Web history, epistemology and didactics

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WS.01 Web science: lecture 1
http://vimeo.com/9454483
http://www.metacafe.com/watch/2806350/big_bang_exploded/
The digital explosion of bits
but not the same for everybody

Flickr usage in the World: Chris Harrison, Human-Computer Interaction Institute, Carnegie Mellon University.
The new Web of Data, Linked Data
Contents

• Course outline
• What is the Web?
• Why is so successful?
• Web milestones
• Underlying ideas
• We knew the web was big...
• Internet & Web current status
• Web generations
• Studying the Web
• Projects
Course outline

- Web history, Epistemology, didactics
- Research methodology
- Conceptual framework for Web Models
- New Web governance & Linked Data
- Web Economics and Business
- Web & the Law
- Privacy & trust in the Web
- Web and Psychology
- Web based development
Course outline

- Wiki
  

Grading
The final mark is defined by the following analogy:
- 70% atomic project
- 30% final exam (grade>5) [multiple choice with reasoning

Projects
Choice between:
- Growing up with the Web
- Ideas for Linked Data Services
What is the Web?

“The dream behind the Web is of a common information space in which we communicate by sharing information. Its universality is essential: the fact that a hypertext link can point to anything, be it personal, local or global, be it draft or highly polished. ..
What is the Web?

There was a second part of the dream, too, dependent on the Web being so generally used that it became *a realistic mirror* (or in fact the primary embodiment) of the ways in which we work and play and socialize. That was that once the state of our interactions was on line, we could then use computers to help us analyse it, make sense of what we are doing, where we individually fit in, and how we can better work together.”

TBL
What is the Web?

a system of interlinked hypertext documents accessed via the Internet. With a web browser a user views web pages that may contain text, images, videos, and other multimedia and navigates between them using hyperlinks.
What is the Web?

The Web is an information space in which the items of interest, referred to as resources, are marked up by a set of rules (i.e. HTML), identified by global identifiers called Uniform Resource Identifiers (URI) using the Hypertext Transfer Protocol (HTTP).
Why is so successful?

Is based on architecture (HTTP, URI, HTML) which is:
• simple
• networked
• based on open standards
• extensible
• tolerant
Why is so successful?

- universal *(regardless hardware platform (iphone applications??), software platform, application software, network access, public, group, or personal scope, language and culture operating system and ability)*
- free or cheap
- fun
- powerful
Web milestones
Web milestones

1992: TBL presents the idea in CERN
1993: Dertouzos (MIT) and Metakides (EU) create W3C
appointing TBL as director

Two Greeks in the Web’s birth,
How many in Web science’s?
First webpages
Underlying ideas

- Overcome deterministic software connections (“waterfall” model)
- Mimics the brain with “random” connections
- From ASCII to hypertext
- Resolve (some) natural language ambiguities (i.e. URI)
- The biggest human system with no central authority and control
We knew the Web was big...

• 1 trillion unique URIs (Google blog 7/25/2008)
• 2 billion users
• Google: 300 million searches/day
• US: 15 billion searches/month
• 72% of the Web population are active on at least 1 social network ...

Source blog.usaseopros.com/2009/04/15/google-searches-per-day-reaches-293-million-in-march-2009/
the new continents

• Facebook: 400 million active users
  – 50% of our active users log on to Facebook in any given day
  – 35 million users update their status each day
  – 60 million status updates posted each day
  – 3 billion photos uploaded to the site each month

• Twitter: 75 million active users
  – 141 employees

• Youtube: 350 million daily visitors

• Flickr: 35 million daily visitors
Web: the new continent

• Online advertising spending in the UK has overtaken television expenditure for the first time [4 billion Euros/year] (30/9/2009, BBC)
• In US, spending on digital marketing will overtake that of print for the first time in 2010
• Amazon.com: 50 million daily visitors
  – 60 billion dollars market capitalization
  – 24,000 employees
Evolution of the Internet Core

Over the last 5 years, Internet traffic has migrated away from the traditional Internet core of 10 Tier-1 international transit providers.

Today, the majority of Internet traffic by volume flows directly between large content providers, datacenter / CDNs and consumer networks.
Internet & Web current status

Rise of the ‘Hyper Giants’

Today, most content has increasingly migrated to a small number of very large hosting, cloud and content providers. Out of the 40,000 routed end sites in the Internet, 30 large companies – “hyper giants” like Limelight, Facebook, Google, Microsoft and YouTube – now generate and consume a disproportionate 30% of all Internet traffic.

Business wise: oligopoly of 5 giant companies (anti-trust policy like IBM fragmentation in the past)
Internet & Web current status

Applications Migrate to the Web

Historically, Internet applications communicated across a panoply of application specific protocols and communication stacks.

Today, the majority of Internet application traffic has migrated to an increasingly small number of web and video protocols, including video over web and Adobe Flash. Other mechanisms for video and application distribution like P2P (peer-to-peer) have declined dramatically in the last two years.
## Web generations

<table>
<thead>
<tr>
<th>eras</th>
<th>description</th>
<th>basic value source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre Web 1980’s <strong>calculate</strong></td>
<td>The desktop is the platform</td>
<td>Computations [<em>no network effect</em>]</td>
</tr>
<tr>
<td>Web 1.0: 90’s <strong>read</strong></td>
<td>Surfing Web: The browser is the platform</td>
<td>hyper-linking of documents</td>
</tr>
<tr>
<td>Web 2.0: 00’s <strong>write</strong></td>
<td>Social Web: The Web is the platform</td>
<td>social dimension of linkage properties</td>
</tr>
<tr>
<td>Web 3.0: 10’s <strong>discover</strong></td>
<td>Semantic Web: The Graph is the platform</td>
<td>URI-based semantic linkages</td>
</tr>
<tr>
<td><strong>Semantic Web</strong></td>
<td><strong>Linked Data</strong></td>
<td></td>
</tr>
<tr>
<td>Web 4.0: 20’s <strong>execute</strong></td>
<td>Metacomputing: The network is the platform Web of things (embedded systems, RFID)</td>
<td>Connection &amp; production in a global computing system for everything</td>
</tr>
<tr>
<td>Web 2<strong>w</strong> <strong>Combine all</strong></td>
<td>Almost everything is (or could be) a Web service</td>
<td>New inter-creativity</td>
</tr>
</tbody>
</table>
Web generations
Studying the Web

The Web is the largest human information construct in history. The Web is transforming society...

It is time to study it systematically as socio-technical artifact
Web Science

The Web Science Research Initiative joint endeavor of MIT CSAIL and University of Southampton became Web Science Trust.
Web science timeline

• Chairs: Tim Berners-Lee, Wendy Hall
• Organizing Committee: J. Hendler, N. Shadbolt, D. Weitzner

11/2006: Web Science Research Initiative is established

2007: “A Framework for Web Science” is published
2007: the book is translated to Greek/introduced in Univ.

4/2008: 2nd Web Science Workshop, China
7/2008: Summer Doctoral Program, Oxford
9/2008: Web science curriculum workshop, UK
9/2008: establishment of W3F

2009: 1st World Conference in Web science
10/2009: master in Web science Greece, UK
9/2010: Web science in Royal Society
Web science core

• The transdisciplinary field of Web science is taking the Web as its primary object of study.
• One of the envelope questions of Web Science could be what technological and other changes need to be made in order for the Web to work better for more people?
• Mathematics and statistics is the base
• Enhanced logging system
• URI
• Business oligopoly
• Computational social science arguments
Computational social science

- The capacity to collect and analyze massive amounts of data has transformed such fields as biology and physics (i.e. CERN experiment).
- This not the case for “computational social science” has been much slower (i.e. economics, sociology, and political science)
- But computational social science is happening in Web business (i.e. Google) and governments (i.e. CIA)
- How will be emerged in the open academic environment?
Web science epistemology
Science Subject Categorization

• **What?** Autonomous taxonomic trees (i.e. ACM, PACS)
• **Why?** Organize and Communicate scientific knowledge
• **How?** doc, pdf, XML, Ontologies (Systems Biology)
• **When?** Updates every 10 years
• **Our proposal:**
  – Semantic representation (i.e. SKOS)
  – Linked to other Science Subject Categorizations
  – Wiki discussion
Top Level

A. General
B. Web History and Methodology
C. Teaching the Web
D. Web Technologies
E. Web Data and Analysis
F. Web Society
Web science epistemology
B. Web History and Methodology

B.1. General
B.2. Forerunners
B.3. Pre-Web technologies
B.4. Standards
B.5. Epistemology
B.6. Web Science Theory
C. Teaching the Web

C.1. General
C.2. Pre-college
C.3. Undergraduate
C.4. Graduate
C.5. Other

....
D. Web Technologies

D.1. General
D.2 Web Milieux
D.3 Basic Web Architecture
D.4 Web 2.0
D.5 Semantic Web/Linked Data
D.6 Internet/Web of Things
E. Web Data and Analysis

E.1. General

E.2 Mathematical and Quantitative Methods

(early draft)
F. Web Society

F.1. Economics and Business
F.2. Social Engagement and Social Science
F.3. Personal Engagement and Psychology
F.4. Law
F.5. Politics and Governance
Two “magics” of WS

Two magics of Web Science
email
Web
blog
Semantic Web
Linked Data
Ερευνητική ύποθεση: ιδιωτικότητα
Web science Didactics
Web science didactics

• why Web science should be taught as a university or school subject?
• How can we move from the utilitarian teaching of Web technologies to a theoretical framework based on pedagogical foundations revealing its social effects?
• How can we change the perception of the Web as a tool to the Web as a socio-technological system?
• How this could be useful to our societies?
The Web understanding deficit

• Elephant in the room
• Curricula about ICT old-fashioned
• The Web generation 75% can’t live without it (Google, Twitter, youtube, facebook)
• class have become a museum compare to real world
The Web science goals

• Understand/study/make better Web
• Enhance it in teaching other disciplines (i.e. on line simulations in mathematics and economics)
Didactic transpositions in Web science

The proposed didactic transpositions in Web science involve the concepts of:

• network
• language
• digital
• virtual
Network

• Web is the biggest artificial network of machines, software, protocols and people.
• Properties of real networks are a popular field of study in various disciplines such as mathematics, computer science, social sciences, economics, life sciences etc.
• aims to help scholars conceive Web’s structure, social and policy implications, topology and value creation mechanisms.
• They could be based in the theory of networks in economics, geography and social sciences coupled with game theory foundations (e.g. informative games).
• Could be thought as a language. Actually, most of mathematics can be represented through graphs.
Language

• Natural language is mainly used to produce, represent and communicate knowledge based on complex polysemic bio-social structures.

• Web extents these functions based on monosemic technologies (e.g. URI) and techno-social structures.

• The scope of didactic transpositions in “language” is to facilitate the understanding of differences and complementarities between natural languages and the Web.
Digital

• Digital goods are sequences of 0s and 1s which have economic value and are nonrival, infinitely expansible, discrete, aspatial and recombinant.

• A didactic transposition on the concept of “digital” needs to make clear in an intuitive way the distinction between physical and digital goods.
Virtual

• The concept of “virtual” is considered to be more abstract than “digital”, enhancing the broader meaning of virtualization and includes also human imagination mechanisms. [explain]

• Didactic transpositions on the concept of “virtual” should be based on existing metaphors in psychology, social sciences and interdisciplinary didactics coupled to Web engineering principles.
Can you think any other didactic transposition

In Web programming, existing didactic transpositions in Computer science (i.e. “variable” could be a compact basis for Web science didactics.
Projects

• Growing up with the Web
• Ideas for Linked Data Services
review

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See also

http://webscience.org
http://www.youtube.com/webscienceegr
Supplemental material
Didactics

• General didactics is the theory and practical application of teaching and learning.
• The main goal of didactics is to improve teaching and learning methodologies in a specific discipline.
• Didactics is based on psychology, sociology, pedagogy, epistemology and lately in ICT.
• There is not a general theory for didactics, but they have been developed separate theoretical frameworks for mathematics, computer science, social science and interdisciplinary subjects.
Didactic triangle

• knowledge content (e.g. didactic transpositions, social reference practices, etc)

• strategies in building knowledge and learning content (e.g. representations, didactic obstacles, problem solving etc.)

• didactic environment building (e.g. didactic contract)

• didactic interactions (e.g. didactic help)
Didactic transpositions
Theories of learning

- [wikipedia] Learning is a process that brings together cognitive, emotional, and environmental influences and experiences for acquiring, enhancing, or making changes in one's knowledge, skills, values, and world views.

- A learning theory is an attempt to describe how people and animals learn, thereby helping us understand the inherently complex process of learning.
Theories of learning

• Behaviorism
• Cognitivism
• Constructivism
• Design-Based
• Humanism

Reference: www.learning-theories.com
Theories of learning

Study classical ones and give special attention to:

• *Problem Based Learning (PBL)*

  instructional method of hands-on, active learning centered on the investigation and resolution of messy, real-world problems (higher education and K-12 settings)

• Find some yours fitting to the Information society
Theories of learning

• Situated Learning
  posits that learning is unintentional and situated within authentic activity, context, and culture (new Web culture?)

• *Actor-Network Theory*
  is a framework and systematic way to consider the infrastructure surrounding technological achievements. Assigns agency to both human and non-human actors (e.g. artifacts)