Evaluating wiki-enhanced ontology authoring

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The 18th International Conference on Knowledge Engineering and Knowledge Management (EKAW2012)
8 - 12 October 2012, Galway, Ireland
Ontology modeling

- Crafting domain ontologies often requires the **collaborative effort** of a team of actors.
- To favor the design of quality ontologies, **collaboration should be supported** in an articulated way:
  - between actors having different roles and skills: domain experts (DE), knowledge engineers (KE)
  - to facilitate communication, discussion, decision making, etc.
Wiki features for collaborative modeling

• Wiki-based systems have been applied for the editing of structured content, including ontologies (e.g. SMW, OntoWiki, MoKi)

• Typical wikis features exploitable to support collaboration in ontology modeling:
  - easy customization of the UI, according to the skills and role of the team members
  - collaborative editing functionalities: e.g., discussion, notification, watchlist, history and revision...
Customization of the UI: multi-mode access
A **mountain** is a large **landform** that stretches above the surrounding land in a limited area usually in the form of a peak. A mountain is generally steeper than a **hill** [...].
A **mountain** is a large **landform** that stretches above the surrounding land in a limited area usually in the form of a peak. A mountain is generally steeper than a **hill** [...]

**Customization of the UI: multi-mode access**

<table>
<thead>
<tr>
<th>Axioms</th>
<th>Mountain \textit{\textbackslash csa Landform}</th>
<th>Remove</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mountain \textit{\textbackslash csa \forall HasLocation.(GeographicalPlace)}</td>
<td>Remove</td>
<td></td>
</tr>
<tr>
<td>Mountain \textit{\textbackslash csa \not \textit{Hill} \textit{\textbackslash cand \not Plain}}</td>
<td>Remove</td>
<td></td>
</tr>
</tbody>
</table>

**unstructured**

**fully-structured KEs**
A mountain is a large landform that stretches above the surrounding land in a limited area usually in the form of a peak. A mountain is generally steeper than a hill.
Collaborative editing functionalities

Discussion

Talk:Locus of control

Esistono sottotipi? -- KE 14:56, 6 December 2011 (CET)

Esistono dei sottotipi di locus of control? In caso contrario si potrebbe considerare come un individuo.

Re: Esistono sottotipi? -- DE 15:27, 6 December 2011 (CET)

ok individuo
Collaborative editing functionalities

Discussion

Watchlist
Collaborative editing functionalities

- Discussion
- Watchlist
- History & Revision
Collaborative editing functionalities

- **Discussion**
- **Watchlist**
- **Notification**
- **History & Revision**
Our contribution

- An empirical evaluation of the effectiveness of wikis collaborative features for ontology modeling:
  (i) making DEs more active in the authoring of ontologies
  (ii) supporting the collaboration during modeling
Experimental Study
Research Questions

• **RQ1**: Do the wiki-enhanced collaborative authoring features improve the involvement (and productivity) of DEs in editing activities?

• **RQ2**: Do the wiki-enhanced collaborative authoring features reduce the effort required to team members to interact?

• **RQ3**: Do the users perceive the support provided by the wiki-enhanced collaborative authoring features as effective?
Experimental Study

Setting

• 4 teams were asked to independently design domain ontologies with and without wiki collaborative features

• Two versions of MoKi were used:
  - MoKi
  - (NC)MoKi: MoKi with all the collaborative features disabled

  ➡️ Rationale: focus on the specific aspects we were interested to evaluate, avoiding the influence of additional factors

• Users were allowed to interact through MoKi/ (NC)MoKi, emails, chat
Experimental Study
Subjects, Design, and Material

• Each team was composed of two DEs and one KE:
  - DEs: pedagogists and psychologists employed in a publishing house (Edizioni Erickson) specialized in educational books
  - KEs: experts in knowledge engineering working at FBK

• Two domains:
  - cognitive abilities: attention and concentration (AC)
  - motivational and emotional aspects of learning process (ME)

• Each team worked with each version of MoKi, in two different labs (L1, L2) of 2 hours each
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Experimental Study
Subjects, Design, and Material

• **Balanced** Experiment Design:

<table>
<thead>
<tr>
<th></th>
<th>L1 (morning session)</th>
<th>L2 (afternoon session)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(NC)MoKi</td>
<td>MoKi</td>
<td>(NC)MoKi</td>
</tr>
<tr>
<td>TeamA</td>
<td>AC</td>
<td>ME</td>
</tr>
<tr>
<td>TeamB</td>
<td>AC</td>
<td>ME</td>
</tr>
<tr>
<td>TeamC</td>
<td>ME</td>
<td>AC</td>
</tr>
<tr>
<td>TeamD</td>
<td>ME</td>
<td>AC</td>
</tr>
</tbody>
</table>

• **Material / Training:**
  - DEs were provided with a document on the domain to be formalized
  - Tutorial and hands-on sessions with both MoKi and (NC)MoKi
Experimental Study
Research Question I

• **Investigated Factor:** involvement (and productivity) of DEs

• **Variables:**
  - number of edited axioms
  - number of editing operations

• **Results:**

```
<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean (NC)MoKi</th>
<th>Mean MoKi</th>
<th>p-value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEs axioms</td>
<td>3.11</td>
<td>4.43</td>
<td>0.03</td>
</tr>
<tr>
<td>DEs operations</td>
<td>21.63</td>
<td>29.13</td>
<td>0.038</td>
</tr>
<tr>
<td>KEs axioms</td>
<td>2.36</td>
<td>1.32</td>
<td>0.025</td>
</tr>
<tr>
<td>KEs operations</td>
<td>31</td>
<td>11.75</td>
<td>0.049</td>
</tr>
</tbody>
</table>
```

*computed according to the paired Wilcoxon statistical test

• **Conclusions:** wiki-enhanced collaborative features increase the involvement of DEs in authoring the ontology
Experimental Study

Research Question II

- **Investigated Factor:** effort to interact
- **Variable:**
  - number of characters in communications
- **Results:**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>p-value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>(NC)MoKi DEs &amp; KEs #characters</td>
<td>3919.25</td>
<td>3319.92</td>
</tr>
</tbody>
</table>

*computed according to the paired Wilcoxon statistical test

- **Conclusions:** wiki-enhanced collaborative features **reduce** the **effort** required by team members to **interact** (and hence collaborate)
Experimental Study

Research Question III

- **Investigated Factor**: perceived effectiveness for collaboration aspects

- **Variables**: 
  - users’ subjective perception on overall effectiveness, overall ease of use, effectiveness for specific collaboration aspects [rating wrt a 0..4 likert scale]

- **Results**:

<table>
<thead>
<tr>
<th>Investigated Factor</th>
<th>Neg</th>
<th>Pos</th>
<th>Median</th>
<th>p-value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>overall effectiveness</td>
<td>0</td>
<td>8</td>
<td>3</td>
<td>0.0047</td>
</tr>
<tr>
<td>ease of use</td>
<td>0</td>
<td>12</td>
<td>2.56</td>
<td>0.0005</td>
</tr>
<tr>
<td>awareness</td>
<td>0</td>
<td>10</td>
<td>3</td>
<td>0.0016</td>
</tr>
<tr>
<td>communication</td>
<td>1</td>
<td>8</td>
<td>3</td>
<td>0.0196</td>
</tr>
<tr>
<td>coordination</td>
<td>1</td>
<td>5</td>
<td>2</td>
<td>0.1025</td>
</tr>
<tr>
<td>decision making</td>
<td>0</td>
<td>9</td>
<td>3</td>
<td>0.0027</td>
</tr>
<tr>
<td>team building</td>
<td>3</td>
<td>6</td>
<td>2.5</td>
<td>0.3173</td>
</tr>
</tbody>
</table>

*computed according to the Chi-squared test

- **Conclusions**: users **perceive** the support provided by wiki-enhanced collaborative features as effective
Conclusions & On-going Work

• We performed a rigorous empirical evaluation of the effectiveness of wiki features to support collaborative ontology authoring

• **Wiki-enhanced collaborative features favor:**
  - the **active involvement of DEs** in the ontology authoring process
  - the **interaction of modelers** with other team members

• **Non wiki-based** modeling tools could also **benefit** from the introduction of wiki-enhanced collaborative features

• Further **on-going** investigations on the **impact** of wiki-enhanced features on
  - the collaborative **modeling process**, and
  - on the ontology **entity life-cycle**
Experimental Study

Further Aspects...: Impact on modeling process
Experimental Study
Further Aspects...: Impact on modeling process
Experimental Study

Further Aspects...: Impact on ontology entity life-cycle

(NC)MoKi

MoKi

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Experimental Study

Further Aspects...: Impact on ontology entity life-cycle

(NC)MoKi

MoKi
Experimental Study

Further Aspects...: Impact on ontology entity life-cycle

(NC)MoKi

MoKi
Thank you! Questions?

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MoKi
the Modelling WiKi ---

https://moki.fbk.eu

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