Exploring and Navigating Ontologies and Data
A Work in Progress Discussion
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Our goal: Provide **cognitive support** for ontology developers and users through visual and intelligent user interfaces

Methodology:

- Observe and learn what users do
- Develop tools that provide cognitive support
- Evaluate the tools and improve understanding of the users’ needs
Subprojects

- Improve ontology **navigation**
- Provide cognitive support for **mapping**
- Design more advanced tools for exploring and comparing **clinical trials** (DBP with Ida Sim)
Technology implementation

- **Navigation:**
  - **FlexViz** – visualization support in BioPortal
  - **Diamond:** Degree of interest browsing

- **Mapping:**
  - **CogZ:** Cognitive support for ontology alignment
  - Authoring and visualizing mappings on the web (**early prototype**)

- **Visualizing Clinical Trials:**
  - **CTExplorer**
  - **CTSearch** (TagClouds)

*Items in red will be demoed this morning*
Ontology navigation

Goal: provide cognitive support for users navigating and exploring ontologies

Research question:
- How to improve support for navigation of ontologies such that the cognitive load of the user is reduced?
  - Internal processes?
  - What is difficult/simple?
  - What do/don’t existing tools support well?
Field Studies

- **Goal**
  - develop a *cognitive support framework* on navigation

- **Two tools / phases**
  - Protégé
    - undirected observations of real users’ tasks
    - 3 participants
  - BioPortal
    - directed and undirected observations of users
    - 8 participants (so far)
## Selected findings from BioPortal studies

- More effective **user control** while loading and navigating ontologies (cancel, auto scrolling)
- Importance of **search** – features for searching multiple ontologies and searching within an ontology
- Improved support needed for displaying and navigating **mappings**
- Interest in **developer tools**
Preliminary Cognitive Support Framework

**Goal:** Develop a theoretical framework describing the cognitive support requirements for navigating ontologies

<table>
<thead>
<tr>
<th>Requirements</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Where am I?</strong></td>
<td></td>
</tr>
<tr>
<td>provide overviews</td>
<td>provide hierarchy overview</td>
</tr>
<tr>
<td>provide context</td>
<td>show path to current focus, indicate current focus, provide neighborhood view</td>
</tr>
<tr>
<td><strong>What else is out there?</strong></td>
<td></td>
</tr>
<tr>
<td>provide overviews</td>
<td>provide hierarchy overview</td>
</tr>
<tr>
<td>reduce complexity</td>
<td>filter uninteresting items, cluster related items</td>
</tr>
<tr>
<td>indicate regions/</td>
<td>indicate high density regions, indicate previously visited items, indicate deep hierarchy</td>
</tr>
<tr>
<td>points of interest</td>
<td></td>
</tr>
<tr>
<td><strong>How do I get there?</strong></td>
<td></td>
</tr>
<tr>
<td>provide overviews</td>
<td>provide hierarchy overview</td>
</tr>
<tr>
<td>allow incremental exploration</td>
<td>look ahead</td>
</tr>
</tbody>
</table>
Recent FlexViz updates:

- Improving the **usability** of FlexViz by implementing some of the ideas from the user studies
- **Customizable** – support groups using custom versions of BioPortal so that other groups wishing to deploy their own custom version of BioPortal
  - **Properties window** for concepts
  - **Warning dialogs** for large graphs
  - **Navigate** to other ontologies
  - Customizable node **labels** and **tooltips**
  - Improved **searching, zooming, spring layout**
FlexViz -- Demo

Protein Ontology

hasSubClass

ProteinComplex

isA

hasSubClass

Structure

hasSuperClass

Conventions

hasSuperClass

Functional Domains

hasSuperClass

Structural Domains

hasSuperClass

n Entry

hasSuperClass

Architecture

hasSuperClass

Chemical Bonds

hasSuperClass

Constraints

hasSuperClass

Residues

hasSuperClass

Chains

hasSuperClass

Family
Discussion on where to go next?

- Can’t **save views** – do we want to?
  Do we want to mail (a **link**) to colleagues?
- **Nested views?** (as in Jambalaya)
- Ability to show a view according to a specific relationship type (**beyond is-a** or **subclass**)?
- Feedback, feedback, **feedback**…
NCBO Presentation Jan 2009
the CHISEL group, University of Victoria
• DIaMOND—Degree of Interest Modeling for Ontology Navigation and Development
• http://www.thechiselgroup.org/diamond
Motivation

- Navigating ontologies can be tedious...
- Users often don’t know where to start when navigating an unfamiliar ontology
DIaMOND -- Approach

- Applies principles of **attention-reactive** interfaces
  - Mechanism to calculate user’s degree of interest (DOI)
  - Dynamic display of information using the DOI

- Goals
  - Draw user’s **attention** to interesting elements
  - Reduce navigation **overhead**
Highlighting and Filtering in the Class Browser (integration with Protégé for now)
Other benefits!

- Will help give feedback to authors of ontologies which concepts are most frequently browsed
- Currently under discussion I believe...
Prototype search UI -- Demo

NCBO Presentation Jan 2009 the CHI SEL group, University of Victoria
## Discussion on Search

- Do we want to able to **save queries** and perhaps share them
- Do we want to **visualize** neighbourhood graphs (in a separate window or to the side)
- Other **features** requested?
- Offers of help to **user test** it?
CogZ

Cognitive Support and Visualization for Human-Guided Mapping Systems

1. Select ontologies
2. Alignment algorithm
3. Candidate mappings
4. Verified mappings

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Ontology alignment

- Very difficult cognitive task
- The user must:
  - Make **decisions** about mapping candidates
  - Supply **custom mappings** that were missed
  - Understand the **domains** and **structure** of both ontologies
  - **Remember** decisions that were made
- Cognitive support framework informed by user studies, a survey and an observational study
CogZ Demo showed in Dec
Web based CogZ – preliminary demo
Web based CogZ – discussion

- Do we want to be able to **edit mappings** on the web?
- How else should we **visualize** the mappings?
- Are **neighbourhood views** desired?
- What other **features of CogZ** make sense to bring to the web?
CTSearch

- **Objective**
  - To improve the experience of seeking and comparing clinical trials

- **Research questions**
  - How can we visualize and filter query results for large and sometimes incomplete collections of clinical trials?
  - How can we improve existing tags/annotations in controlled data collections to obtain better query results? (e.g. different terms used to describe the same underlying concept)
ClinicalTrials.gov
A service of the U.S. National Institutes of Health

Found 683 studies with search of: liver cancer

1. Recruiting
   Efficacy and Safety Study of Bevacizumab and Erlotinib to Treat Primary Liver Cancer That Can Not be Removed By Surgery
   Conditions: Hepatocellular Carcinoma, Liver Cancer
   Interventions: Drug Avastin; Drug Erlotinib

2. Active, not recruiting
   Positron Emission Tomography Using Carbon-11 Acetate and Fluodeoxyglucose F-18 (PET/CT) in Patients With Known or Suspected Liver Cancer
   Condition: Liver Cancer
   Interventions: Drug carbon-11 acetate; Drug fludeoxyglucose F 18; Procedure: computed tomography; Procedure: magnetic resonance imaging; Procedure: positron emission tomography

3. Recruiting
   Phase III Study of PI-88 in Post-Resection Hepatocellular Carcinoma
   Conditions: Cancer; Liver Cancer; Primary Liver Cancer; Hepatocellular Carcinoma; Hepatoma
   Interventions: Drug PI-88; Drug: placebo

4. Recruiting
   Radiolabeled Glass Beads (TheraSphere®) in Treating Patients With Primary Liver Cancer That Cannot Be Removed by Surgery
   Condition: Liver Cancer
   Interventions: Drug ytrium Y 90 glass microspheres; Procedure: brachytherapy; Procedure: intrahepatic infusion procedure

5. Completed
   Vaccine Therapy in Treating Patients With Stage II, Stage IIIA, Stage IIIB, or Stage IVA Liver Cancer
   Condition: Liver Cancer
   Interventions: Drug alpha fetoprotein adenoviral vector vaccine; Drug alpha fetoprotein plasmid DNA vaccine; Drug sargramostim plasmid DNA hepatocellular carcinoma vaccine adjuvant; Procedure: non tumor cell-derived vaccine therapy; Procedure: recombinant viral vaccine therapy

6. Recruiting
   National Registry and Blood Bank of Patients With Liver Cancer
   Condition: Liver Cancer
# CTSearch

- Supports Visual search refinement for **semi-structured** documents on ClinicalTrials.gov
- **Features**
  - Multiple linked tag clouds
  - Highlight **relationships** among multiple terms across **facets**
  - **Synchronization** with traditional list of results
  - Supports **summarization** and **comparison** of query results
  - Favors **recognition** of terms over recall

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**NCBO Presentation Jan 2009**
CTSearch -- Discussion

- Recent changes were made in response to feedback from Rebecca Crowley (thanks!)

- **Deployment** of CTSearch (CTExplorer later)
- Investigating using the faceted tag clouds for **OBR**
- **User input** would be great!
Summary

- Dealing with information overload and providing views that are useful (FlexVis and BioPortal Search)

- CogZ: Cognitive support for ontology alignment and for visualizing mappings in BioPortal (moving towards the web)

- CTExplorer and CTSearch: browsing and comparison of clinical trials
Future research directions and themes

- **Web based visualizations** for a diverse and evolving user base and task set
  - Customizable and flexible views
  - Visualization as a service (**mashups**)

- **Cognitive support** rather than visualization
  - Ontologies, annotations and mappings
  - Search
  - Concept comparison (local, global and historical information)
  - Meta-analyses
Future research directions and themes cont.

- **Collaborative aspects**
  - Humans and software agents
  - Ontologies and visualizations as “boundary objects”
  - A collaborative space for ontology exploration?

*Boundary object* refers to an object that serves as an interface between different communities of practice. Boundary objects are shared by several different communities but viewed or used differently by each of them, e.g. Classification systems. (Bowker & Star, 2000).
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Ida Sim, Driving Biological Project Lead, and Simona Carini San Francisco University

BioPortal team!
References and websites

Reference:

Websites:
- Diamond:  
  - [http://thechiselgroup.org/diamond](http://thechiselgroup.org/diamond)
- Jambalaya and BioPortalViz:
  - Jambalaya: [http://www.thechiselgroup.org/jambalaya](http://www.thechiselgroup.org/jambalaya)
  - BioPortalViz: see BioPortal for now... (older version)
- Visualization and Alignments:
  - CogZ website: [http://www.thechiselgroup.org/cogz](http://www.thechiselgroup.org/cogz)
- CTSearch: