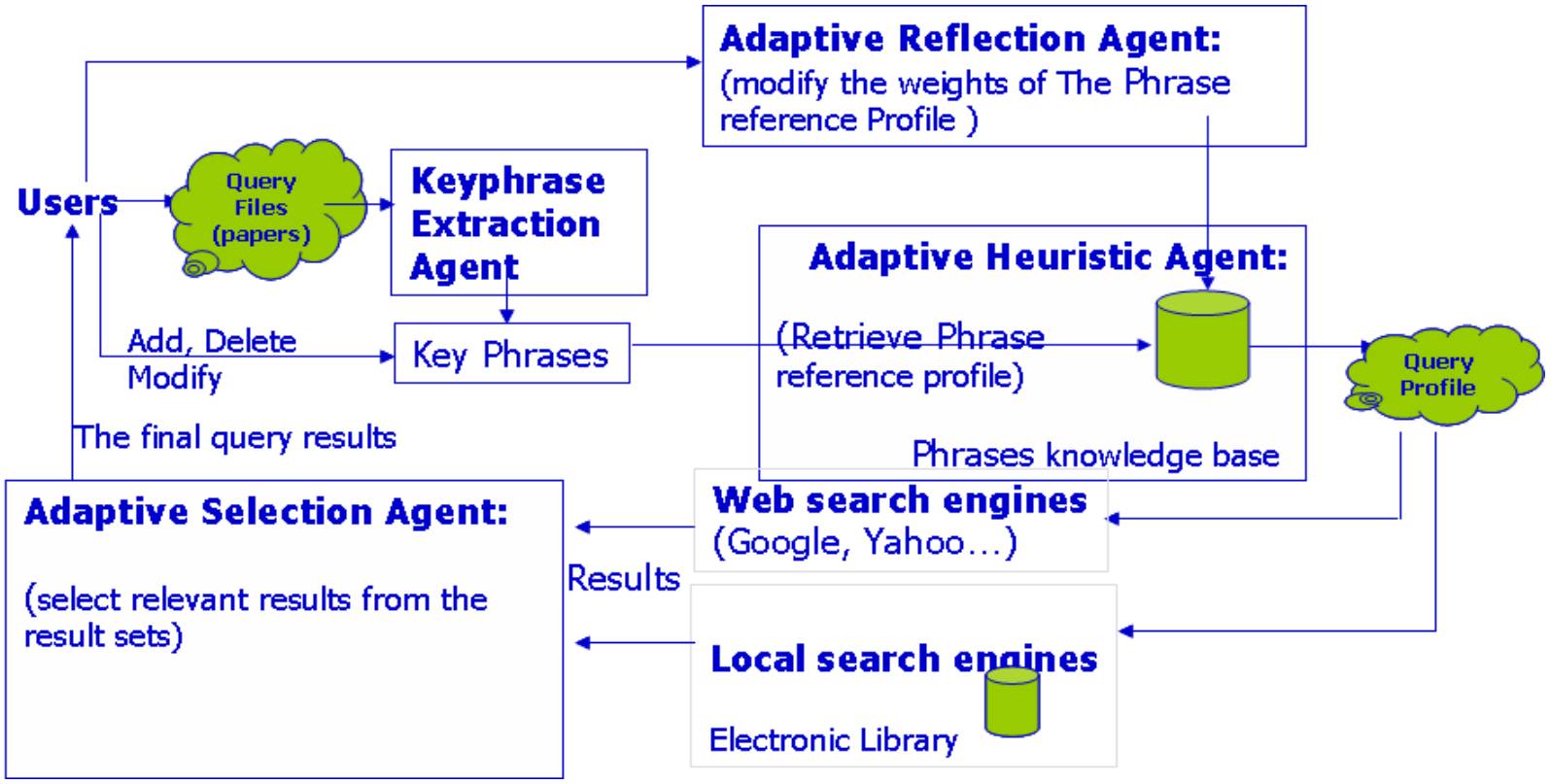
EL:
Electronic Library
AHA:
Adaptive Hermeneutic Agents
WGDS
Web-based Group Debate Space

Design: A Framework of the CE

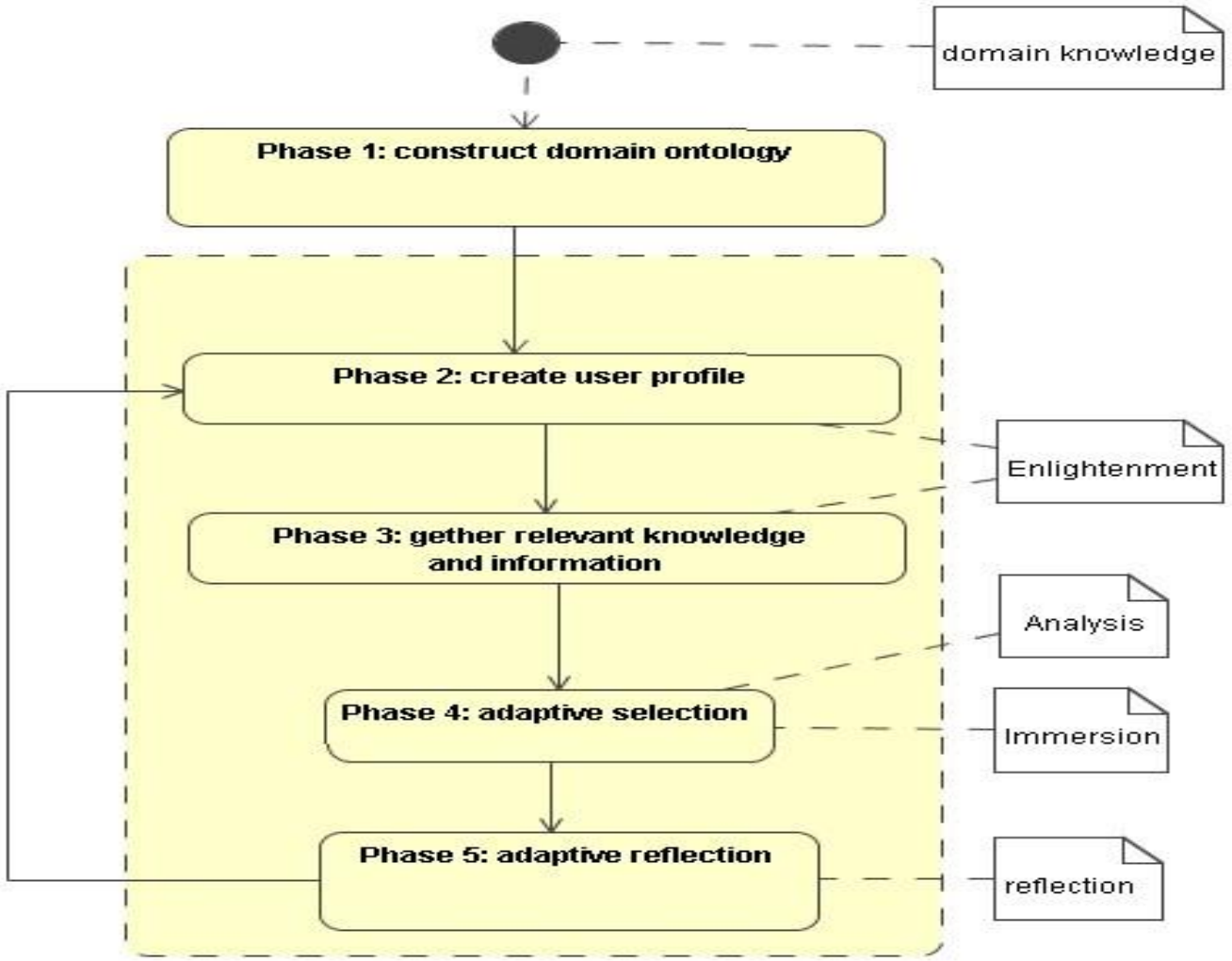


Implementation: A Selected Subsystem

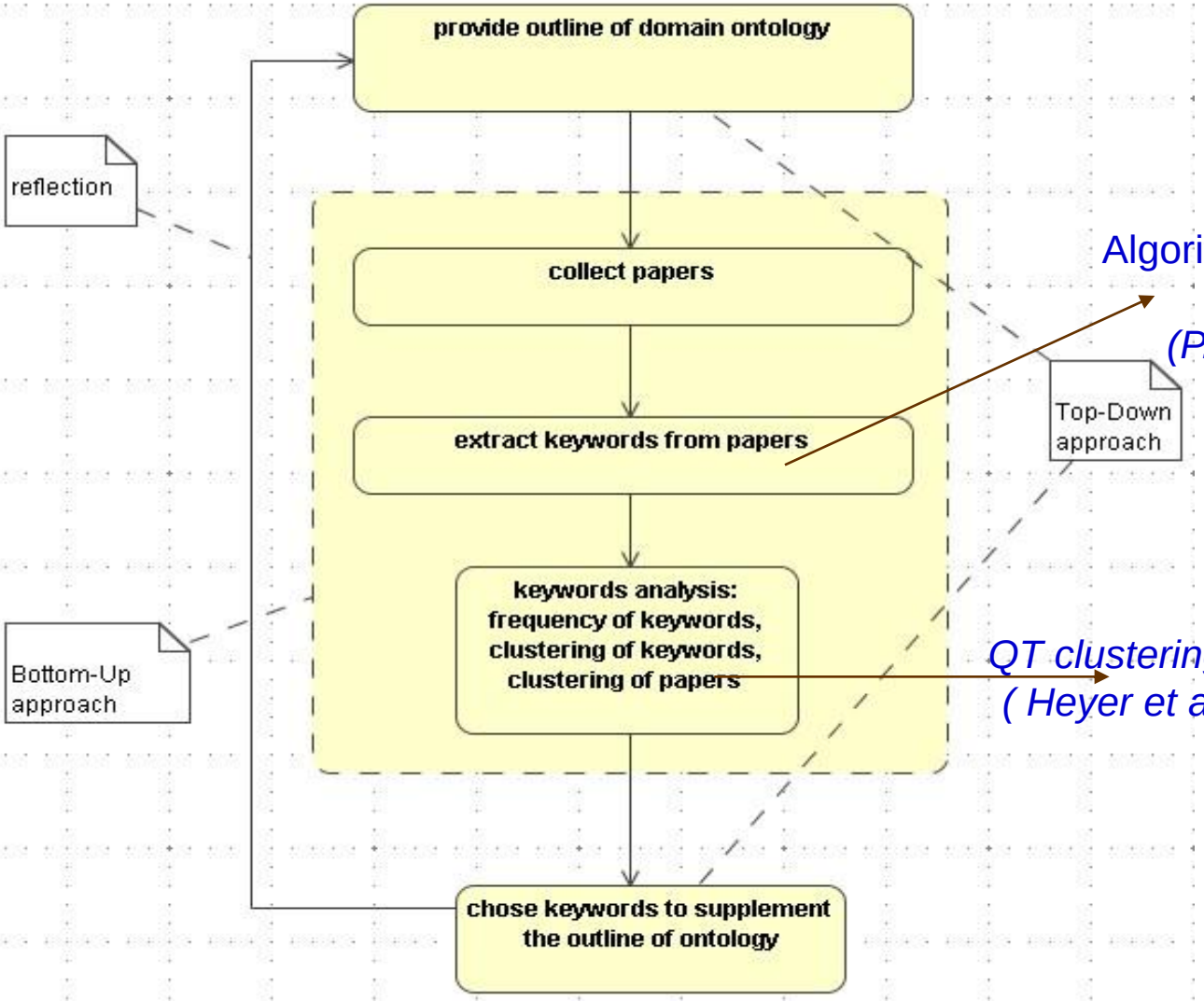
Adaptive Hermeneutic Agent: (AHA)



Implementation:
A General process of hermeneutical activity



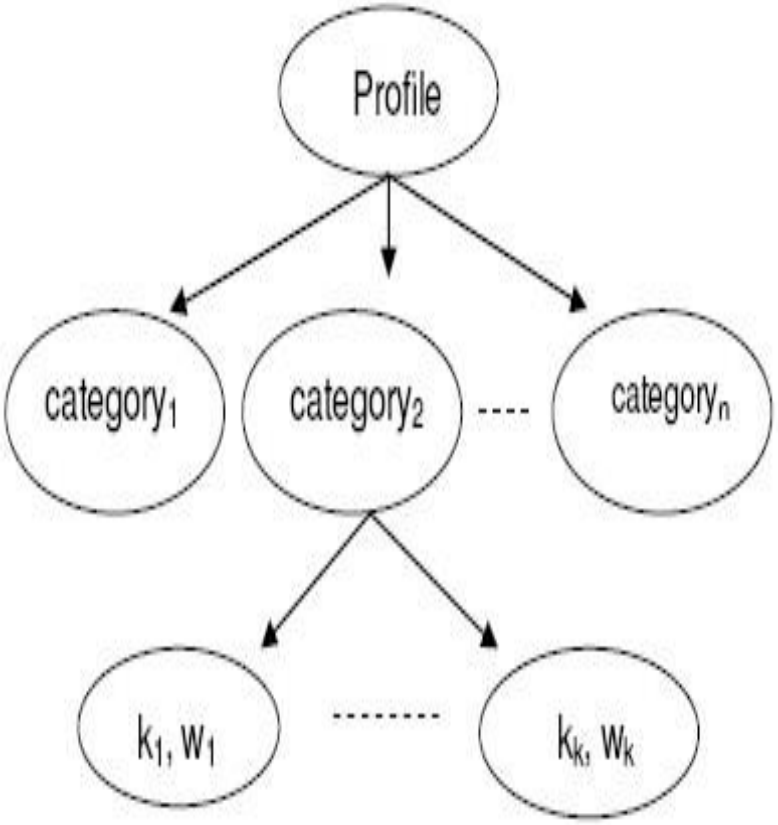
Implementation:
Phase1: Construct Domain Ontology



Algorithm for keyphrase extraction
(P. Turney 1999)

QT clustering method
(Heyer et al. 1999)

Implementation:
Phase2: Create User Profile



Hierarchy structure of the user's profile

```
- <scientific_interests_root id="-1" org="Nakamori-lab" email="hongtao@jaist.ac.jp" name="H.T Ren's Profile">
  - <node id="1" name="1. Knowledge creation and transformation">
    - <node id="2" name="1.1. Theory of knowledge creation">
      - <node id="3" name="1.1.1. Knowledge transformation (conversion)">
          <leaf id="4" name="knowledge sharing" weight="10" />
          <leaf id="5" name="informal communication" weight="9" />
          <leaf id="6" name="conceptual knowledge" weight="6" />
        </node>
      - <node id="7" name="1.1.7. Creative space: a network model of knowledge creation">
          <leaf id="8" name="knowledge creation processes" weight="1" />
          <leaf id="9" name="creative space" weight="2" />
        </node>
      </node>
    </node>
  - <search_items id="11">
      <last_search id="12" searchdate="2007-02-21" folder="hongtao_20070221_001" index="yes" />
      <search_preference id="13" search_engines="google" document_types="doc and pdf" maximum_of_returns="10" />
    </search_items>
  - <potential_collaborators_root id="14">
      <within_project id="15" collaborator_name="Tian Jing" email="jtian@jaist.ac.jp" address="" />
      <outside_project id="16" collaborator_name="Adam Wierzbicki" email="adamw@pjwstk.edu.pl" address="" />
    </potential_collaborators_root>
</scientific_interests_root>
```

An example of user profile presented in XML

Implementation:
Phase 3: Gather Relevant Knowledge

The input of the download agent:

1) Import user profile;

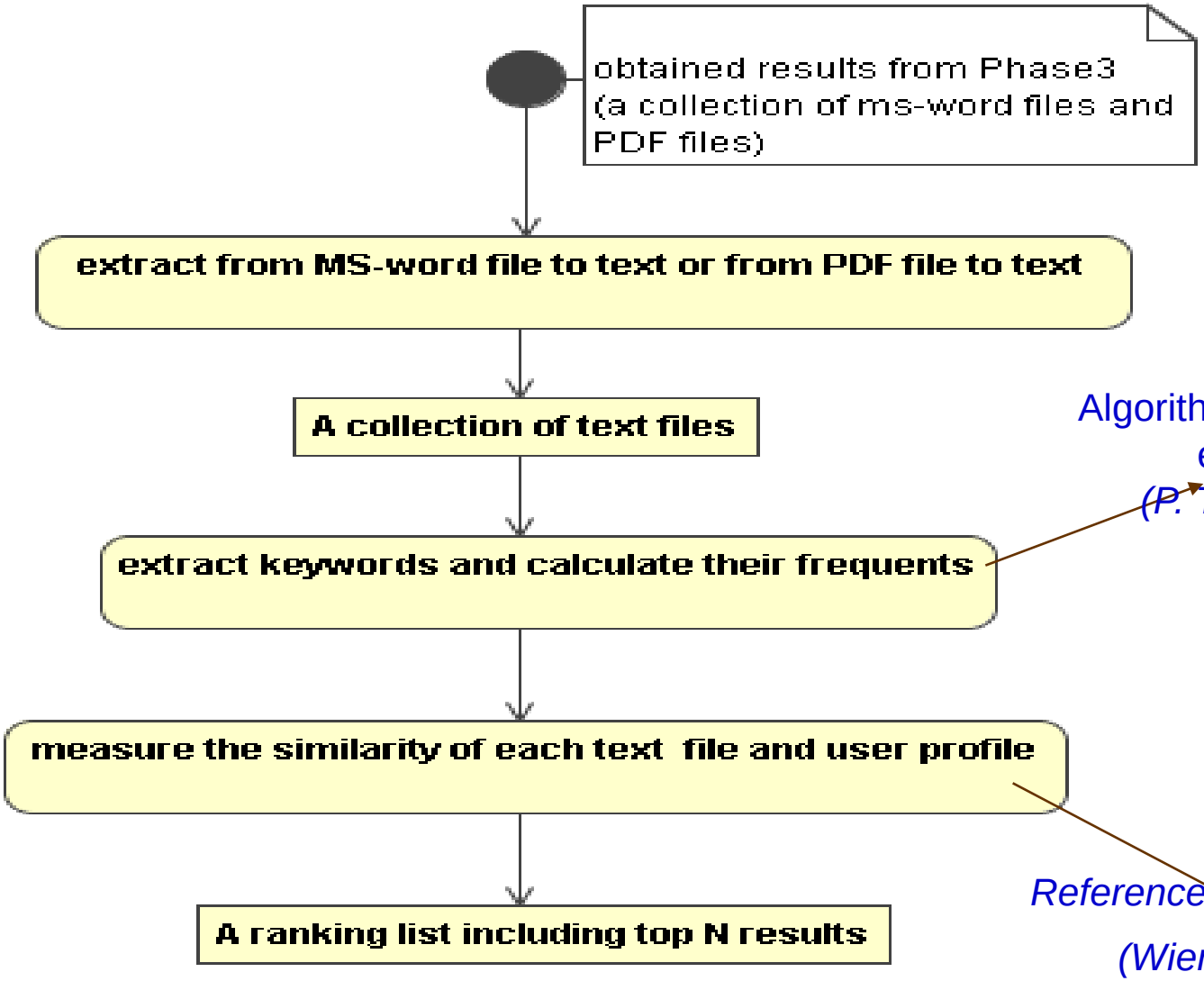
2) Select search engines;

3) Select the maximum number of the returns.

The output of the download agent:

A collection of relevant documents.

Implementation:
Phase 4: Adaptive Selection



Algorithm for keyphrase extraction
(P. Turney 1999)

Reference point approaches

(Wierzbicki 2007)

Implementation:
Phase 5: Adaptive Reflection

1) Modify user profile;

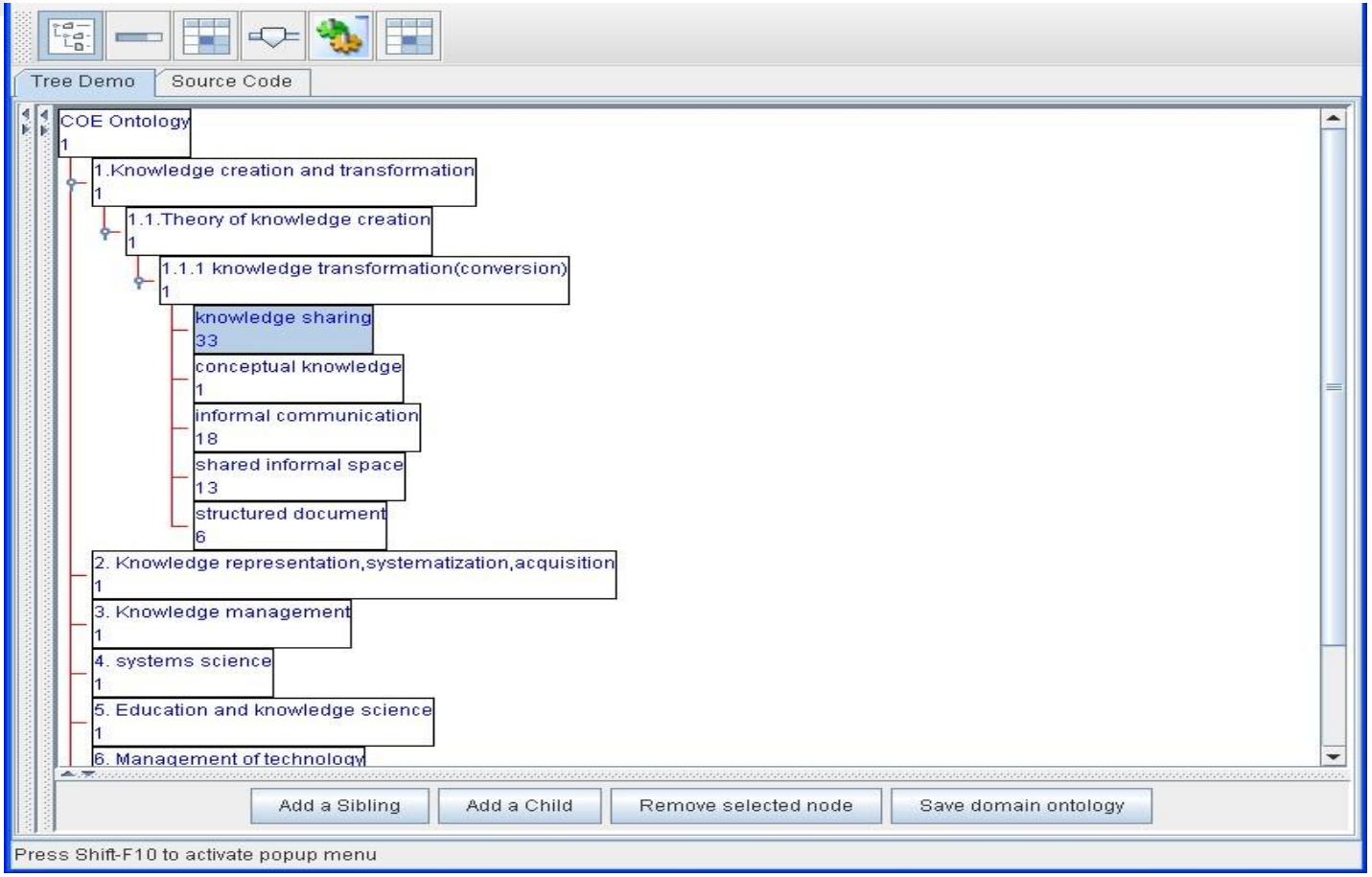
(add new keywords, delete existing keywords, modify the weights of keywords, etc).

2)Make user's interests explicit;

(user profile)

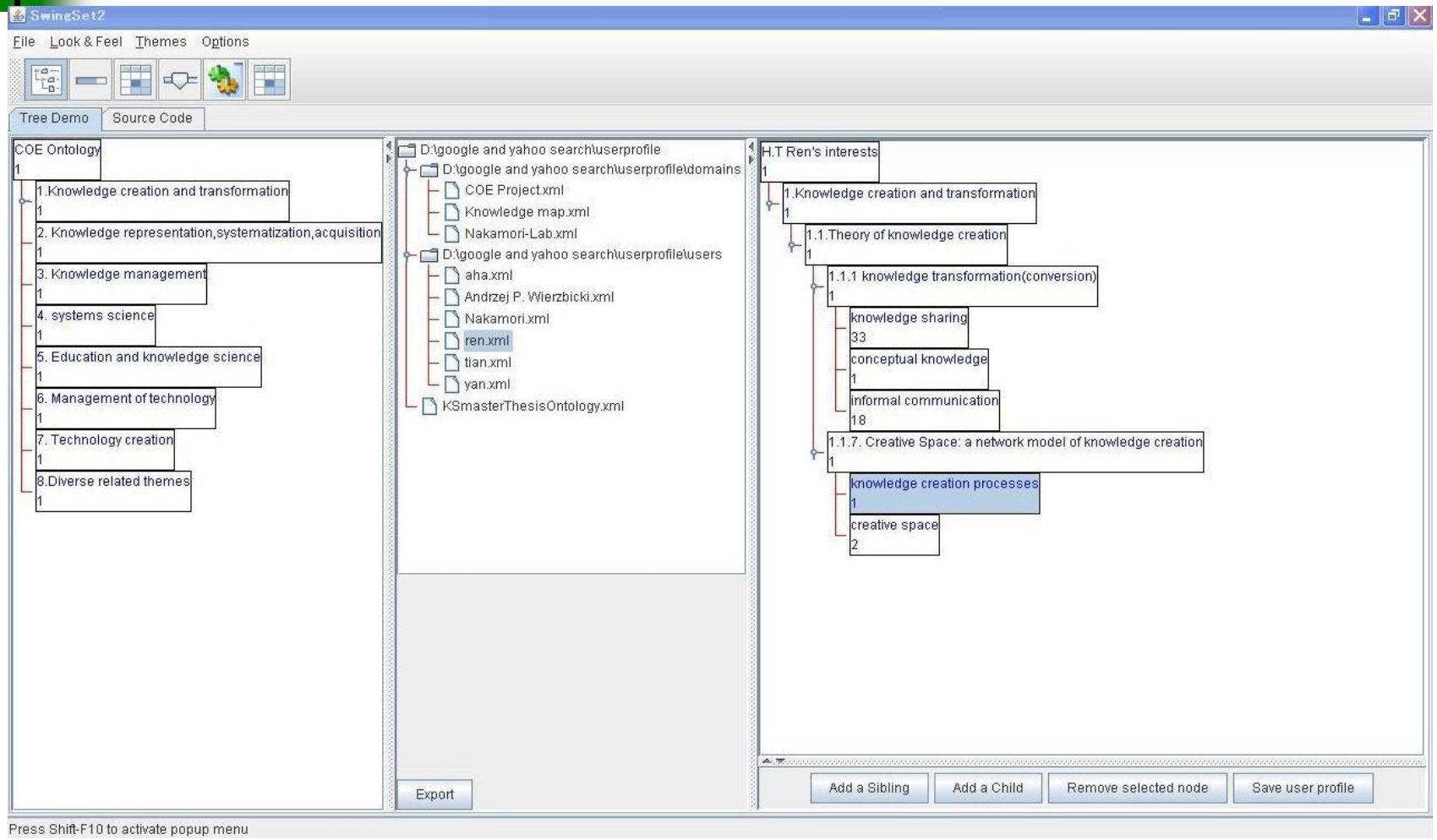
3) Enclose the Hermeneutic (EAIR spiral)

User Interface of the AHA(1)



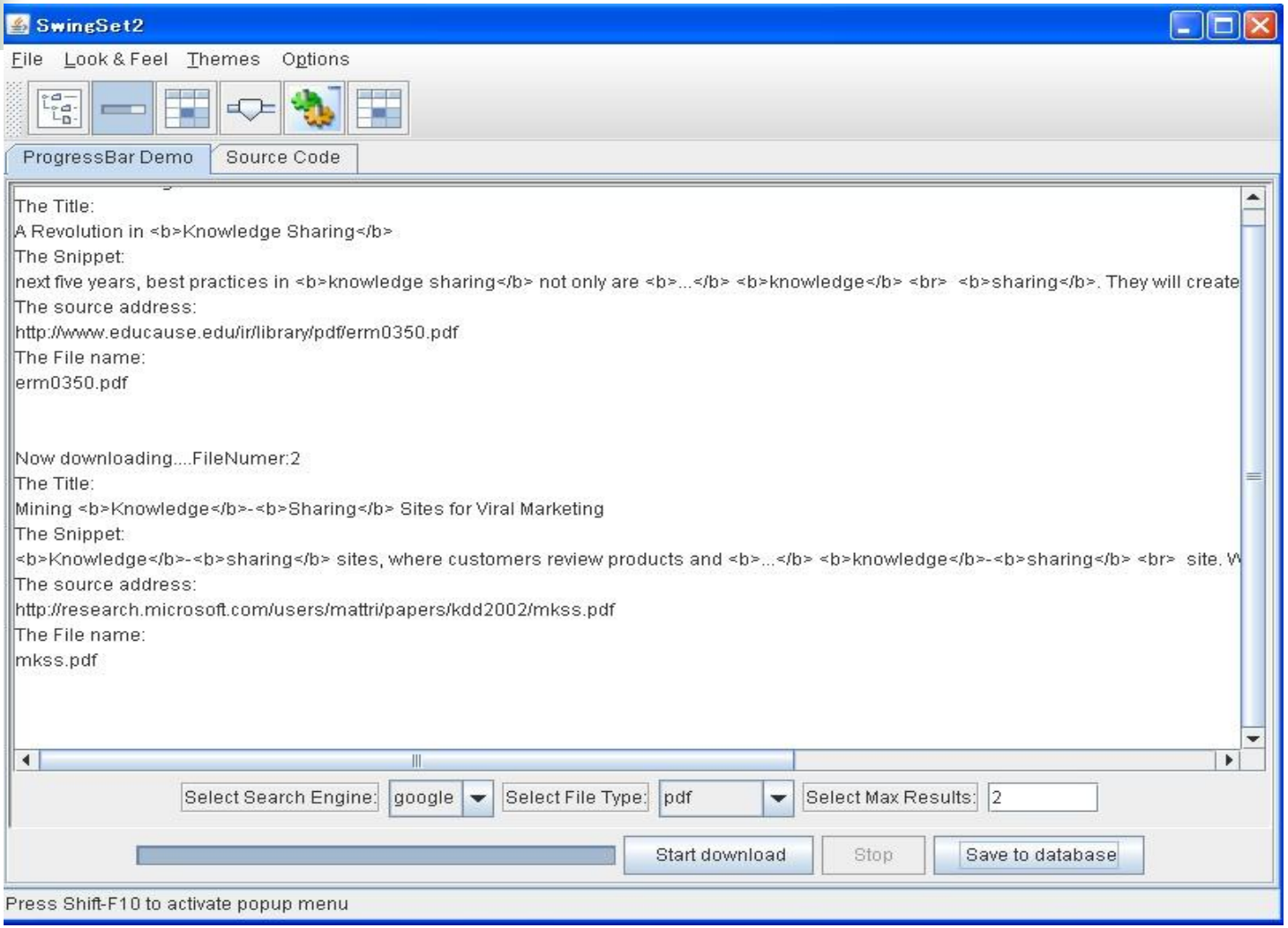
The domain ontology editor

User Interface of the AHA(2)



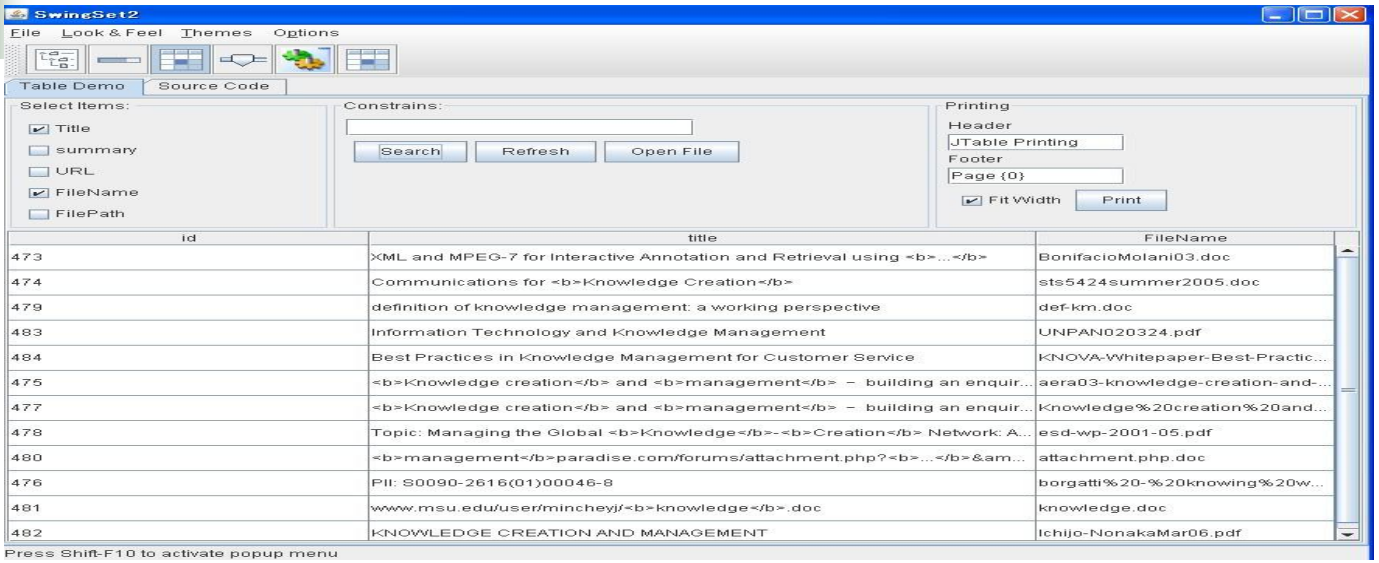
The main interface of creating user profile

User Interface of the AHA (3)

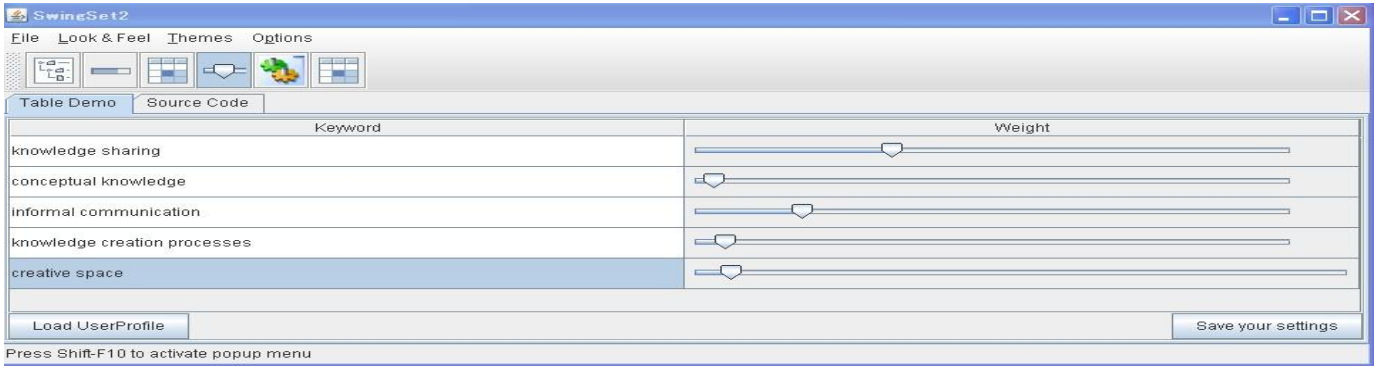


The interface of the download agent

User Interface of the AHA (4)

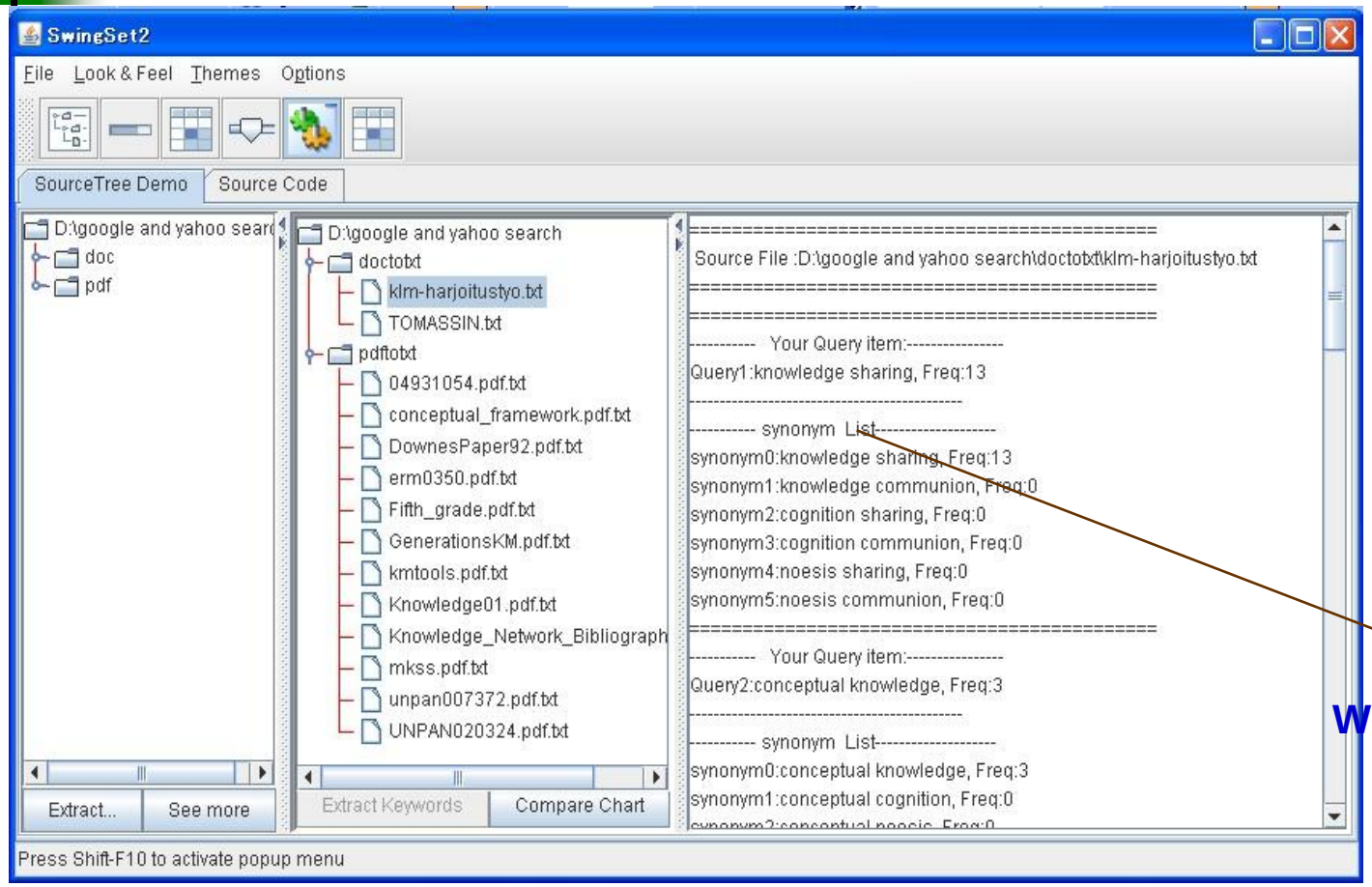


The interface of management of download files



The interface of modifying reference profile

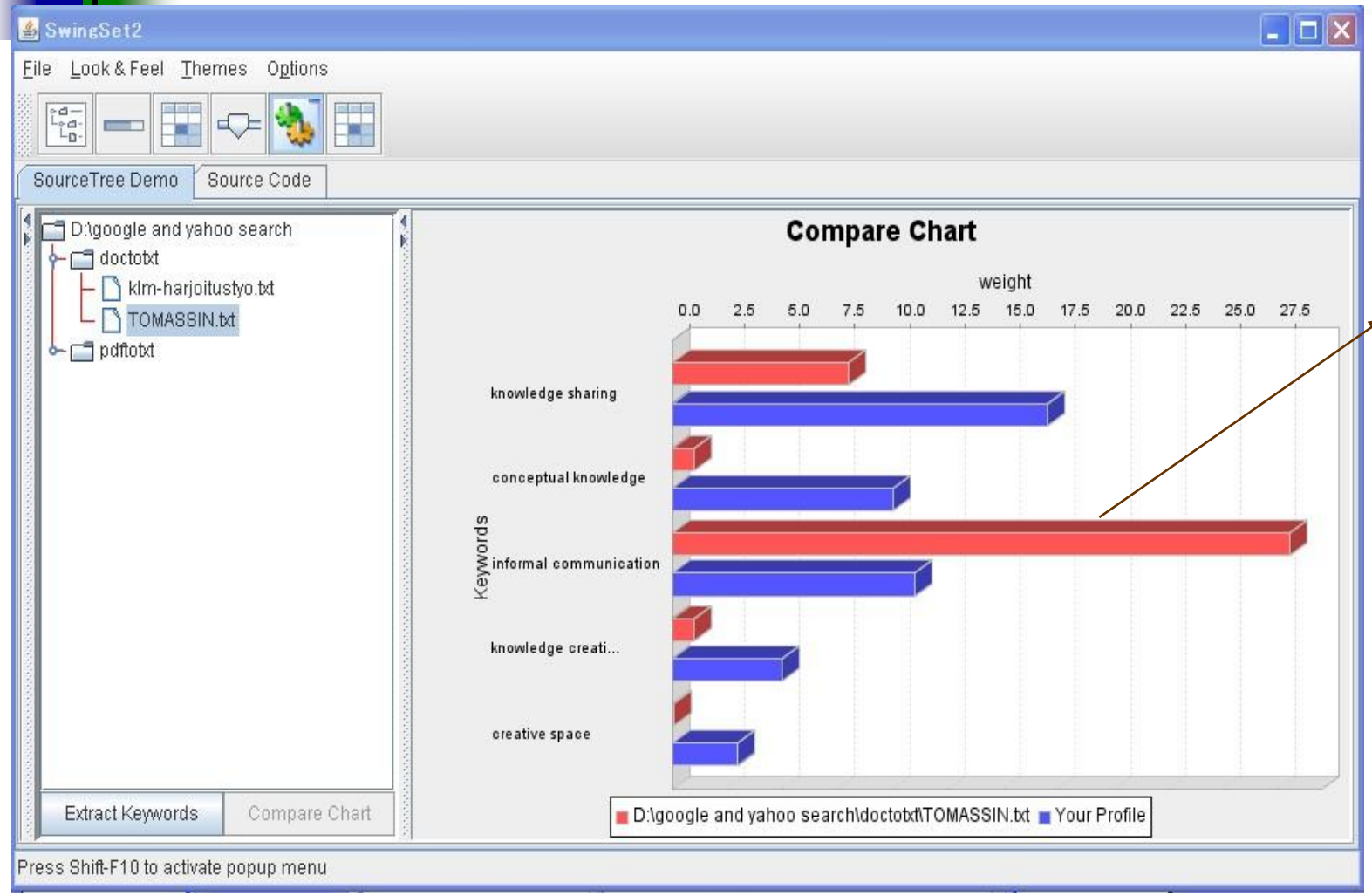
User Interface of the AHA (5)



Technique: Wordnet prolog

The interface of text processing

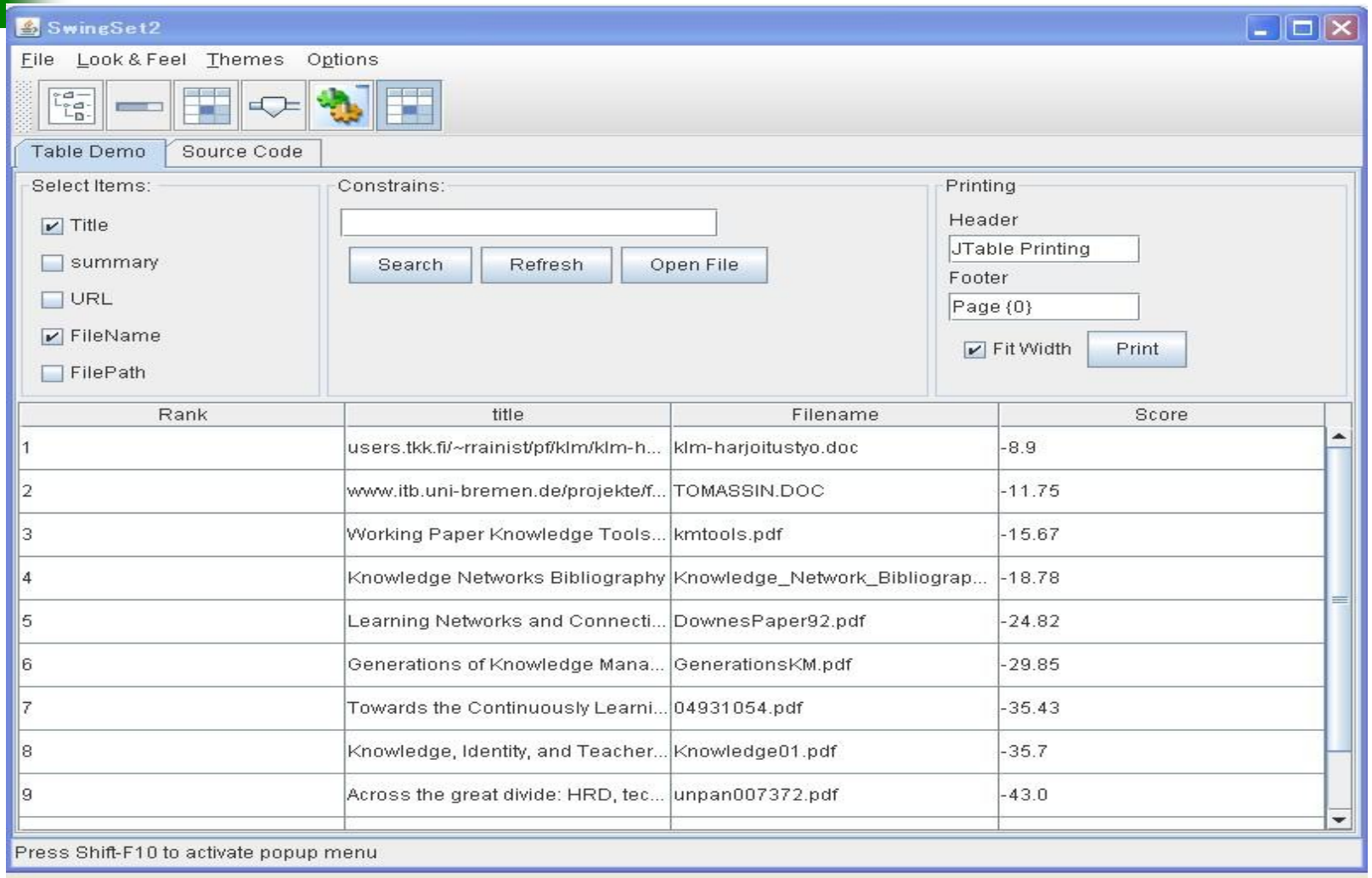
User Interface of the AHA (6)



Technique:
JFreeChart

Graphical presentation of similarity of each file and the user profile

User Interface of the AHA (7)



A ranking list of the search results

Conclusions

1 An framework of a computerized CE for scientific research;

2 **A Subsystem (AHA):**

Helping users to gather relevant knowledge :

1) **Making explicit** of the search input (ontology-based);

2) **Graphical presentations** of the search results;

3) **Adaptive Selection** by user's interests (user profile);

- **Other outcomes:**
- 1) Help junior users to get background knowledge (from domain ontology)
- 2) Help users to find the potential collaborators (measure the similarity of their profiles)
- 3) Help users to create Electronic Library (store domain ontology, searching materials with their user profiles in EL).