

Ph.D. Thesis

submitted in partial fulfillment of the requirements for the degree of
Doctor of Philosophy in Computer Science

**Enabling Collaboration
on Semiformal Mathematical Knowledge
by Semantic Web Integration**

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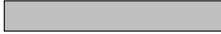










Survey Results

D.1 Reporting and Solving Issues with Mathematical Knowledge Items

52 people participated in this survey, whose results are summarized in [section 3.6.2.1](#).

What is your previous experience with mathematical knowledge management?

52 participants answered this question. Multiple answers were possible.

Operated/hosted/maintained a knowledge base	15	
Developed a knowledge base or a system for managing it	17	
Participated in a website (e.g. Wikipedia, Planet-Math)	25	
Contributed to a library of a software tool (e.g. of an automated theorem prover or a computer algebra system)	30	
Participated in a knowledge base open for any contribution (e.g. Wikipedia)	22	
Participated in a knowledge base writable by a group of editors/developers, where users could comment	11	
Participated in a knowledge base only writable by editors/developers, read-only for others	17	
Participated in a completely closed, non-public knowledge base	5	
Collected general-purpose knowledge (as e.g. in Wikipedia)	15	
Edited knowledge for e-learning (as e.g. in ActiveMath)	15	
Edited knowledge for scientific publishing	22	
Other	6	

“Other” responses:



















- “teaching”
- “used mathematical assistance systems for formalizing mathematical statements and proofs”
- “developed an ontology of instructional objects, used, e.g., in ActiveMath ”
- “WWW usage”
- “build and coordinate research for a Mathematica Grid network”
- “developed an ontology”

What knowledge management and issue reporting/resolving features did the mathematical knowledge base(s) support that you participated in?

33 participants answered this question. Multiple answers were possible. The following explanation of the term “knowledge item” was provided:

Note that by “knowledge items” we mean the smallest unit of resources that knowledge management tasks can be done on. This definition includes knowledge items that consist of subitems, e.g. a theory consisting of definitions and axioms. With plain, unstructured text, a knowledge item would be a file. With structured documents, this unit can be a smaller fragment of a file or a web resource.

D.1 Reporting and Solving Issues with Mathematical Knowledge Items

Knowledge items of the size of a course unit or lecture	21	
Knowledge items of the size of one presentation slides	13	
Knowledge items of the size of one mathematical theory (i.e. a few related definitions and axioms)	19	
Knowledge items of the size of one mathematical statement (e.g. one definition, one axiom, one assertion, one proof, one example)	18	
built-in facility to submit structured issue reports where you could select from pre-defined types of issues	7	
built-in facility to submit unstructured issue reports or general comments	5	
Mailing list, forum, newsgroup or any other place to report issues outside of the knowledge base	18	
Contacting authors/editors personally (e.g. by e-mail)	19	
Guidance given on how to report issues	8	
Ability for issue reports to refer to exactly one knowledge item	8	
Ability for issue reports to refer to multiple knowledge items	7	
Issues tracked on a general level (e.g. in one mailing list for the whole knowledge base)	13	
Support for manual editing and restructuring of knowledge items in a rather formal language (looking like a programming language)	17	
Manual editing and restructuring of knowledge items in a representation that looked like mathematics written on paper (e.g. WYSIWYG editing of formulæ)	10	
Assistance with restructuring (like refactoring support in software development environments)	5	
Semi-automated solutions offered for common issues, e.g. by software assistance	6	
Automated solutions offered for common issues	8	
Other	2	

“Other” responses:

- “automatic generation of courses”
- “maintain and continually expand the learning and distribution capabilities of the network”

Issues and Solutions

What types of knowledge items have you ever experienced issues with?

26 participants answered this question.

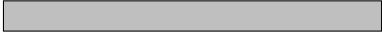
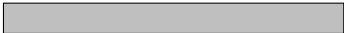










Definitions of new mathematical symbols or concepts	21	
Axioms stating properties of mathematical symbols or concepts	12	
Proven assertions, e.g. theorems, lemmas, corollaries, etc., for which there usually is a proof	14	
Unproven assertions, e.g. hypotheses, conjectures, postulates, etc. for which there is no proof (yet)	10	
Proofs	14	
Examples, e.g. given to explain a definition or a theorem	15	
Notation definitions, which state how an abstract symbol (e.g. the “derivative of a function”) is to be rendered; we assume that there can be multiple notations for different audiences, e.g. f' or $\frac{df}{dx}$ for the derivative of a function f .	13	
Theories, i.e. collections of interrelated definitions, axioms, and probably their consequences (theorems)	14	
Other	2	

“Other” responses:

- “proof steps, formulas”
- “implicit knowledge items, e.g. hidden home theories in a discussion”

What kind of issues with knowledge items have you ever experienced?

21 participants answered this question.




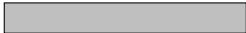








It was incomprehensible	10	
It was wrong (applies, e.g., to a theorem or a proof)	10	
It was uncertain whether it was true or false	9	
It was not clear how to use it or how to apply it to solve a problem	5	
It was not clear whether it was useful	8	
It was not appropriate for the domain of interest (applies, e.g., to an example applying a theorem in a different domain, or to a notation that is not common in a certain domain)	4	
It had an uncommon style (e.g. a proof that used some very strange and unrelated method)	8	
It was not clear in what way a knowledge item related to another one (e.g. an example for something) actually was related to the other one	7	
It was underspecified (e.g. a definition leaving out an essential property of something)	9	
It was overspecified (e.g. a definition or an axiom imposing too many constraints on something)	6	
It contained too many independent subparts (e.g. a theorem stating two independent properties of something, or a theory containing axioms independent of each other)	5	
It was a reinvention of the wheel (e.g. a statement that had already been made before, in a different place of the knowledge base, probably in slightly different words or in an equivalent but different formalisation)	9	
Other	1	

“Other” responses:

- “how to represent adequately?”

How was an issue with a knowledge item solved?

22 participants answered this question.








The affected knowledge item was fixed, changing its formal semantics (e.g. changing a definition)	12	
The affected knowledge item was improved, not changing its formal semantics, but improving its wording/structure/presentation	11	
The affected knowledge item was not changed, but a directly related knowledge item (e.g. the proof of a theorem) was improved	7	
A new, directly related knowledge item was created, e.g. an example to explain the original knowledge item, a proof, or a counter-example	8	
A sibling knowledge item, pointing to the same other knowledge item as the affected one, was created to provide an alternative, e.g. a second example for something, when the first example was criticised	2	
The affected knowledge item was split into more than one knowledge item	11	
Parts of the affected knowledge item were removed	9	
Parts of the affected knowledge item were replaced by references to other knowledge items.	5	
Other knowledge items were merged or integrated into the affected one	3	
The affected knowledge item was kept as an instructive example of how not to do it	1	
The affected knowledge item was deleted from the knowledge base	10	
The issue was not solved at all	9	
Other	0	

If your experience does not fit into the schema of the previous questions, please explain it below, e.g. by describing the affected knowledge item, the issue, and the solution.

The two responses given to this question were rather descriptions of collaboration environments than of problems and solutions; therefore I have omitted them.

If an issue remained unresolved, why?

14 participants answered this question.

Insufficient tool support for editing knowledge items	5	
Insufficient tool support for reorganising/refactoring/restructuring knowledge items	7	
Insufficient awareness of the users that there actually is an issue	6	
Insufficient social interaction (e.g. unresponsiveness of the maintainer)	6	
Users considered the issue irrelevant or illegitimate	4	
Users were no longer interested in a solution	2	
Other	1	

One “other” response has been omitted due to irrelevance.

D.2 OpenMath Wiki Evaluation



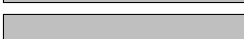


15 people participated in this survey, whose results are summarized in [section 10.4](#). Four of them did not make it past the second question; their data were removed from the sample.

The spelling and formatting of free-text answers has been moderately adapted for readability.

D.2.1 General OpenMath Questions

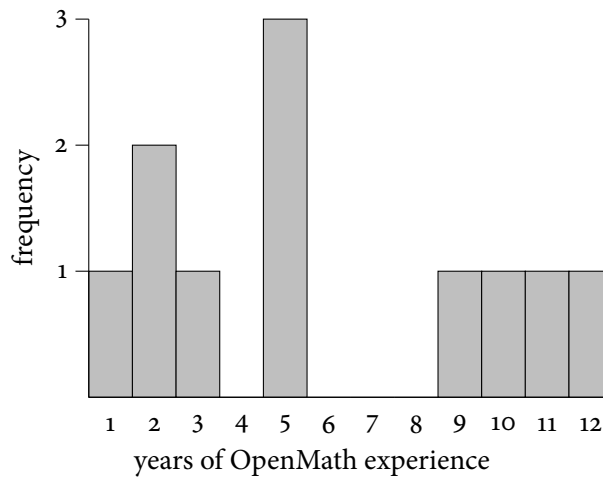
D.2.1.1 What is your role in OpenMath?

Multiple answers were possible.

Author of documents that use OpenMath	9	
Developer of Software using OpenMath	10	
Editor/maintainer/contributor of OpenMath CDs	8	
Organizational work in the OpenMath Society or community	6	
Other	4	

relevant “other” responses:

- “Interested in the area and I use it as an example project for MSc students to develop online CD maintenance and management systems”
- “writer of translations from/to OpenMath ”



D.2.1.2 Since when have you been using OpenMath?

D.2.1.3 How often do you work on the following CD-related tasks?

Throughout this questionnaire, “CD” refers to content dictionaries, signature dictionaries, and notation dictionaries.

	more than once a week	once a week	more than once a month	once a month	more than once a year	less often	never
Looking up information about CDs, symbols, CMPs/FMPs, ...	3	3	0	2	2	1	0
Reviewing CDs	1	1	1	0	5	2	1
Discussing about CDs	1	0	2	1	4	2	1
Presenting/publishing CDs	1	0	1	0	3	3	3
Other	1	0	2	0	0	1	7

“Other” responses:

- “Looking at the general structure of CDs and the reasons for their creation.”
- “I use the CDs in bursts: short periods with lots of accesses, long periods when I don’t access them at all”
- “work on transformations from or to OpenMath ”

D.2.1.4 On what types of CDs do you work?

	mostly	second	third	least
Official CDs approved by the OpenMath Society	7	2	2	0
non-standard CDs developed by yourself	3	2	5	1
non-standard CDs developed by others	1	4	4	2
Other	0	3	0	8

“Other” responses:

- “CDs developed by RIACA/our group (which is almost the same as ‘yourself’, but not quite)”
- “CDs developed by the RIACA group”
- “Most of my CD work is in the shape of OMDoc CDs”

D.2.1.5 How do you locate information about a CD or symbol?

	always	most of the time	some-times	rarely	never
I know what CD file to open	1	6	3	1	0
I do a text-based search on the CD files (e.g. grep)	0	2	1	5	3
I do an XML-based search on the CD files (e.g. XPath)	0	0	1	2	8
I browse human-friendly presentations of the CDs	2	7	1	1	0
I query a database that contains CD information	0	1	2	2	6
Other	0	0	1	0	10

“Other” responses:

- “... and that renders the formulæ!”
- “I browse the openmath website symbol list: <http://www.openmath.org/cdindex.html>”

D.2.1.6 How do you edit a CD?

	always	most of the time	some-times	rarely	never
Text editor	3	1	5	1	1
XML-aware editor	3	3	3	0	2
OpenMath-aware editor (please state below which one)	1	0	3	2	5
Other	0	0	3	1	7

relevant “other” responses:

- “My own OpenMath editor”¹

¹This comment refers to a tool that has been discussed in [section 6.2.1.4](#).

- “Wiris input editor sometimes, rather always QMath ”
- “Emacs with nxml package. Otherwise I occasionally use the tools developed by my MSc students.”¹
- “I rarely edit CDs, but am interested in efficient ways of doing so”
- “but my text editor (Emacs) is XML OpenMath aware via nxml-mode”

D.2.1.7 How do you create a new CD?

This may differ from editing a CD that already exists.






	always	most of the time	some-times	rarely	never
Text editor	2	3	1	1	4
XML-aware editor	3	3	0	0	5
OpenMath-aware editor	0	0	0	3	8
Interactive assistant (e.g. web form)	0	0	0	1	10
Automatically (e.g. generated from program code)	1	0	1	2	7
Other (state below)	1	0	1	1	8

“Other” responses:

- “My own OpenMath editor”
- “Not done this.”
- “Only using the tools developed by my MSc students”
- “I don’t create new CDs often, but interested in efficient ways of doing so”
- “but my text editor (Emacs with nxml) is XML OpenMath aware via nxml-mode”

D.2.1.8 What communication media do you use to communicate about CDs?

Please check all that apply:

Personal communication	11	
Mailing lists	10	
Trac	1	
Wiki	3	
Other	2	

“Other” responses:

- “ActiveMath collections and preview. Scribbles for the earlier stage and also for debating steps, e.g. on Drupal.”
- “svn RSS feed (sometimes to keep up to date on what has changed)”

D.2.1.9 How often do you use the OpenMath wiki for the following tasks?

	more than once a week	once a week	more than once a month	once a month	more than once a year	less often	never
Looking up information about CDs, symbols, CMPs/FMPs, ...	0	0	0	1	2	4	3
Reviewing CDs	0	0	0	0	2	3	5
Discussing about CDs	0	0	1	0	2	1	6
Presenting/publishing CDs	0	0	0	1	2	2	5
Other	0	0	0	0	1	2	7

relevant “other” responses:

- “I have used the static CD pages so far.”
- “this only applies in the periods where I am actively working on CDs, which is not always.”

D.2.2 Minor Edits

This feature is described in [section 9.4.1](#) under the revised title “Quickly Fixing Minor Errors”.

How do you agree with the following statements about such a feature?

	strongly agree	agree	neutral	disagree	strongly disagree
This feature is relevant for OpenMath	6	2	1	0	0
This feature is relevant for me	3	2	2	1	1
It would save me time	2	2	3	1	1
It would give me new possibilities of working	3	3	1	1	1
I would enjoy using it	4	2	2	1	0

Have you ever used this feature?

Frequently	0	
A few times	1	█
Never or only once	8	██████████

Reasons for the latter:

- “I didn’t know this feature up to now.”

- “I have found errors in CDs, but I never knew how to fix them.”
- “I have a full local svn checkout of the OpenMath site and Emacs key bindings built into my brain, so I do XML editing in Emacs nxml mode almost exclusively.”
- “I did not need to do this.”
- “I hadn’t observed it”
- “Never needed to”
- “I am currently not so involved in working with CDs”
- “just for testing ”

How well did it work for you?

	didn't do this	not at all	very badly	quite badly	moderately	quite well	very well
Navigating to the piece of the CD that had a mistake	5	0	0	1	2	1	0
Opening the affected piece for editing	5	0	0	1	1	2	0
Editing it	5	1	0	1	1	1	0
Saving it	6	0	0	0	1	2	0
Making use of the Subversion log message	6	0	0	0	2	1	0

Any further comments on this feature?

- “I think this is important.”
- “It feels a bit slow, which is a bit of a problem with navigation (which people expect to be quickly). For the other tasks (opening, editing, saving) people might expect and accept a bit of waiting. I couldn’t find how to enter a log message. It was not clear that I should use the summary. I wasn’t sure whether this was a summary of the thing I was editing. When I saw no comment in the history I added a summary for the next edit and then noticed that this was put in subversion log. An easy solution is mentioning it in the documentation of the feature or to rename the field.”
- “I think this would be an excellent feature *if* there was some proper moderator support for it: namely that rather than generating lots of new, single entry CDs, if there was an interface for moderators to view all the suggested changes and accept or reject them, possibly after corrections. Otherwise there is a serious danger of large numbers of questionable suggestions clogging up management of the CDs.”

D.2.3 Discussing Major Revisions

This feature is described in [section 9.4.3](#) under the revised title “Peer Review and Preparing Major Revisions by Discussion”.

How do you agree with the following statements about such a feature?

	strongly agree	agree	neutral	disagree	strongly disagree
This feature is relevant for Open-Math	3	4	2	0	0
This feature is relevant for me	4	2	3	0	0
It would save me time	3	1	3	2	0
It would give me new possibilities of working	3	3	2	1	0
I would enjoy using it	3	2	4	0	0

Have you ever used this feature?

Frequently	0	
A few times	2	█
Never or only once	7	██████████

Reasons for the latter:

- “I’m using the wiki for a few time.”
- “In practice, discussion happens on email lists perhaps about other subjects (in particular about the MathML 3 spec) and then only tangentially touches on CD issues, so discussion often carries on at the same place rather than switching to a wiki. It may be different if (as we were in the beginning) actively generating new CDs”
- “Discussion has taken place mostly on mailing lists.”
- “I feel the mailing-list is already sleepy enough!”
- “Never needed to”
- “I am not active”
- “just for testing once”

How well did it work for you?

	didn't do this	not at all	very badly	quite badly	moder- ately	quite well	very well
Posting an initial discussion post about some topic	4	0	0	0	1	3	1
Posting a reply to a discussion post	5	0	0	0	1	2	1
Choosing a type for a discussion post	5	0	0	0	3	1	0
Finding open discussions from the main page	5	0	0	2	2	0	0
Reading existing discussions	5	0	0	0	2	2	0
Configuring e-mail subscription for discussion post	6	0	0	1	1	1	0
Receiving and reading notification e-mails	7	0	0	1	0	1	0

Any further comments on this feature?

- “I really like the feature, but it needs a lot of polish.”
- “It might be nice to be able see the (topics of) discussion items for the whole page and/or to navigate to them. This might work better for people better used to working with wikis. With some experience choosing a discussion type and finding open discussions, as well as configuring e-mail would work quite well.”
- “I am sure this works well for those who actively are creating CDs. I wish there was when I was editing and submitting CDs”
- “In general, I think it is a useful feature, but I would prefer it to be accessible directly from the CDs web page, rather than on a separate wiki”
- “Trouble is... why can't we use existing infrastructures to do this communication, mailman being the tool of choice, instead of adding yet another spot to monitor.”

D.2.4 Editing and Verifying Notations

This feature is described in [section 9.4.2](#) under the revised title “Fixing and Verifying Notations”.

How do you agree with the following statements about such a feature?

	strongly agree	agree	neutral	disagree	strongly disagree
This feature is relevant for OpenMath	6	3	0	0	0
This feature is relevant for me	4	2	2	1	0
It would save me time	4	0	2	3	0
It would give me new possibilities of working	3	1	3	2	0
I would enjoy using it	4	0	5	0	0

Have you ever used this feature?

Frequently	1	
A few times	2	
Never or only once	6	

Reasons for the latter:

- “Never had the necessity”
- “I maintain the main ‘alternative’ to these notation declarations, the XSLT stylesheets to MathML, so these come more naturally to me.”
- “no need.”
- “I don’t really edit CDs: I am interested in the CD management problem, rather than the CDs themselves.”
- “I am not active”
- “didn’t found out how to test this in the SWiM test.”

How well did it work for you?

	didn’t do this	not at all	very badly	quite badly	moderately	quite well	very well
Navigating from a mis-rendered symbol to its notation definition	6	0	0	1	1	1	0
Editing the notation definition	7	0	0	1	1	0	0
Verifying whether you got the notation right	6	0	0	0	2	1	0

Any further comments on this feature?

- “Probably wouldn’t use it often, but it seems useful.”

D.2.5 Other Wiki Features

Other Supported Features

Short judgments on the following other features of the OpenMath wiki.

1. Do you consider a feature relevant?
2. Have you used it?
3. If so, how well did it work?

	relevant	I have used it	worked very badly	quite badly	moderately	quite well	very well
RSS feed of recently changed pages	9	2	0	0	0	1	1
User permission management	9	0	0	0	0	0	1
Sample queries (linked from main page)	8	1	0	0	1	3	0
Possibility to do your own queries	6	1	0	0	2	0	0
Interaction with the Subversion repository	9	1	0	0	0	2	0
Semantic navigation ("References" box)	9	1	0	0	0	1	0
Symbols being linked to their CDDefinition (middle mouse button)	8	2	1	0	0	1	0
Document-oriented editor for CD structures	6	1	0	1	0	0	0
Form-based editor for metadata	5	1	0	1	0	1	0
Visual formula editor	8	1	0	0	1	0	0
Full-text search	7	0	0	0	0	0	0
Online help (FAQ, troubleshooting, other explanations)	9	1	0	0	1	1	0
Usability in general	7	2	0	0	3	1	0

Wishlist

How much would you wish to have the following features?

	not all	at	not necessarily	some-what	much	very much
A text search that works better	0	4	2	0	2	
Formula search	0	1	2	3	2	
Global search/replace for text	0	2	4	2	0	
Global search/replace for CD structures	0	2	4	2	0	
Global search/replace for formulae	0	3	3	2	0	
Assistance with implementing solutions for common problems	0	2	3	1	2	
Better Subversion integration (currently only update/commit/lock supported)	0	4	1	1	2	
Usable support for adding new content (CDs, symbols)	0	0	3	1	4	
Ability to link to discussion posts	0	0	4	2	2	
More appropriate types for discussion posts	0	3	3	1	1	
A personalized view on your topics and discussions of interest	0	3	2	1	2	
More interactive features in documents (e.g. customizable notations)	0	2	4	1	1	
Editing of types (e.g. STS)	0	1	1	4	2	
Type-checking of expressions	0	1	2	1	4	
CAS integration	0	3	2	0	3	
Dedicated CD review workflow	0	2	0	2	4	
Other	5	1	1	0	2	

“Other” responses:

- “Help with checking the ‘formal mathematical properties.’”
- “I really wanted to enter ‘No Opinion’ for all of this question, but that was not an option so I entered ‘Somewhat’ for everything here. By far my biggest problem with the wiki is its poor speed and reactivity. I am really put off using it, or even exploring it properly, before this issue is fixed.”²
- “speed up (if possible) especially for (simple/CD) navigation.”
“easy link to parent if there is one (symbol→CD→CD group)”

D.2.5.1 General Comments

- “The wiki seems a good idea. It makes it easier to make small changes or start discussions on them (for those who do not like to edit the CDs themselves).”
- “I am afraid that my comment is really of the unhelpful form ‘If I were you I wouldn’t start from here...’ (Sorry): My preference would be to not have a separate wiki from the CD

²In response to this statement, all answered of that participant have been removed from the table given above, except for the “other” option.

management site but to have the wiki features fully integrated: users could attach discussion threads to individual CDs or definitions in CDs, when viewing a CD, the discussions would be available there, just like the FMPs, CMPs etc. Suggestions could be made in place but moderators could log in to vet them, reject or accept, even a voting system on changes could be supported if required. One of the critical barriers to this is getting a much better quality OpenMath to MathML translator working. All of the currently available ones have serious problems.”

- “One problem with (any) wiki which isn’t really addressed in the survey is editorial control. For both OpenMath and MathML we need, or seemed to need, close editorial control and consistent editorial style over the whole collection. This is somewhat at odds with the more fluid editorial style that tends to be adopted in a wiki. In particular the versions of the CDs in the wiki were based on a somewhat speculative set of CDs from the svn repository which in the end we couldn’t use for MathML 3, which needed to be based on the CDs at openmath.org/cd and with text that was copied into chapter 4 of the MathML spec and then edited consistently rather than (as was tried at the start) dynamically pulling each symbol description from the relevant CD, which produced a far too disjointed chapter of the MathML spec”
- “The system seems not completely stable. I have received several warning windows and unknown errors”

D.3 OpenMath Wiki Usability Experiments

How to move the cursor one character forward in vi

The correct answer is: <ESC>l which works in all modes. Except at the beginning of a line, where the above command will move the cursor two characters forward. If it did anything else, it would not be vi. So at the beginning of the line, this answer is the correct one: <ESC>li. And of course neither will work at the end of the line. At the end of the line, the correct command is: <ESC>j^i. The topic of the next two lectures will be “how to move the cursor one character backward in vi”.

—Per Abrahamsen [Abr]

14 test persons participated in the usability experiments. Section 10.5 explains the setting and summarizes the results; detailed logs are given here.

Some test persons gave more detailed feedback on these features, or additional feedback on other features. Literal quotes from the test persons are quoted and highlighted in italics. “*Just like this sentence.*” My own interaction with the test persons, such as instructions or explanations given, is quoted and highlighted in a sans-serif font. “Just like this sentence.” Further explanatory comments for the reader are given as footnotes.

I classified distinct feedback statements in the following way:

- ☺ Positive feedback, subclassified into:
 - U** The user gave explicit positive feedback about a feature
 - T** Actions or verbalizations show evidence that the user understood how to accomplish a certain task, and it worked
 - D** Verbalizations show evidence that the user understood a design concept behind the user interface.

- ⊙ Negative feedback, subclassified into:
 - U** The user gave explicit negative feedback about a feature.
 - E** The user explicitly stated that the system did not meet his expectations
 - N** Verbalizations show evidence of dissatisfaction with an aspect of the interface.
 - C** Verbalizations show evidence of confusion/uncertainty about an aspect of the interface.
 - S** Verbalizations show evidence of confusion/surprise at the outcome of an action.
 - T** The user tried a wrong approach, or verbalizations show evidence that the user did not know how to accomplish a certain task.
 - D** Verbalizations show evidence that the user did not understand a design concept behind the user interface
 - P** The user wanted to do the right thing but then experienced an unexpected problem of which I had not been aware of before, or a bug of which I had been aware of before starting the experiments.
- ⊛ The user made a suggestion. There is no clear distinction between suggestions and “negative feedback” in the sense of the system not meeting a user’s expectation; I tended to classify requests as ideas that were to-the-point constructive suggestions, or that the users themselves classified as “nice to have” or as enhancements, or whose realization in SWiM would be a major effort, as compared to just fixing a minor bug.
- ▷ This groups a list of subtopics, ...
 - such as this one.

D.3.1 User 1 (2009-12-03)

Quickly Fixing Minor Errors

Navigating to the document editor:

- ⊙E expected a text box in place
 - ▷ “open this” links:
 - ⊙T didn’t figure out that it opens the section *starting* there (but rather clicked on the following “open this” link)
 - ⊛ should be directly attached, e.g., to the section headline, instead of showing up far on the right, in order to make its functionality more obvious
 - ⊛ on pages with little content, there should be a horizontal rule designating the end of the content
 - ⊛ expected the “edit” button at the bottom of the window³. – “The user interface is similar to MediaWiki.”
 - ⊛ Generally, the page actions should be grouped more logically. A user may not be used to MediaWiki.

In the document editor:

- ⊙C confused when moving the text cursor around, e.g. into the bold labels of the metadata fields
- ⊙N particularly irritated by the “non-text” “=” sign, found it easy to get something wrong when editing metadata

In the metadata editing form:

³The user had previous experience with Trac, where the button for editing a wiki page is at the bottom.

- ☹U did not find it obvious that a double click was needed to edit a field; the field rather seemed to be read-only
 - ⚙ Suggestion: don't put the "delete" button into a column titled "action" if that is the only action that can be performed
 - ☹U too many metadata fields related to IkeWiki maintenance
 - ⚙ maybe rename metadata fields
 - ☹T figured out himself/herself that "Return" saves a metadata field.
- Subversion log message:
- ☹U fine

Fixing and Verifying Notations

Navigating to the symbol and notation definition:

- ⚙ There should be some online help saying that you have to middle click on symbols.
- ☹T/D It was not clear that the notation definition of a symbol is linked from the symbol via the navigation tree.
 - ⚙ Better labels should be provided for the RDF links in the navigation tree.

Preview of the notation definition:

- ☹N The meaning of "arg1" and "arg n " in the preview of the rendering of an n -ary operator was not obvious.
 - ⚙ use subscripts, e.g. "arg₁"
 - ⚙ There should be a larger padding of the cells in the table
 - ⚙ "I have been thinking about coloring." – Yes, or highlight matching parts on hover
 - ⚙ distinguish symbols from variables

Editing:

- ☹T no idea how to edit – "click 'edit'"
- ☹U not familiar with cluttered tables
 - ⚙ there should be a palette for inserting Unicode symbols⁴, or support for XML-like entities, e.g. $\&\#1234$;
- ☹C/D not sure whether I'm editing the right table – in the rendered view, the preview is on the right side, but now in the editor one is supposed to *edit* on the right side?

Complete workflow:

- ☹U The idea that you can edit and instantly see the result is good
- ☹U did not like it that symbol links were only accessible by the middle mouse button
 - ⚙ It should be particularly easy to edit the *rendering* of a symbol; usually you don't need to edit the *prototype*.
 - ⚙ It should be easier to change a rendered symbol, e.g. a button "change notation" next to rendered symbols in formulæ, then a popup dialog, where you can select the desired rendering from a symbol palette, or enter a Unicode character.

Peer Review and Preparing Major Revisions by Discussion

Discussion forum user interface:

⁴Such a palette exists in the TinyMCE toolbar (a button with an Ω icon), but it may not be obvious to identify

- ✧ In the popup menu for posting a position, the order should be more logical, namely “agree/neutral/disagree” instead of “agree/disagree/neutral”
- ☹N What if I agree but have one concern? (I.e. how to combine two argumentative types?)
 - ✧ The untyped “reply” button should be more clearly separated from the others
 - ✧ Domain-specific issues: “A definition – in the strict sense – cannot be wrong.” – But there *are* wrong definitions; consider RUSSELL’s paradox
- ☹E “*The drop-down list for selecting a specific Issue/Idea type must not be editable; otherwise I wonder what I should enter there.*”
 - ▷ Icons:
 - ☹U The “issue” icon is not intuitive.
 - ☹N The difference between the icons for “evaluation” vs. “position” is unclear.
 - ✧ There should be a lighter editor, maybe only show the heavy editor on request
 - ✧ Assistance (cf. [section 6.6.3](#)): can’t judge whether it would work, because there are no *real* discussions here.⁵
- ☹U “*I don’t like user interface, nor the colors used.*”
- ☹U “*The workflow is nice for mathematical discussions.*”

E-mail notification:

- ▷ Subscription:
 - ☹E The “auto-watch” checkbox belongs into a user profile dialog, not here.
 - ✧ Suggestion: “[watch this](#) / [unwatch this](#)” as a link

Queries:

- ✧ Hide queries from the editor; they might confuse newbies.
- ☹U Queries combining mathematical and argumentative structure would be useful
 - ▷ suggested further queries:
 - ✧ “symbols with ≥ 2 notations, of which one has an issue”
 - ✧ What CDs are used most?
 - ✧ Who reused symbols from CDs that I wrote?
 - ✧ When a discussion is about a symbol, the rendered symbol should be shown in the query results.
- ☹U The results of the query for ongoing discussions are not presented nicely; it is not obvious what the discussions are about.
 - ✧ A discussion with two issues should show up as two query results
 - ✧ Have each discussion on a separate line, the most recent one on top.
 - ✧ Display a limited subset of query results if there are many; offer an “expand” button (e.g. “+”) that will show more

General Feedback

- ✧ Pay more attention to small usability features

⁵There *were* some real discussions in the wiki (cf. [section 10.3](#)), but we did not study them for this experiment.

D.3.2 User 2 (2009-12-04)

Quickly Fixing Minor Errors

Navigating to the document editor:

▷ “open this” links:

☹U It is a bit confusing to understand where it belongs

☹S After clicking “open this”: “*Now I’m seeing the same again?*”

☹U Where is the “edit” button? – Too far away

In the document editor:

☹U Display of XInclude links is confusing

☹U Editing of metadata is unintuitive

☹E I cannot add anything.⁶

☹E Some of the “forbidden” markup (e.g. metadata labels) can be edited

In the metadata editing form:

☹U Liked this better [than the document editor]

☹U It takes too long to load

✧ Enable cursor key navigation between the cells, like in Excel

Other comments:

☹C How do I navigate to the parent page?

✧ Breadcrumbs for navigating back

☹U Some of the labels in the navigation tree are a bit unintuitive

✧ Formulæ should directly be editable in the formula editor, without going through the document editor; that formula editor window should be accessible via its own URL for more flexible integration

✧ Similarly, informal sections should be directly editable in a text box.

✧ For text mixed with formulæ, the TinyMCE view could simply contain links to the formula editor instead of also making the formulæ editable in linear syntax

▷ Formula editor dialog:

✧ The linear syntax of a long formula should spread over multiple lines

✧ The functional tree structure should be exposed.

Subversion log message:

☹U helpful

Fixing and Verifying Notations

Navigating to the symbol and notation definition:

✧ Symbol $\xleftarrow{\text{rendersSymbol}}$ NotationDefinition: inverse relation would be more intuitive

Preview of the notation definition:

✧ There should be a larger padding of the cells in the table

☹U Looks good!

✧ Add a “prototype preview”, i.e. `<OMA><OMS cd="the" name="symbol"/><OMSTR>arg1</OMSTR>...</OMA>`

✧ In the prototype, use colors for `expr/@name`

⁶Metadata can be added here, but not in an obvious way (cf. [section 8.3.3](#)).

Editing:

- ☺U The two-column arrangement makes sense.
- ☹U The tables use too much space.

Complete workflow:

- ☺U Actually good, ...
- ☹U but the document editor is too clumsy

Peer Review and Preparing Major Revisions by Discussion

Discussion forum user interface:

- ✧ Offer local links to the discussion forum, e.g. in the place where “open this” is at the moment
- ✧ Think about offering a review workflow

Queries:

- ✧ Display the subject of a discussion thread as a part of the query result

D.3.3 User 3 (2009-12-04)**Quickly Fixing Minor Errors**

Navigating to the document editor:

- ☺T picked the right “open this” link.
- ☹C slightly confused: “*Can I edit it here?*”

In the document editor:

- ☺P Tried to remove a metadata field; exception occurred on save
- ☹U Metadata vocabulary is different from the terminology used in the rendered CD ⇒ confusing

In the metadata editing form:

- ☺P Encountered the cursor highlighting bug⁷
- ☹N In the drop-down list for adding a new property, only the formal identifiers are shown
 - ✧ Offer metadata language selection from a drop-down list instead of forcing the user to enter a two-letter string⁸

Subversion log message:

- ☺U helpful
- ☹E when changing a metadatum in the document editor, its name does not show up in the log message⁹

Other comments:

- ☺P no “open this” for *discussion* children of a symbol definition;¹⁰ they are only linked via the general *hasDirectPart* relation, but not via a more specific one, such as *hasDiscussion*
- ☹U not always intuitive what links are incoming vs. outgoing

⁷Most users were irritated by this bug; in subsequent experiments I gave instructions for a workaround and did not record this bug any more.

⁸While this is generally a valid concern, the OpenMath CD language does not have any means of expressing multilingual metadata, which makes this feature of IkeWiki useless here.

⁹We would need an XML diff in order to identify the change made in the document editor (cf. section 9.6.4.2).

¹⁰*discussion* elements were an experimental feature of the OpenMath 3/MathML 3 draft CDs.

- ☹N no dependencies/imports shown¹¹
- ☹P the “prefix form” view of a formula does not have valid links to symbol definitions

Fixing and Verifying Notations

Navigating to the symbol and notation definition:

- ☹S didn’t notice that the symbol definition opened in a new tab after the middle click¹²
- ☹S clicking on a rendered symbol does not lead to the notation definition but to the symbol’s (semantic) definition

Preview of the notation definition:

- ☹U The terms “prototype” and “rendering” are not intuitive for non-experts.

Editing:

- ☹E Cannot enter a Unicode or \LaTeX symbol
- ✧ Fold those large HTML tables
- ☹P While editing the cell for the content of an *mo* element (i.e.

mo
this one

), one must not hit “Return”, as that would insert an HTML *p* element, which would then confuse the parser on saving.

Complete workflow:

- ☹U getting to the notation definition is too cumbersome
 - ✧ suggested improvement: right click on symbol shows context menu with entries “show definition” and “show notation”
- ☹D didn’t know *when* to use the navigation tree
 - ✧ more self-explanatory labels in the navigation tree, e.g. “go to notations”

Peer Review and Preparing Major Revisions by Discussion

Argumentation ontology:

- ☹D didn’t understand difference between “idea” and “supporting argument”
- ☹D otherwise understood the argumentation ontology quite well intuitively

Discussion forum user interface:

- ☹U mostly clear
 - ✧ for an *Example* supporting an *Issue*, use a “!”-like icon, as it is an *Idea*-like discussion post
- ☹N/U posts not ordered by time. “*That destroys the order of replies.*”
 - ✧ suggestion: identify, display and print out conflicts, e.g. “User A and B conflict, so let’s ...”¹³
 - ✧ count votes, display the count in the discussion user interface

E-mail notification:

- ☹D understood how it works
 - ✧ suggestion: select argumentative types of posts about which I want to be notified
- ☹E reveal a bit more of information about the post in the notification e-mail, e.g. “new idea”, “decision made”

¹¹This is a valid concern w.r.t. dependencies, but OpenMath CDs do not have import declarations.

¹²The user was not used to Unix-like systems, where this is the default browser behavior.

¹³This has indeed been one of the design goals of the DILIGENT model adopted here (cf. [section 6.6.5](#)).

Queries:

- ☺U queries for discussions are helpful
- ☺P clicking on URIs containing a “+” doesn’t work

D.3.4 User 4 (2009-12-11)

Quickly Fixing Minor Errors

Navigating to the editor:

- ☺T intuitively understood “open this” link
- ☺T first went to the metadata editor because he or she had instantly spotted that tab (but also recognized the “edit” tab)
 - ▷ After editing a symbol: *“How do I get back to the page of the complete CD?”*
 - ☺E “Back” button does not work – “due to excessive usage of AJAX ”
 - ☺T Navigation via “references”→“incoming” was intuitively clear¹⁴
 - ☺D grasped that the symbol definition is a semantic object, ...
 - ☺T ... therefore noticed the incoming link “contains symbol definition”
 - ☺T *“Can I also open a mathematical property via ‘open this?’”*
 - ✧ In the navigation tree, the way back to where you came from should be unfolded by default.
 - ☺S When using the linked data style navigation navigation links while in the “edit” tab, the user found it unintuitive that the edit tab remains active, i.e. that the control is not handed back to the article tab.

In the metadata editing form:

- ☺N *“I can only delete here?!”*
- ☺C *“How do you save?”* – “Return.”
 - ✧ Saving with “Return” is easier than opening a field for editing (= double click), but actually *opening* should be easier
- ☺S What does the status indicator in the lower right corner do? “It indicates that your edit is being saved.” – found that irritating
- ☺C *“Can I cancel an edit?”* – Yes, with “Escape”.
- ☺T Wondered whether the “annotate” tab is somehow related to metadata
- ☺E Expected the metadata edit to show up in the history

Subversion log message:

- ☺N *“Why does it show dc:description but not the label shown in the metadata editor, or the name of the OpenMath CD XML element?”*
 - ✧ Instead of *cd:swimtest+swim*, show human-friendlier names of resources, such as “symbol *swim* from the CD *swimtest*”.
- ☺C *“When I switch the language to German, does the Subversion log also become German?”* – “Unfortunately not, and IkeWiki’s language switching is not supported by the SWiM extensions anyway ☺”

Other comments:

¹⁴The user had previous experience with semantic annotation and links.

- ⊗ If language switching were supported (see above), the labels in the rendered document (e.g. “Description”) should be multilingual, but still the connection to the OpenMath CD XML element should be clear.¹⁵
- ▷ on “minor edits”:
 - ⊙U “What does ‘minor edit’ mean; why is this scenario called ‘*minor* edits?’” – One can also make a *major* edit with the same interface.
 - ⊗ “One could introduce a way of marking an actual minor edit as ‘minor’, as, e.g., in MediaWiki” – “*Yes, this feature is missing.*”

Fixing and Verifying Notations

Rendered objects:

- ▷ (re)presentations of a mathematical object:
 - ⊙T/D What do the green buttons mean? “They reveal different (re)presentations of an object.” – “*I didn’t know that these are four views on the same.*” – not intuitive
 - ⊗ use more informative labels for these buttons

Navigating to the symbol and notation definition:

- ⊙D understood that the notation of a mathematical object is in Presentation MathML
- ⊙T tried “open this” for the mathematical property
- ⊙T “*I want to change the presentation*” – clicked on “presentation” (the button that toggles the Presentation MathML display of a mathematical object), then on the “edit” tab
- ⊙E expected “*presentation editor*” there
- ⊙S “Middle click on the symbol.” – “*Did I open it?*” (didn’t notice the new tab)¹⁶
- ⊙C looking at the symbol definition that was opened, confused: “*Where is the notation?*” – “Navigate there via the navigation tree!”

Preview of the notation definition:

- ⊙C Why “prototype”?
- ⊙U Rendering is green – “*Good, that way I see that it is output.*”
- ⊙C “*I see arg₁, but where is that in the prototype?*”
- ⊙N Important distinction: The rendering preview is the rendering of an *instance* of the prototype (i.e. `<OMA><OMS cd="the" name="symbol"/><OMSTR>arg1</OMSTR>...</OMA>`), but not the prototype itself.
- ⊗ Extend preview by examples: What mathematical objects are concrete instances of this rendering?

Editing:

- ⊙C Why is the toplevel element `mcd:notation`¹⁷? “*I didn’t see that in the ‘article’ view.*”
- ⊙T “*I recognize the operator symbol ...*”
- ⊙N “*... but do not understand much otherwise*”
- ⊙C/⊙U “*What are the empty white fields for?*” – “elements without text content” – “*OK, that is like XML, one can get used to that.*”
- ⊙E Hitting “Return” in the edit summary field does not work

¹⁵This is obviously easy to realize for English, but harder for other languages.

¹⁶another Windows user

¹⁷The notation definition markup is now in the OMDoc namespace.

Complete workflow:

- ✧ Context-sensitive notation selection (e.g. according to settings in the user profile) would be important
- ✧ Looking at a complete notation dictionary: “A table of contents would be nice.”

Peer Review and Preparing Major Revisions by Discussion

Discussion forum user interface:

- ▷ Posting a new *Idea* for an existing *Issue*:
 - ☹N “In the ‘new post’ form I don’t see that I have clicked on ‘Idea’ before.”
 - ☹U nonsense that the subject of my *Idea* is predefined by the subject of the *Issue* I’m replying to.
- ☹S Confused by the status bar enabled in TinyMCE, which shows the path to the currently selected HTML element.
- ☹C Challenging *Argument* – “How would I recognize such a post?” – “At the moment only from the ‘thumbs down’ icon” – was not clear to the user
 - ✧ Provide a legend of the icons, particularly for clarifying the appearance of ratings (positive/negative/neutral *Positions*)
- ☹N chronological order of the posts unclear
- ☹U good to have untyped posts as an alternative

Argumentation ontology:

- ☹D Difference of *Argument* and *Position* was clear
- ☹E When there is an *Example*, why can’t one reply with an *Argument* or an *Elaboration*, e.g. “I agree with regards to content” (as opposed to a merely subjective *Position*), or “it is a bad example”

E-mail notification:

- ▷ Subscription:
 - ☹U “automatically watch” checkbox is inappropriate, does not belong here
 - ☹U “automatically watch” and “watch/unwatch” do not fit together
 - ✧ Use “save” instead of “OK”. “Actually I expected that my settings would directly be saved after clicking the checkboxes.”

Queries:

- ✧ Would be interesting to have a list of resolved issues (for experience management and e-learning)

General Feedback

- ☹U a lot of usability issues
 - ☹ an evaluation of the wiki in a collaboration scenario is missing
 - ▷ this experiment was titled “usability evaluation”, but actually it was also about understanding the semantic structure behind the user interface:
 - document vs. graph structure
 - “Where you have chosen semantic objects different from the ones typically occurring in wikis, has a user used them?”

- “What new possibilities do people have?” – analyze the potential
- “Did the people become aware of the nature of the semantic objects they have worked with?”

D.3.5 User 5 (2009-12-16)

Quickly Fixing Minor Errors

Navigating to the document editor:

- ☹E expected to edit description directly by clicking
 - ▷ “open this” links:
 - ☹C not *exactly* clear what it does
 - ☹T nevertheless identified the right one (“*analogous to MediaWiki*”)
 - ☹E expected direct access to the edit mode
 - ☹U “*The user does not understand the granularity*”
- ☹T instantly found and used the “edit” tab

In the document editor:

- ☹T instantly found the description field
- ☹T wrote summary, saved

In the metadata editing form:

- ☹C/☹T “*Can I click into the fields?*”
- ☹C “*How do I save?*”
- ☹E no possibility to give a summary here

Subversion log message:

- ☹T user recognized his/her changes
- ☹U didn’t find *swimtest+swim* completely obvious
- ☹U on the other hand, for well-known CDs and symbols e.g. *arith1+plus*, it is quite OK; then, it is short and concise
- ☹E you only see *that* a metadatum was changed, but not what *exactly* has changed
 - ✱ use “/” as a separator

Fixing and Verifying Notations

Navigating to the symbol and notation definition:

- ☹E/T tried to click on the symbol, nothing happened, frustrated – “middle button”
- ☹U It is easy to miss the symbol when clicking
- ☹D It was clear to the user that clicking leads to the symbol’s definition
- ☹T/D “*Outgoing – those seem to be irrelevant*”
- ☹D “*Watches? – that is related to watching/viewing*”¹⁸
- ☹D “*rendersSymbol’ – that is related to appearance*”
- ☹T “*How do you expand a tree?*” With “+”?

Preview of the notation definition:

- ☹N couldn’t recognize the prototype in the rendering

¹⁸There was a link from the article to a person watching it (actually: its discussion forum) for changes, labeled “watches”.

- ☺D “args” corresponds to “arg1... argn”, separated by the operator symbol
- ☼ would like to see the source code of the rendering in an additional column

Editing:

- ☺U/☺T “I didn’t read all that [the tables]” – just spotted the operator symbol
- ☺T entered summary
- ☺T saving worked

Complete workflow:

- ☺U rendered objects are a bit small, ...
- ☼ ... suggested a larger font

Peer Review and Preparing Major Revisions by Discussion

Discussion forum user interface/Argumentation ontology:

- ☺C/☺T read the tooltip for “new issue”, then clicked “new comment”
- ☺S Confused by the TinyMCE status bar
- ☺D “Why didn’t you choose to post an *Issue*?” – “*Because I found ‘wrong’ too strong*”¹⁹
 - ☼ would have preferred something weaker, like Bugzilla’s “new feature”
 - ☼ would like to enter Presentation MathML
- ☺T would study existing discussions in order to learn the argumentative structure
 - ☼ position for voting? – A poll user interface would be better.
- ☺C/☺T “*Agree with an Idea? What happens here?*” – writes a reply to an idea
- ☺T next replies to the same idea with a challenging *Example*
- ☺T always changes the subject manually
- ☺D “*The reply buttons are restricted context-sensitively*”
 - ☼ “*I would like to directly post a counter-argument to an argument*”

Queries:

- ☺U good that this feature exists
 - ▷ query result lists on the main page:
 - ☺N not clear whether they are disjoint; disjoint lists would probably be more clearly arranged
 - ☺U separation of query results by dashes is confusing
 - ▷ custom SPARQL queries:
 - ☺U “*If I worked with the system more often, I could imagine to write some queries that are relevant for me.*”
 - ☺D “*But for that I would have to know the ontology. How do I get access to it and to its documentation?*”

D.3.6 User 6 (2009-12-18)

Quickly Fixing Minor Errors

Navigating to the document editor:

¹⁹The tooltip for the “New Issue” button reads: “something that is wrong with this knowledge item and should be solved”.

▷ “open this” links:

☹T tried “open this” for the mathematical property, as that was the closest link

☹E expected something like “open this” on the same line as the description, which directly leads to the editor, or directly click to edit in place

☹N “the ‘edit’ toolbox [on the left of the screen] does not contain relevant stuff”

☹T did not initially notice the tab bar (possibly due to its light color)

☹T opened “metadata” tab ...

☹S/N ... but then left it again, as he or she didn’t find any obvious possibility to *edit*

In the document editor:

☹P inserted a line break

▷ XInclude links to sub-fragments:

☹P can’t follow any link to included documents

✧ would be more intuitive to have them out of the main view, e.g. below, as we can’t edit them anyway

In the metadata editing form:

☹C “I can’t edit” – didn’t see any possibility to edit

☹E expected a “save” button – saving by pressing “Return” was not obvious

Subversion log message:

☹C wondered why the log message said (no comment)

☹N “You can enter a summary in the editor.” – Probably hadn’t noticed the edit summary text box due to distraction by the box-like XIncludes.²⁰

Fixing and Verifying Notations

Navigating to the symbol and notation definition:

☹P the “prefix form” view of a mathematical object does not have valid links to symbol definitions

☹T it was not obvious that one had to use the middle mouse button, ...

☹S ... and that the symbol opened in a new tab

☹T found “rendersSymbol” in the navigation tree

Preview of the notation definition:

✧ on the page of the symbol, there should be a directly editable “notation” field (as the user had requested for the description and other symbol metadata before)

Editing:

☹T editing worked

☹U found tables representing prototype and rendering and their children disturbing

✧ would like a symbol palette

Complete workflow:

✧ would like to hover over a mathematical object to see alternative notations: “This symbol can also be rendered as ...”

²⁰This is possibly a “*later rationalization*” [Nie93] that should not be overrated. As additional recording equipment, such as an eye tracker, was not available, the actual reason why the user overlooked the summary field is unknown.

Peer Review and Preparing Major Revisions by Discussion

Discussion forum user interface:

- ☹T looked at an existing thread, posted an *Elaboration* on an *Idea*
- ☹N random post ordering
- ☹C confused by structure
- ☹E expected an *Elaboration* to be shown in the same box as the *Issue/Idea* it elaborates on
- ☹U found icons helpful
- ☹U found supply of reply types OK

Argumentation ontology:

- ☹D wanted to say “this is the case because ...” and posted an *Elaboration* – it was not clear that here an *Argument* would have suited better

E-mail notification:

- ☹U found subscription configuration GUI self-explanatory
- ☹E include the title of the thread in the e-mail if there are multiple threads in the forum

Queries:

- ✧ The warning boxes suggesting assisted problem solutions should link to the discussion thread containing the suggested idea, so that the user can check that once before running the assistant.
- ▷ Query result lists:
 - ☹U a good feature
 - ✧ but would prefer a link to the thread instead of a link to the article
- ▷ Writing queries:
 - ☹N You have to know SPARQL – “Eventually, there will be a GUI for composing queries”
 - ✧ In such an interface, allow for selecting the type of resource to search, as well as filter criteria from drop-down lists with reasonable preselections, then generate SPARQL from that

D.3.7 User 7 (2009-12-21)

Quickly Fixing Minor Errors

Navigating to the document editor:

- ▷ “open this” links:
 - ☹U found them to work as in MediaWiki, ...
 - ☹E ... but expected direct access to editor
 - ☹D comment about the target of the link: “*This is only the symbol.*”
- ☹T looked at “edit” toolbox on the left
 - ✧ local access to the editor – just next to the rendered text – would be most intuitive
- ☹T on the symbol page, tried “open this” of the property, then opened the “Edit” tab

In the document editor:

- ☹P inserted line break
- ☹T saving was clear
 - ✧ suggested improvement for summary field (see “Subversion log message” below): have a help text “enter summary here” as an initial content

In the metadata editing form:

- ▷ saving:
 - ☹U found it OK that one metadata field is saved if one selects another field with the mouse
 - ✧ but the same should also work when clicking into the whitespace outside of the whole metadata table

Subversion log message:

☹U/D “I can see what has actually changed.”

☹C/☹D why (no comment)? – “Ah, because of the ‘summary’ field in the editor”

- ☹U “Why didn’t you enter a summary?” – “If it [the summary field] is empty, it doesn’t mean much.” (see suggested document editor improvement above)

Other comments:

- ✧ could use a load progress indicator (as when opening the metadata form) also when loading a rendered page takes long
- ☹T How do you navigate to the main page?
 - ▷ navigation tree:
 - ☹N text is quite small
 - ✧ put references on top of the page
 - ▷ open most relevant trees by default, such as:
 - ✧ incoming *usesSymbol* link (\cong “appears in”) for a symbol definition
 - ✧ outgoing *hasDiscussion* link to the discussion page²¹
 - ▷ (re)presentations of a mathematical object:
 - ☹U green color for an “opened” representation is useful
 - ✧ the gray buttons should have the same color as the buttons used elsewhere on the user interface

Fixing and Verifying Notations

Navigating to the symbol and notation definition:

- ☹T first entered the rendering of the symbol into the page search box²²
- ☹U middle mouse button is OK, once you know it
 - ✧ maybe one could catch the middle click event and handle it like a left click on a normal link (so that the link would not open in a new tab)
- ☹D clear that the link from the rendered symbol leads to the symbol’s definition

Preview of the notation definition:

- ✧ provide labels for the two prototype formats: “OpenMath ” and “MathML ”
- ☹E missed the *declaration* of the rendering (i.e. its XML source code) in the preview

Editing:

- ☹T after saving: “Now let’s see if it got applied everywhere” – user wanted to see if the change worked
- ☹U tables are probably confusing if you don’t know XML
- ☹T understood the two-column arrangement of prototype and rendering: “It follows the design of the ‘Article’ view.”

²¹That would make sense but does not work in the current IkeWiki design (cf. [section 9.4.3](#)).

²²During this experiment, the rendering was an ASCII character.

☺T looked at the second notation defined for the symbol (for the “constant” role, i.e. the case without arguments), understood it

☺S tried language switching

Complete workflow:

☺U found two-step editing workflow (first navigate to the symbol, then to the notation definition) acceptable

✧ of course, an in-place popup on any rendered symbol would be nice

Peer Review and Preparing Major Revisions by Discussion

Discussion forum user interface:

▷ made a comment about a symbol on the discussion page of the CD – because ...

☺U locally discussing goes via “open this” and is inconvenient

☺T/D one symbol might interact with others in the CD – “*I’d rather report on CD level*”

✧ would be good to see on the CD-level discussion page all discussions about the subitems of the CD

☺T posted an *Issue* and replied to that with a *Position*

✧ suggested ▲/▼ as a fast way for stating one’s position

Argumentation ontology:

☺D “Did you understand the difference between *Argument* and *Position*?” – “*In an Argument, you can give more details; it has more semantics.*”

▷ decisions:

☺C/D confused by the fact that one can only post an untyped reply to a *Decision*

☺D “explained the argumentation ontology” – then understood it

E-mail notification:

☺E “*Why is ‘auto-watch’ here and not in the user profile?*”

☺E why no direct link to the discussion in the e-mail?

Queries:

▷ “Explained problem-solving assistance idea”

☺U “*In a general wiki, it might work.*”

☺U “*In a mathematical wiki, the right assistance is hard to provide.*”

☺U “*It might be too much inhibiting the user’s thinking; the suggested action, e.g. ‘delete this’, might be too tempting, even with a better user interface.*”

✧ only offer it in certain extreme cases, e.g. an *Issue* with a lot of negative feedback

✧ instead of suggesting an action, merely provide a link to the discussion of the *Issue*

▷ Query result list:

✧ would like a list of “most discussed”, “most active”, “best rated” topics, as in forums

☺E no order of the results

✧ symbols in the result set should be formatted as sym [found in cd], with links to the symbol and CD

✧ there should be more vertical space between results, and more horizontal space between different queries

▷ Writing queries:

☺U “*SPARQL is a bit involved*”

- ☼ would like an interactive display of the RDF graph

D.3.8 User 8 (2009-12-21)

Quickly Fixing Minor Errors

Navigating to the document editor:

- ▷ “open this” links:

- ☹T rightly found out which of the links does not belong to the symbol but to its mathematical property
- ☹T had trouble finding the “edit” button
- ☹T tried to search the content of the page for “edit”

In the document editor:

- ☼ for the value of the description, there should be more space than for name or title (where there is just one line)
- ☹P inserted a line break

In the metadata editing form:

- ☹E “How do you enter a newline?”

Subversion log message:

- ☹N slight mismatch *dc:description* vs. *Description*
- ☹U otherwise OK

Fixing and Verifying Notations

Rendered objects:

- ☹D understood what the different (re)presentations of a mathematical object are about
- ☹E “Is it editable?” – “Can I edit a formula’s source code?”
- ☹P the “prefix form” view of an object does not have valid links to symbol definitions
- ☹D “How does it know which notation to choose?”

Navigating to the symbol and notation definition:

- ☹U found operators too small for hitting them by clicking
 - ☼ a “hand” cursor would obviously indicate that the operators are linked
- ☹D “Why is the notation separate?”
 - ☼ display it together with the symbol definition
 - ▷ navigation tree:
 - ☹T/D tried to find the notation via *hasPart*, didn’t find anything
 - ☹C/D looked at “incoming” *hasPart*, confused
 - ☹D expected an outgoing “has symbol” link; expected the notation definition to be a *part* of the symbol definition
 - ☹D “How does the ontology work?” – imagined a class for each operator, then a subclass or instance for each of its renderings or instances – “explained the difference between the system ontology and the CDs being its instances”

Preview of the notation definition:

- ☹N this view is quite different from the view of a rendered object, for no obvious reason
 - ☼ when prototypes are large, maybe show the rendering on top

Editing:

- ☺C “Am I editing the page of the operator [in general], or of its occurrence in this formula?” – ...
- ☺D ... “the general one” – “That makes sense, because I came from the general symbol definition.”
- ☺N the names of the *mcd*:* elements are not self-explanatory
- ☺C/☺T “Can I put more than one character for the operator symbol?”²³

Editing formulæ:

- ☺D “How can I enter non-ASCII symbols?” – “The formula editor is content-oriented, not presentation oriented. It allows for entering some symbols, such as *arith1#sum*, as Unicode symbol (Σ) or in ASCII (*sum*).” – “The ASCII variant should be made more obvious”
- ☺S entered $f(x)$ – recognized as “variable f times variable x ” – “You would probably first have to tell the editor that f is a function symbol in some CD.”
 - ✧ there should be a way of entering a new function symbol directly, without first defining it in a CD
- ☺C/☺D user wondered how to use the symbol, whose notation he or she had edited before, in the formula editor.²⁴

Complete workflow:

- ✧ should be possible to fix a rendering locally by clicking

Peer Review and Preparing Major Revisions by Discussion

Discussion forum user interface:

- ✧ “How can I initiate a vote?”
- ✧ first write a post, *then* use buttons [in the post editing dialog] to select its argumentative type
- ✧ “Can you insert formulæ into posts?” – also found it important to intermix text and mathematical objects, e.g. f_{name} ²⁵
 - ▷ tree structure:
 - ☺N random post ordering
 - ☺U found tree difficult to browse
 - ✧ should be collapsed when there are many issues
 - ✧ differentiate between open issues vs. closed threads
 - ✧ put *Decisions* on top of the thread they decide on
 - ✧ provide ▲/▼ buttons for voting (“as in reddit”); “You do not always elaborate on your vote”

Argumentation ontology:

- ☺D noticed the difference between *Argument* and *Position*
- ☺T/D allow for multiple decisions²⁶

E-mail notification:

- ☺U OK not to provide the content of the discussion in the e-mail: “You can’t do that in an e-mail-friendly way; people need to go to the site anyway”

Queries:

²³That is no problem.

²⁴The symbol was not part of the official CDs covered by Sentido’s symbol palette.

²⁵This would require a presentation markup editor.

²⁶This is possible.

- ⊙U warning messages about issues are good to tell people that the content is not complete/not trustable
- ⊙N “How can users who are not familiar with the argumentation ontology query or search discussions?”
 - ✧ offer a query composer as in Protégé
 - ▷ improve the structure of the queries on the main page:
 - ✧ show all unresolved issues, then arrange more specific lists in subtrees: unresolved issues with CDs/symbols
 - ⊙U the current state is confusing, as some lists are disjoint (discussions about CDs/symbols/other), whereas others are not ($(CDs \cup symbols \cup other) \cap unresolved\ issues \neq$)

D.3.9 User 9 (2010-01-19)

Quickly Fixing Minor Errors

Navigating to the document editor:

- ⊙C wondered about the buttons that expose alternative (re)presentations of a mathematical object, ...
- ⊙T/D ... tried them, understood them
 - ✧ would like to edit in place, e.g. using a context menu
- ⊙S went to the “edit” tab while still being on the toplevel page of the CD – “This is not the right place to edit.” – went back to the “Article” tab.
- ⊙T used “open this” for the symbol, then again “open this” for its mathematical property – “You overshot the mark a bit.” – “I didn’t realize that I was wrong.”
 - ▷ Navigating back from the mathematical property to the symbol definition:
 - ⊙C/T/E “How do I go back [to the page I came from]?” – no breadcrumbs or similar – “There is a facility for that.”
 - ⊙T/D used incoming *hasProperty* reference
 - ⊙U/D “I didn’t know that I should use the navigation tree, ...”
 - ⊙U “... but once I saw it, it was OK”
 - ▷ “edit” toolbox on the left:
 - ⊙C first confused by it
 - ⊙T/D “Oh, I see it’s something global”
 - ✧ maybe rename it

In the document editor:

- ⊙C wondered about the three columns (element name, *@xml:id*, other attributes) in the first row of the table
- ⊙S “I don’t see the text I want to edit” (while editing the toplevel of the CD in the first try)
- ⊙D “The user has to understand the semantic structure in order to edit.”
 - ✧ system should explain itself and guide the user (tutorial or inline/live guidance)
 - ✧ “A real XML editor would be good, as I’m familiar with XML”
- ⊙P “How do I see that I saved?” – experienced the bug that, after pressing “Save” in the editor, SWiM would not jump back into the “Article” view.

In the metadata editing form:

- ☺E expected an “edit” button
- ☺T figured out double click himself/herself

Subversion log message:

- ☺N “*Why does it say ‘actually changed’?*”
 - ✧ it would be helpful to prepend “summary: ...”
- ☺U replaced metadata field dc:description is clear

Fixing and Verifying Notations

Navigating to the symbol and notation definition:

- ✧ would like to have a context menu
- ☺C On the page of the symbol definition of *swimtest#testop*, the user was confused by a mathematical property of *that* symbol, which looked strikingly similar to the one of *swimtest#swim* on which the experiment started and which was at the same screen position²⁷
- ☺T/D went to the “edit” tab – “*I can’t change it!*” – “The notation definition is a separate object.”
- ☺E “*How would I open ab [invisible times]?*”
 - ✧ The mathematical object should be larger
 - ✧ Show a special cursor (e.g. hand)
 - ✧ highlight the symbol on hover

Preview of the notation definition:

- ☺U found the preview OK²⁸
 - ✧ would like n -ary operators to be rendered as $\text{arg1} \circ \text{arg2} \circ \dots \circ \text{argn}$, i.e. two actual operators, so that one can see the spacing of the operator symbol

Editing:

- ✧ Tables should be smaller
- ☺T “*I can only enter ASCII*” – wants a character map

Peer Review and Preparing Major Revisions by Discussion

Discussion forum user interface:

- ☺T/U read the tooltip of the “New Issue” button, liked it
 - ▷ “new post” dialog:
 - ☺U “*very nice post popup*”
 - ✧ would be nice to see what type of post I’m writing (i.e. what button I clicked)
 - ▷ icons:
 - ✧ should have tooltips
 - ✧ “thumbs up” icon for a supporting *Argument* should be accompanied by a text label
- ☺N random post ordering
- ☺U same user interface for posting *Positions* – “*I don’t mind. Keep the UI simple.*”

Argumentation ontology:

- ✧ when a decision has already been made, let users still say “I like/don’t like that”

²⁷This was an unfortunate condition that I should have avoided when setting up the test pages; in realistic CDs, such similarities are much less likely to occur.

²⁸The user was familiar with the syntaxes of OpenMath and Content MathML.

Queries:

- ✧ use a different separator sign in the list of results – “Does the ‘-’ separator have any semantics?” – “No, it doesn’t.”
- ⊙D “You need to know SPARQL and the ontologies [for writing your own queries].”

D.3.10 User 10 (2010-01-21)

Quickly Fixing Minor Errors

Navigating to the document editor:

- ▷ “open this” links:
 - ⊙T knew section editing from Wikipedia, ...
 - ⊙N ... so “why is it called ‘open this’?”
 - ⊙T “open this” link for the mathematical property “is not the right one”; then opens the right fragment
 - ⊙T “Aha, up there, there is an ‘Edit’ button, as in Wikipedia ”

In the document editor:

- ⊙E “Would I be able to change [the metadata field label] ‘Description’?”
- ⊙P didn’t see the text of the symbol’s *discussion* child in the editor.²⁹
- ⊙N “Much of the content of a page I don’t see in the editor.”

In the metadata editing form:

- ⊙T “How do I open a field [for editing]?”
- ⊙U “It’s nice that I don’t have to hit ‘save’.”
- ⊙P/U overly sensitive to clicks: clicked the “language” drop down list (without editing!), but still a “change” was saved

Subversion log message:

- ⊙C In the “actually changed fragments”, “what do those IDs mean?”
 - ✧ choose better names
 - ▷ granularity of commits:
 - ✧ “I do not always want to commit my change instantly.” – “KiWi will support transactions.” – “That would be nice.”
 - ⊙U fine-granular commits are good, ...
 - ⊙N ... but there will be quite a bunch of them – how to identify which ones are relevant?
 - ✧ “It would be nice to be able to manually add coarse-granular messages [to a set of multiple commits], such as ‘incorporated the results of the last OpenMath meeting’.”

Other comments:

- ⊙U multiple interaction patterns, all following a different style ⇒ should be uniform

Fixing and Verifying Notations

Navigating to the symbol and notation definition:

- ⊙T clicks “open this” for the mathematical property, ...
- ⊙T/D goes to “edit” tab.

²⁹This element should actually have been a fragment of its own but was not accessible in the wiki due to a bug.

- ☹T in the editor, did not notice that the Sentido button was pressed, i.e. that the cursor was in an editable formula
- ☹D “*But now I can only edit the semantics, the content markup, so it has to be in a different place.*”
- ☹T tried the buttons that expose alternative (re)presentations of a mathematical object, understood them
 - ✧ some action for the right mouse button would be nice
- ☹T/D then noticed the “rendersSymbol” link, and noticed that “the ID of the target is something about ‘notation’”

Preview of the notation definition:

- ☹U didn’t find preview intuitive
 - ✧ would like to see the XML source of the rendering, and possibly *additionally* the rendered preview³⁰

Editing:

- ☹T instantly spots the operator symbol
- ☹C otherwise confused by too many tables
 - ✧ “*I would best like to directly edit the XML; I’m used to that. – Or a formula-editor like interface that can generate Presentation MathML*”
 - ✧ such an editor could log which palette symbols are used

Complete workflow:

- ☹U workflow with the “symbol definition→notation definition” deviation is too cumbersome
 - ✧ would like to change the notation directly using “Edit”, e.g. in the formula editor
 - ✧ then there should be a warning “Attention, this will have a global effect, not just on *this* mathematical object!”

Peer Review and Preparing Major Revisions by Discussion

Discussion forum user interface:

- ☹T posted an untyped new comment – “*How do I get a ‘thumbs up’ now?*”
- ☹E “*You would have had to post a supporting argument instead.*” – “*I’d prefer having the buttons for choosing the argumentative type in the ‘new post’ form, because in the editor I know what kind of argument I have made.*”
 - ✧ an untyped post should also allow for a typed reply
 - ✧ “*Can I delete a comment?*”
- ☹U found *Elaboration* icon unclear
- ☹U “*The idea is good, but its realization could be improved.*”
 - ✧ would like (un)foldable threads for a better overview
- ☹E copy/paste from other posts is impossible, because the “new post” dialog blocks the rest of the GUI

Argumentation ontology:

- ✧ do not initially restrict the possible reply types, but rather see what users want
- ☹D why can’t one reply to an *Idea* with another *Idea*?

³⁰The user was familiar with the XML syntax of notation definitions.

☺U “Explained the rationale for restricting reply types” – “OK, on the other hand forcing people to make up their mind is helpful.”

☺D did not understand supporting/challenging initially

E-mail notification:

☺C “What does ‘auto-watch’ mean?”

☺U “It is good that the ‘auto-watch’ option exists, ...”

☺E “but it belongs into the user profile”

☺D need for notification e-mails is unclear

Queries:

☺U liked the automated assistance idea

▷ improve the structure of the queries on the main page:

☺U links to result pages are confusing

✧ instead of page IDs, author and subject should be listed

✧ restrict display to the three latest posts, ...

✧ ... only on request display all posts on a searchable, filterable page

▷ Writing queries:

☺N there should be a more user-friendly access than SPARQL

✧ aggregated pages should be possible (like the virtual documents in TNTBase), e.g. a page of all notation definitions.³¹

D.3.11 User 11 (2010-01-21)

Quickly Fixing Minor Errors

Navigating to the document editor:

☺T when searching for the editor, clicked “open this” link of the mathematical property

☺C/S/☺T “Where am I?” – opened “metadata” tab: no “description” field there; opened “edit” tab: no “description” either. – “This is not what I wanted to edit”

☺T next tried the buttons that expose alternative (re)presentations of a mathematical object

☺U/D those buttons look good, “green means opened”

☺T looked at navigation tree and “edit” toolbar

☺T goes back to the CD, tried “edit” tab there – “Use ‘open this’ for the symbol definition!”

☺U “When you know it, e.g. from the manual, it is OK.”

☺T/D opens the “metadata” tab without further instructions, “because ‘description’ is a metadatum.”

In the metadata editing form:

☺S “There is only ‘delete’ there”

☺T ... but then figures out double click himself/herself

☺U nice to have the saving status displayed as a green popup

☺P after editing the metadata, the “Article” perspective was not re-rendered

In the document editor:

☺T everything worked fine

Subversion log message:

³¹Porting SWiM to a TNTBase backend will bring such functionality (cf. sections 8.3.4.1 and 9.6.4.4).

- ☺T understood the *swimtest+swim* (i.e. *cd+name*) page name format
- ☺U replaced metadata field – “OK, short and concise”
- ☺U (no comment) – “If I want to know more, I can make a diff anyway.”
- ☺T “The comment (if given) comes from the ‘summary’ field in the editor” – “Ah, there is a ‘summary’ field? I thought that was part of the document!”
- ✧ rename the “summary” field to “change summary”

Fixing and Verifying Notations

Navigating to the symbol and notation definition:

- ☺E clicked on the symbol in the mathematical object – doesn’t work
- ☺T tried “open this” for the mathematical property
- ☺T tried the buttons for the OpenMath/MathML views
- ☺T/D tried the “edit” tab: does not work, ...
- ☺D as there is only a semantic formula editor
- ☺S “Do a middle click” – went to the symbol definition; confused by the mathematical property similar to the one on the page before (cf. [appendix D.3.9](#) for an explanation)
- ☺T explores the navigation tree, looks at *usesSymbol* – “Keep looking there!”

Preview of the notation definition:

- ☺U refers to the symbol as *swimtest#testop*; inconsistent with the *swimtest+testop* notation used elsewhere
- ☺T/D “I see a preview of the rendering.”

Editing:

- ☺T “I would like to edit the symbol” – opens “edit” tab
 - ✧ “In-place editing would be nice, ...”
- ☺U “but, OK, going via the ‘edit’ tab is definitely consistent.”
- ☺T found the operator symbol
- ☺U “The table is hard to read, ...”
- ☺U “... but the [knowledge] structure is complex after all.”
- ☺T back in the “Article” perspective: “Aha, I see a preview of my change!”
- ☺T how to enter a Unicode symbol? – discovered the Ω icon in the toolbar³²

Complete workflow:

- ✧ Would like to click on the symbol. Left click should be reserved for navigating to the symbol’s definition, ...
- ✧ ... but on right click, there should be a popup menu with an “edit notation” entry, even if that was the only entry.
- ✧ “The editor could be arranged more clearly, ...”
- ☺U “... but I understand the complexity.”
- ☺U found the perspective tabs (e.g. “Article”, “Edit”) nice, compared them w.r.t. usability to the menu bar of Mac OS: “I know that the ‘Edit’ button is always in the same place.”

³²This was the first user who discovered that icon.

Peer Review and Preparing Major Revisions by Discussion

Discussion forum user interface:

- ✧ would like to collapse threads
- ☹T posts an agreement with an existing *Issue* – does not object against having to write a text for each *Position*
- ▷ icons:
 - ☹U “*I can recognize agreement/disagreement from their icons ...*”
 - ☹N “*... but only from the icons.*”
 - ✧ would like to configure that (as you configure a toolbar in an application)
 - ✧ “*Remove the parentheses in the tooltips*”
- ☹T/D understood the difference between “New Issue” and “New Comment”

Argumentation ontology:

- ☹D “*What is the difference between a supporting argument and an agreeing position?*”
- ☹D understood what an *Elaboration* is from the tooltip of the reply button

E-mail notification:

- ▷ Subscription:
 - ✧ use more coherent labels: when a user is currently watching a discussion, provide an option “unwatch” instead of a checked checkbox labeled “watch”
 - ☹U good to have the auto-watch option
- ▷ Mail text:
 - ☹U “*Short, concise, then [the user can go] into the system for details.*”
 - ☹N what exact post does the mail refer to? – “*In the forum, I can only identify it by its date.*”³³
 - ☹E include the subject in the e-mail

Queries:

- ▷ “Explained problem-solving assistance idea”
 - ☹U in principle this is good, ...
 - ☹U ... but it will be hard to find post types on which consensus might be obtained
 - ☹U “The community will be able to edit and thus adapt the argumentation ontology.” – “*That is good.*”
- ▷ improve the structure of the queries on the main page:
 - ☹U “*The idea is good – this is information I want to get.*”
 - ☹U “*The presentation is bad*” – i.e. that the URIs of the pages appear as results
 - ✧ do it as in some feed aggregators: subject, author and date of recent posts
 - ✧ for each such preview item, provide a “read more” link.
- ▷ Writing queries:
 - ☹U “*Cool!*”
 - ☹C/☹T does SPARQL support *LIMIT*?³⁴
 - ☹U/D “*Everybody can change/adapt the presentation of the results.*”

³³Additionally, one can identify a post by its author, whose name is also included in the notification e-mail.

³⁴Yes, it does.

D.3.12 User 12 (2010-01-26)

Quickly Fixing Minor Errors

Navigating to the document editor:

▷ “open this” links:

☹T first tried the “Edit” tab, but then discovered “open this” link

☹T “*This is like in Wikipedia.*”

☹T “*How do you get back [from a symbol to the CD]?*”

In the document editor:

☹T used the summary, then saved

In the metadata editing form:

☹C/☹T “*Where can I edit?*” – then tried double clicking

☹T also found out himself/herself that one can save by pressing “Return”

Subversion log message:

☹S “*Why does it say ‘fragment’?*”

✧ Rather say “symbol” or “example”, depending on the type of fragment

☹U found metadata change log OK

Other comments:

☹N “*There is a lot of information in the surrounding toolbars, ...*”

☹U “*... but otherwise one gets along.*”

☹U “*With a little technical background, it is all at a normal level of difficulty*”

Fixing and Verifying Notations

Navigating to the symbol and notation definition:

✧ would like a tooltip with the name of the symbol

☹S confused by the middle click opening a new tab

☹T/D “*Where am I? – Aha, in the definition of the symbol.*”

☹T tried the “Edit” tab but doesn’t find anything helpful there

☹T “*Where is the link to the notation definition?*”

☹D “*‘outgoing’... – oh, well, it could as well be ‘incoming’*”

☹U “*hasProperty is too technical a name*”

☹U “*rendersSymbol – sounds logical, ...*”

☹C/D “*... but why in that direction?*”

Preview of the notation definition:

☹U looks OK

☹E “*Where is the rendering described? – That [i.e. some view on the rendering element itself] is missing.*”

Editing:

☹T “*You don’t have to understand the [table] structure.*”

☹T changes the symbol, gives a summary

☹U “*How did you find the symbol?*” – “*There was such a chaos; I just changed it on spec.*”

▷ Special characters:

☹T “*Where do you enter special characters? Aha, there is the Ω symbol.*”

☼ “Can you also enter •?”

Complete workflow:

- ☺U “When you know that the symbol links are always listed under ‘references’³⁵, and when you know the schema – what is incoming, what is outgoing –, then it is OK”
- ☺T/D “The ‘references’ box is your main tool”
 - ☼ it could be larger, or colored, as it is important.
 - ▷ Difficulties pointed out:
 - ☺U going on from the occurrence of the symbol in a mathematical object
 - ☺U/T going back to the original object³⁶
 - ☼ idea: link to the “referrer”, e.g. by breadcrumbs
 - ☺U changing the rendering is at a normal level of difficulty (as in an XML editor)

Peer Review and Preparing Major Revisions by Discussion

Discussion forum user interface/Argumentation ontology:

- ☺N each entry uses a lot of space
- ☺U “looks provisional”
- ☺C what do the icons mean?
 - ☼ provide a legend for the icons
- ☺D “‘Agree’ – is that my opinion?”
- ☺U “complex – you can do a lot”
- ☺U “After a bit more of feeling around, it makes sense.”
- ☺D “‘Decision’ – and then the answers disappear?”
 - ☼ provide +/- buttons for (un)folding threads: nobody will probably use them manually, ...
 - ☼ ... but there should be a reasonable pre-folding
 - ▷ Positions:
 - ☺D “‘Position’ is a rating – ...”
 - ☺E “do you see them anywhere?”
 - ☼ directly display ratings
 - ☼ or, e.g., as on YouTube: content rated negatively is initially invisible
- ☺U about the reply possibilities: “convention over configuration”
- ☺U “First impression: ‘quite a lot’”
 - ☼ give posts of different types more distinction – not just by icon, but also by color

E-mail notification:

- ☺C did not understand what “auto-watch” means: “the whole discussion, or just replies to me?”
 - ▷ Mail text:
 - ☺U “Something has happened [i.e. the e-mail does not tell its receiver much more than that] – OK”
 - ☺N “What if it is a large discussion?”
 - ☼ include subject
 - ☼ could also include content of the post

Queries:

³⁵I.e. the navigation tree

³⁶The user did not notice that the original object is still open in the original tab.

- ⊙N “*The presentation looks like text – no optical guides*”
 - ✧ show “discussions that are expiring now” – those with unsolved problems are probably relevant
- ⊙N “*Am I interested in that?*”
- ⊙N “*What if the list overflows?*”
 - ✧ when logged in, show or prefer those discussions in which *I* am participating
 - ▷ Writing queries:
 - ⊙U “*You can draw attention to topics.*”
 - ✧ “*A bird’s eye view – how else can you get that?*”

General Feedback

- ⊙D “*I consider it [the design decisions behind the user interface] reproducible*”
- ⊙U with appropriate explanations it is OK
- ⊙U “*But if everything will be accessible in a ‘blind flight?’*”
- ⊙U found “socialise” links unnecessary
 - ✧ move them to the bottom of the left column

D.3.13 User 13 (2010-02-04)

Quickly Fixing Minor Errors

Navigating to the document editor:

- ⊙E expected “*edit this*” instead of “open this” (as known from other wikis)
- ⊙T clicked the right “open this” link
- ⊙T from the symbol page: “*How do you get back to the whole CD?*” – expected a navigation tree
- ⊙T “*There is a navigation tree, i.e. the navigation tree.*” – “*I didn’t notice that.*”
- ⊙T/D looked at some outgoing links, then at some incoming links; had not noticed the “outgoing”/“incoming” headings
- ⊙E expected outgoing *isPartOf*

In the document editor:

- ⊙T edited and saved successfully

In the metadata editing form:

- ⊙E expected an “edit” button
- ⊙T clicked into another field in order to save

Subversion log message:

- ⊙U replaced metadata field – OK
- ⊙U actually changed fragment – OK
- ⊙E “*It could also tell me that something was changed from ‘old value’ to ‘new value’ – but you can also see that from the diff.*”
- ⊙C “*Why no comment?*”
- ⊙T/D “*You can give a summary in the ‘edit’ tab*” – “*I didn’t notice it. And I wasn’t aware that the summary goes to a database.*”

Fixing and Verifying Notations

Navigating to the symbol and notation definition:

- ☺T/D “How do I identify the CD the symbol comes from?” – tried the OpenMath view of the mathematical object
 - ✧ would like to click on a symbol and see its CD or name in a popup
 - ✧ ... or to have a menu item “go to notation”
 - ▷ Clicking on symbols:
 - ☺E “How would I navigate to $\frac{a}{b}$ or ab [invisible times]?”
 - ☺E “Can I click on variables?”
- ☺T/D after navigating to the symbol definition with the middle mouse button: “So this is the definition of the operator.”
 - ☺T “How do you go to the notation now?”
 - ☺T again tried to view the alternative (re)presentations of the FMP that the current symbol had,
...
 - ☺T ... then noticed the *rendersSymbol* link in the navigation tree
- ☺T/D after editing (while on the page with the notation definition): “How do I navigate back?” – used the link referring to the symbol (here: *swimtest#testop*, then went from the symbol to the CD via the navigation tree

Preview of the notation definition:

- ☺C/D “What are the OpenMath and Content MathML [prototype] parts about; what is the difference?”
- ☺C/D user did not realize what the XML does, did not realize that it is about pattern matching
 - ☺C “How do I know that the symbol is rendered as \otimes^{37} ? – Where does it come from?”
 - ✧ additionally show the XML code of the rendering

Editing:

- ☺D “The left part reminds me of what I have seen before.”
- ☺S/☺D “The right part I have not seen before – I guess it is the rendering.”
 - ☺T discovered the Ω button; chose a Unicode symbol
 - ☺T also tried to open the formula editor³⁸
 - ☺P rendering preview was empty after saving

Complete workflow:

- ☺U identifying the symbol and finding the place where the notation of the symbol is defined are much easier now [compared to the traditional file system/text editor alternative that was mentioned in the description of the experiment]
- ☺U “I couldn’t understand the pattern.”
- ☺U editing the notation got much easier
- ☺U checking whether the symbol is rendered correctly in its original occurrence after editing now got much easier (thanks to the preview)

³⁷That was its rendering at the time of the experiment.

³⁸Using the [content markup] formula editor should actually be forbidden when editing renderings.

Peer Review and Preparing Major Revisions by Discussion

Discussion forum user interface:

- ☺D understood the basic argumentative structure
- ☺C/☺D “*What does the label ‘Justification’ [on a post] with ‘thumbs down’ mean? – Aha!*”
- ☺U “*The icons are helpful; they give a quick overview without reading a lot*”
- ☺C/☺D/U first wondered about missing icons on some posts, but then found the idea of untyped posts good
- ☺E “*I’m more used to linear forums where I can just write.*”
- ☺D/U “*Here, I have to think first (which is good), e.g. ‘am I for or against it?’*”
- ☺C/E “*What is a ‘supporting evaluation?’*” – no tooltips in the popup menus of the *Argument* button

E-mail notification:

- ☺U good that the feature is there
- ☺U “*The mails have exactly the right content.*”

Queries:

- ▷ “Explained problem-solving assistance idea”
 - ☺U found the general idea good
 - ☺U “*Refining Idea types seems too restrictive, or in any case quite challenging to get right.*”
 - ☺U “*Assistance is good, but maybe hard to implement.*”
- ▷ Query result lists:
 - ☺U generally helpful, e.g. for the administrator
 - ☺U/D “*If I’m responsible e.g. for the arith1 CD, I see what’s going on*”
 - ☺D “*So it’s like an advertisement or motivation.*”
- ▷ Writing queries:
 - ☺U “*You can use foaf:knows with user profiles*” – “*That’s really cool!*”

D.3.14 User 14 (2010-02-04)

Quickly Fixing Minor Errors

Navigating to the document editor:

- ☺E expected table of contents in “Article” perspective
 - ▷ “open this” links:
 - ☺T “*As it says ‘open this’ here, I rather tend to clicking on ‘Edit’.*”
 - ☺E expected “edit this”, as in other wikis
 - ☺T still, did “open this”, then “Edit”
- ☺D looking at the navigation tree: “*I see all kinds of dependencies here.*”
- ☺C confused by the toolbars for ontology editing

In the metadata editing form:

- ☺E misses “edit” button
- ☺T discovered double click for editing and “Return” for saving
- ☺T “*At the bottom, it says ‘saved’.*”
- ☺P after editing the metadata, the “Article” perspective was not re-rendered

In the document editor:

- ☹T clicked the Sentido button
- ☹N “Did you see that it is already pressed?” – “No, I didn’t notice that.”
- ☹T confused by the pressed button; thought that one can no longer click it.

Subversion log message:

- ☹C/D “What is the difference between ‘field’ and ‘fragment’ – *aha, the fragment provides context.*”³⁹
- ☹C Why no comment?
- ☹C confused by the relation between the two lines replaced metadata field and *actually* changed – “*The first line says something, whereas the second line says ‘no, actually something else was changed’; this is misleading*”
- ☼ use changed field F in CD+name

Fixing and Verifying Notations

Navigating to the symbol and notation definition:

- ☹T first tries “open this” for the mathematical property
- ☹T uses the outgoing *usesSymbol* links from the navigation tree
- ☹T identified the symbol in question from the list of linked symbols – “Respect!” – “*But that works when I understand the formula, i.e. then I can associate rendered symbols to ‘usesSymbol CD+name’.*”
- ☹T on the page of the symbol, found the incoming *rendersSymbol* link intuitive

Preview of the notation definition:

- ☹U OK

Editing:

- ☹N “Uuuuaah...”
- ☹U “*Aha, in the part on the right I have to change something, that is the relevant part.*”
- ☹T gave a summary (after a hint)
- ☹T/D navigates back using the navigation tree with superior ease⁴⁰

Peer Review and Preparing Major Revisions by Discussion

Discussion forum user interface:

- ☹T studies a long existing thread
- ☹T reads the tooltips of the existing reply buttons
- ☹T “*As I am an admin, may I post a Decision?*”
- ☹D “*Why do certain posts have fewer reply buttons?*”
- ☹D did not understand the difference between a challenging and a supporting argument from the user interface
 - ▷ icons:
 - ☹T intuitively understood what a “Justification” label with “thumbs down” icon means on a post
 - ☹U “*You quickly get used to the icons.*”

³⁹This is a misunderstanding of the log message generated on a metadata field change.

⁴⁰The user had previous knowledge about representing dependencies in [mathematical] documents and therefore did not miss certain inverse relations and was able to deal with incoming/outgoing links.

☹N random post ordering

☹N “What if I want to change something [i.e. a post] later on? As a user or as an admin?”

✧ allow an admin to turn e.g. an untyped reply into what it actually is, e.g. an elaboration

☹E picks a *Decision* post, intends to say “I don’t like this that much.”

☹U “*The community will adapt its discussion culture to the prescribed structure.*”

☹U “*The discussion threads are already pre-structured. This is better than in Wikipedia.*”

E-mail notification:

☹E found that “auto-watch” rather belongs on a preference page

☹U found mail text OK: “*When I want to jump in, I have to go into the system anyway.*”

✧ filter notifications by argumentative type: “*I would only like arguments, no positions. I would like to know when a decision has been taken.*”

Queries:

▷ “Explained problem-solving assistance idea”

☹D “*Specific Issue types restrict me in that I cannot take a Position on them.*”⁴¹

☹U considered such a feature helpful for Wikipedia

☹U considered the querying support generally helpful⁴²

▷ “*I would like to watch a whole CD with a query tailored to that CD*”:

✧ prepare a query template for “a given CD or a part of it is being discussed”

✧ allow users to copy that template to their user page and adapt it.

⁴¹No, that was a misunderstanding.

⁴²The test person moderates a MediaWiki-driven site.