

Hide the Stack: Toward Usable Linked Data

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Key Message

- Linked Data
 - connections between disparate, independent (albeit related) data
 - rendering public interest data accessible
 - allowing hidden information to be discovered more easily
 - enabling questions to be answered more fully
 - Potential widely recognised, but
 - very large-scale, wide-coverage, highly inter-linked data repositories
 - under-utilised outside Semantic Web community
- Aims of the research
 - explore new methods for presenting Linked Data to wider audience
 - support more intuitive exploration and knowledge retrieval
 - encourage wider use by web-savvy but non-technical users

Outline

- Challenges
- Illustrative Scenario
- Existing Work
- Approach

- Initial Evaluation
- Conclusions & Next Steps

- Acknowledgements

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- **Challenges**
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Challenges in Linked Data Consumption

1. Combating information overload
2. Exploration starting point
3. Returning something *useful*
4. Enabling interaction

How can we make Linked Data usable to real, end users?

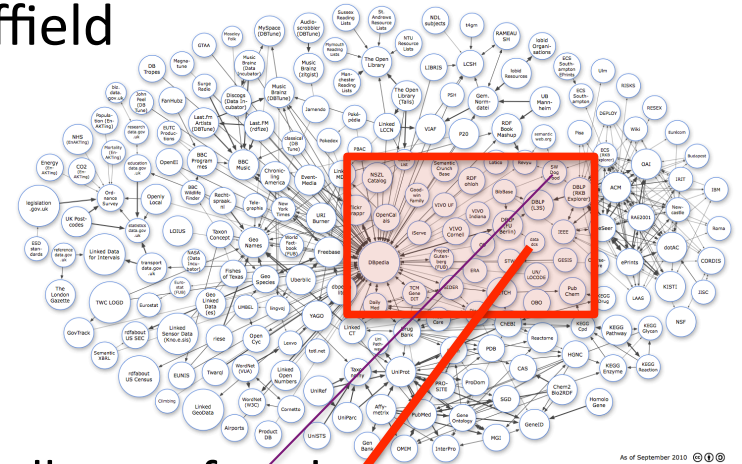
- where end users broadly classified into one of:
 - Semantic Web experts
 - web-savvy but non-technical

Outline

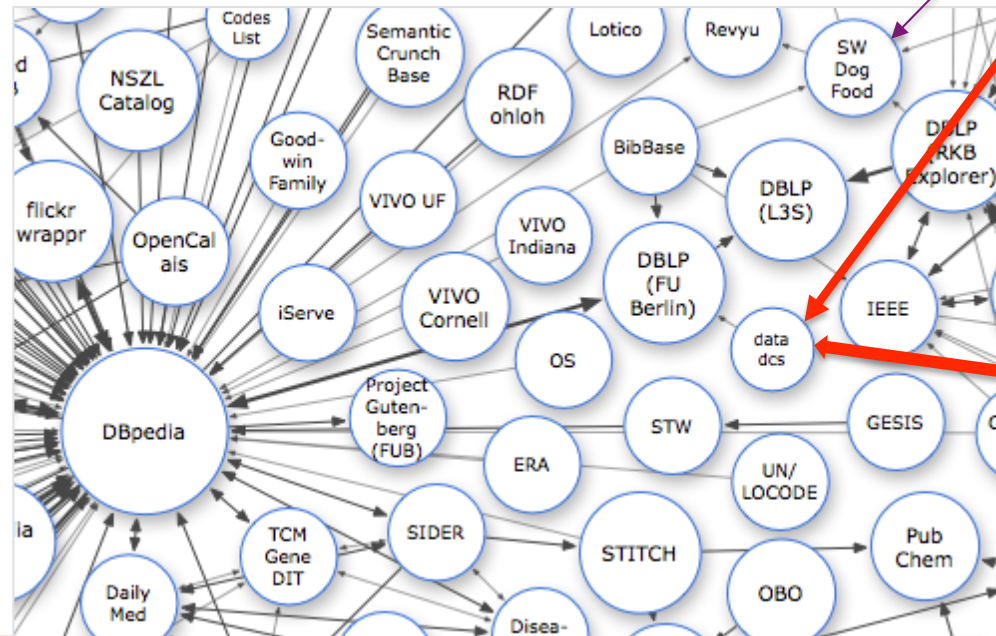
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Sample dataset - Data.dcs

- research groups in DCS, University of Sheffield
- ontologies (re)used
 - FOAF, PRV, SWRC, BIB
- by Linked Data standards very small
 - over 8000 statements
 - ~3000 (distinct) graph nodes
 - however still highlights the scale of the challenges faced



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Scenario

- Information-seeking scenario
 - **end user:** a primary school teacher
 - **task:** looking for research in local university on 'Web Technology'
 - **tools typically used for information seeking activities:**
 - web search/browse
 - library
- consider the university department's web site built on top of *Data.dcs*

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Tools for consuming Linked Data

- Semantic Web user
 - well catered for
 - typical tasks
 - browsing RDF
 - validating data and models
 - extracting data using formal query syntax
- mainstream web user
 - lower tool support
 - typical tasks - exploratory information seeking
 - search and query (using less formal methods, e.g., forms)
 - browsing to discover information
 - sharing of information discovered, results of any analysis

Tools for consuming Linked Data

Tool Type	Examples of Tools
formatted text display of RDF (e.g., using HTML tables, templates)	<i>Sig.ma, Marbles, URI Burner, Haystack, Tabulator</i>
RDF graph model	<i>W3C RDF Validator, Sindice Inspector</i>
other graph visualisation	<i>IsaViz, RDFGravity, Cytoscape, RelFinder</i>
other domain-specific visualisation	<i>DBPedia Mobile, Talis Research Funding Explorer</i>

Expected Skill Set	Examples of Tools
understanding of SW technology stack	<i>Sig.ma, Marbles, URI Burner, W3C RDF Validator, RelFinder, Tabulator</i>
formal querying, e.g., SPARQL	<i>LESS</i>
basic to advanced knowledge seeking, exploratory navigation	<i>DBPedia Mobile, RelFinder, Talis RFE, IsaViz</i>
web browsing (desktop, mobile)	<i>LESS, DBPedia Mobile</i>

See also:

- Dadzie, A.-S. & Rowe, M. (In press). *Approaches to Visualising Linked Data: A Survey*, the Semantic Web Journal — Special Call for Survey articles on Semantic Web topics.
- Katifori, A., Halatsis, C., Lepouras, G., Vassilakis, C. & Giannopoulou, E. (2007). *Ontology visualization methods — a survey*, ACM Computing Surveys.

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A Template-based Solution

- taking advantage of self-describing RDF data
 - look up class of a given resource
 - load template based on class – i.e., `rdf:type` of the instance
- focus on pertinent information in a dataset
- highlight relationships within data
- allow end users to retrieve detail in ROIs (regions of interest)
- combine templates with information/knowledge visualisation
 - hide the complexity of the underlying data
 - remove the need for specialist SW knowledge or skill

Why this approach?

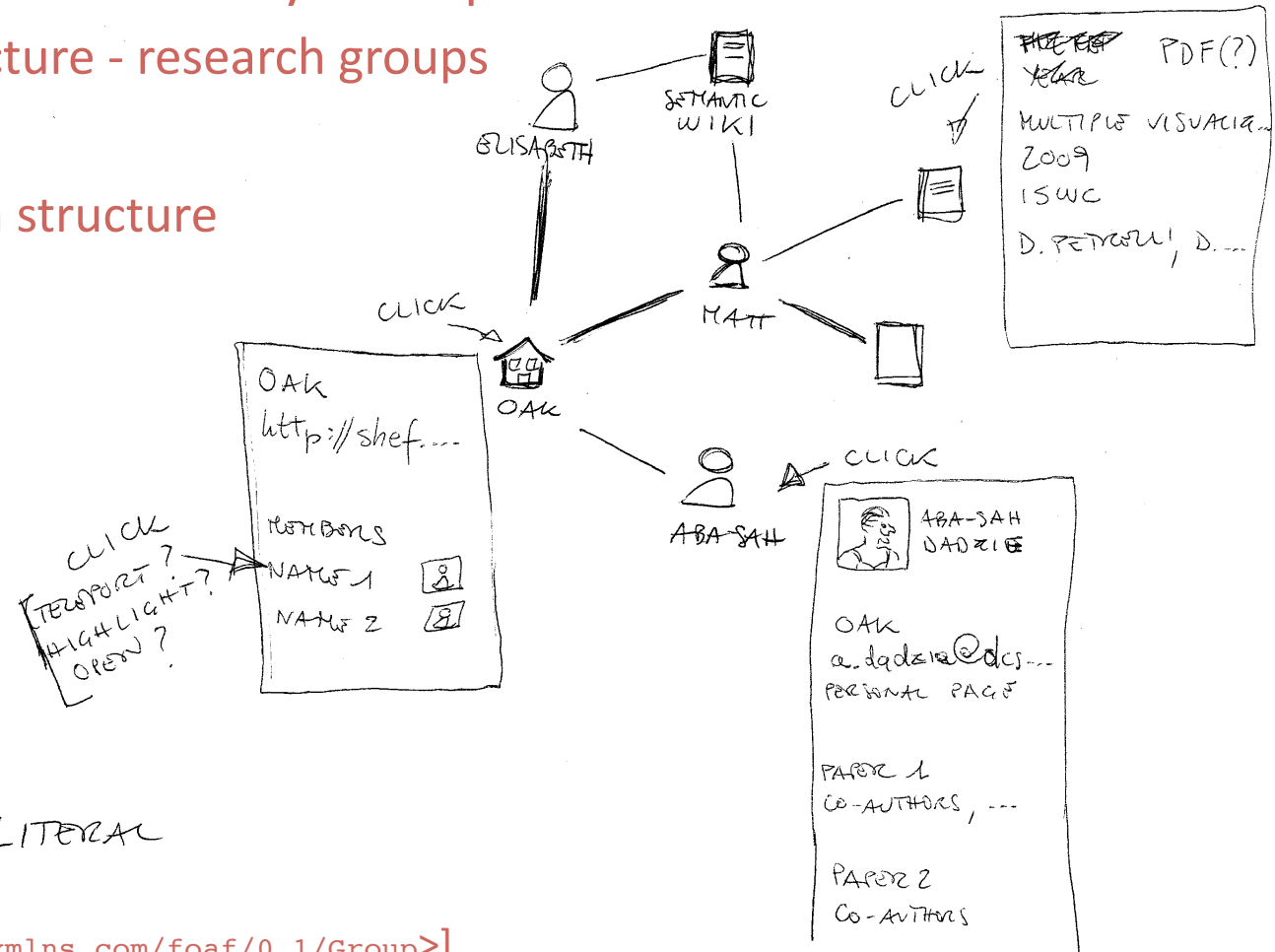
- Templates
 - value seen in the wide use of *Fresnel lenses* and other template development tools and languages, e.g., *IsaViz*, *LENA*, *LESS*
 - simplicity, reusability, extensibility, flexibility
- Visualisation
 - overview to support detection of data structure
 - exploratory information seeking
 - identifying/highlighting relationships
 - recognising anomalies, errors
 - reduction in cognitive load – through advanced human perception
 - especially useful for analysis of large, complex data

Template Design

- identify key concepts & relevant metadata to define templates
 - match to standard ontologies, e.g., FOAF, PRV, SWRC, BIB
 - SPARQL queries – built based on Fresnel lens SPARQL selectors
- presentation methods
 - visual overview - node-link graph
 - collapse information related to key concepts into compound nodes
 - filter out less immediately relevant data – provide more room for ROIs
 - visual encoding
 - colour coding based on RDF type (nodes and links)
 - icons based on RDF type (nodes)
 - size to encode node properties, e.g., no. of outlinks
 - detail view
 - text and thumbnails/icons

Data.dcs templates

- information of main interest – key concepts
 - organisational structure - research groups
 - people
 - relationships within structure



- main concepts

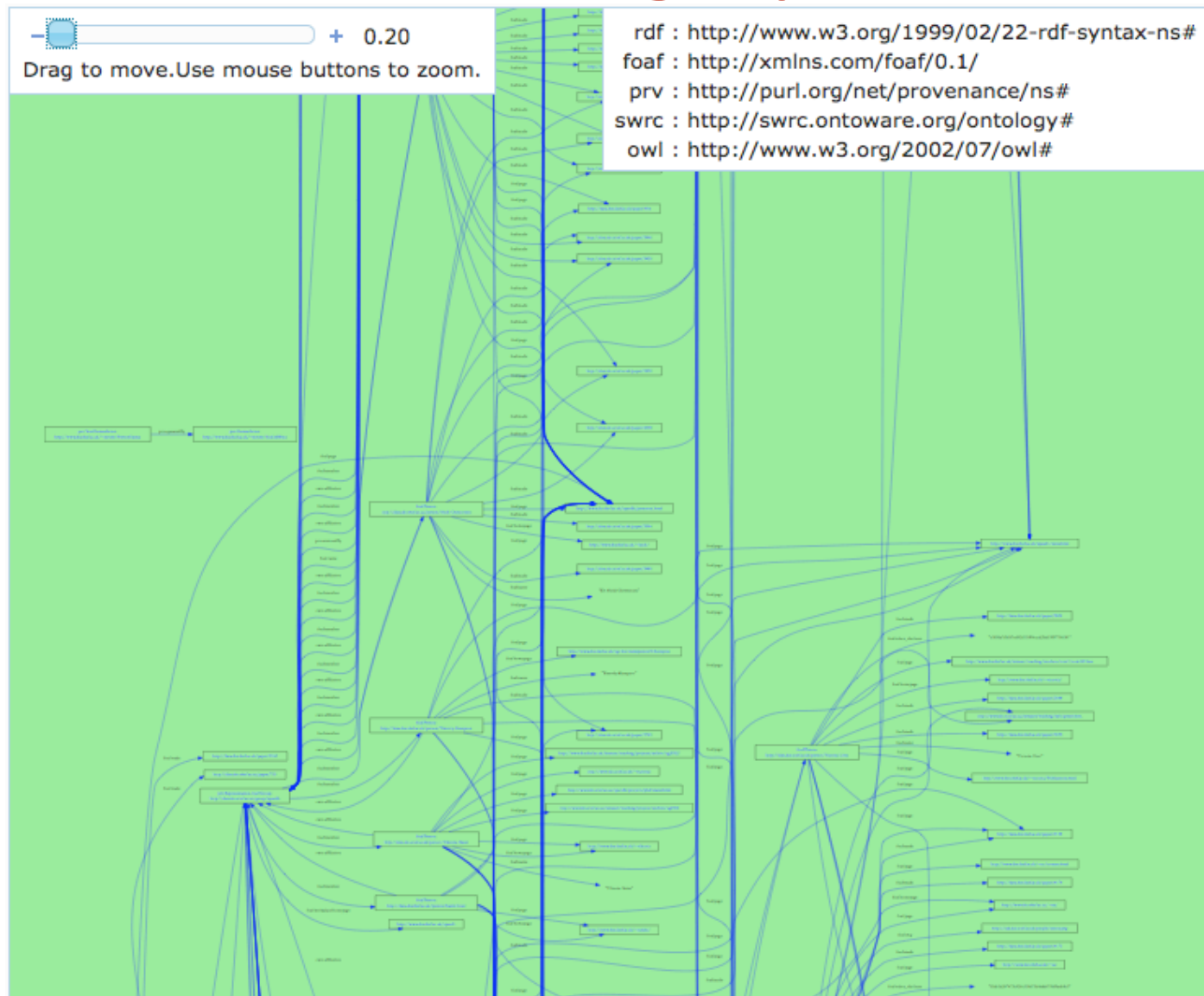
- **Organisation** [<http://xmlns.com/foaf/0.1/Group>]
- **Person** [<http://xmlns.com/foaf/0.1/Person>]
- **Publication** [<http://zeitkunst.org/bibtex/0.1/bibtex.owl#Entry>]

Challenge 1:

Combating information overload

- very large amounts of distributed, heterogeneous data
- high inter-linking

Data.dcs – RDF graph



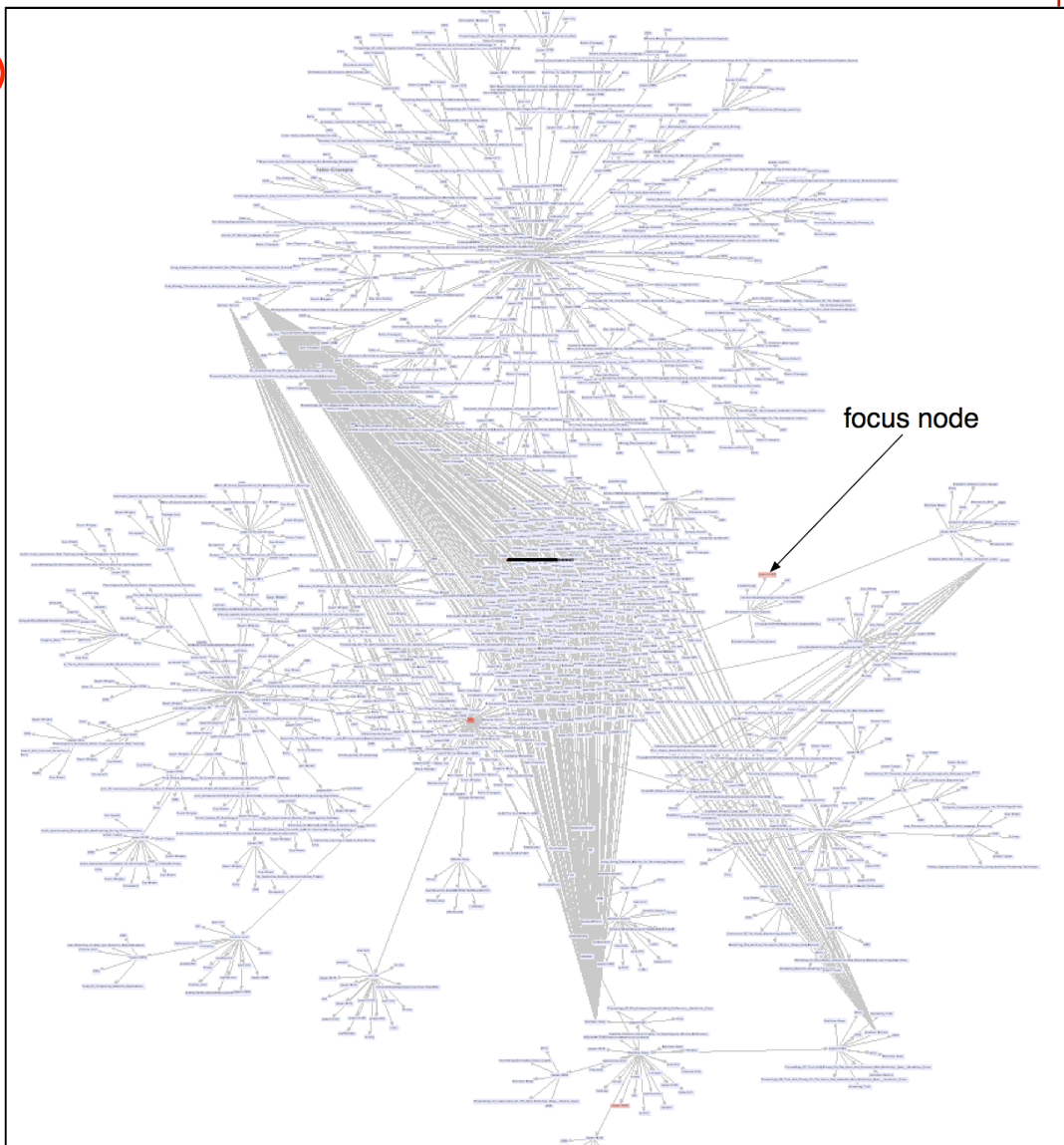
Drawn using Sindice Inspector – first 1000 triples only for usability reasons

Data.dcs - RDF Text vs Basic Graph

```
emacs@ABA-SAH
File Edit Options Buffers Tools SGML Help
<>Xml version="1.0" encoding="UTF-8"?>
<rdf:RDF
  xmlns:bib="http://zeitkunst.org/bibtex/0.1/bibtex.owl#"
  xmlns:prv="http://purl.org/net/provenance/ns#"
  xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#"
  xmlns:admin="http://webns.net/mvcb/"
  xmlns:foaf="http://xmlns.com/foaf/0.1/"
  xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:owl="http://www.w3.org/2002/07/owl#"
  xmlns:dc="http://purl.org/dc/elements/1.1/"
  xmlns:dcterms="http://purl.org/dc/terms/"
  xmlns:swrc="http://swrc.ontoware.org/ontology#"

  <rdf:Description rdf:about="http://data.dcs.shef.ac.uk/group/oak">
    <rdf:type rdf:resource="http://purl.org/net/provenance/ns#Representation"/>
    <rdf:type rdf:resource="http://xmlns.com/foaf/0.1/Group"/>
    <foaf:name>Organisations, Information and Knowledge Group</foaf:name>
    <prv:retrievedBy rdf:nodeID="node14sam1ib8x193"/>
    <foaf:workplaceHomepage rdf:resource="http://oak.dcs.shef.ac.uk"/>
    <foaf:member rdf:resource="http://data.dcs.shef.ac.uk/person/Stuart-Wrigley"/>
    <foaf:member rdf:resource="http://data.dcs.shef.ac.uk/person/Matthew-Rove"/>
    <foaf:member rdf:resource="http://data.dcs.shef.ac.uk/person/George-Demetriou"/>
    <foaf:member rdf:resource="http://data.dcs.shef.ac.uk/person/Daniela-Petrelli"/>
    <foaf:member rdf:resource="http://data.dcs.shef.ac.uk/person/Victoria-Bren"/>
    <foaf:member rdf:resource="http://data.dcs.shef.ac.uk/person/Jonathan-Butters"/>
    <foaf:member rdf:resource="http://data.dcs.shef.ac.uk/person/Sam-Chapman"/>
    <foaf:member rdf:resource="http://data.dcs.shef.ac.uk/person/Christopher-Brewster"/>
    <foaf:member rdf:resource="http://data.dcs.shef.ac.uk/person/Lei-Xia"/>
    <foaf:member rdf:resource="http://data.dcs.shef.ac.uk/person/Joao-Magalhaes"/>
    <foaf:member rdf:resource="http://data.dcs.shef.ac.uk/person/Neil-Ireson"/>
    <foaf:member rdf:resource="http://data.dcs.shef.ac.uk/person/Vitaveska-Lanfranchi"/>
    <foaf:member rdf:resource="http://data.dcs.shef.ac.uk/person/Simon-Tucker"/>
    <foaf:member rdf:resource="http://data.dcs.shef.ac.uk/person/Rodrigo-Carvalho"/>
    <foaf:member rdf:resource="http://data.dcs.shef.ac.uk/person/Ajay-Chakravarthy"/>
    <foaf:member rdf:resource="http://data.dcs.shef.ac.uk/person/Gregoire-Burel"/>
    <foaf:member rdf:resource="http://data.dcs.shef.ac.uk/person/Aba-Sah-Dadzie"/>
    <foaf:member rdf:resource="http://data.dcs.shef.ac.uk/person/Alfonso-Sosa"/>
    <foaf:member rdf:resource="http://data.dcs.shef.ac.uk/person/Jose-Iria"/>
    <foaf:member rdf:resource="http://data.dcs.shef.ac.uk/person/Suvodeep-Mazumdar"/>
    <foaf:member rdf:resource="http://data.dcs.shef.ac.uk/person/Ziqi-Zhang"/>
    <foaf:member rdf:resource="http://data.dcs.shef.ac.uk/person/Philip-Webster"/>
    <foaf:member rdf:resource="http://data.dcs.shef.ac.uk/person/Ravish-Bhagdev"/>
    <foaf:member rdf:resource="http://data.dcs.shef.ac.uk/person/Elizabeth-Amparo-Cano-B">
  </foaf:member/>
</rdf:Description>

  <rdf:Description rdf:about="http://data.dcs.shef.ac.uk/person/Stuart-Wrigley">
    <rdf:type rdf:resource="http://xmlns.com/foaf/0.1/Person"/>
    <foaf:name>Stuart Wrigley</foaf:name>
    <foaf:homepage rdf:resource="http://www.dcs.shef.ac.uk/~stu"/>
    <foaf:page rdf:resource="http://www.dcs.shef.ac.uk/spandh/personnel.html"/>
    <foaf:page rdf:resource="http://www.dcs.shef.ac.uk/spandh/seminars"/>
    <foaf:page rdf:resource="http://www.dcs.shef.ac.uk/dcs/people/staff.htm"/>
    <foaf:page rdf:resource="http://www.dcs.shef.ac.uk/spandh/news.html"/>
    <foaf:page rdf:resource="http://www.dcs.shef.ac.uk/spandh/seminars/abstracts2008.htm">
  </foaf:page/>
  <foaf:page rdf:resource="http://www.dcs.shef.ac.uk/dcs/people/staff14.htm"/>
</rdf:Description>
</rdf:RDF>
-u(Unix)-- datadcs-withdhpv1-02Mar2010.rdf Top (56,78) (XML Fill)
```



Challenge 1: Solution Proposed

- **Combating information overload**
 - very large amounts of distributed, heterogeneous data
 - high inter-linking
- our solution:
 - visual overview + filters
 - highlighting key relationships
 - detail view
 - focus on graph ROI within context of surrounding data
+ text detail & thumbnails or representative icons

Challenge 2:

Exploration starting point

- SW users
 - may have a specific URI to explore
- mainstream users
 - may or may not have a specific starting point
 - often start with a vague idea and browse to find if there is anything interesting

Design ideas: Detail templates

The image illustrates design ideas for detail templates in a network visualization context. It features three main components:

- Network Diagram:** A central node labeled "Matthew-Rowe" is connected to various other nodes. These include file paths like "/paper/4161", "/paper/4166", "/paper/4156", and "/paper/4159", as well as document types like "publications.html", "cv.html", "links.html", "interests.html", and "index.html". Other nodes include "Person", "mrowe", "atoz.htm", "~/mrowe/", "people/", "Entry", "Aba-Sah-Dadzie", and "Elizabeth-Amparo-Cano-Basave". The node "/paper/4169" is highlighted with a red background.
- Profile Page Screenshot:** A browser window showing a profile page for Matthew Rowe. The page includes a photo of a man in a graduation cap and gown, and the following information:

Name	Matthew Rowe
Web	http://www.dcs.shef.ac.uk/~mrowe/
Affiliation	Organisations, Information and Knowledge Group
- Paper Detail Page Screenshot:** A browser window showing a paper detail page for "Improving Support for Web-based Visual Analysis of Social Graphs". The page includes the following information:

Title	Improving Support for Web-based Visual Analysis of Social Graphs
Authors	Aba-Sah Dadzie Elizabeth Amparo Cano Basave Matthew Rowe
Published at	IEEE VisWeek Workshop
Year	2009

Challenge 2: Solution proposed

- **Exploration starting point**

- SW users

- may have a specific URI to explore

- mainstream users

- may or may not have a specific starting point
- often start with a vague idea and browse to find what they want

- **our solution:**

- support both

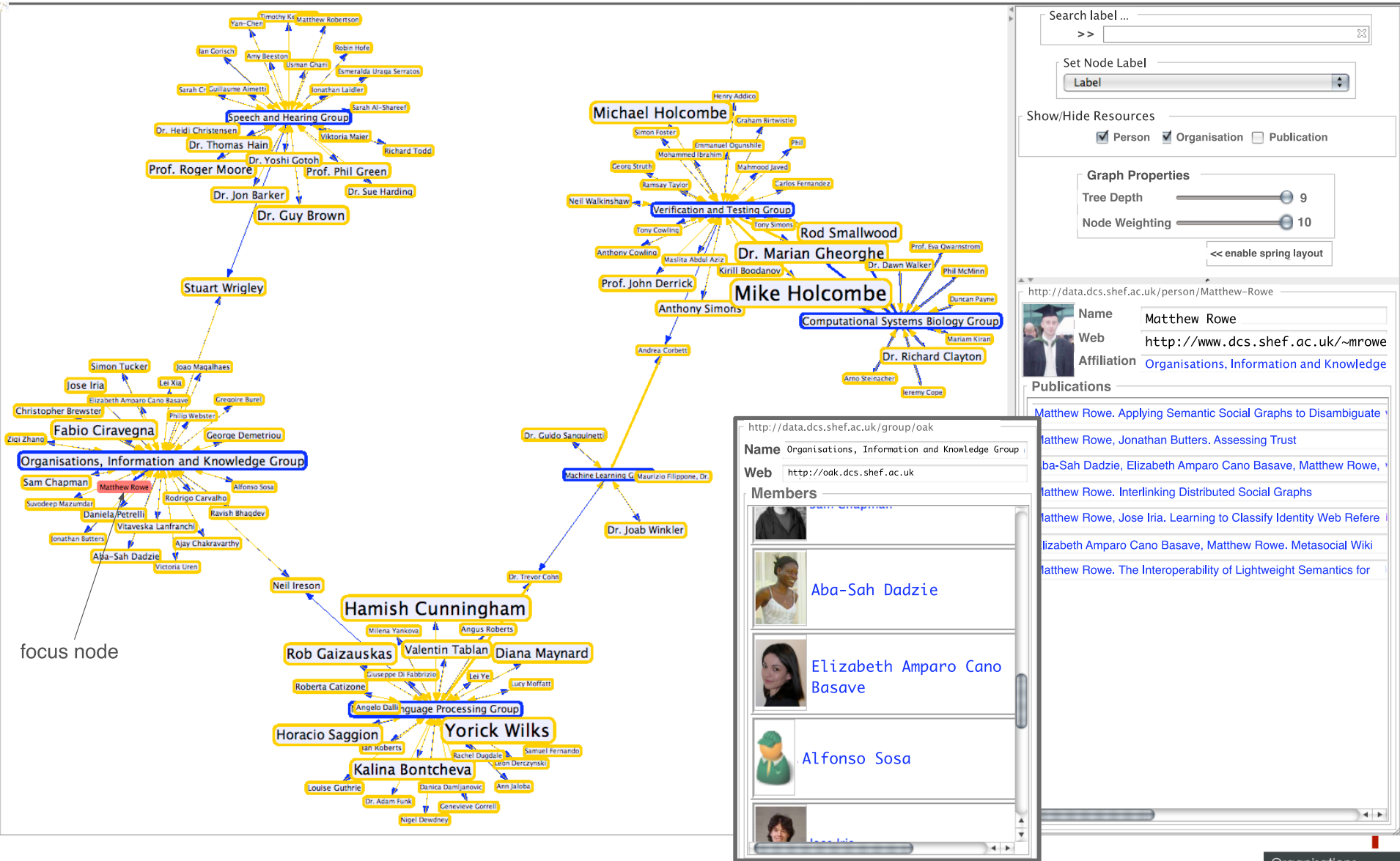
- where input, specific URI as focus at start
- extract list of potential start points
 - selected from key RDF types in a dataset
 - randomly chosen focus – influenced by context
- centre graph on focus

Challenge 3:

Returning something *useful*

- what is the end user looking for?
- how can we present the data so they are able to find it?

Co-ordinated Template Views



Search label ... >> [input field]

Set Node Label [dropdown menu]

Show/Hide Resources Person Organisation Publication

Graph Properties

Tree Depth [slider] 9

Node Weighting [slider] 10

<< enable spring layout

http://data.dcs.shef.ac.uk/person/Matthew-Rowe

Name	Matthew Rowe
Web	http://www.dcs.shef.ac.uk/~mrowe
Affiliation	Organisations, Information and Knowledge

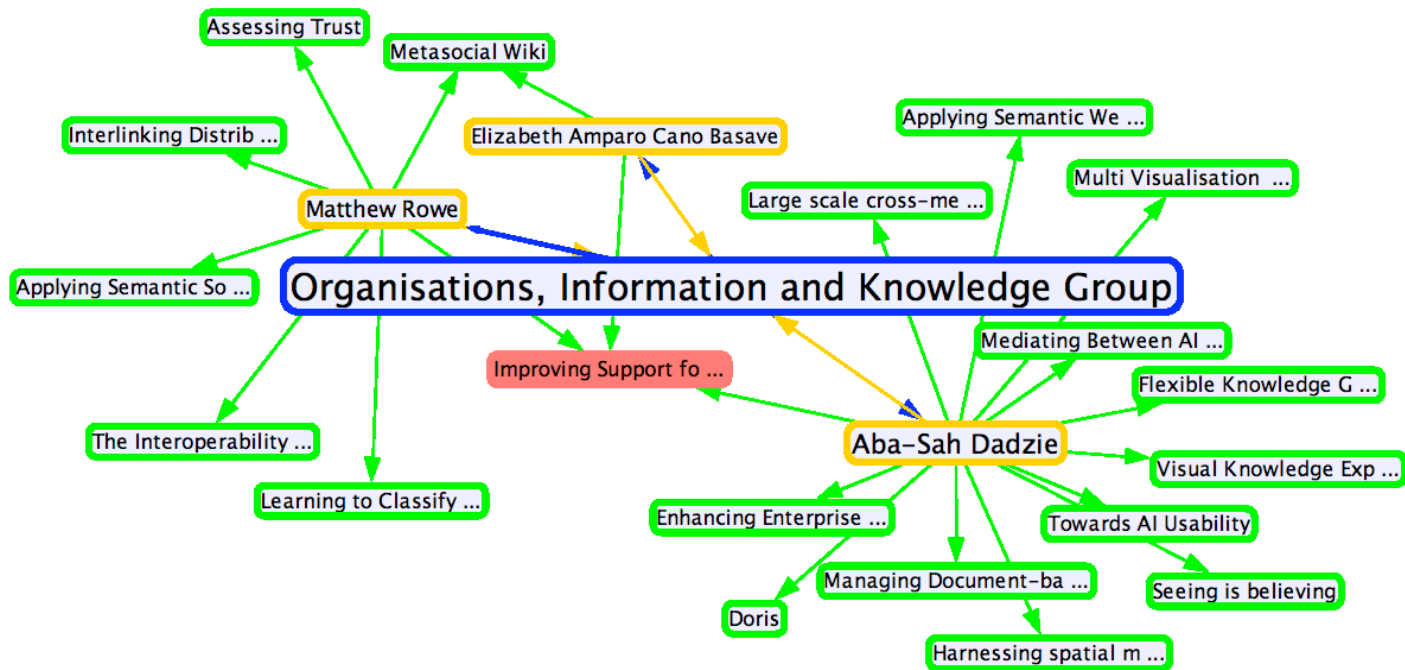
Publications

- Matthew Rowe. Applying Semantic Social Graphs to Disambiguate
- Matthew Rowe, Jonathan Butters. Assessing Trust
- Aba-Sah Dadzie, Elizabeth Amparo Cano Basave, Matthew Rowe,
- Matthew Rowe. Interlinking Distributed Social Graphs
- Matthew Rowe, Jose Iria. Learning to Classify Identity Web Refere
- Elizabeth Amparo Cano Basave, Matthew Rowe. Metasocial Wiki
- Matthew Rowe. The Interoperability of Lightweight Semantics for

http://data.dcs.shef.ac.uk/group/oak

Name	Organisations, Information and Knowledge Group
Web	http://oak.dcs.shef.ac.uk
Members	<ul style="list-style-type: none"> Aba-Sah Dadzie Elizabeth Amparo Cano Basave Alfonso Sosa

Co-ordinated Template Views



http://data.dcs.shef.ac.uk/paper/4169

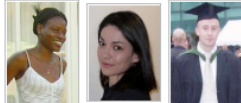
Title: Improving Support for Web-based Visual Analysis

Authors:

[Aba-Sah Dadzie](#)

[Elizabeth Amparo Cano Basave](#)

[Matthew Rowe](#)



Published at: IEEE VisWeek Workshop

Year: 2009

Under the Hood- Detail View

- e.g., SPARQL query template for the full publication view

```
PREFIX foaf: <http://xmlns.com/foaf/0.1/>
PREFIX bib: <http://zeitkunst.org/bibtex/0.1/bibtex.owl#>

SELECT DISTINCT ?publicationTitle ?year ?bookTitle ?personUri ?author ?
    imageUri
WHERE {
    <data.dcs:publicationUri> bib:title ?publicationTitle ;
        bib:hasYear ?year ;
        bib:hasBookTitle ?bookTitle ;
        foaf:maker ?personUri .
    ?personUri foaf:name ?author ;
        foaf:img ?imageUri
} ORDER BY DESC(?year) ?publicationTitle
```

Challenge 3: Solution

- **Returning something *useful***
 - what is the end user looking for?
 - how can we present the data so they are able to find it?
- **Our solution**
 - graph overview + detail template view
 - reuse familiar web browser look and feel (detail)
 - interactive graph
 - to support exploratory navigation
 - retain context of surrounding information
 - colour coding to highlight key resource types and relationships

Challenge 4: Enabling interaction

- Our solution
 - graph overview + detail template view
 - reuse familiar web browsing interaction
 - click to navigate through data (in both views)
 - pan + zoom for graph view
 - filters to remove less relevant information

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Formative Evaluation

- at ESWC 2010 ‘Essential HCI for the Semantic Web’ tutorial
 - focus group of (14) “expert reviewers”
 - assessing usability for both mainstream and expert users
 - training task and an information exploration exercise
- graphs found to be expressive
- graph view effective in giving a sense of data distribution
- detail view effectively displayed key resources “*in a neat and concise way*”
- prototype seen to have potential for exploring and debugging LD
- some difficulty for users not familiar with interactive graph layout
 - “*eventually you got a big picture of the data*”
 - “*I liked the direct manipulation but the graph should stay put [when I click]*”

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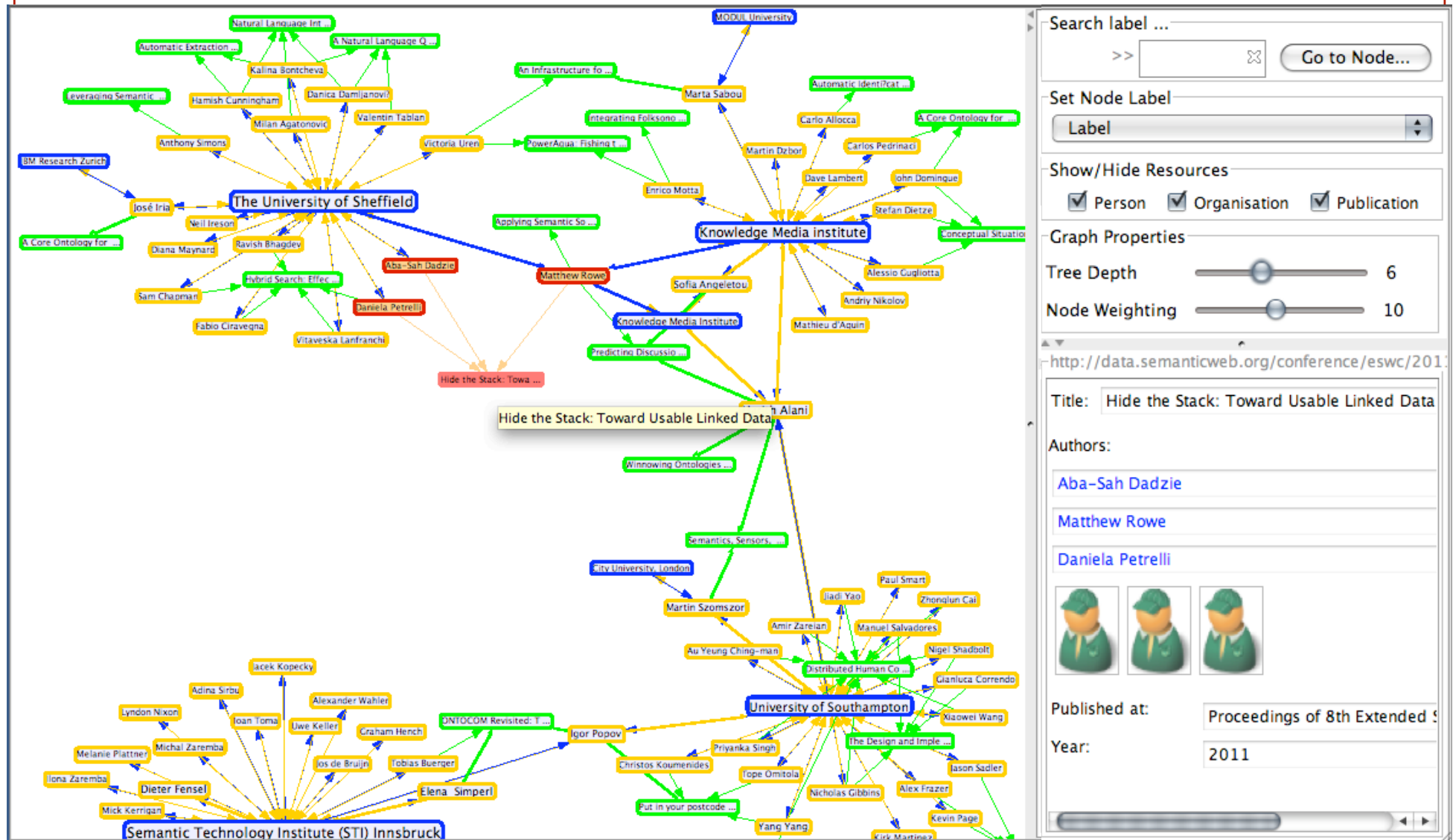
Conclusions

- explored human-centred solution for consuming Linked Data
 - exploiting templates (via SW technology)
 - combined with visualisation
- evaluation highlighted challenges still remaining - among others:
 - scale
 - complexity
- however – promising start....
- **Next Steps**
 - more user control - (intuitive) support for defining templates, filters
 - dynamic update with new Linked Data
 - formal usability evaluation with wider range of users

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- **Acknowledgements**
 - participants of ESWC 2010 ‘Essential HCI for the Semantic Web’ tutorial
 - Funding
 - A-S Dadzie – SmartProducts & WeKnowIt (EU FP7), X-Media (EU FP6)
 - M Rowe – WeGov (EU FP7)
 - D Petrelli – X-Media (EU FP6)

Hide the Stack @ SW Dogfood



Search label ...
Go to Node...

Set Node Label
Label

Show/Hide Resources
 Person Organisation Publication

Graph Properties
Tree Depth: 6
Node Weighting: 10

http://data.semanticweb.org/conference/eswc/2011

Title: Hide the Stack: Toward Usable Linked Data

Authors:
Aba-Sah Dadzie
Matthew Rowe
Daniela Petrelli

Published at: Proceedings of 8th Extended S
Year: 2011