Semantic Web HCI:
Discussing Research Implications

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CHI
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Goals

For this session

- Start a conversation
  - User interaction enhanced by semantic technologies
  - Semantic Web designs informed by HCI methods
- Capture discussion for upcoming SWUI activities
  - www.webscience.org/swuiwiki

For the HCI / Semantic Web conversation

- Start fostering a community
- Share knowledge and ideas
- Identify who else should be involved
A “Semantic” Web?

Semantic: Of or relating to meaning, especially meaning in language.

“The Semantic Web is an extension of the current web in which information is given well-defined meaning, better enabling computers and people to work in cooperation.”

AND… not OR… Relating to HCI

- Dynamic interaction, web-based apps, intelligent interfaces
- Mashups, sharing, tagging, and interweaving information
- Search: exploratory, natural language, faceted, etc.
- Large-scale information visualization (with heterogeneous data)
- Privacy, trust, social relationship-building
- Adaptivity, context-aware computing, location-awareness
- Personalization, user profiles
- Agents and avatars (e.g. instructing, giving permission)
- Machine learning and information complexity
Why?

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A brief overview
Now . . .

- I know my destination
- I know what I want
- I don't know what to do
- Navigate or Search
- Read / View / Learn
- Sort / Select
- Evaluate / Explore
- Search
The Know–ability of the Web: Human

What do I need for HTML?

```html
<html>
<body>
<p>
... your stuff ...
</p>
</body>
</html>
```
Future ... ?

I express what I need/want

I do something

Contextual awareness of me and situation

Negotiated exploration/selection

Agent
Know-ability for Semantic Web: Human + Machine

More than HTML?

The XML Family of Specifications: The Big Picture

Last Updated: April 19, 2003

Copyright (c) 1998-2003 Kenneth B. Sall. All Rights Reserved. http://kensall.com/big-picture/
Layer Cake (c. 2000)

Layer Cake (c. 2005)

Trusted Action
- autonomously or semi-autonomously, on our behalf

Interpretation
- of data and metadata to derive “meaning”

Self-Describing Content
- based on machine-readable metadata

Portable / Common Syntax
- data that machines can process

Future – ubiquitous, machine-to-machine collaboration

Today – consistency of metadata for localized uses

The “New” Layer Cake, September 2006

Users and Tasks

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What are we seeing so far?
## Categories of Users in the Literature

<table>
<thead>
<tr>
<th>End Users</th>
<th>Content Curators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ordinary people seeking information or trying to accomplish something in the course of their everyday life or work.</td>
<td>Subject-matter experts, who as part of their jobs are responsible for providing or updating information used by others.</td>
</tr>
<tr>
<td>Knowledge of subject: ★★★ (Low to high)</td>
<td>Knowledge of subject: ★★★★★ (High)</td>
</tr>
<tr>
<td>Knowledge of ontologies: ★ (Low or none)</td>
<td>Knowledge of ontologies: ★★★ (Moderate)</td>
</tr>
<tr>
<td>Knowledge of semantic web: ★ (Low or none)</td>
<td>Knowledge of semantic web: ★★ (Low)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ontologists</th>
<th>Sem. Web Developers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specialists in content categorization who participate in development and maintenance of ontologies and interactive systems.</td>
<td>Technology specialists and members of a development team who are creating semantic web applications.</td>
</tr>
<tr>
<td>Knowledge of subject: ★★★★★ (High)</td>
<td>Knowledge of subject: ★★★ (Low to high)</td>
</tr>
<tr>
<td>Knowledge of ontologies: ★★★★★ (High)</td>
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## Categories of Tasks in the Literature

### Information Seeking Tasks

<table>
<thead>
<tr>
<th>Role</th>
<th>Task Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>News seekers</td>
<td>Read news of interest to me from various on-line newspapers (filtered by time, geographical area, subject, and other attributes)</td>
</tr>
<tr>
<td>Entertainment seekers</td>
<td>Find a restaurant near the movie theater that will still be open after the movie</td>
</tr>
<tr>
<td>Music fans</td>
<td>Find new music similar to other music I like</td>
</tr>
</tbody>
</table>

### Information Synthesis Tasks

<table>
<thead>
<tr>
<th>Role</th>
<th>Task Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical researchers</td>
<td>Draw conclusions about appropriate medical treatment based on synthesis of information on specific drugs and diseases from a wide range of published sources</td>
</tr>
<tr>
<td>Terrorism experts</td>
<td>Identify connections between suspected terrorist groups, based on pieces of information, some of it unreliable, from very disparate sources</td>
</tr>
<tr>
<td>Biologists</td>
<td>Predict the effect of introducing a new beetle into the ecosystem</td>
</tr>
</tbody>
</table>
## Categories of Tasks in the Literature

**End Users**

### Action Tasks

**Examples include:**

<table>
<thead>
<tr>
<th>Role</th>
<th>Task Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients</td>
<td>Schedule an appointment with a medical specialist covered by insurance in a certain geographic area with high approval ratings and who has available appointments</td>
</tr>
<tr>
<td>Emergency responders</td>
<td>Coordinate the efforts of multiple emergency response teams during an incident</td>
</tr>
<tr>
<td>Car buyers</td>
<td>Buy a used car from someone who is selling the type of car I want within 30 miles of my home</td>
</tr>
</tbody>
</table>

### Information Sharing Tasks

**Examples include:**

<table>
<thead>
<tr>
<th>Role</th>
<th>Task Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amateur photographers</td>
<td>Share pictures with friends and family</td>
</tr>
<tr>
<td>Friends with shared interests</td>
<td>Share bookmarks within my personal network</td>
</tr>
<tr>
<td>Consumers</td>
<td>Write a review of a restaurant, movie, etc.</td>
</tr>
</tbody>
</table>
Categories of Tasks in the Literature

**Content Update Tasks**

- **Biologists**: Adding new findings about bird migrations to existing repositories
- **Photo editor**: Annotating photos to make them searchable
- **Policy expert**: Writing or editing policy and procedures to be added to a policy repository

**Content Distribution Tasks**

- **National Library of Medicine (NLM)**: Providing all known medical ontologies for others to download and use
- **Museum/historic site curators**: Providing information and interactive learning opportunities to visitors via a pervasive computing system and PDAs
## Categories of Tasks in the Literature

### Ontology Update Tasks

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<thead>
<tr>
<th>Role</th>
<th>Task Description</th>
</tr>
</thead>
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<tr>
<td>Biologists</td>
<td>Adding a new insect to an existing hierarchy</td>
</tr>
<tr>
<td>Policy expert</td>
<td>Adding new terms for tagging content within the public policy repository; re-organizing existing terms</td>
</tr>
<tr>
<td>“Owner” of an ontology</td>
<td>Cleaning up ontologies</td>
</tr>
</tbody>
</table>

### Ontology Creation & Mapping Tasks

<table>
<thead>
<tr>
<th>Role</th>
<th>Task Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Member of project team creating a semantic application</td>
<td>Finding and selecting an existing ontology to use in a new semantic web application</td>
</tr>
<tr>
<td>Intelligence analyst</td>
<td>Reviewing the results of terms automatically extracted from text; populating an ontology through automated pattern recognition and information extraction</td>
</tr>
<tr>
<td>Health informatics specialist</td>
<td>Cross-referencing terms between different medical ontologies</td>
</tr>
</tbody>
</table>
User Interaction Discussion Topics

Ontology Creation and Editing

Information Seeking

Information Synthesis

Content Update and Sharing

Formative Work
Ontology Creation and Editing

Beyond XML: Semantic definitions

- class hierarchies (taxonomies)
- defining formal vocabularies through logical restrictions
- Protégé demonstration

Formal vocabularies and logical inferencing

- infer class membership
- consistency checking (data integrity)
Ontology Creation and Editing

Understanding ontology structure and scale

- Pizza domain – 100+ concepts
- Protégé/OWL Viz

- Fungal Web domain – 10,000+ concepts
- Protégé/OWL Viz & Jambalaya

Hierarchical concept visualization

- SWOOP/Crop Circles
Ontology Creation and Editing

Logical concept definitions

- Benefit of automated machine processing?
- Who incurs cost of creating formal definitions?
- Implications of collaborative editing?
- Some answers with consistency checking and distributed editing?

Visualization of concept definitions

- “is-a” represented OK in visualizations (sans scaling)
- What about other relationship types?
- Are visualizations the answer?
- If not what other representations could be helpful?
Information Seeking

Facets

- mSpace – faceted browsing from many data sources

Metadata-rich navigation/search

- MultimediaN E-Culture demonstrator

Natural language search

- Ginseng – underlying data relationships
- Complex questions use ontology relationships
Information Seeking

- Scalability? Wayfinding?
- HCI implications of the “open world scenario”?
- Cognitive issues for users switching facet relationship order? Losing “containership” concepts?
- Importance of naming, labeling and parallelism?
- How to expose or signpost data provenance? Can transparency be unobtrusive and yet convenient?
- As possibilities and relationships expand, how does a user’s interaction with an application help filter the myriad possibilities and hone in on what is relevant?
- The role of context, preferences, agents in searches?
Information Synthesis

Subjects and structure

- AnimalDiversity.org – domain structure, adopting visualization techniques (TreePlus)
- IRS TaxMap – what other useful domains? Research, security?

Location and activity focus

- mSpace Mobile – multiple sources, in local context
- Controlling views (frame + context)

Integrating diverse approaches

- Design patterns ontology
Information Synthesis

- How to manage “views” of highly interconnected data, where the structure may not be known in advance?
- What do you do once you’ve found and synthesized?
- Role of visualization, and what kind of controls to go from “finding” to “using” data?
- Improving ease of use? Integrating seeking with action?
- Creating consistency – integrating information from multiple sites and formats?
- User control of relating new/added concepts?
Content Update and Sharing

FOAF (Friend of a Friend)

- Standard way of describing people
- Unique id (through e-mail or encoded e-mail address)
- Using forms to fill in data
- Standardized - many applications can read and use

PhotoStuff

- Metadata-based information
- Ontologies define (flexible) structures for standard information capture and use
- Semi-structured tagging
Content Update and Sharing

Metadata enabled knowledge capture

- More than personalized tagging - structured tagging?
- Will users understand metadata semantics?
- What is the balance between user control and consistency?
  ...formal vs. informal annotation?

Lowering costs of knowledge capture

- Use what is known already (time & date, location etc.)
  ...ambient data capture?
  ...but this assumes standards?
- Are the costs of formality worth the benefits?
Formative Work

- **Novel uses**
  - e.g. SADiLe

- **Revisiting methods**
  - Adapting usability/user-centered design methods for dynamic, data-driven applications?

- **Plenty of future research directions**
  - Keeping the user experience seamless when it is constructed from multiple underlying sources of data and agents?
  - Instructing and responding to agents?
  - Alerting users when ambiguous or contradictory situations are encountered?
  - Provenance and “correct-ability”?
  - Trust?
  - Privacy? Informed consent, and broader data transparency issues?
  - Adaptivity?
SWUI Information on the Web

- [swui.semanticweb.org](http://swui.semanticweb.org)
  - Prior workshop papers, also link to W3C mailing list

- [www.webscience.org/swuiwiki](http://www.webscience.org/swuiwiki)
  - Includes notes on the CHI 2007 discussion

- [www.ipgems.com/content/swui.html](http://www.ipgems.com/content/swui.html)
  - Links to a range of examples and background information focused on user interaction