Negotiating the Web Science Curriculum through Shared Educational Artefacts

Su White, Madalina Croitoru, Stéphane Bazan, Stefano Cerri, Hugh Davis, Raffaella Folgieri, Clement Jonquet, François Scharffe, Steffan Staab, Thanassis Tiropanis and Michalis Vafopoulos

Web Science 2011, Koblenz, Germany

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ABSTRACT

The far-reaching impact of the Web on society is widely recognised. The interdisciplinary study of this impact has crystallised in the field of study known as Web Science. However, defining an agreed, shared understanding of what constitutes web science requires complex negotiation and translations of

Categories and Subject Descriptors

K.3.2 [**Computing Milieux**] Computer and Information Science Education

WSSC: webscience.org/2010/B.3 Web Science Theory and Epistemology; webscience.org/2010/F Teaching the Web

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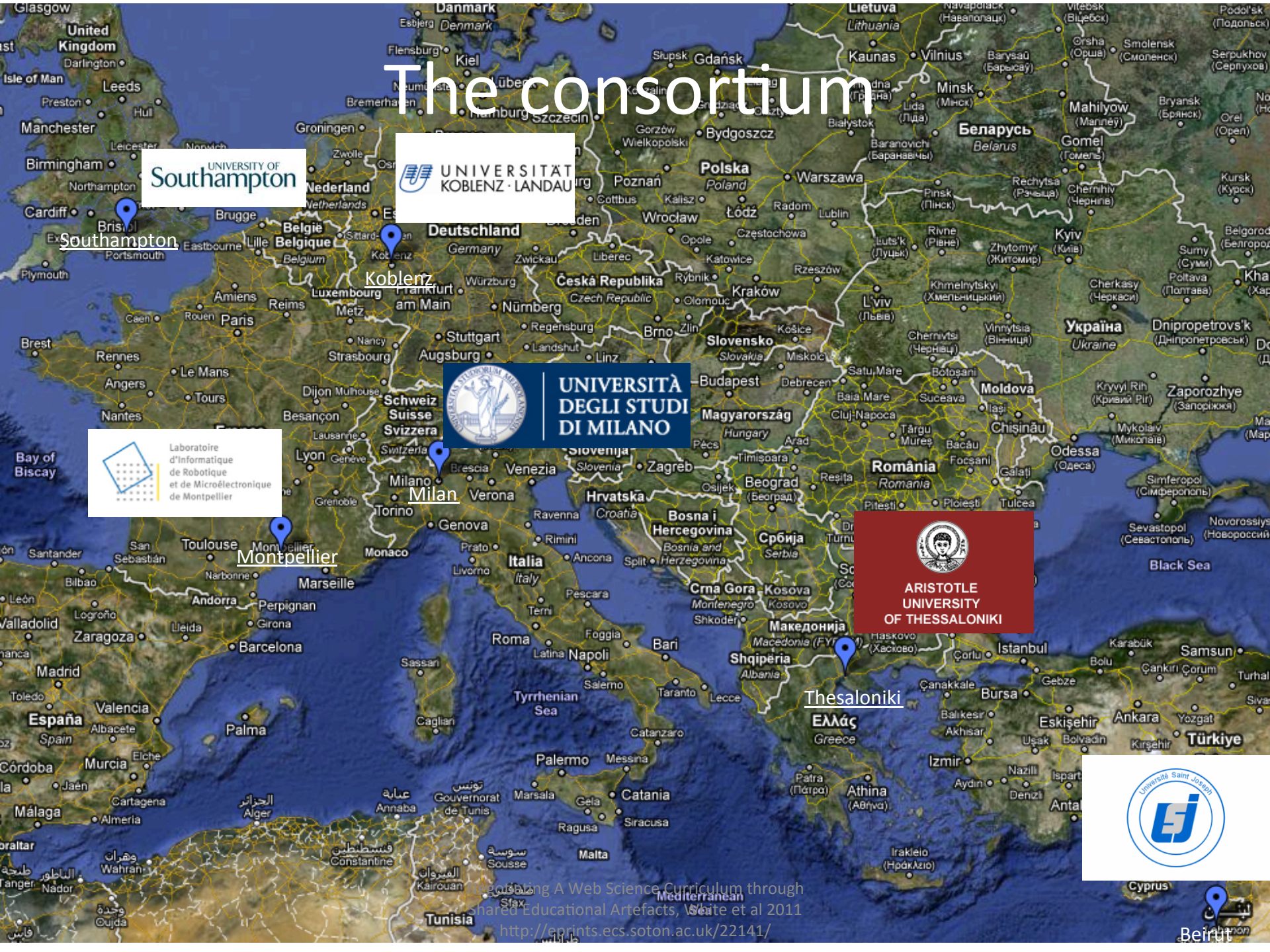
The consortium



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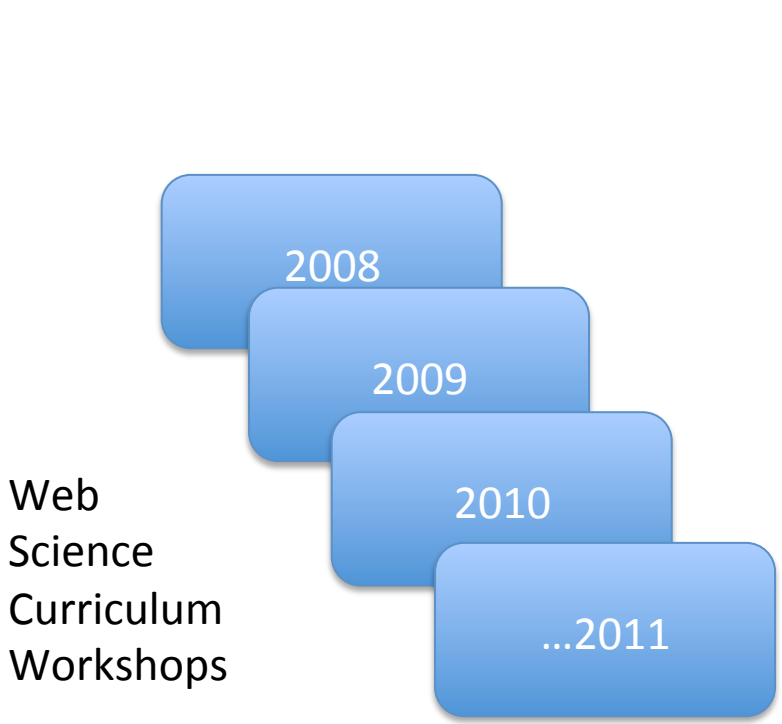
The History

- Lots of people have been talking and thinking about this sort of thing for a while….



Web Science Curriculum Workshops

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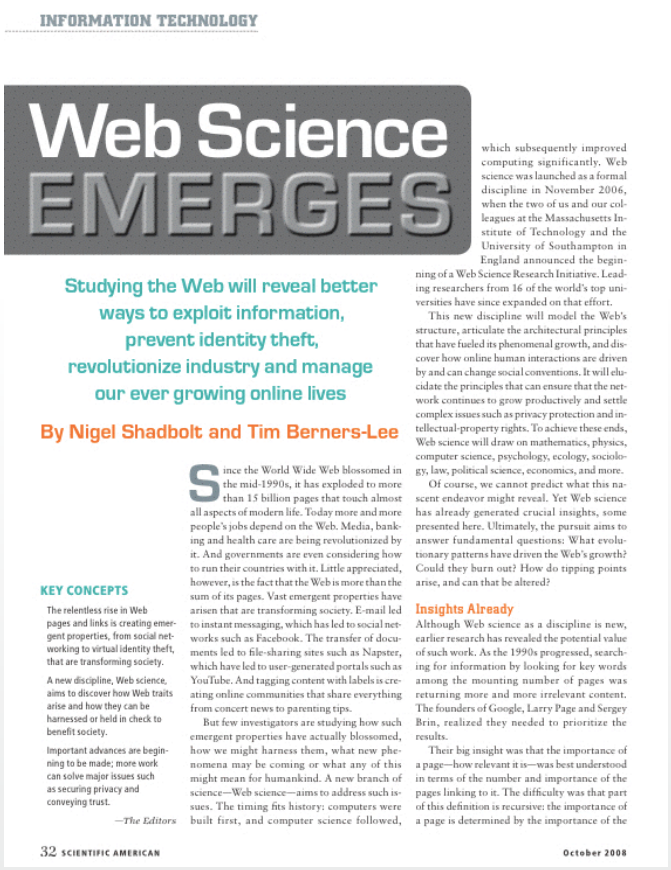
Web Science emerges



INFORMATION TECHNOLOGY

Web Science EMERGES

Studying the Web will reveal better ways to exploit information, prevent identity theft, revolutionize industry and manage our ever growing online lives

By Nigel Shadbolt and Tim Berners-Lee

KEY CONCEPTS

The relentless rise in Web pages and links is creating emergent properties, from social networking to virtual identity theft, that are transforming society.

A new discipline, Web science, aims to discover how Web traits arise and how they can be harnessed or held in check to benefit society.

Important advances are beginning to be made; more work can solve major issues such as securing privacy and conveying trust.

—*The Editors*

Since the World Wide Web blossomed in the mid-1990s, it has exploded to more than 15 billion pages that touch almost all aspects of modern life. Today more and more people's jobs depend on the Web. Media, banking and health care are being revolutionized by it. And governments are even considering how to run their countries with it. Little appreciated, however, is the fact that the Web is more than the sum of its pages. Vast emergent properties have arisen that are transforming society. E-mail led to instant messaging, which has led to social networks such as Facebook. The transfer of documents led to file-sharing sites such as Napster, which have led to user-generated portals such as YouTube. And tagging content with labels is creating online communities that share everything from concert news to parenting tips.

But few investigators are studying how such emergent properties have actually blossomed, how we might harness them, what new phenomena may be coming or what any of this might mean for humankind. A new branch of science—Web science—aims to address such issues. The timing fits history: computers were built first, and computer science followed, which subsequently improved computing significantly. Web science was launched as a formal discipline in November 2006, when the two of us and our colleagues at the Massachusetts Institute of Technology and the University of Southampton in England announced the beginning of a Web Science Research Initiative. Leading researchers from 16 of the world's top universities have since expanded on that effort.

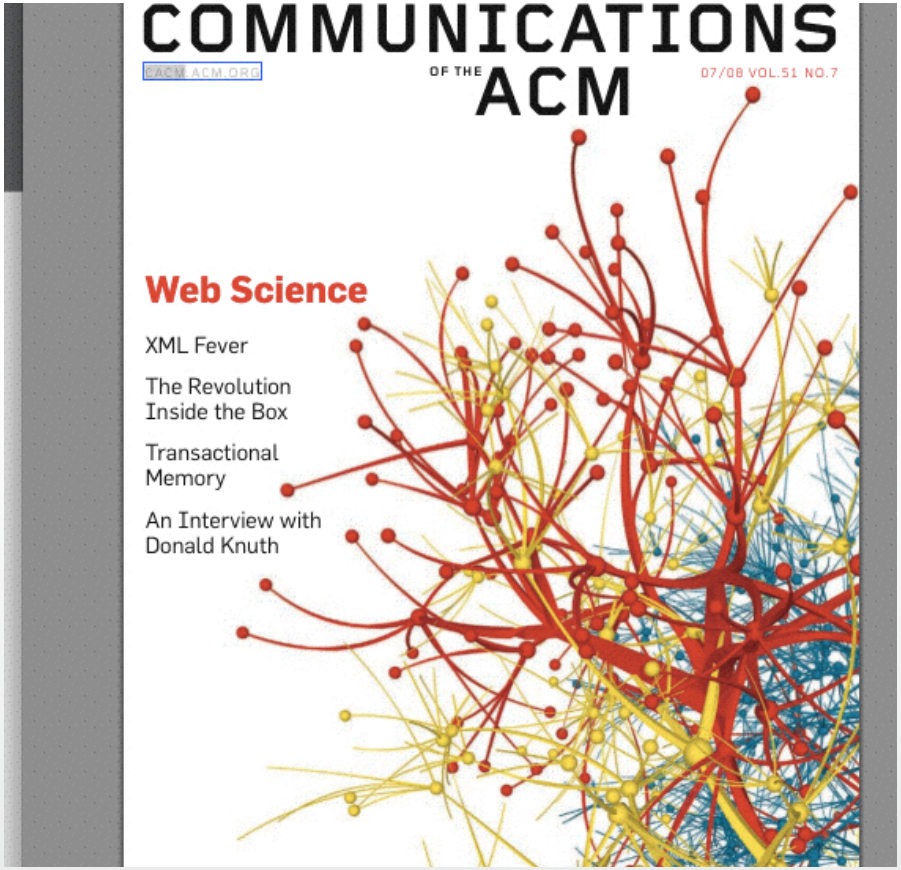
This new discipline will model the Web's structure, articulate the architectural principles that have fueled its phenomenal growth, and discover how online human interactions are driven by and can change social conventions. It will elucidate the principles that can ensure that the network continues to grow productively and settle complex issues such as privacy protection and intellectual-property rights. To achieve these ends, Web science will draw on mathematics, physics, computer science, psychology, ecology, sociology, law, political science, economics, and more.

Of course, we cannot predict what this nascent endeavor might reveal. Yet Web science has already generated crucial insights, some presented here. Ultimately, the pursuit aims to answer fundamental questions: What evolutionary patterns have driven the Web's growth? Could they burn out? How do tipping points arise, and can that be altered?

Insights Already

Although Web science as a discipline is new, earlier research has revealed the potential value of such work. As the 1990s progressed, searching for information by looking for key words among the mounting number of pages was returning more and more irrelevant content. The founders of Google, Larry Page and Sergey Brin, realized they needed to prioritize the results.

Their big insight was that the importance of a page—how relevant it is—was best understood in terms of the number and importance of the pages linking to it. The difficulty was that part of this definition is recursive: the importance of a page is determined by the importance of the



…And will continue to emerge, evolve and develop

Curriculum

This page is for discussions on the curriculum of Web Science degrees at various levels. If you would like to add a resource, please email Les Carr, lac@ecs.soton.ac.uk .

Contents [show]

Proposed Curriculum Topics

A first draft of a list of topics that should be covered in a Web Science course was discussed at the Network For Web Science Workshop on Web Science Curriculum in September 2008. It is listed in detail on the curriculum topics page.

- History of the Web
- Building the Web
- The Web in Society
- Operationalising Web Science for a World of International Commerce
- Analysing the Web

Existing Web Science M.Sc. Programs

1. Aristotle University of Thessaloniki, Department of Mathematics, Master Program in Web Science funded by Municipality of Veria and Cyta Telecommunications

The Master degree in Web science is based on the study of Web assessment, mathematical modeling and operation coı organized as follows:

Winter semester

- WS.01 Web science

Web history, epistemology and didactics. Research methodology. Research practice in the Web. Conceptual framework globalization, Social capital, power inequality, Virtual communities & politics. Privacy & trust in the Web. Web & the Law.

- WS.13 Web Languages and Technologies

Basic Internet Protocols. Basic Web technologies (http, html,URI). XML-based languages. Client-side Web Programming Retrieval algorithms & Search engines Technologies. Web 2.0 Technologies and Applications. Advanced Internet Protoc networking.

- WS.04 Networks and Discrete Mathematics

Graphs & Combinatorics. Graph Topology. Random Graphs. Small Worlds. Scale-free Graphs. Information, Entropy, Prc

- WS.07 Information Processing and Networks

Information, Entropy, Probability Statistics. Information Sources. Channels. Coding. Graphs & Combinatorics. Graph Top

Spring semester

- WS.09 Economics and Business in the Web

Web economics. Games & the Web. Web business models. Web business cases. Project management. Project graphs. Macroeconomic issues in the Knowledge Society: developing world (W3F), local development. Economics of Security. P

Existing Web Science Courses

1. Rensselaer Institute. Jim Hendler. Web Technology oriented. HTTP, URI, Crawling, Social Networks. Last taught Fall 2007. http:/
2. University of Southampton. Les Carr and Catherine Pope. Masters in Web Science http://www.ecs.soton.ac.uk/admissions/pg/ms
3. Technical University of Graz. Markus Strohmaier, Klaus Tochtermann. http://kmi.tugraz.at/staff/markus/courses/SS2009/707.000_
    1. The Small World Problem
    2. Network Theory and Terminology
    3. Social Network Analysis
    4. Affiliation Networks
    5. Network Evolution and Processes
    6. Link Analysis and Search
    7. Webtechnologies I
    8. Metadata, Tagging and Folksonomies
    9. Web Mining and Information Retrieval I (lecture in German)
    10. User Intentions and Intentional Structures on the Web
    11. User Intentions and Intentional Structures on the Web II
    12. Webtechnologies II
4. Oxford Internet Institute Summer School on Web Science (2008). http://students.oii.ox.ac.uk/sdp:sdp2008:readings
    1. Essential background reading
    2. Towards Web Science: the Past, Present and Future of the Web
    3. Civic Technologies and the Future of the Internet
    4. Information Accountability: Rethinking technical, legal and social privacy protection strategies for the Web
    5. Optional Methods Class - Ethnographies of the Internet
    6. Dependency Tracking in Everyday Computation (for a more detailed overview see the top paper linked below)
    7. Trust in the Internet as an Experience Technology
    8. Ontologies and the Semantic Web
    9. Engineering privacy-friendly e-government
    10. Optional Methods Class - Webometrics: Large-scale analysis and the use of ready made tools for gathering data
    11. Companions: persistent agents as internet interfaces

We each structure our own web science curriculum - in our own way

What is the web? How is it made?	• Web, Social Web, Semantic Web
Understanding the impact of the web from different perspectives	• Technological, Social Sciences and Humanities, Inter-disciplinarity
What are the key research questions	• Foundations of Web Science
How do we undertake research	• Research planning, research methods
Individual Extended Research Activity	• Project and Dissertation

expertise

needs

...

perspectives

Negotiating A Web Science Curriculum through Shared Educational Artefacts, White et al 2011
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Table 1. An abridged representation of the Web Science Curriculum.
NB: The full version at http://webscience.org/2010/wssc.html also specifies level 3 headings

A General – *not concerned with course content*

Web History and Methodology

B.1 General Web History and Methodology

B.2 Web History
Web Forerunners; Biographies and related stories

B.3 Web Science Theory and Epistemology
Two Magics of Web Science; Actor Network Theory

Web Technologies

C.1 General Web Technologies

C.2 Web Milieux
Document technologies; Hypertext technologies; Internet technologies; Mobile Web technologies; Grid and Cloud computing technologies

C.3 Basic Web Architecture
HTTP and related technologies; URIs; HTML; XML; CSS and related technologies; Interfaces and Browsers; Servers Web Services

C.4 Web 2.0 technologies

C.5 Semantic Web/Linked Data
Metadata; Knowledge Representation; Ontology Languages; Linked Data; Natural Language Processing; Provenance systems in the Web

C.6 Internet/Web of Things

D. Web Analysis

D.1 General Web Analysis

D.2 Mathematical Methods of Web analysis
Web data sampling and analytics; Logic and Inference in the Web; Statistical Inference in the Web; Statistical Analysis of the Web; Web as a Complex System; Graphs; Networks; Mathematical methods for describing Web services; Crawling; Indexing and Searching; Data Mining; Information Retrieval and Machine Learning; Other Algorithms for the Web

E. Web Society

E.1a Economics
Goods in the Web; The Web economy; Antitrust Issues and Policies in the Web; Intellectual property and digital rights management; Web-based economic development

E.1b Business
E-commerce Business models in the Web; Advertising in the Web; sponsored search

E.2 Social Engagement and Social Science
Social networks; Mass phenomena; Collective intelligence; Peer production; Globalization; Systems; Social structures and processes; Virtual communities, groups and identity; Social capital and power inequality in the Web; On-line lives, intergenerational differences; Mass media

E.3 Personal Engagement and Psychology
System Psychology and Behaviour; Child and adolescent psychiatry; Tele-working

E.4 Philosophy
Philosophy of information; Objects; Reference and Cognition in the Web; Ethics in the Web

E.5 Law
Intellectual Property in the Web; Digital Rights Management; Digital crime; Laws for Web access; Antitrust Law

E.6 Politics and Governance
Political science; E-Government; E-Politics; E-Democracy; Policy and Regulation; Web Governance; Privacy; Trust; Security; Network neutrality; E-Inclusion

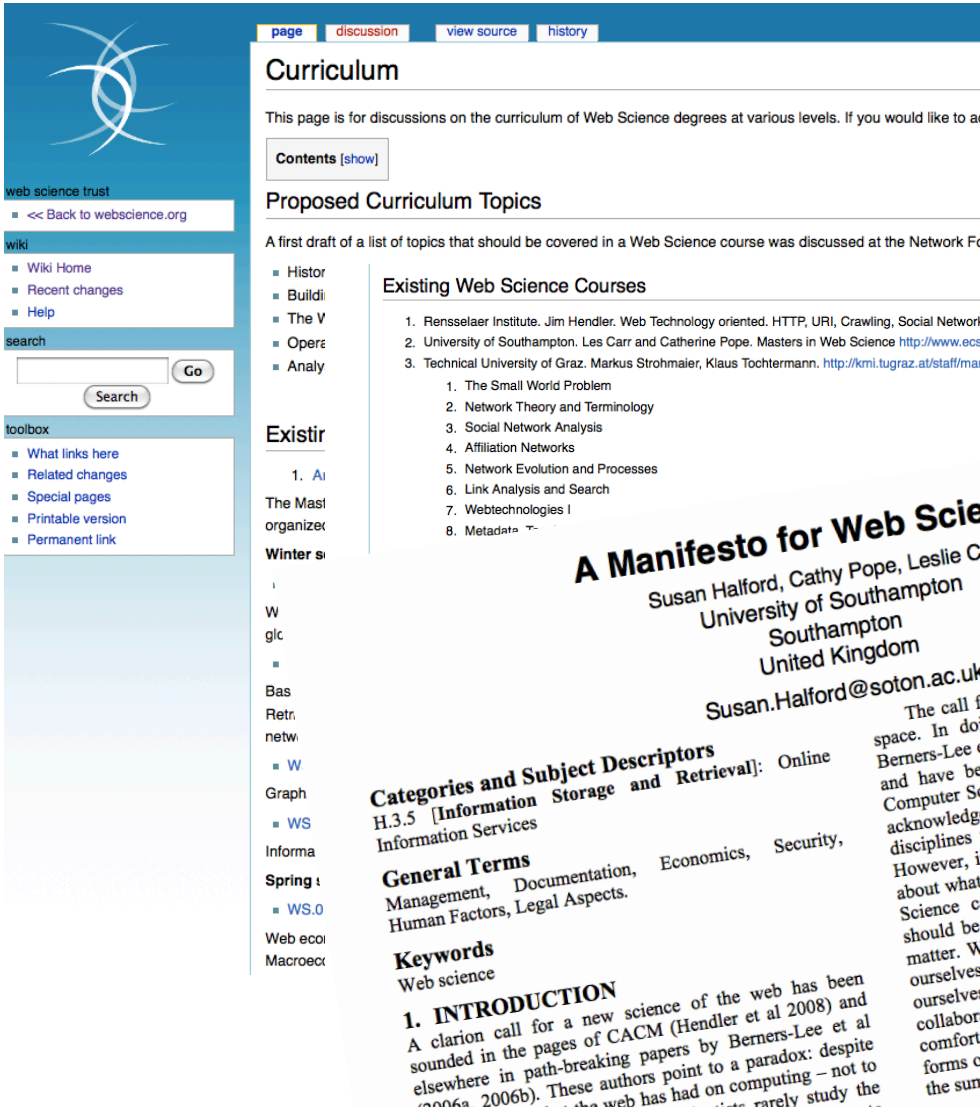
F Teaching the web – *not concerned with course content*

http://webscience.org/2010/wssc.html

Can we “verify” (?) the Web Science Curriculum?

Starting point

- Compare the formal curriculum with
  - existing ‘de facto’ curricula
    - Programmes
    - modules, summer schools, seminar series



WebSci 09

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Shared Educational Artefacts, White et al 2011
http://eprints.ecs.soton.ac.uk/22141/

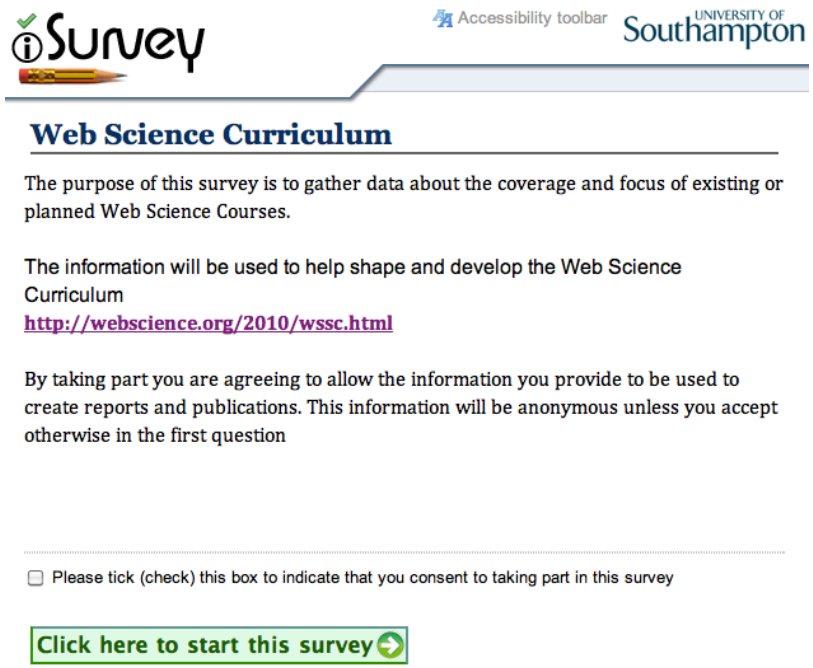
Web Sci 10

Negotiating A Web Science Curriculum through
Shared Educational Artefacts, White et al 2011
http://eprints.ecs.soton.ac.uk/22141/

Comparing with it with existing curricula

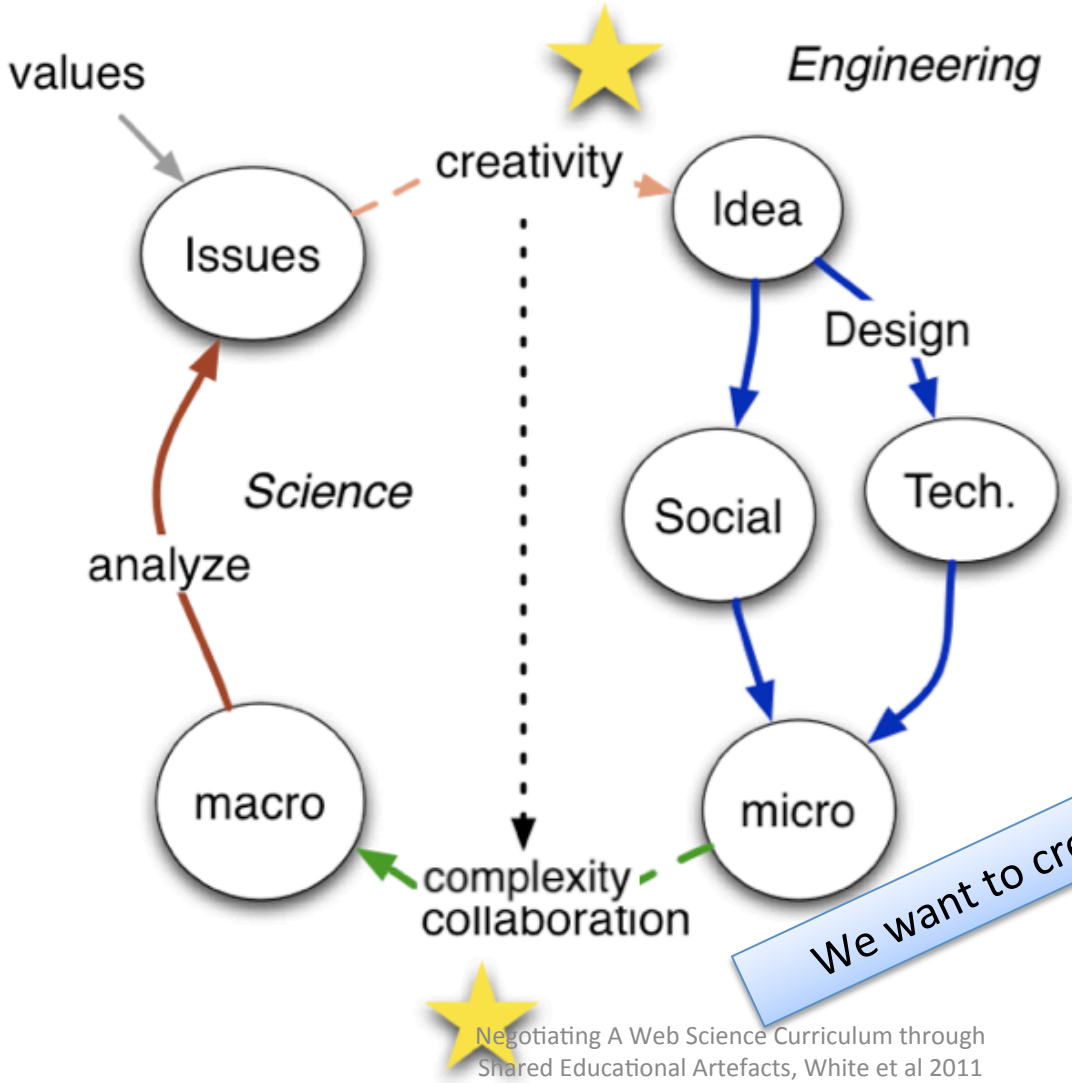
- web science curriculum (modules/programmes)
  - against the web science curriculum

http://wiki.websciencetrust.org/w/Curriculum



Please do the survey
https://www.isurvey.soton.ac.uk/2290

Working with the two magics



We want to create some repository magic

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http://eprints.ecs.soton.ac.uk/22141/

So next… lets gather some evidence

- Share exemplar teaching materials and resources

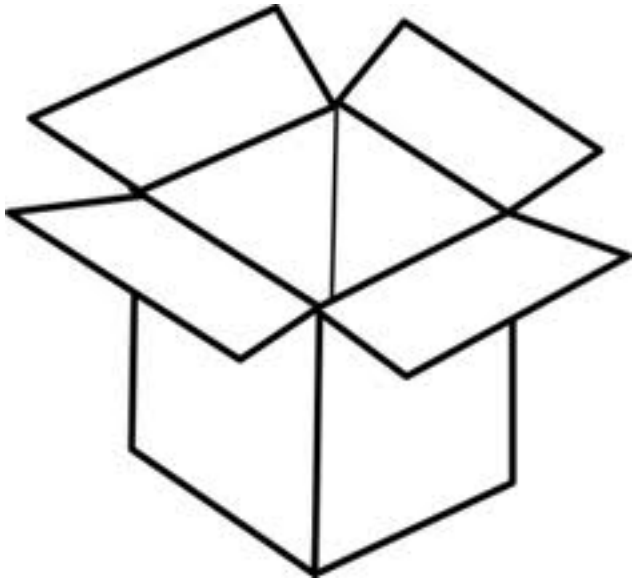
- We have an EU proposal for a project to get people to share (multilingual) content

- We will ask them to share (and annotate) via
- The Web Science Community repository (WSCR) (pronounced Whisker – think cats!) based on EdShare - http://www.edshare.soton.ac.uk

Our idea….

- By identifying, sharing, exposing resources by course and by curriculum topic

- The curriculum will emerge!



The Potential

- Asking people to share exemplar teaching materials and resources
  - annotate them against the curriculum taxonomy
  - and to invent keywords
    - Gap spotting
    - Gap filling
    - De facto definitions
- Enrich and elaborate our understanding of the curriculum
- Broaden the discourse
- Provide a set of shared artefacts around which the discourse can take place
- Negotiate our understanding of the web science curriculum …and web science?

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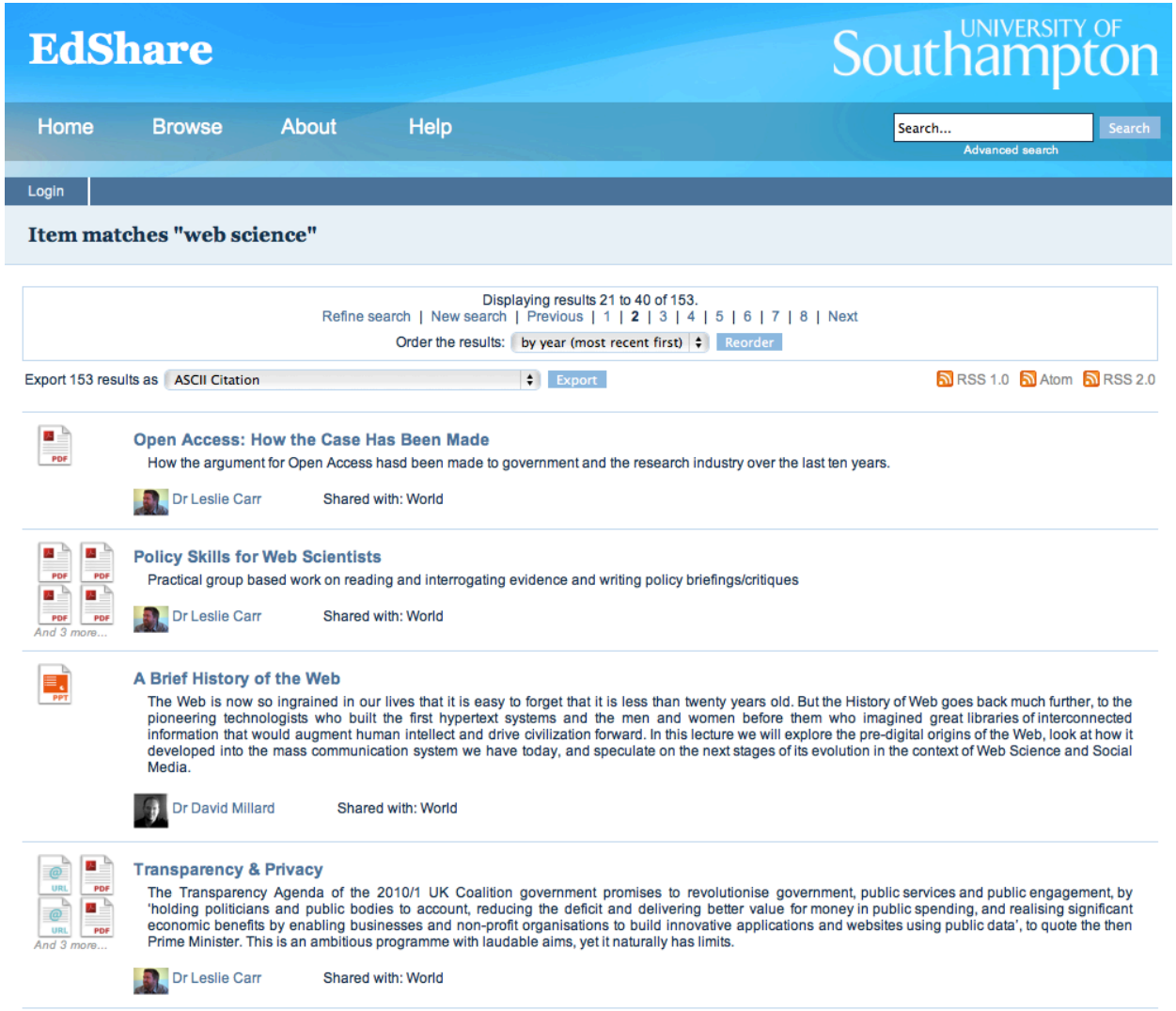
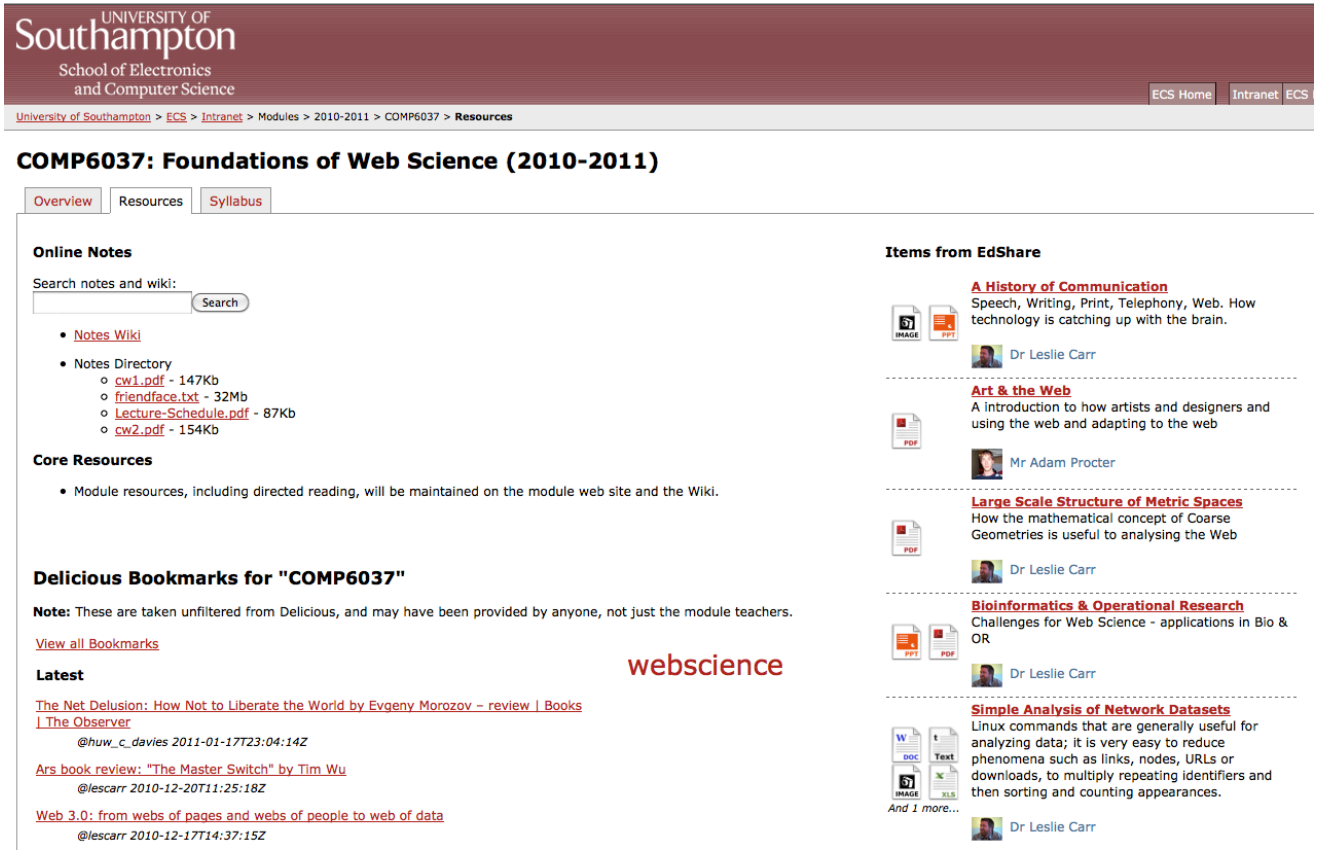
Edshare – a model for WSCR



Building on what we already do



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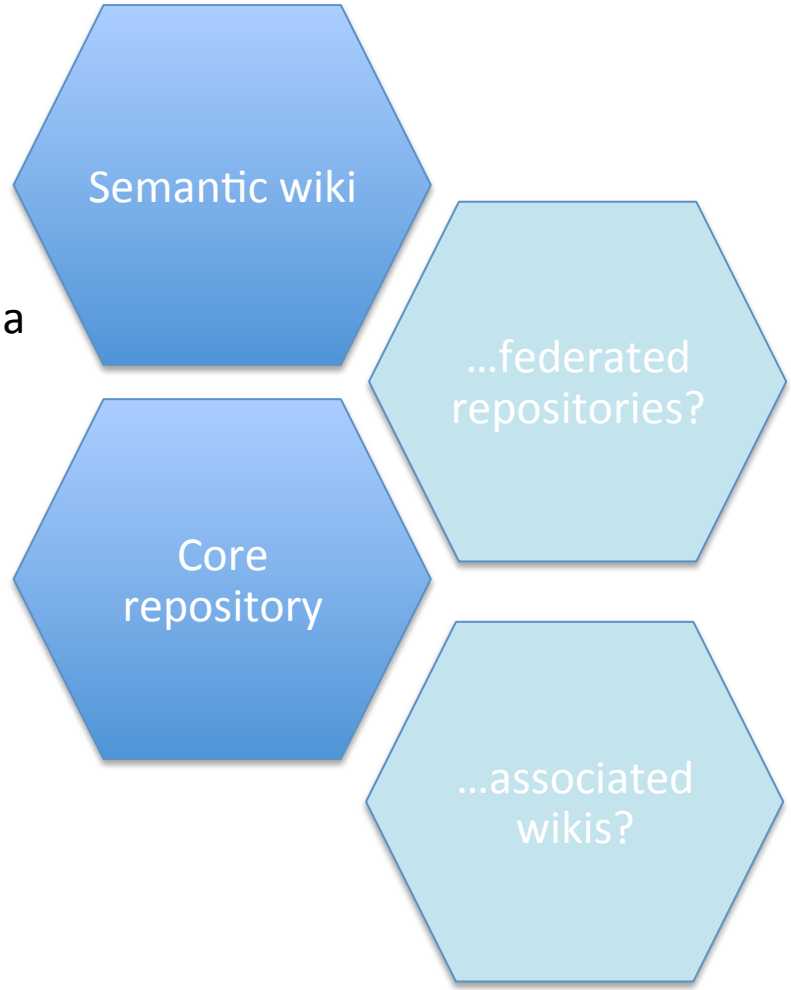
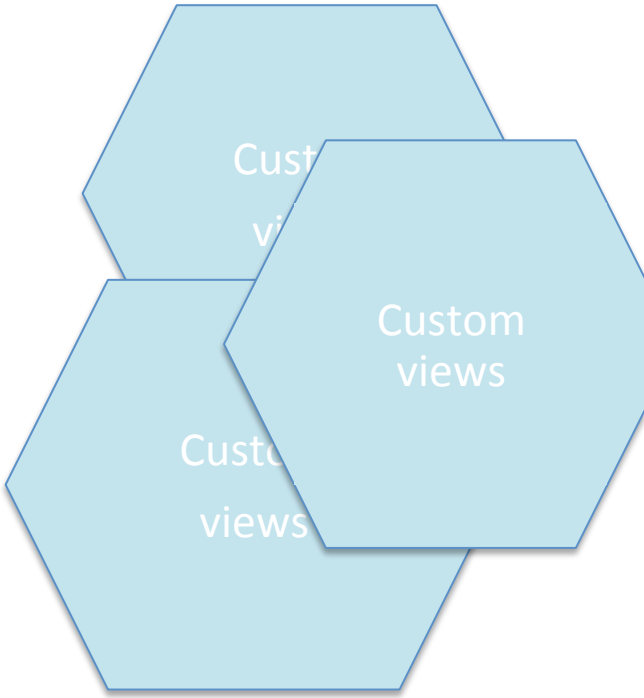
Basic concept

We create a core



Available to augment and use



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What it might look like…

A programme

University of Southampton. Les Carr and Catherine Pope. Masters in Web Science
http://www.ecs.soton.ac.uk/admissions/pg/msc/1011/web_science.php

Semester 1

Semester 2

- Semantic Web/Linked Data (SKOS:C.5) (*Compulsory*)

  Material

  Source:WSCCR

  The Social Semantic Web — Dr Thanassis Tiropanis

  

  Semantic Web and Business Models — Dr Michalis Vafopoulos

  

  Web 2.0 and the Semantic Web — Dr Nicholas Gibbins

  

  Knowledge Representation and Manipulation — Dr Madalina Croitoru

  

  Multi-agent Reasoning — Professor Stefano Cerri

  

- Social Engagement and Social Science (SKOS:E.2) (*Compulsory*)

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...

A Curriculum view

- Web 2.0 technologies (See also: E.2.2 Mass phenomena)
- C.5 Semantic Web/Linked Data (See also: D.2.2 Logic and Inference in the Web, D.2.5 Web as a Complex System, Graphs, Networks, Games, E.1.1.6 Web-based economic development)

Source:WSCCR

The Social Semantic Web	Semantic Web and Business Models
 Dr Thanassis Tiropanis	 Dr Michalis Vafopoulos
Web 2.0 and the Semantic Web	Knowledge Representation and Manipulation
 Dr Nicholas Gibbins	 Dr Madalina Croitoru
Multi-agent Reasoning	
 Professor Stefano Cerri	

- C.5.1 Metadata
- C.5.2 Knowledge Representation

Methods and Affordances

Opportunities

- Associates
- Community of practice
  - Made real
  - Made physical
- Artefacts for the discourse

Methods

- Peer review
- Open to contributions
- Community review workshop series
- Fill fests -

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Benefits and the future?

- See what is actually being taught
  - Share assignments
  - Project ideas
  - Reading lists
  - Data sets
  - Web science 'in the wild'
- Spot what is missing
- Share the task of filling gaps
- Identify multiple web sciences

- The web is worldwide
  - Lets make this an international picture
    - Multilingual
    - Commentaries
- Functions
  - Mapping the territory
  - Contributor for an observatory
  - Sandbox
  - Generator
  - Students as participants
    - Faceted user generated content

Negotiating A Web Science Curriculum through Shared Educational Artefacts, White et al 2011 http://eprints.ecs.soton.ac.uk/22141/

Thank You ☺

And special thanks to the many different participants and leaders of the web science curriculum workshop 2008-2011 and counting ;-)

Please do the survey
https://www.isurvey.soton.ac.uk/2290

White, Su and Croitoru, Madalina and Bazan, Stéphane and Cerri, Stefano and Davis, Hugh and Folgieri, Raffaella and Jonquet, Clement and Scharffe, François and Staab, Steffen and Tiropanis, Thanassis and Vafopoulos, Michalis (2011) Negotiating the Web Science Curriculum through Shared Educational Artefacts. pp. 1-8. In: Proceedings of the ACM WebSci'11, June 14-17 2011, Koblenz, Germany.
http://journal.webscience.org/439/

Slides, paper and original extended abstract available at http://eprints.ecs.soton.ac.uk/22141/

The todo list from the curriculum workshop this week

- Action List
- list of course/programmes/curriculum (wiki) Jim H
- mailing list (announcements) - exists- use it (join)
- co-ordinating calls, monthly meetings Craig
- lecturer/expert list (talks, ideas etc) <this is one naturally for either Craig, or for WSCR profiles)
- project ideas hcd
- literature hcd
- exemplary examples hcd
- textbooks (online/discussion)
- resources site hcd, stéphane
- match making service <after the event - enhancement >
- datasets steffen S
- commentary/discussion resources Su W
- index (and connections of ideas to above)
- review process (max)
- list of people/areas <WSCR profiles>

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