Should we throw the Semantic Web into the Garbage Can?

Abraham Bernstein

http://www.flickr.com/photos/wes2theg/2542300885/
## Applications and Multi-Media

**Chair:** Tim Finin

- Towards Ontology-driven Discourse
  - Joost Geurts, Stefano Bocconi, Jacco van Ossenbruggen and Lynda Hardman

- FrameNet meets the Semantic Web
  - Srin Narayan, Collin Baker, Charles Fillmore and Miriam Petruck

- A Q-Based Architecture For Semantic Information Interoperability On Semantic Web
  - Zhen-Jie Wang, Huan-ye Sheng and Peng Ding

## Foundations

**Chair:** Peter F. Patel-Schneider

- Web Ontology Reasoning with Datatype Groups
  - Jeff Z. Pan and Ian Horrocks

- Merging Topics in Well-formed XML Topic Maps
  - Richard Widhalm and Thomas A. Mueck

- Semantic Processing of the Semantic Web
  - Kunal Patel and Gopal Gupta

## Industrial Track

**Chair:** Massimo Paolucci

- KIM - Semantic Annotation Platform
  - Borislav Popov, Atanas Kiryakov, Angel Kuniev, Dimitar Manov, Dmytro Ognyanoff and Miroslav Goranov

- Ontology-Oriented Programming: Static Typing for the Inconsistent Programmer
  - Neil M. Goldman

- A Semantic Infosphere
  - Michael Uschold, Peter Clark, Fred Dickey, Casey Fung, Sonia Smith, Stephen Uzczekaj, Michael Wilke, Sean Bechhofer and Ian Horrocks

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Theory

Θεωρία
Welcome to China Mobile
A proud partner of the Beijing Olympic Games

What's New

Event Focus
China Mobile Limited becomes the first company from mainland China to be named to the Dow Jones Sustainability Index (DJSI).

Product Focus
Feton is a kind of comprehensive telecommunication service provided by CMCC, integrating IVR, GPRS and SMS.

Press Releases

2008-09-08 China Mobile provides special services for the Beijing Paralympics
2008-08-25 Mobile phones become the new compass for Olympic visitors
2008-08-18 China Mobile provides 3G-TD mobile phones to visitors, volunteers and officials
2008-08-18 Beijing Olympic Games spur another technological leap forward
2008-08-19 China Mobile introduces the ‘Palm Olympics’ to millions of visitors
2008-08-19 Multilingual Hotline ‘12580’ handles millions of inquiries
2008-08-15 China Mobile brings you Mobile Phone television Anytime, Anywhere
2008-08-13 Ten million subscribers now receiving China Mobile’s Olympic Newsletter
2008-08-11 “You and Me” sets Olympic wireless download record
2008-07-31 China Mobile Runs with the Olympic Flame
2008-07-31 Overseas Phones and China Mobile
2008-07-31 People’s Olympics
2008-07-31 Green Olympics
2008-07-31 2008 Paralympic
2008-07-31 Olympic Services

Hot Products
- Feton
- BlackBerry
- Wireless Music Club
- Mobile Newspaper
- PIM
- SMS Receipt

Stock Quotes
- HKEx
- NYSE

2008 Corporate Social Responsibility Report
Advantages of Localization

Interfaces that are adapted to a certain country can increase...

• market share
  (Search engine market share in South Korea [NY Times, 2007]):
  • Naver.com: 77%
  • Daum.net: 10.8%
  • Yahoo: 4.4%
  • Google: 1.7%

• user satisfaction

• work efficiency
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  - (Source: [Market Share Asia](https://www.marketshareasia.com/))

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- work efficiency

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### Advantages of Localization
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Goal
• Lower the costs of the localization process
• Improve the usability for members of different cultures

Method: Cultural Adaptivity
• Intelligent software that
  • Classifies the user’s culture
  • Adapts the software to user preferences
  • Enables cross-system personalization for holistic usability

Main enabling technologies
• Cultural User Model Ontology and Adaptation Ontology
• Rule-based adaptation of the user interface
• Data Mining for user interaction tracking

Hofstede’s Cultural Dimensions

- Power Distance Index (PDI)
- Individualism (IDV)
- Masculinity (MAS)
- Uncertainty Avoidance Index (UAI)
- Long-Term Orientation (LTO)

Countries:
- USA
- China
- Switzerland
- Greece
- Japan
Hofstede’s Cultural Dimensions

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<table>
<thead>
<tr>
<th></th>
<th>USA</th>
<th>China</th>
<th>Switzerland</th>
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</thead>
<tbody>
<tr>
<td>PDI</td>
<td>120</td>
<td></td>
<td></td>
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<tr>
<td>IDV</td>
<td>95</td>
<td></td>
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<tr>
<td>MAS</td>
<td>70</td>
<td></td>
<td></td>
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<tr>
<td>UAI</td>
<td>45</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LTO</td>
<td>20</td>
<td></td>
<td></td>
</tr>
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- USA
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![Graph showing cultural dimensions across different countries](image-url)
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So how does it work?

Applications

User Model Server

User

provide information

interact with

Initial Questionnaire

• Where do you currently live?
• Have you lived in another country before? Where?
• How long have you lived at each of these places?

add information
(explicit from questionnaire, or implicit from user interaction)

adaptations

RDF-based User Model Instances

Cultural User Model Ontology

UI Ontology plus adaptation rules

Calculate the user’s cultural dimensions
So how does it work?

- Where do you currently live?
- Have you lived in another country before? Where?
- How long have you lived at each of these places?
So how does it work?

User interacts with Applications, which contains an Initial Questionnaire. The questionnaire asks:
- Where do you currently live?
- Have you lived in another country before? Where?
- How long have you lived at each of these places?

The user provides information which is added to the User Model Server. The server includes:
- RDF-based User Model Instances
- Cultural User Model Ontology
- UI Ontology plus adaptation rules

From these components, the server calculates the user's cultural dimensions and provides adaptations based on this information.
Example UIs
Example UIs

[Image of a MOCCA UI with categories, projects, and a TODO list with tasks such as 'Clean up room', 'Go to party', 'Finish Holidays', and 'Buy travelbook Portugal'.]
Example UIs

South Korea
Example UIs
Example UIs
Example UIs
Example UIs
Example UIs
Example UIs

South Korea

Japan

China
Example UIs

South Korea

China

Japan
Example UIs
Example UIs

South Korea

Switzerland
Example UIs

South Korea

South Korea

Japan

Switzerland
Experiment 1: Setup

- Subjects
  - 30 CS students (∅ age 28.7 y; 7 female)
  - from CH, CN, Romania, Columbia, India, ...
    (majority lived > 2 countries; 22 ¬ CH, but in CH > 9 m)
- lay UI with paper elements
- Answer questionnaire embedding the 3 questions

- Procedure:
  - Questionnaire containing the 3 questions
  - Put yourself in the Role of UI designer for ToDo List App
  - Lay out UI with paper mockups (10 Tasks @ 3 choices)
Experiment I: Results
## Experiment I: Results

### Summary of the results (in %)

<table>
<thead>
<tr>
<th></th>
<th>Correct</th>
<th>Deviation of 1</th>
<th>Deviation of 2</th>
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</thead>
<tbody>
<tr>
<td>Information Hierarchy</td>
<td>90</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>Navigation</td>
<td>57</td>
<td>37</td>
<td>7</td>
</tr>
<tr>
<td>Accessibility of functions</td>
<td>60</td>
<td>40</td>
<td>0</td>
</tr>
<tr>
<td>Workflow within dialogs</td>
<td>63</td>
<td>33</td>
<td>3</td>
</tr>
<tr>
<td>Colorfulness</td>
<td>50</td>
<td>33</td>
<td>17</td>
</tr>
<tr>
<td>Brightness &amp; Contrast</td>
<td>53</td>
<td>30</td>
<td>17</td>
</tr>
<tr>
<td>Support</td>
<td>47</td>
<td>53</td>
<td>9</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td><strong>60</strong></td>
<td><strong>33</strong></td>
<td><strong>7</strong></td>
</tr>
</tbody>
</table>

all significant by $X^2, p \in [3\times10^{-11}, 0.048]$
Experiment II: Efficiency and Satisfaction
Experiment II: Efficiency and Satisfaction

Participants

• 41 participants, 25 different nationalities
• 20-36 years (mean = 26)
• 25 female
• High education level
• Regular computer users
## Experiment II:
### Efficiency and Satisfaction

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- 41 participants, 25 different nationalities
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### Test Design
- Main experimental factor: Interface version
- Within-subjects design, versions counterbalanced
- 3 tasks per interface version
- post-version questionnaires
- 30-60 minutes
Experiment II:
Efficiency and Satisfaction

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Test Design
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## Experiment II Results: Objective Measures

<table>
<thead>
<tr>
<th></th>
<th>US Version</th>
<th>adapted Version</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avg. completion time</td>
<td>276.46 s</td>
<td>215.39 s</td>
<td>$p &lt; .05$</td>
</tr>
<tr>
<td>Avg. number of clicks</td>
<td>31</td>
<td>24</td>
<td>$p &lt; .05$</td>
</tr>
<tr>
<td>Avg. number of errors</td>
<td>2.39</td>
<td>0.73</td>
<td>$p &lt; .05$</td>
</tr>
</tbody>
</table>

Average performance improvement of 22 %
### Experiment II Results: Subjective Measures

<table>
<thead>
<tr>
<th>Evaluation measurement</th>
<th>US Version</th>
<th>adapted Version</th>
<th>Significance</th>
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<tbody>
<tr>
<td>Usability</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Effort expectancy</td>
<td>-</td>
<td>+</td>
<td>p &lt; .01</td>
</tr>
<tr>
<td>Aesthetics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expressive</td>
<td>-</td>
<td>+</td>
<td>p &lt; .05</td>
</tr>
<tr>
<td>Classical</td>
<td>≈</td>
<td>≈</td>
<td>n.s.</td>
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</tbody>
</table>
Nothing is as practical as a good theory!

Kurt Lewin
Reflection

Theory

- analytical tool for understanding, explaining, and making predictions
- Validity & Simplicity
πράξη

Practice
Smurfing in Financial Institutions
Smurfing in Financial Institutions

Source Account

Account #1

Account #2

Target Account

\[ t \]
Smurfing in Financial Institutions

Source Account → Account #1 → Account #2 → Target Account

Source Account → Account #1 → Account #2 → Target Account

$t$
Smurfing in Financial Institutions

- Source Account
- Account #1
- Account #2
- Target Account

- Source Account
- Account #1
- Account #2
- Target Account
Smurfing in Financial Institutions

Source Account

Account #1

Account #2

Target Account

Source Account

Account #1

Account #2

Account #3

Account #4

Account #5

Target Account

Source Account

Account #1

Account #2

Account #3

Account #5

Target Account
Smurfing in Financial Institutions
Data Properties
Transactions

in (log₂)

out (log₂)

customers (log₂)
15-20
10-15
5-10
0-5
Data Properties

Transactions

in (log₂) 0 3 6 9 12

out (log₂) 0 5 10 15 20

customers (log₂)

Data Properties

Transactions

RDBMS are ill suited for graph analyses
RDBMS are ill suited for graph analyses.

Graph-flow pattern detection rarely scale.
Hexastore: The main Idea!

http://www.mpi.de/Gerhard_Weikum

http://www.lubm.org/teaches

?course

http://www.lubm.org/atUniversity

?university

Weiss et al, 2008
Hexastore: The main Idea!

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<table>
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<tr>
<th>Subject</th>
<th>Predicate</th>
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<tbody>
<tr>
<td>GW</td>
<td>teaches</td>
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<tr>
<td>JU</td>
<td>lives in</td>
</tr>
<tr>
<td>AB</td>
<td></td>
</tr>
<tr>
<td>A.I.</td>
<td>teaches</td>
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<tr>
<td>DBMS</td>
<td></td>
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<tr>
<td>IM &amp; DM</td>
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<tr>
<td>introAI</td>
<td></td>
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<tr>
<td>Saarland</td>
<td>atUniv.</td>
</tr>
<tr>
<td>UZH</td>
<td>atUniv.</td>
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Weiss et al., 2008
Hexastore: The main Idea!

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Weiss et al., 2008
Hexastore: Plusses/Minuses
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+ Concise & Efficient handling of multi-valued attributes / NULLs
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- Requires more storage
  - 5 times in worst case, as sorted lists can be shared
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- Requires more storage
  - 5 times in worst case, as sorted lists can be shared
- Updates expensive
  - Addressed in *Tokyo TyGr* & *RDFBox* (B+H Trees)
Reality check!

- Security
  - Access Control
  - Encryption
  - Swap-partition erasure
  - Logging

- Maintenance
  - 24/7 support
  - 99.999% uptime?
  - Program throttling & RAM limitation
  - Maintenance APIs
Reality is the murder of a beautiful theory by a gang of ugly facts

Robert L. Glass
Reflection

Theory
- analytical tool for understanding, explaining, and making predictions
- Validity & Simplicity

Practice
- The application of an approach to solve a problem
- Usefulness & Efficiency
So, should we throw the Semantic Web into the Garbage Can?
Garbage Can Theory

Cohen, March, and Olsen, 1972
Garbage Can Theory

Problems

Cohen, March, and Olsen, 1972
Garbage Can Theory

Problems

Solutions

Cohen, March, and Olsen, 1972
Garbage Can Theory

Problems

Solutions

Cohen, March, and Olsen, 1972
Garbage Can Theory

Problems → Solutions

Cohen, March, and Olsen, 1972
σύνθεση
Synthesis
Recombination

Sandwich

"Starch"
- French
- Multi-Grain
- Bagel
- Tortilla
- Rice

"Meat"
- Turkey
- Chicken
- Caviar
- Shrimps
- Buffalo

Vegetables
- Lettuce
- Tomatoes
- Peppers
- Beans
- Seaweed
Process Recombination

- Identify staffing needs
- Identify potential sources
- Select human resources
- Make offer
- Enroll employee

Bernstein et al, 1999
Process Recombination

Identify staffing needs
- by manager
- by committee
- by forecasting

Identify potential sources
- using the Internet
- by self-identification
- advertising
- headhunter
- conferences
- in journals

Select human resources
- by HR-manager
- by role-playing
- by simulation
- by attrition
- by certification

Make offer
- electronically
- by mail
- in person

Enroll employee
- in job environment
- by special trainer
- in learning environment
- using simulation

Bernstein et al, 1999
Process Recombination

Bernstein et al, 1999
Process Recombination
Translating a Document

To be or not to be, that is the question. Sein oder nicht Sein, das ist die Frage. To be or not to be, that is the question. Sein oder nicht sein, das ist die Frage. To be or not to be, that is the question. Sein oder nicht sein, das ist die Frage. To be or not to be, that is the question. Sein oder nicht sein, das ist die Frage. To be or not to be, that is the question. Sein oder nicht sein, das ist die Frage. To be or not to be, that is the question. Sein oder nicht sein, das ist die Frage. To be or not to be, that is the question. Sein oder nicht sein, das ist die Frage. To be or not to be, that is the question. Sein oder nicht sein, das ist die Frage. To be or not to be, that is the question. Sein oder nicht sein, das ist die Frage. To be or not to be, that is the question. Sein oder nicht sein, das ist die Frage. To be or not to be, that is the question. Sein oder nicht sein, das ist die Frage. To be or not to be, that is the question. Sein oder nicht sein, das ist die Frage.
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Minder & Bernstein, 2012
Translating a Document

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Machine Translate

Rewrite

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Machine Translate

Rewrite

Check Syntax

Improve Language Quality

Minder & Bernstein, 2012
Translating a Document

Table 3. Mean evaluation scores and standard deviation (σ) for the evaluation of adequacy (ad), fluency (fl), and grammar (gr) by professional translators (p) and crowd worker (c).
Translating a Document

**Results**

<table>
<thead>
<tr>
<th>Method</th>
<th>ade</th>
<th>ade_p</th>
<th>flc</th>
<th>flp</th>
<th>grp</th>
</tr>
</thead>
<tbody>
<tr>
<td>CP x CP</td>
<td>3.16 (σ=0.25)</td>
<td>3.5</td>
<td>3.37 (σ=0.22)</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>CP x II</td>
<td>3.14 (σ=0.22)</td>
<td>3</td>
<td>3.12 (σ=0.23)</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Baseline</td>
<td>2.90 (σ=0.25)</td>
<td>1.5</td>
<td>2.88 (σ=0.22)</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Reference</td>
<td>4.24 (σ=0.18)</td>
<td>5</td>
<td>3.58 (σ=0.24)</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>

Table 3. Mean evaluation scores and standard deviation (σ) for the evaluation of adequacy (ade), fluency (fl), grammatical correctness (gr) by professional translators.

“Nonsensical. Tenses are the big issue here - [...] and therefore makes the sense very difficult to understand.”
Translating a Document

“This would be fine except for two places that incorrectly use a relative clause [...]”

<table>
<thead>
<tr>
<th>Method</th>
<th>Mean (σ)</th>
<th>SD (σ)</th>
<th>Adequacy</th>
<th>Fluency</th>
<th>Grammar</th>
</tr>
</thead>
<tbody>
<tr>
<td>CP x CP</td>
<td>3.16 (0.25)</td>
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Table 3. Mean evaluation scores and standard deviation (σ) for the evaluation of adequacy (fl), fluency (ad), and grammar (gr) by professional translators.

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Should we throw the Semantic Web into the Garbage Can?
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Hexastore: The main Idea!

Advantages of Localization

Interfaces that are adapted to a certain country can increase:

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- work efficiency

Weiss et al., 2008
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Example UIs

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