Semantic Web Interface Design: Opportunities and Techniques

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Today

- Perspective
  - On Design
  - On the role of the Semantic Web

- Purpose
  - Solve user problems
  - Be responsive

- Flexibility: extending the model

- Intelligibility: animating the data

- Structure: capturing semantic & structured data

- Respect: privacy, transparency, humility, provenance
Perspective

...on Design

...on the role of the Semantic Web
“After 10+ years of work into various aspects of the Semantic Web… I am now fully convinced (read: no longer in denial) that most of the remaining challenges to realize the Semantic Web vision have nothing to do with the underlying technologies…

Instead, it all comes down to user interfaces and usability.”

http://www.lassila.org/blog/archive/2007/03/semantic_web_so_1.html
What is Usability?

- Usability is a **quality** attribute that relates to how a product interacts with the person using it.

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People get things done quickly and productively

The technology does not get in the way

**Efficiency**

They get the info they need, complete work accurately and achieve their goals

They don’t make mistakes

**Effectiveness**

They feel confident and pleased; they would come back again

They are not frustrated

**Satisfaction**

— Based on ISO 9241, Part 11
What impacts a web site’s usability?

When a site is easy to use, there is a good fit between the site and...

The users + Their tasks and questions + The situations that bring them to the site (context)
The Core of Usable Design

Understanding the needs

Users
Goals, Tasks
Context

Designing a solution that works

Best practices for usable design

Brainstorm
Design
ITERATION
Test with users

Multidisciplinary collaboration

Usable Design
strategic role
Usability BoK
Building Usable Design in from the beginning

- Involve real users early and often
- Observe their actual work
- Work collaboratively with a multi-disciplinary team
- Follow human factors & usable design guidelines
- Design the user interface deliberately
- Iterate the design with user feedback
The big difference

Subject  Predicate  Object

Naming the lines makes the difference
The big difference... known relationships
About this "Web 3.0" stuff... is it the Data Web?

- Open Linked Data
  - *Lots* of structured data
  - More common syntax
  - More self-describing

- Models that represent data domains
  - Vocabularies
  - Ontologies

- Increasing number of tools for data display, translation and manipulation

- Plenty of enthusiasm

- Tim Berners-Lee's 2009 and 2010 TED talks
- Linked Data
- Freebase
- Data.gov and Data.gov.uk
- City government: NYC, DC, SF
- Apps for Democracy, example: Stumble safely
- NY Times topic data
- World Bank
- Amazon's >1Tb
- DBpedia
Web 3.0 is about *more* than data

- **The Context Web**
  - Personal
  - Managed and scalable social
  - Mobile and location-aware
  - Temporal
  - Situated – sensors and the "Internet of Things"
  - Multi-modal – gesture, voice, haptic, etc.

- All these things rely on structured, linked data as an *enabler*
Purpose

Solve user problems

Be responsive
Solve real user problems

- How do you articulate your users’ *tasks* and *situations*?
- Do you have methods to understand changing needs over time?

**Exercise:**
- Interview each other to identify key user scenarios
  - User profiles
  - Goal / task
  - Situations (triggers)
- Prioritize key requirements for task support

**Examples for discussion**
- Emergency/disaster management
- Medical information delivered/sent via mobile devices
Be responsive

- Context = Value
- How do you identify what needs to be flexible in your design, and what can be more precisely crafted?
- How do your modularize your design, so it can change over time?
- How do you build elements that allow you to:
  - Deploy quickly
  - Share easily
  - Integrate simply and seamlessly

- Examples for discussion
  - Missing persons
Flexibility

Extending the model
What is flexibility?

- The ability to easily manipulate an interface to respond to a user’s situation and support user and organizational goals

- Interaction is:
  - Seamless – User goals and tasks are facilitated more easily, no matter what technologies and applications involved
  - Frictionless – Data is free to move between applications and uses as needed

- The underlying model(s) that drive interaction are easily extended and changed – to remain relevant to users
Examples

- Facet navigation
  - Refinement
    - Flamenco
    - Solr
  - Browsing
    - Parallax
    - mSpace & mSpace Mobile
Overview

- There are two types of interaction:
  - **Refinement** is about starting with large sets and narrowing... a *relevance* funnel
  - **Browsing** is about *exploring the structure* of data to find areas of interest

- Add semantic relationships – complexity, yet potential elegance
Facet Refinement

- Drawn from instance data
- Not often leveraging metadata relationships (if they exist)

- Zappos (flat, reordering)
- Amazon (hierarchy)
- eBay (layered)
- Smithsonian (query) based on Solr
- Exhibit (lightweight) e.g. Design for Semantic Web examples page
Facet Browsing

- Along with refinement, visualize relationships between elements (can be explicit or derived)

- Flamenco (flexible, simple)
- Relation Browser (linear)
- Aqua Browser (multi-modal), e.g. Queens Library
Facet Browsing

- Flexible – add new data types and relationships any time
- Expose relationships for greater user control
mSpace and the user's mental model

- The path through the data and the sequence of facets are determined (consciously or unconsciously) by the user’s goal.

```
Composer Creates Songs Heard on Albums

“I’m interested in a particular Bach concerto. What album can I get to hear it?”

Composer Featured on Albums Contains Songs

“I’m looking for a gift for someone who loves Bach. What has rare compositions?”

Period Includes Instruments Played on Songs Heard on Albums

“I love the harpsichord. What modern music still uses that instrument?”
```
Adaptivity and process/application control

- What if the interface could be more adaptive? Responding to:
  - Quantity of data
  - Attributes of data and user's interactions
  - Available and new predicate relationships it could leverage
  - User-provided parameters and structures

- Context
Examples

- Facet navigation
  - Refinement
    - Flamenco
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  - Browsing
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- Extensible forms
  - Ontology–driven forms
    - PhotoStuff
    - LepTree
    - CMS integration
  - Ontology–driven layout
    - SADle
Ontology-driven forms

- Defining the fields / data users see
- Providing valid data values
- Managing flow and business rules
  - E.g. initial data entry vs. editing/updating
More integrated architectures

- Capabilities in current CMS tools
  - Drupal, WordPress, Joomla, etc.
  - Configuration, tagging, UI element selection, cross-referencing, etc.
  - Not always “semantic”... but structured

- Architectural coherence and integration

  ![Diagram of vocabulary and nodes]

  - More Like This
  - Topic Hubs
  - Geo
  - Linked Data
  - Calais
  - Drupal
  - Marmoset

  Tools for page and widget generation
  - Microformats / RDFa for search engines
  - Importing and managing linked data
  - Entity identification and tagging
  - CMS / data engine
Ontology-driven layouts

- Control the way application UI behaves

![Diagram showing the relationship between authentication, internet display page, transformation service (HTML, CSS), transformation rules store (OWL), intranet staff display page, original site 1, original site 2, accessibility department, and localization/translation department.]

- SADie site and demo
Intelligibility

Animating the data
What do we mean by “intelligibility”? 

- Making data and relationships easily understandable
- Levels of abstraction
- Bringing out useful aspects
  - Important issues
  - Exceptions that require attention
  - Unexpected insights
- Allowing the user to have some control over the representation
  - Every picture tells a story
  - Does the algorithm or the user control that story?
Visualization

➢ Increasing control of visualizations
  • Timelines
  • Filters
    • HCIL visualizations (e.g. LifeLines)
    • GapMinder
    • NY Times interactions

➢ Linked Data is an engine

➢ Many styles of visualization interactions, e.g.
  • Flat X : Y charting
  • Scalable / zoomable views
  • Overlays
  • Parameter–filtering views
  • Swappable data parameters (pivoting/turning views)
  • Blending visual representation with textual/list presentation (e.g. side–by–side layouts, panels, pop–ups)
  • Marking key points that link to outside references

➢ As I watch visualization interfaces mature over time, the main trend is: Expose controls for the user
Exploratory interactions

- Challenges exploring...
  - Large heterogeneous data sets
  - Large vocabulary sets / ontologies

- Analysis methodology
  - *SII interaction framework* ([http://mspace.fm/sii](http://mspace.fm/sii))
Structure

Capturing semantic & structured data
How do we support structured data creation?

- Encourage first, enforce second

- Make it easy to do
  - Aid data entry with relevant options
  - Interpret natural language
  - Reduce the risk of breaking the structure

- Use what we can from existing sources
  - Adopt conventions & metaphors/affordances
  - Adopt standard data and models from vocabularies, ontologies
Examples

- Lightweight data entry
  - Supportive info/selection in context
    - Social bookmarking / tagging
  - Text-based interfaces
    - Current social interfaces
    - PLUM project (http://plum.csail.mit.edu/)
Tagging and social bookmarking

- Grouping tags
- Suggestions based on structured data sets, e.g.:
  - Defined terminology database
  - Wikipedia subjects
- Extracting rich data from other sources
- Organizing tags around subjects of interest, as primary navigation
Micro syntax and mobile

- Temporal "micro-blogging"
  - First it was status, then alerting, now referencing, next...
  - People beginning to use it for more functional actions
  - Structured information, but high cognitive overhead!

- OMHE – delivering health status updates, retrieving information (microsyntax.org)

- TwitPay – authorizing payments using PayPal

- TrialX – search for clinical trial information, based on location
  
  *Semantic Web Challenge winner 2009*
Personal information “scraps”

- What are scraps?
  - Apps: rich interaction with structured data
  - Scraps: lightweight capture of unstructured data with high contextual relevance
  - Easy, lightweight, and flexible for different styles
  - Jourknow, Inky, and AtomsMasher: exploratory and very interesting!
  - Ethnographic process: study of scientists' PostIt notes, desks, notebooks, and computer filing

- Structure
  - Jourknow project
  - Overview paper
  - Short demo video (YouTube)
  - ListIt Firefox extension and ongoing research project
  - PLUM project
Personal information “scraps”

- The group is working on a range of small interfaces to facilitate easy and *useful* scrap management. Here are a few examples (but keep your eye on this group, because they refine and improve the work regularly):
  - Simple data capture
  - Exploring context behind a particular scrap
  - Relating scraps to other things

Overview, with rich context:

Syntax and note-taking:

- `@class:HCI @lecturer:smith @topic:PIM`
- Personal information management:
  - Most popular apps: Outlook, Lotus Notes,
  - Project planners
  - Support collaborative work
  - Reminders
- Mobile PIM
- `@todo - pick up project 2`

- `@school @urgent`
- Meet **with** Prof. Karger **at** 3pm Wednesday **in** his office **about** named entity res

- `@zagat`
- **Burger-Vous a restaurant**: *price:cheap, atmosphere:poor, rating:4, cuisine:nouveau-american*
Personal information “scraps”

- ListIt project is exploring the patterns people use when making simple, commonplace notes
- The goal is to identify patterns for parsers to tease out structure
- Examples:

<table>
<thead>
<tr>
<th>sloppy pidgin</th>
<th>jane 3pm diesel cafe</th>
<th>&quot;Sloppy parsed&quot; to allow out-of-order matching and recursive nesting of typed templates.</th>
</tr>
</thead>
<tbody>
<tr>
<td>tame pidgin</td>
<td>Meet with Jane phone 617-555-1212 tomorrow at diesel cafe about SWUI submission</td>
<td>Hand-written grammars for common domains, with semi-open SW-KB defined lexicon, and support for nested expressions. Not user-extensible or re-orderable.</td>
</tr>
<tr>
<td>clay pidgin</td>
<td>meet 3pm with jane smith about swui</td>
<td>User-defined N3 macro language using &quot;means&quot; templates written by the user. Support for nesting. No re-ordering clauses. Template: &quot;meet when with whom about what&quot; means [ a :Meeting; vcal:start &quot;when&quot;; xcal:attendees &quot;whom&quot;; xcal:description &quot;what&quot;].</td>
</tr>
<tr>
<td>n3+res pidgin</td>
<td>swui mtg a Meeting; starts at: 3pm tomorrow; with jane; location Diesel Cafe</td>
<td>N3 with entity and property and value resolution. Uses a colon or dash to delimit multi-word properties from their values, and semicolons to delimit clauses.</td>
</tr>
</tbody>
</table>
Examples

- Lightweight data entry
  - Supportive info/selection in context
    - Social bookmarking / tagging
  - Text-based interfaces
    - Current social interfaces
    - PLUM project

- Blending structured and unstructured
  - The challenge of wikis
    - Semantic wikis
    - Ontology editing
  - Vocabulary & ontology identification/management
Wikis

- Made for collaborative editing
- Unstructured and lightweight data format – strength and weakness
- Does blending structured and unstructured data require more from the user?
  - More experience
  - More attention to detail
  - More understanding of the model and the site goals
Semantic Wiki: semantic extensions to MediaWiki

- Builds on the success of MediaWiki (which drives Wikipedia)
- Syntax for relationships between topics as triples
- Not easy for the "average user" -- they've been working on that...

New interfaces for three tasks:
- Adding relationship, category and property information to terms in the wiki page
- Browsing the ontology in the wiki
- Querying the ontology using structured query syntax to find particular information
Collaborative ontology editing

- Some growing use of wikis, as well as new elaborations of platforms like Protégé that many of us use

- For users, what's the focus of the work effort?
  - Vocabulary expansion or relationship expansion/refinement?
  - Collaborative creation or review/reference?
  - Ongoing maintenance activities?

- What are roles of traceability, annotation, narrative, explanations?

- How are the *processes* of vocabulary creation managed and captured (e.g. negotiation, variation)?
Vocabulary & ontologies

- There is an increasing amount of publicly available, *structured* terminology to use
- There are also economical ways to extract structure from unstructured content
- We still need good tools, to:
  - Create our own domain/organization-specific vocabulary
  - Review and make decisions about external or extracted vocabulary
  - Integrate/merge vocabularies from different sources, to suit our particular purpose
  - Manage vocabulary and tagging over time

- Further thoughts/ideas: *Coming to Terms with Keywords*

Examples

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- Blending structured and unstructured
  - The challenge of wikis
    - Semantic wikis
    - Ontology editing
    - Vocabulary & ontology identification/management

- Other data entry models
  - Table / grid
  - Scraping
Other data entry / acquisition models

- Other approaches trying to handle data entry or management of large amounts of data or data from multiple sources

- Grid – the spreadsheet is still the most-used database format
  - Direct & easy to learn/use
  - ...but not very leveraged

- Scraping – useful, but needs support to reduce development load

- Different types of approaches being explored
  - Tables, staying with spreadsheet representation, but interconnected so web/data dynamic interactions available
  - Visual query and relationship building
  - Guided query building that provides more structure and support to the process
  - Format translator services and tools

- Gridworks
- Needlebase
- Yahoo Pipes
- Babel
Respect

Humility, transparency, provenance, privacy
How does a design respect its user?

- **Humility**
  - Know thy limitations
  - Ask

- **Provenance & transparency**
  - Trust as a user interaction challenge
  - Tracing data history... more possible than ever... and more important than ever

- **Conscious sharing**
  - Building on the strength of Web 2.0
  - Stronger relationships... between each other... between our data "selves"

- **Privacy**
  - Who's in charge?
  - Informed consent: How to we know what we've given permission for?
  - In future, we're not just giving permission for data... we could empower agents with responsibility for *action* on our behalf
Examples

- **Humility**
  - Wolfram|Alpha
  - ARIA progressive interruption levels

- **Provenance**
  - Wolfram|Alpha, CS AktiveSpace
  - InferenceWeb
  - Tabulator

- **Sharing**
  - Establishing permissions in preferences
  - “Interviewing” users

- **Privacy**
  - How do users understand the implications of “yes”?
For Discussion: Facebook

- Open Graph and application cross-fertilization
  - Taking on Google?

- Profile topic links
  - Taking on Wikipedia?

- Understanding application behavior
  - Ability to understand underlying algorithms from the interaction?

- Privacy
  - Users’ sense of control and predictability?
Summary

- Design is about:
  - Users, their tasks, and the context of use
  - Iterative design process: goals > structure > communication > appearance

- Purpose in the design of semantic web applications is:
  - Solving users’ real world problems
  - Able to be responsive
  - Delivering value

- Flexibility: extending the model
- Intelligibility: animating the data
- Structure: capturing semantic & structured data
- Respect: humility, transparency, provenance, privacy
How do we make sure the next web is...

- Even better than the experience we have today
- So easy, anyone can describe themselves/their information semantically
- Able to clearly show what a "good" experience is (complete, understandable, transparent, semantically rich, trustable, not overwhelming), when much of the activity is happening in the background using semantic applications and agents
- Able to grow organically (and with few dependencies), while also moving toward the "web of meaning" idea
- Forgiving of differences in language and meaning, being clear and respectful of semantic "shades of gray"
- A trust–worthy and provable representation of our interests
Call to action...!

Usable Design Now

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