How can we describe and use digital learning materials more effectively? University of Leeds

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Question: How can we better use and describe learning material?

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Hypothesis: By providing sufficient metadata.

Why do we use metadata in E-Learning Systems?

- **E-Learning Systems** or Learning Management Systems (LMS) deliver learning material to learner's, to achieve a pedagogical goal.
- **Metadata** used describes Learning Objects (learning material).
- Metadata helps people and **computers** find learning appropriate material more easily.
- Since the current focus of e-learning systems is personalization through adaptation, machines need consistent and abundant metadata over which to reason.

Learning Object Repositories Research Network (LORNET)

Theme 1 Interoperability of Learning Object Repositories - *Simon Fraser University and l'École Polytechnique de Montréal*

Theme 2 Learning Objects Design and Aggregation - *Distance University of the University of Quebec at Montreal (TELUQ)*

Theme 3 **Active and Adaptive Learning Objects - University of Saskatchewan**

Theme 4 Object Mining and Knowledge Extraction - *University of Waterloo*

Theme 5 Creation, Search and Distribution of Complex Multimedia Learning Objects - *University of Ottawa*

Theme 6 Telelearning Operating System - *l'École Polytechnique de Montréal and TELUQ*

LORNET Experiences

- Learning Object Repositories with Learning Objects but no metadata. (ie. PALOMA - TELUQ, CAREO - Prov. of Alberta; LOM based)
- Learning Objects with metadata but metadata is insufficient. (ie. Merlot)
- But we haven't quite given up on learning objects yet.
- Perhaps we require too much for metadata and metadata authors?
- Perhaps we need more metadata authors?

Two approaches for solving metadata

1. Improve the process human created metadata - my research.
2. Create and use metadata automatically - The Ecological Approach.

The Ecological Approach

- Motivates a process for reasoning over learner interactions.
- Focuses on using purpose and context coupled with complex learner modeling to describe learning objects.
- Wengang Liu investigating data mining.
- Journal Papers: (McCalla, JIME 2004) (Brooks and McCalla, IJCEELL 2006)

KESP Overview

- Summer of 2006 in Dublin, Ireland
- Knowledge Economy Skills Passport
- Consortium of 5 of the most prominent Irish e-learning companies
- Create an e-learning solution to retrain the Irish workforce for the new economy

KESP Organizations

1. Intuition - Content
2. Electric Paper - Content
3. Servecast - Video
4. WBT Systems - LMS - Top Class
5. Intel - silent partner
6. National College of Ireland - curriculum and research

KESP Research

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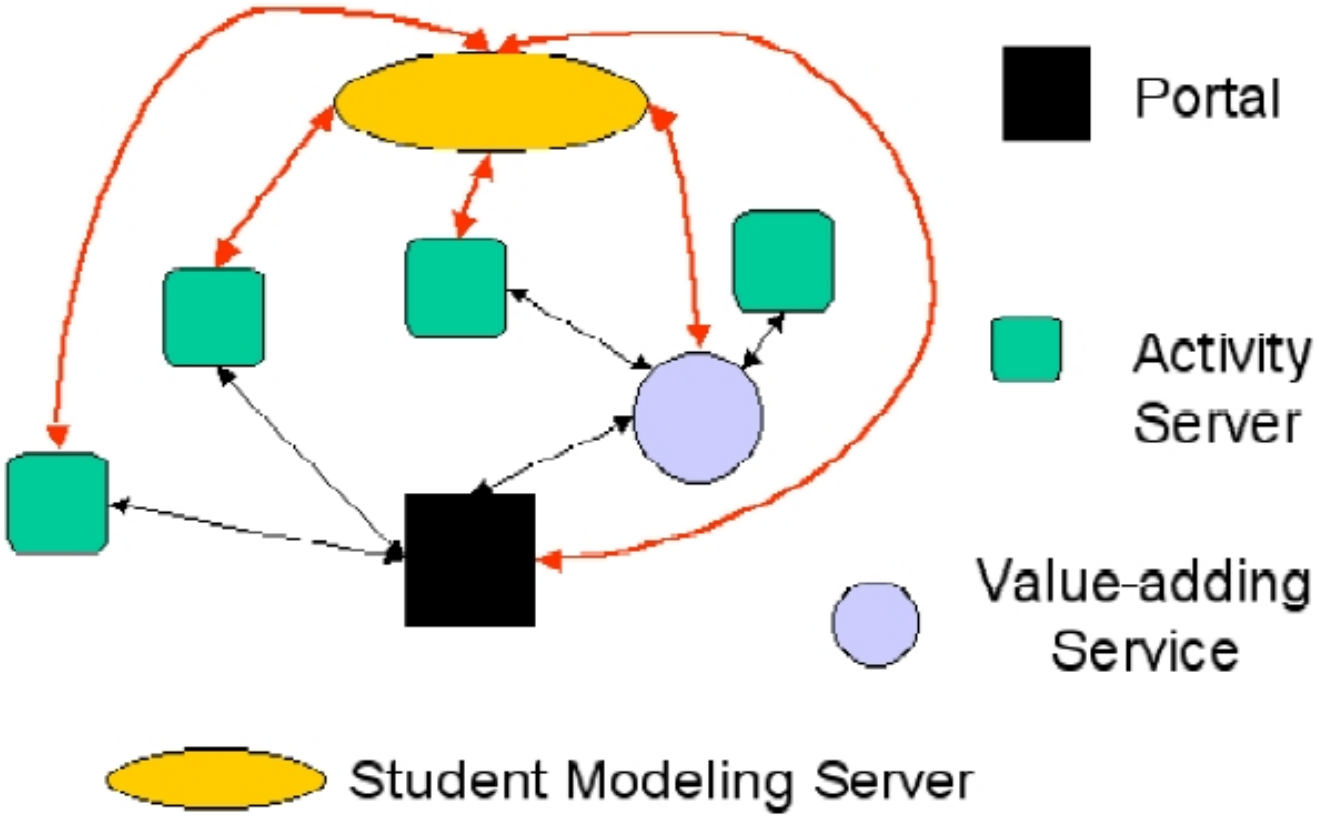
- ... a few problems

Research Performed

1. Standard based approach for user event tracing - SCORM
2. Protocols and architecture for distributed adaptive content
3. Social and collaborative software for e-learning

Protocols and architecture



(Brusilovsky, WWW 2004)

What are the problems with metadata standards?

- Remember the empty repositories. Empty sets of human created metadata.
- Learning Object Metadata Standard - IEEE LOM
- 250 randomly chosen learning objects only half of them used 1/3 of the LOM fields. (Friesen 2004)

Standards based approach flawed from the start?

Many vendors expressed little or no interest in developing products that were required to support a set of meta-data with over 80 elements... [and the] burden to support 80+ meta-data elements on the first iteration of a product is too great for most vendors to choose to bear. (Anderson and Wason, 2003)

Two nice technologies

We will contrast two approaches for metadata creation, both with desirable and undesirable characteristics.

1. **Collaborative tagging**, in which metadata creation is easy but not machine consumable.
2. **Ontologies**, in which metadata is machine consumable but too difficult to author.

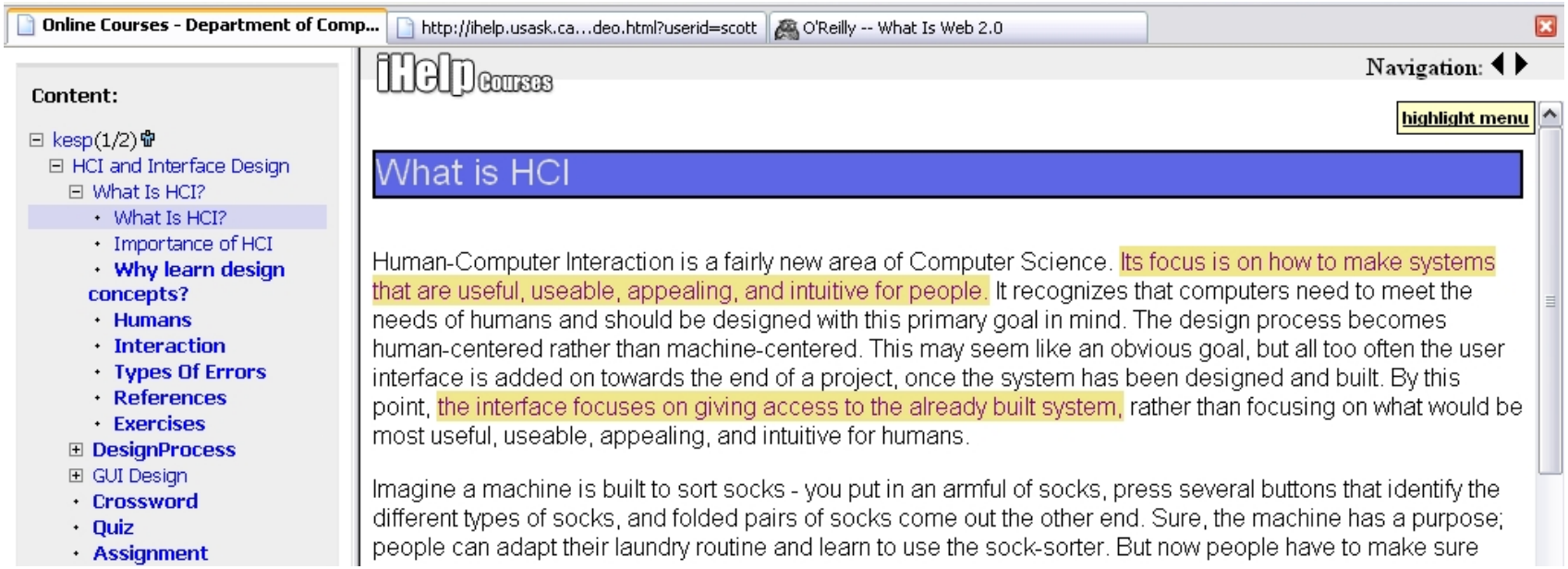
So what is Collaborative Tagging?

Collaborative Tagging:

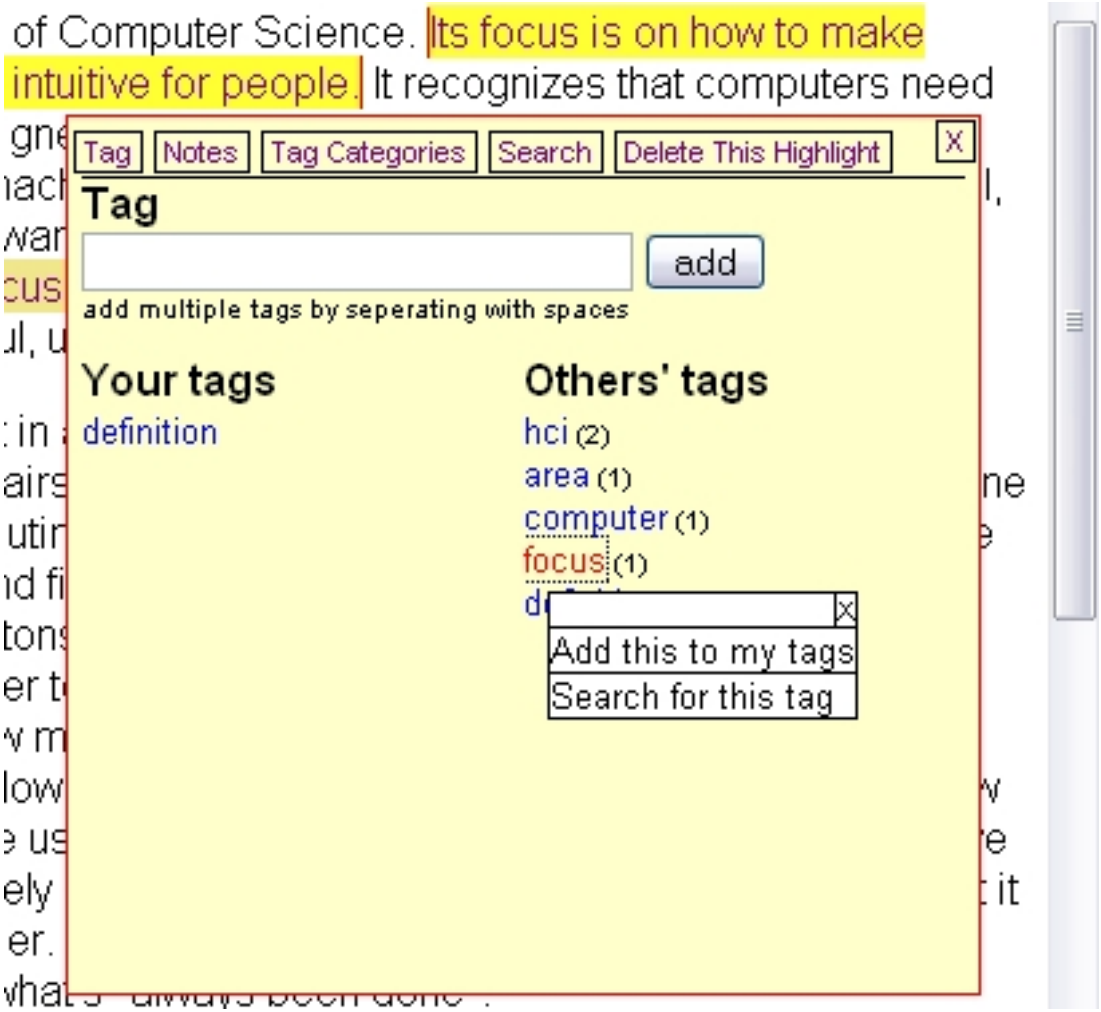
- A Web 2.0 technique
- Seen in practice on websites like: flickr.com, del.icio.us, and CiteULike.org
- Uses simple keywords (tags) for creating **human consumable** metadata. (tagging)
- Each keyword is not only an annotation but a *vote* for the tag to be recommended to others for the same resource.
- Possibly a useful cognitive tool for learners in e-learning.

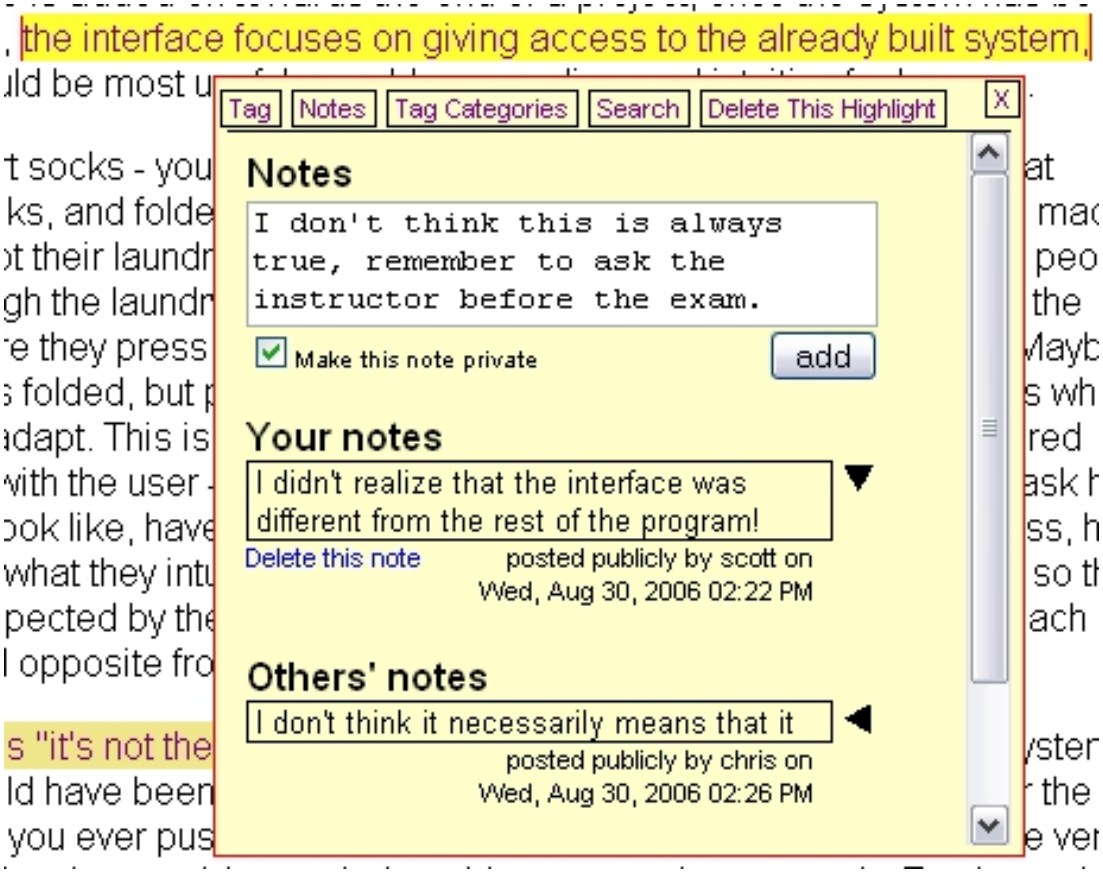
OATS: The Open Annotations and Tagging System

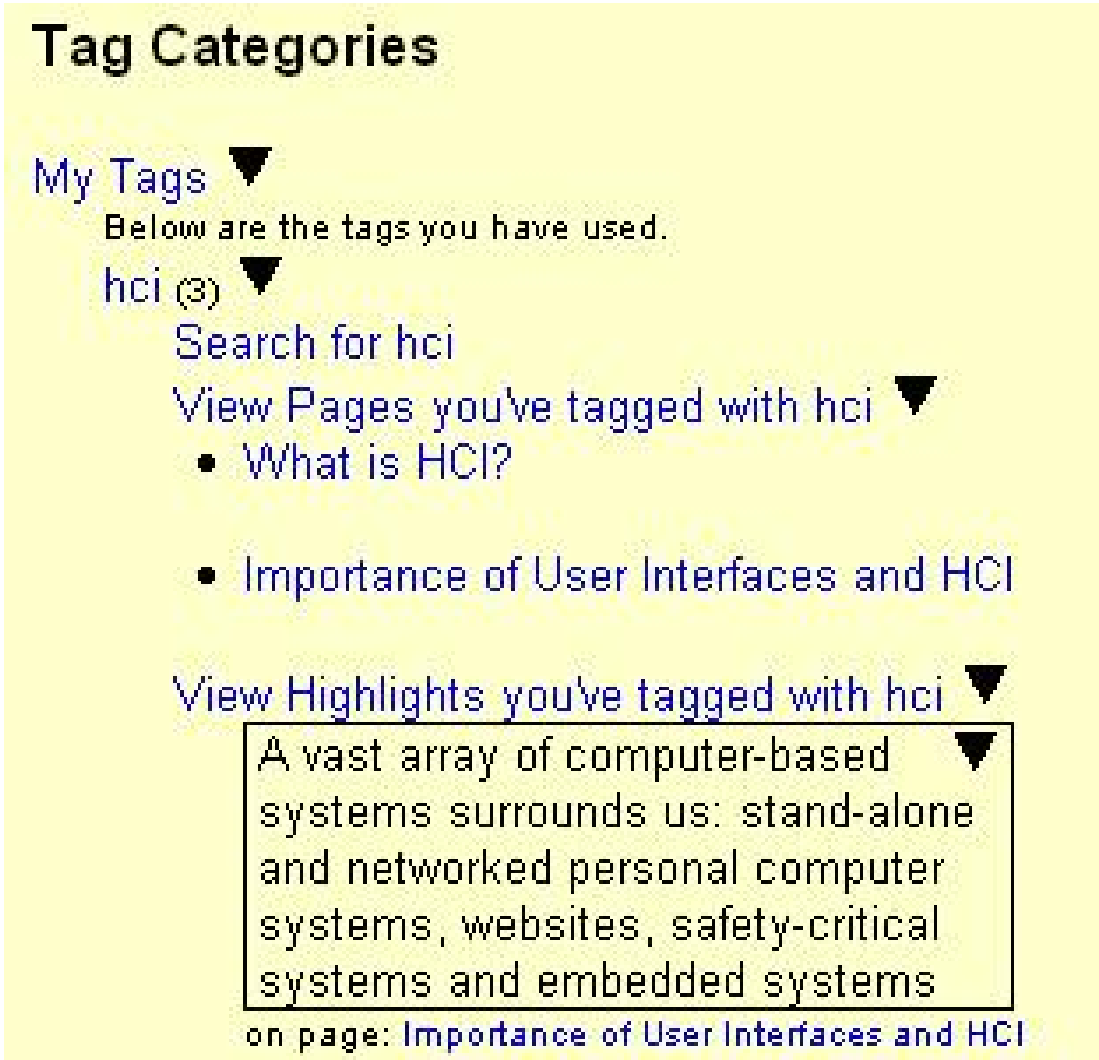
A demo of the OATS system was given, in its place are some screen shots.


Online Courses - Department of Comp...
http://ihelp.usask.ca...deo.html?userid=scott
O'Reilly -- What Is Web 2.0
Content:
kesp(1/2)
HCI and Interface Design
What Is HCI?
What Is HCI?
Importance of HCI
Why learn design concepts?
Humans
Interaction
Types Of Errors
References
Exercises
DesignProcess
GUI Design
Crossword
Quiz
Assignment
iHelp Courses
Navigation:
highlight menu
What is HCI
Human-Computer Interaction is a fairly new area of Computer Science. Its focus is on how to make systems that are useful, useable, appealing, and intuitive for people. It recognizes that computers need to meet the needs of humans and should be designed with this primary goal in mind. The design process becomes human-centered rather than machine-centered. This may seem like an obvious goal, but all too often the user interface is added on towards the end of a project, once the system has been designed and built. By this point, the interface focuses on giving access to the already built system, rather than focusing on what would be most useful, useable, appealing, and intuitive for humans.
Imagine a machine is built to sort socks - you put in an armful of socks, press several buttons that identify the different types of socks, and folded pairs of socks come out the other end. Sure, the machine has a purpose; people can adapt their laundry routine and learn to use the sock-sorter. But now people have to make sure


hide my highlights
show community highlights
search
tag categories


of Computer Science. Its focus is on how to make
intuitive for people. It recognizes that computers need
Tag
Notes
Tag Categories
Search
Delete This Highlight
X
Tag
add
add multiple tags by seperating with spaces
Your tags
definition
Others' tags
hci (2)
area (1)
computer (1)
focus (1)
Add this to my tags
Search for this tag


the interface focuses on giving access to the already built system,
Tag
Notes
Tag Categories
Search
Delete This Highlight
X
Notes
I don't think this is always true, remember to ask the instructor before the exam.
Make this note private
add
Your notes
I didn't realize that the interface was different from the rest of the program!
Delete this note
posted publicly by scott on Wed, Aug 30, 2006 02:22 PM
Others' notes
I don't think it necessarily means that it
posted publicly by chris on Wed, Aug 30, 2006 02:26 PM


Tag Categories
My Tags
Below are the tags you have used.
hci (3)
Search for hci
View Pages you've tagged with hci
What is HCI?
Importance of User Interfaces and HCI
View Highlights you've tagged with hci
A vast array of computer-based systems surrounds us: stand-alone and networked personal computer systems, websites, safety-critical systems and embedded systems
on page: Importance of User Interfaces and HCI


Tag
Notes
Tag Categories
Search
Delete This Highlight
X
Tag Categories
My Tags
Community Tags
Below are the 10 most popular tags used.
hci (43)
interesting (11)
definition (8)
computer (7)
important (7)
study (7)
boring (6)
history (5)
ov
ex
ex
limitations (4)
X
Search for this tag
Tag this highlight with it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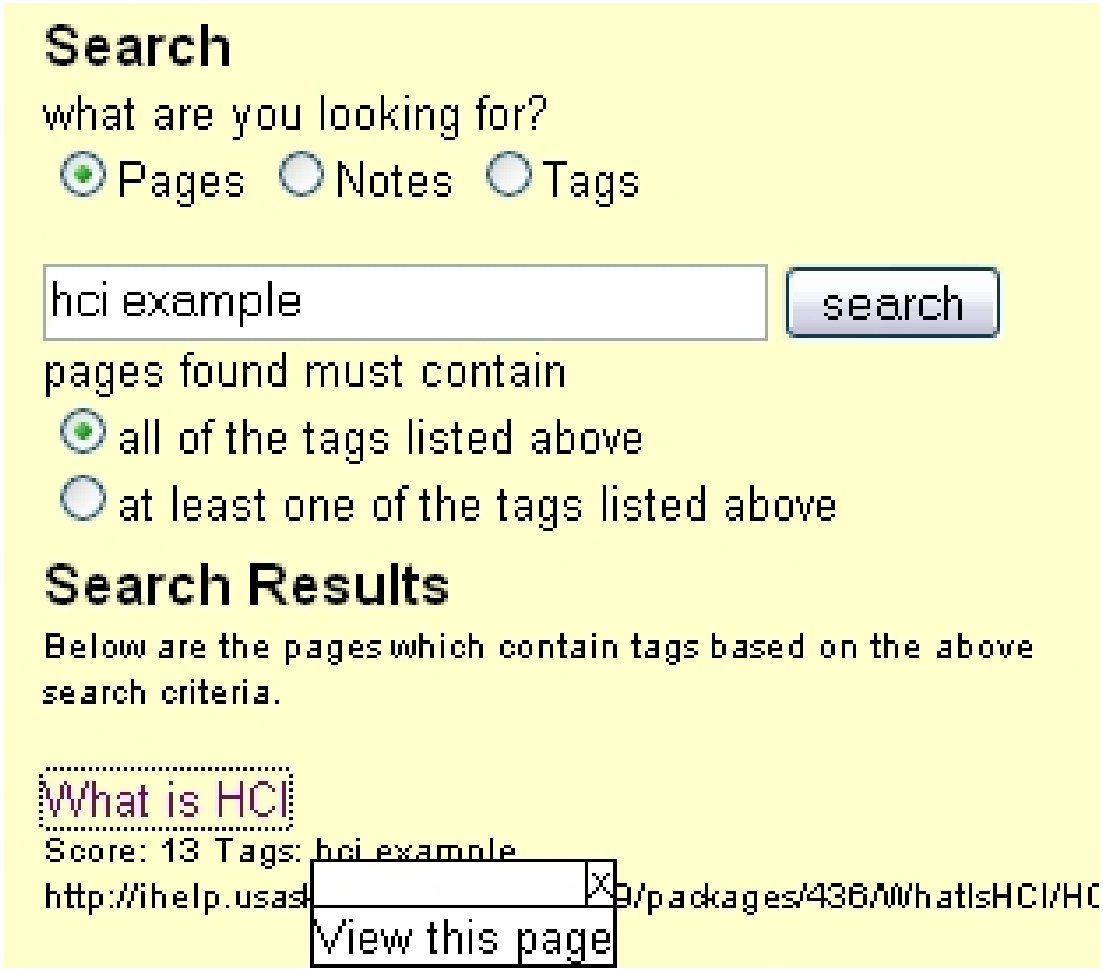

Search
what are you looking for?
Pages
Notes
Tags
hci example
search
pages found must contain
all of the tags listed above
at least one of the tags listed above
Search Results
Below are the pages which contain tags based on the above search criteria.
What is HCI
Score: 13 Tags: hci example
http://ihelp.usas
9/packages/436/WhatIsHCI/HC
View this page

Search

what are you looking for?

○ Pages ◉ Notes ○ Tags

example [search]

notes found must

◉ contain the text like above

○ must have a title like above

Search Results

Below are the notes which match the above search criteria.

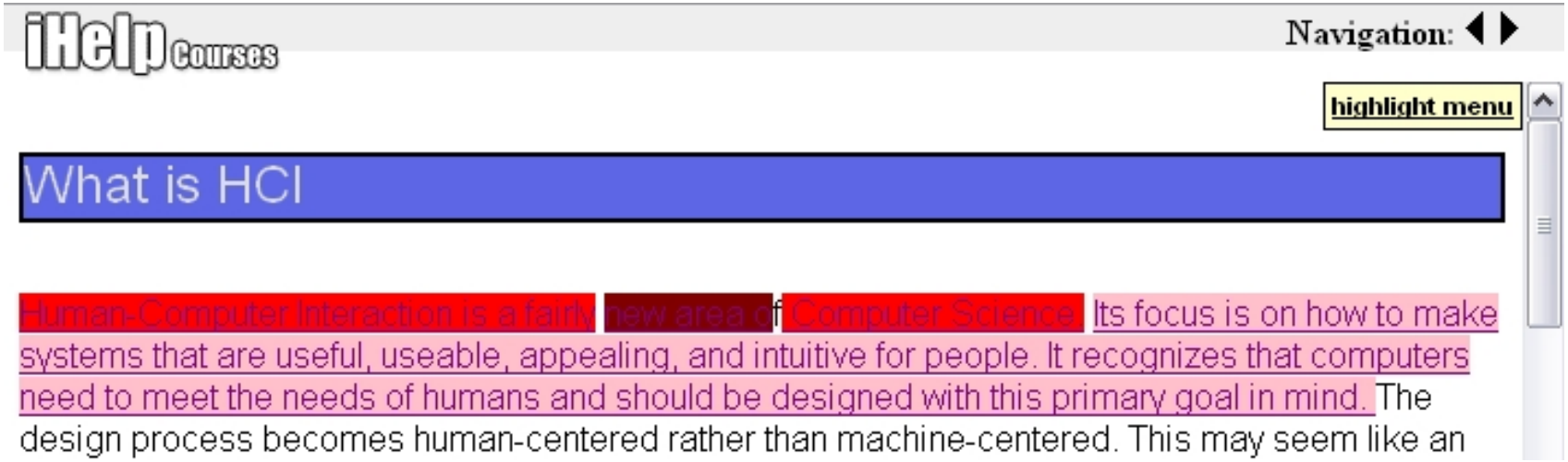
Yeah this example is cool... I wish I had

What is HCI posted publicly by smith on Wed, Aug 30, 2006 02:44 PM

I really like this example.

What is HCI posted publicly by scott on


Tag
Notes
Tag Categories
Search
Delete This Highlight
X
Search
what are you looking for?
Pages
Notes
Tags
computer science
search
find tags used with the tags I have listed above
Search Results
Below are the tags which are most commonly found with the tags you provided.
hci (3)
field (1)
area (1)
goals (1)
part (1)
definition (1)


iHelp Courses
Navigation:
highlight menu
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Pros of Collaborative Tagging

The pros:

+ Simple to use because of: easy tools, no rules and uses natural language.
+ Promotes a a type of **collective intelligence** through community consensus.
+ Provides user support.
+ Opens the door for more people to become metadata creators (shown by its popularity).

Cons of Collaborative Tagging

The cons hinder the ability of this being an applicable solution for learning material metadata.

- Not machine consumable, since tag semantics in the users; only useful for humans.
- As breadth becomes large, users must create order for their tags.
- Meta noise: out of context and/or bad tags can emerge.

What are ontologies?

- Ontologies describe concepts, the properties of concepts, and the relationships between concepts.
- They provide machine consumable knowledge representation over which to reason.
- The key approach to achieving the Semantic Web.
- The focus of learning material metadata research.

Ontologies: Still not a solution for creating metadata

While ontologies give a method to add machine consumable semantics they are too difficult.

- Ontologies, even with good tools, require some expert knowledge.
- Machine consumable labels may be misinterpreted by metadata creators and consumers.
- Standardized domain ontologies are rigid and don't meet the needs of all end-uses.

Review of the Approaches

Can we combine everything we know into a new approach?
Recall:

- Ontologies create machine consumable info but are too difficult and rigid for metadata creators.
- Collaborative tagging techniques create human consumable metadata but are not machines consumable because of the lack of semantics and rules.
- What is the missing link?

The missing link.

"... del.icio.us has no idea what the tags mean. The tag overlap is in the system, but the tag semantics are in the users. This is not a way to inject linguistic meaning into the machine." - Clay Shirky

Hypothesis:

Collaborative tagging can be employed, with an English language ontology, to make metadata creation fast, easy, and machine consumable.

WordNet an English language ontology

WordNet is a natural language ontology based on human lexical memory.

```
Sense 1
hat, chapeau, lid
       => headdress, headgear
           => clothing, article of clothing, vesture, wear
               => covering
                   => artifact, artefact
                       => object, physical object
                           => entity
                       => whole, whole thing, unit
                           => object, physical object
                               => entity
               => consumer goods
                   => commodity, trade goods, goods
                       => artifact, artefact
                           => object, physical object
                               => entity
                           => whole, whole thing, unit
```

CommonFolks

With CommonFolks we wish to define a system framework:

- which makes use and extends the natural language ontology in WordNet.
- incorporates (but hides from the user) a RDF/XML syntax, to maximize system interoperability.
- provides collaborative tagging like tools to facilitate the metadata creation process.

First Prototype

The first working prototype allows a user to annotate learning material represented by a URL with terms in WordNet.

What will CommonFolks buy us?

- A more intuitive method to create ontologies for metadata.
- A way for metadata authors to receive support.
- A better alternative to a standardized domain ontology.
- Allow more metadata authors to become involved.

Future Work for CommonFolks

The extension of the prototype to include:

- Ability to add new terms.
- Collaborative based suggestions.
- RDF/XML definition.
- Ontology versioning.

My Future Work

Focus: Integration of CommonFolks within OATS, as an annotation system for students and instructors in an E-Learning System. Other applications we are investigating:

- integration with learning object repositories.
- a general purpose web annotation system.

Thank you!

Please contact me: scott.bateman@usask.ca

For more details see:
"Collaborative Tagging Approaches for Ontological Metadata in Adaptive E-Learning Systems" (Bateman, Brooks, McCalla SW-EL @ AH06)

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