

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 Vafoopoulos

Web Science 2011, Koblenz, Germany

Negotiating the Web Science Curriculum through Shared Educational Artefacts

Su White
University of Southampton
UK

saw@ecs.soton.ac.uk

Madalina Croitoru
University of Montpellier II
France

madalina.croitoru@lirmm.fr

Stéphane Bazan
University Saint Joseph
Lebanon

stefan.bazan@usj.edu.lb

Stefano Cerri
University of Montpellier II
France

cerri@lirmm.fr

Hugh C Davis
University of Southampton
UK

hcd@ecs.soton.ac.uk

Raffaella Folgieri
University of Milan
Italy

raffaella.folgieri@unimi.it

Clement Jonquet
University of Montpellier II
France

jonquet@lirmm.fr

François Scharffe
University of Montpellier II
France

francois.scharffe@lirmm.fr

Steffan Staab
University of Koblenz-Landau
Germany

staab@uni-koblenz.de

Thanassis Tiropanis
University of Southampton
UK

tt2@ecs.soton.ac.uk

Michalis Vafopoulos
Aristotle University
Greece

vafopoulos@gmail.com

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

The consortium

UNIVERSITY OF
Southampton

UNIVERSITÄT
KOBLENZ · LANDAU

Southampton

Koblenz



UNIVERSITÀ
DEGLI STUDI
DI MILANO

Milan

Laboratoire
d'Informatique
et de Microélectronique
de Montpellier

Montpellier

ARISTOTLE
UNIVERSITY
OF THESSALONIKI

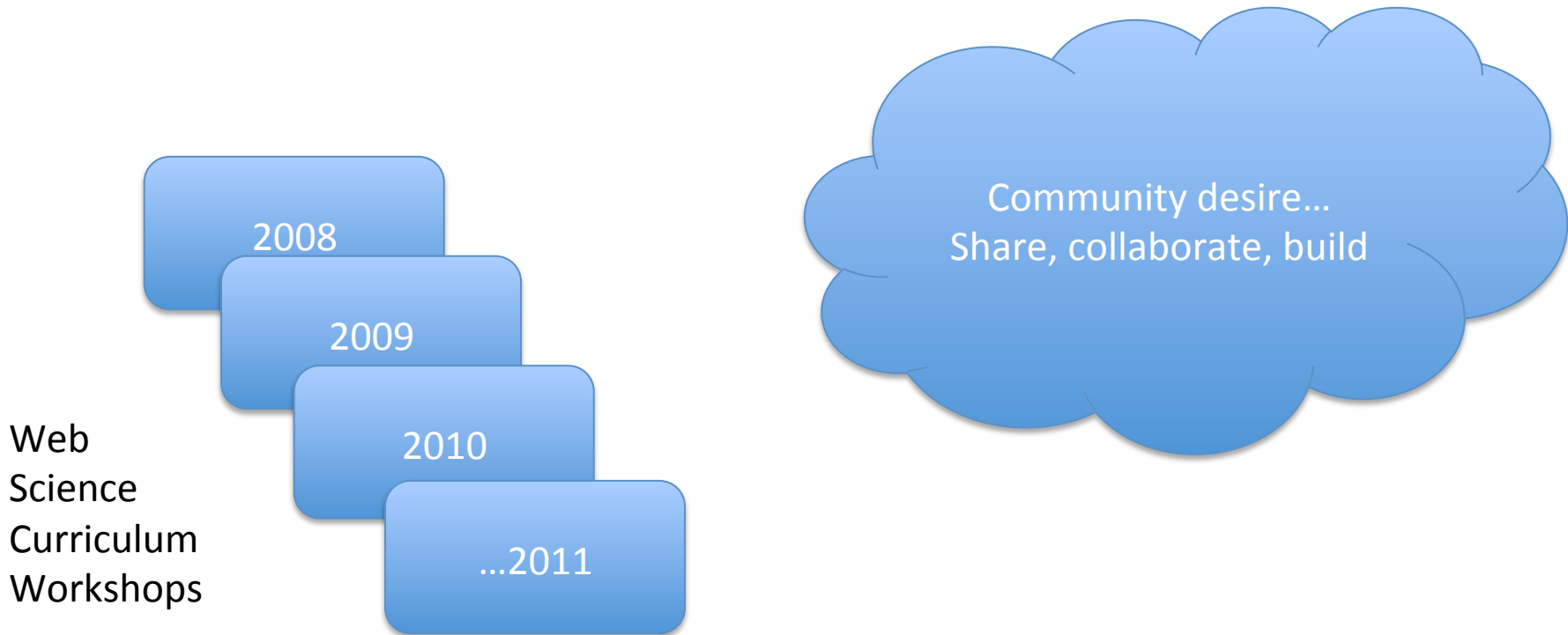
Thessaloniki



Sharing A Web Science Curriculum through
Shared Educational Artefacts, Soete et al 2011
<http://eprints.ecs.soton.ac.uk/22141/>

The History

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



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

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


32 SCIENTIFIC AMERICAN October 2008

COMMUNICATIONS OF THE ACM

ACM.ACM.ORG 07/08 VOL. 51 NO. 7

Web Science

XML Fever
The Revolution Inside the Box
Transactional Memory
An Interview with Donald Knuth



...And will continue to emerge, evolve and develop



web science trust

■ << Back to webscience.org

wiki

- Wiki Home
- Recent changes
- Help

search

toolbox

- What links here
- Related changes
- Special pages
- Printable version
- Permanent link

Log in

page discussion view source history

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 co 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://www.ecs.soton.ac.uk/admissions/pg/ms>
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://kml.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
 12. Government on the Web

Negotiating A Web Science Cur
Shared Educational Artefacts, \n
<http://eprints.ecs.soton.ac>

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

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	

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

Starting point

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

The screenshot shows the 'Curriculum' page of the web science trust. The page has a blue header with the trust's logo and navigation tabs for 'page', 'discussion', 'view source', and 'history'. The main content area is titled 'Curriculum' and includes a 'Contents [show]' link. Below this is a section for 'Proposed Curriculum Topics' and a list of 'Existing Web Science Courses' from various institutions. A sidebar on the left contains links to 'wiki', 'search', and 'toolbox'. At the bottom right, there is a tilted section titled 'A Manifesto for Web Science' by Susan Halford, Cathy Pope, and Leslie Carr, along with 'Categories and Subject Descriptors' and 'Keywords'.

web science trust

- << Back to webscience.org

wiki

- Wiki Home
- Recent changes
- Help

search

toolbox

- What links here
- Related changes
- Special pages
- Printable version
- Permanent link

Curriculum

This page is for discussions on the curriculum of Web Science degrees at various levels. If you would like to add a new topic, please discuss it on the discussion page.

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 Science Summer School 2006.

Existing Web Science Courses

1. Rensselaer Institute. Jim Hendler. Web Technology oriented. HTTP, URI, Crawling, Social Network Analysis.
2. University of Southampton. Les Carr and Catherine Pope. Masters in Web Science <http://www.ecs.soton.ac.uk/~web/>
3. Technical University of Graz. Markus Strohmaier, Klaus Tochtermann. <http://kmi.tugraz.at/staff/markusstrohmaier/>

Existir

1. A. J. C. Cook. The Mast organizer.

Winter s

W

glic

Bas

Retri

netw

W

Graph

WS

Informa

Spring

WS.0

Web eco

Macroec

A Manifesto for Web Science

Susan Halford, Cathy Pope, Leslie Carr
University of Southampton
Southampton
United Kingdom
Susan.Halford@soton.ac.uk

The call for a new science of the web has been space. In do
Berners-Lee e
and have be
Computer Sc
acknowledg
disciplines
However, i
about what
Science c
should be
matter. W
ourselves
ourselves
collabor
comfort
forms o
the sun

Categories and Subject Descriptors

H.3.5 [Information Storage and Retrieval]: Online Information Services

General Terms

Management, Documentation, Economics, Security, Human Factors, Legal Aspects.

Keywords

Web science

1. INTRODUCTION

A clarification call for a new science of the web has been sounded in the pages of CACM (Hendler et al 2008) and elsewhere in path-breaking papers by Berners-Lee et al (2006a, 2006b). These authors point to a paradox: despite the fact that the web has had on computing – not to mention on society – a profound impact, it is rarely studied in the

WebSci 09



Web Sci 10



Comparing with it with existing curricula

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

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



Accessibility toolbar **UNIVERSITY OF Southampton**

Web Science Curriculum

The purpose of this survey is to gather data about the coverage and focus of existing or planned Web Science Courses.

The information will be used to help shape and develop the Web Science Curriculum

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

By taking part you are agreeing to allow the information you provide to be used to create reports and publications. This information will be anonymous unless you accept otherwise in the first question

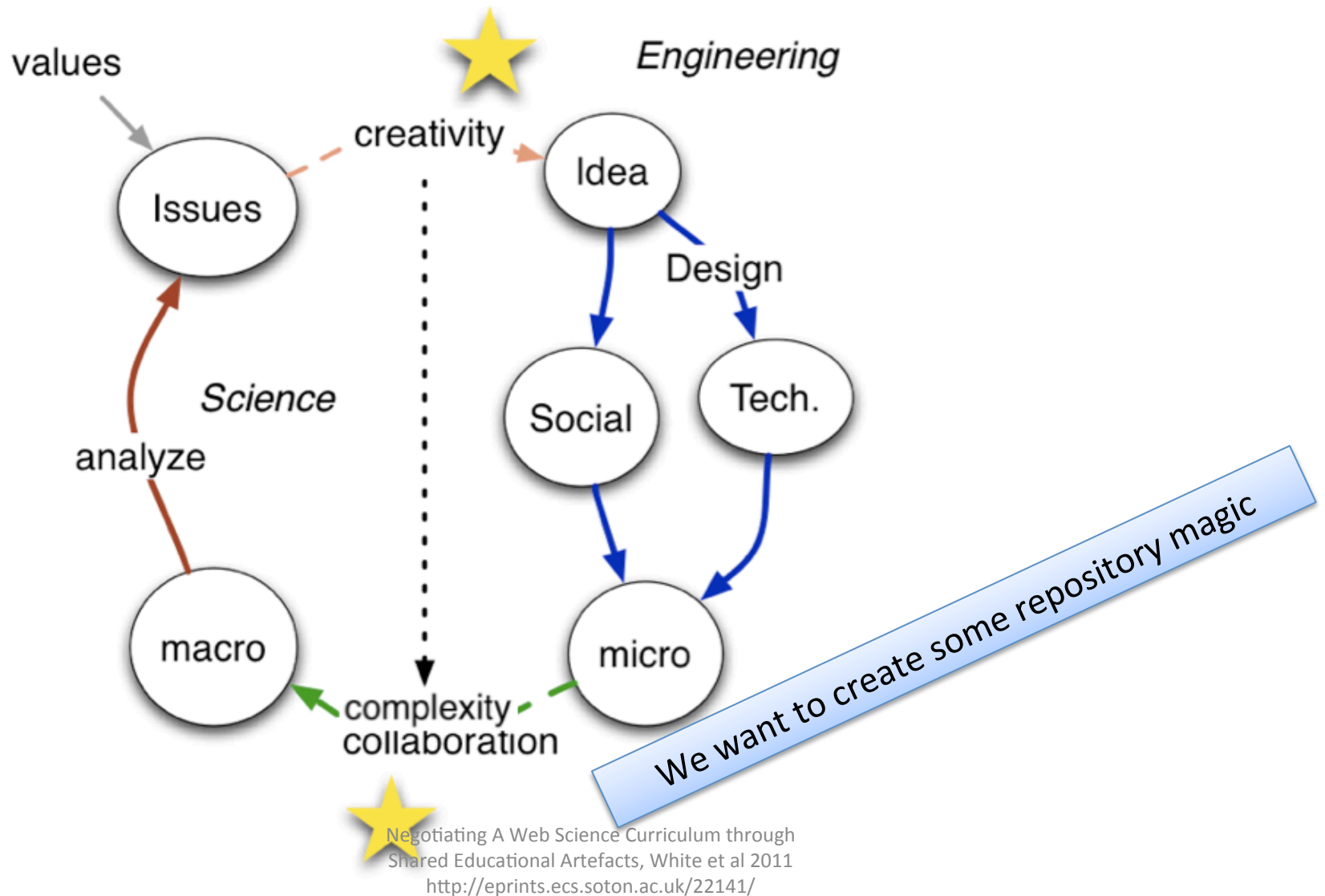
☐ Please tick (check) this box to indicate that you consent to taking part in this survey

[Click here to start this survey](#)

Please do the survey

<https://www.isurvey.soton.ac.uk/2290>

Working with the two magics

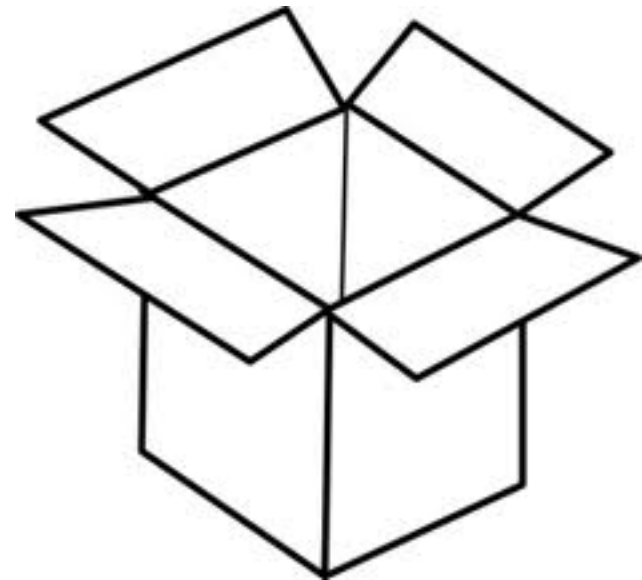


So next... lets gather some evidence

- 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?

Edshare – a model for WSCR

EdShare

UNIVERSITY OF
Southampton

HomeBrowseAboutHelp


Search...
Advanced search


Login





Item matches "web science"


Displaying results 21 to 40 of 153.
Refine search | New search | Previous | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Next
Order the results: by year (most recent first) Reorder


Export 153 results as ASCII Citation ExportRSS 1.0AtomRSS 2.0








Open Access: How the Case Has Been Made
How the argument for Open Access has been made to government and the research industry over the last ten years.
 Dr Leslie Carr Shared with: World




Policy Skills for Web Scientists
Practical group based work on reading and interrogating evidence and writing policy briefings/critiques
 Dr Leslie Carr Shared with: World
And 3 more...



A Brief History of the Web
The Web is now so ingrained in our lives that it is easy to forget that it is less than twenty years old. But the History of Web goes back much further, to the pioneering technologists who built the first hypertext systems and the men and women before them who imagined great libraries of interconnected information that would augment human intellect and drive civilization forward. In this lecture we will explore the pre-digital origins of the Web, look at how it developed into the mass communication system we have today, and speculate on the next stages of its evolution in the context of Web Science and Social Media.
 Dr David Millard Shared with: World



Transparency & Privacy
The Transparency Agenda of the 2010/1 UK Coalition government promises to revolutionise government, public services and public engagement, by 'holding politicians and public bodies to account, reducing the deficit and delivering better value for money in public spending, and realising significant economic benefits by enabling businesses and non-profit organisations to build innovative applications and websites using public data', to quote the then Prime Minister. This is an ambitious programme with laudable aims, yet it naturally has limits.
 Dr Leslie Carr Shared with: World
And 3 more...

Building on what we already do

UNIVERSITY OF
Southampton
School of Electronics
and Computer Science

ECS HomeIntranetECS

University of Southampton > ECS > Intranet > Modules > 2010-2011 > COMP6037 > Resources

COMP6037: Foundations of Web Science (2010-2011)

OverviewResourcesSyllabus

Online Notes

Search notes and wiki:

- [Notes Wiki](#)
- Notes Directory
 - [cw1.pdf](#) - 147Kb
 - [friendface.txt](#) - 32Mb
 - [Lecture-Schedule.pdf](#) - 87Kb
 - [cw2.pdf](#) - 154Kb

Core Resources

- Module resources, including directed reading, will be maintained on the module web site and the Wiki.

Delicious Bookmarks for "COMP6037"

Note: These are taken unfiltered from Delicious, and may have been provided by anyone, not just the module teachers.

[View all Bookmarks](#)



Latest


[The Net Delusion: How Not to Liberate the World](#) by Evgeny Morozov – review | Books | The Observer
@huw_c_davies 2011-01-17T23:04:14Z


[Ars book review: "The Master Switch" by Tim Wu](#)
@lescarr 2010-12-20T11:25:18Z


[Web 3.0: from webs of pages and webs of people to web of data](#)
@lescarr 2010-12-17T14:37:15Z


Items from EdShare






A History of Communication
Speech, Writing, Print, Telephony, Web. How technology is catching up with the brain.
 [Dr Leslie Carr](#)








Art & the Web
A introduction to how artists and designers and using the web and adapting to the web
 [Mr Adam Procter](#)




Large Scale Structure of Metric Spaces
How the mathematical concept of Coarse Geometries is useful to analysing the Web
 [Dr Leslie Carr](#)



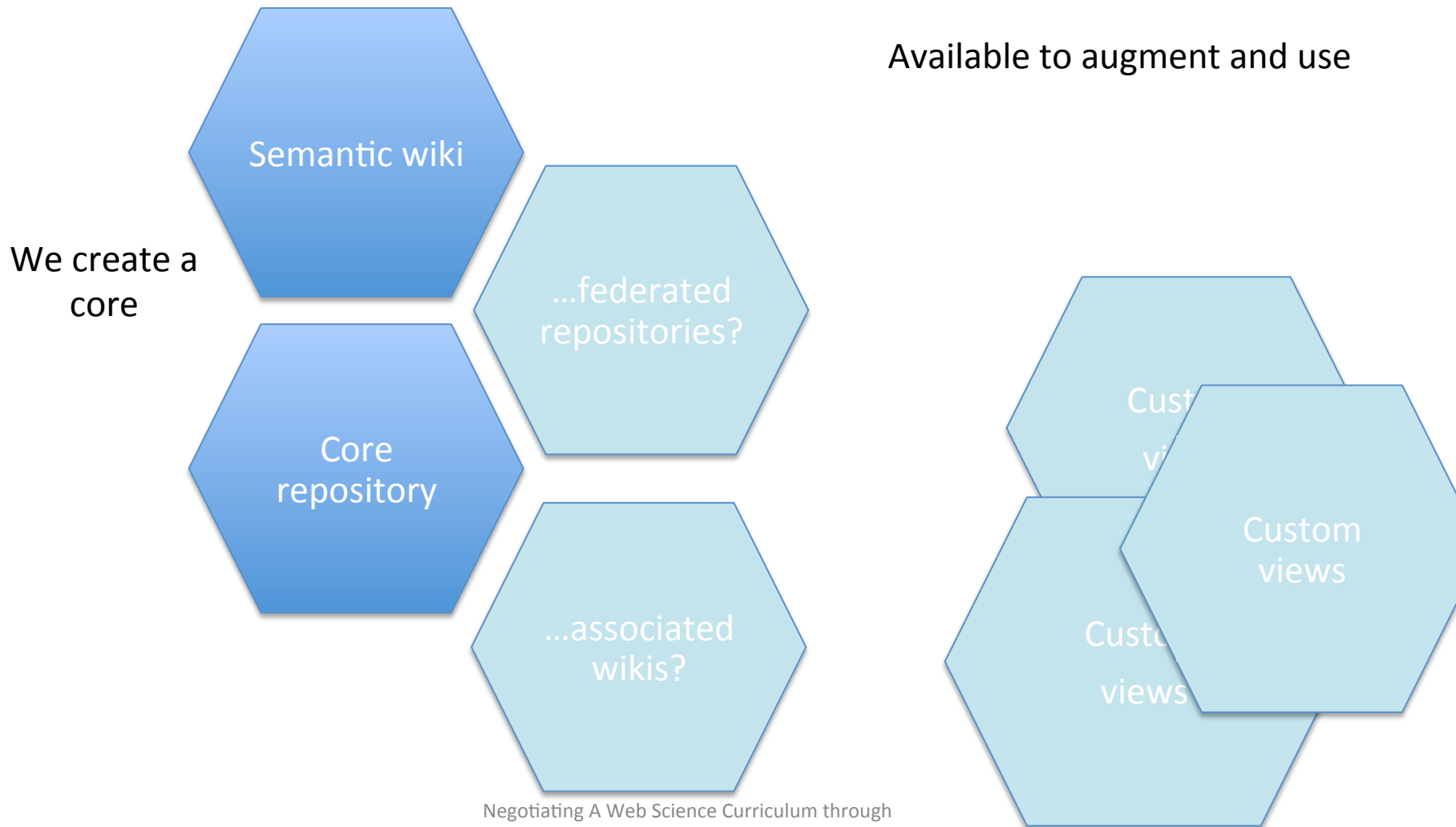
Bioinformatics & Operational Research
Challenges for Web Science - applications in Bio & OR
 [Dr Leslie Carr](#)



Simple Analysis of Network Datasets
Linux commands that are generally useful for analyzing data; it is very easy to reduce phenomena such as links, nodes, URLs or downloads, to multiply repeating identifiers and then sorting and counting appearances.
And 1 more...
 [Dr Leslie Carr](#)

webscience

Basic concept



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

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

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

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 -



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

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/](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>

references

- Anderson, J. (2003). "Des Communautés Virtuelles ? Vers Une Théorie « Techno-Pratique » D'internet Dans Le Monde Arabe." *Revue Maghreb – Machrek* **178**(Winter 2003-2004): 45-59.
- Barab, S., K. Squire and W. Dueber (2000). "A Co-Evolutionary Model for Supporting the Emergence of Authenticity." *Educational Technology Research and Development* **48**(2): 37–62.
- Bazan, S. and C. Varin (2010). *Web Science in the Context of the Arab near East*. WebSci10: Extending the Frontiers of Society On-Line. Raleigh, NC: US, Web Science Trust.
- Becher, T. and P. Trowler (2001). *Academic Tribes and Territories : Intellectual Enquiry and the Cultures of Disciplines*. Buckingham, Open University Press in association with The Society for Research into Higher Education.
- Berners-Lee, T. (2007 <http://www.w3.org/2007/Talks/0509-www-keynote-tbl/>). The Process of Designing Things in a Very Large Space: Kenote Presentation. WWW2007. Banff, Alberta, Canada.
- Berners-Lee, T., W. Hall, J. A. Hendler, K. O'Hara, N. Shadbolt and D. J. Weitzner (2006). "A Framework for Web Science." *Foundations and Trends® in Web Science* **1**(1): 1:130.
- Biglan, A. (1973a). "The Characteristics of Subject Matter in Different Academic Areas." *Journal of Applied Psychology* **57**(3): 195–203.
- Biglan, A. (1973b). "Relationships between Subject Matter Characteristics and the Structure and Output of University Departments. ." *Journal of Applied Psychology* **57**(3): 204–213.
- Carr, L., C. Pope and S. Halford (2010). *Could the Web Be a Temporary Glitch? . WebSci10: Extending the Frontiers of Society On-Line*, Raleigh, NC: US., Web Science Trust.
- Council of Europe (2001). *Common European Framework of Reference for Languages*.
- Davis, H., L. Carr, J. Hey, Y. Howard, D. Millard, D. Morris and S. White (2010). "Bootstrapping a Culture of Sharing to Facilitate Open Educational Resources." *IEEE Transactions on Learning Technologies* **3**(2): 96-109.
- Fincher, S., M. Kölling, I. Utting, N. Brown and P. Stevens (2010). *Repositories of Teaching Material and Communities of Use: Nifty Assignments and the Greenroom*. Proceedings of the Sixth international workshop on Computing education research. Aarhus, Denmark, ACM: 107-114.
- Halford, S., C. Pope and L. Carr (2010). *A Manifesto for Web Science?* <http://journal.webscience.org/297/> Last Accessed April 2011. WebSci10: Extending the Frontiers of Society On-Line, Raleigh, NC: US., Web Science Trust.
- Hendler, J., N. Shadbolt, W. Hall, T. Berners-Lee and D. Weitzner (2008). "Web Science: An Interdisciplinary Approach to Understanding the Web." *Communications of the ACM* **51**(7): 60-69.

references

- Hitchcock, S., T. Brody, J. Hey and L. Carr (2007). "Digital Preservation Service Provider Models for Institutional Repositories: Towards Distributed Services." *DLib Magazine* **13**(5/6).
- Korzybski, A. (1933). *Science and Sanity: An Introduction to Non-Aristotelian Systems and General Semantics*.
- McSweeney, P., K. Borthwick, C. Hargood and D. Millard (2011). *The Mechanisms and Impact of Encouraging Community Engagement in Teaching Repositories*. Open Repositories 2011. Austin, Texas.
- Millard, D., Y. Howard, P. McSweeney, K. Borthwick, M. Arrebola and J. Watson (2009a). *The Language Box: Re-Imagining Teaching and Learning Repositories*. International Conference on Advanced Learning Technologies. Riga, Latvia.
- Millard, D. E., Y. Howard, P. McSweeney, M. Arrebola, K. Borthwick and S. Varella (2009b). *Phantom Tasks and Invisible Rubric: The Challenges of Remixing Learning Objects in the Wild*. Proceedings of the 4th European Conference on Technology Enhanced Learning: Learning in the Synergy of Multiple Disciplines. Nice, France, Springer-Verlag: 127-139.
- Mitchell, S. M. and W. G. Lutters (2006). *Assessing the Value of Computer Science Course Material Repositories*. The 19th Conference on Software Engineering Education and Training Workshops.
- Shadbolt, N. and T. Berners-Lee (2008). "Web Science Emerges." *Scientific American* **299**(4): 76.
- Topi, H., J. S. Valacich, R. T. Wright, K. M. Kaiser, J. J. F. Nunamaker, J. C. Sipior and G. J. d. Vreede. (2010). "The IS 2010 Curriculum: Curriculum Guidelines for Undergraduate Degree Programs in Information Systems." http://www.acm.org/education/curricula/is_2010_acm_final.pdf."
- Tungare, M., X. Yu, W. Cameron, G. Teng, M. A. Pérez-Quñones, L. Cassel, W. Fan and Edward A. Fox (2007). *Towards a Syllabus Repository for Computer Science Courses*. The 38th SIGCSE Technical Symposium on Computer Science Education, Covington, Kentucky, USA.
- Vafopoulos, M. (2010a). "Web Science Subject Categorization (WSSC) ".
- Vafopoulos, M. (2010b). "Web Science Subject Categorization (WSSC) a Proposal for Discussion (Wiki)."
- White, S. and H. C. Davis (2011). "Making It Rich and Personal: Crafting an Institutional Personal Learning Environment." *International Journal of Virtual and Personal Learning Environments* **In press** <http://eprints.ecs.soton.ac.uk/22030/>.
- Xia, J. (2007). "Assessment of Self-Archiving in Institutional Repositories: Across Disciplines." *The Journal of Academic Librarianship* **33**(6): 647-654.