



September 1-6, 2014 | Kalamaki, Crete, GR  
4th ESWC Summer School

# SOCIAL SEMANTIC WEB AND CROWDSOURCING

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*WITH CONTRIBUTIONS FROM "COMBINING THE SOCIAL AND THE SEMANTIC WEB", TUTORIAL @ESWC2011 BY SHEILA KINSELLA, DERI, IE AND DENNY VRANDECIC, KIT, DE,  
[HTTP://SEMANTICWEB.ORG/WIKI/COMBINING THE SOCIAL AND THE SEMANTIC WEB](http://semanticweb.org/wiki/Combining_the_Social_and_the_Semantic_Web)*

UNIVERSITY OF  
Southampton



# FUNDAMENTALS OF THE SOCIAL WEB

# THE SOCIAL WEB

**Software deployed over the Web, designed and developed to foster and leverage social interaction**

**Users are connected via common digital artifacts they share and through social ties**

- Sharing platforms such as flickr
- Collaborative platforms such Wikipedia, discussion forums, Quora, Groupon etc
- Social networks such as Facebook combining both aspects

# DEVELOPMENT

## Early '90s

- Read-only, static Web sites
- Interaction via posts on personal Web sites possibly responding to someone else's statements

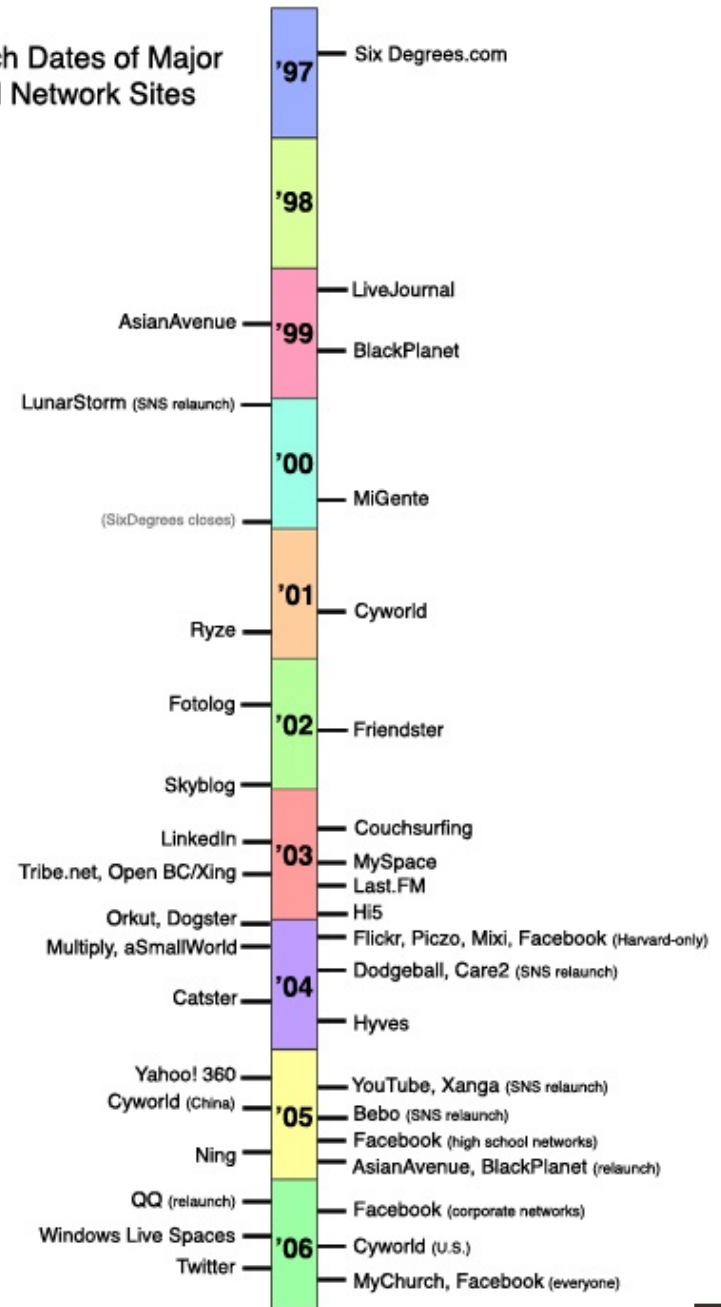
## Mid '90s

- Read-write applications
- Gradual increase in interaction between site owners and their readers/customers through various communication features

## Late '90s to present

- First social sites, increasingly ubiquitous deployment of social features in non-social Web sites

Launch Dates of Major Social Network Sites



# CHALLENGES OF SOCIAL SOFTWARE

## Many isolated communities

- Data silos

## Challenges

- Data cannot be shared and reused easily
- No control over the management and transfer of personal data
- User engagement and incentives engineering



# SEMANTIC SOCIAL SOFTWARE

# THE ROLE OF SEMANTIC TECHNOLOGIES

## SEMANTICS FOR...

**Advanced  
information  
management**

**Data interoperability**

**Data privacy**

**Data liberation**



## SCENARIOS

1. Semantic technologies as integral part of the functionality of social software, enabling interoperability
2. Enhanced information management through the usage of machine-processable semantics

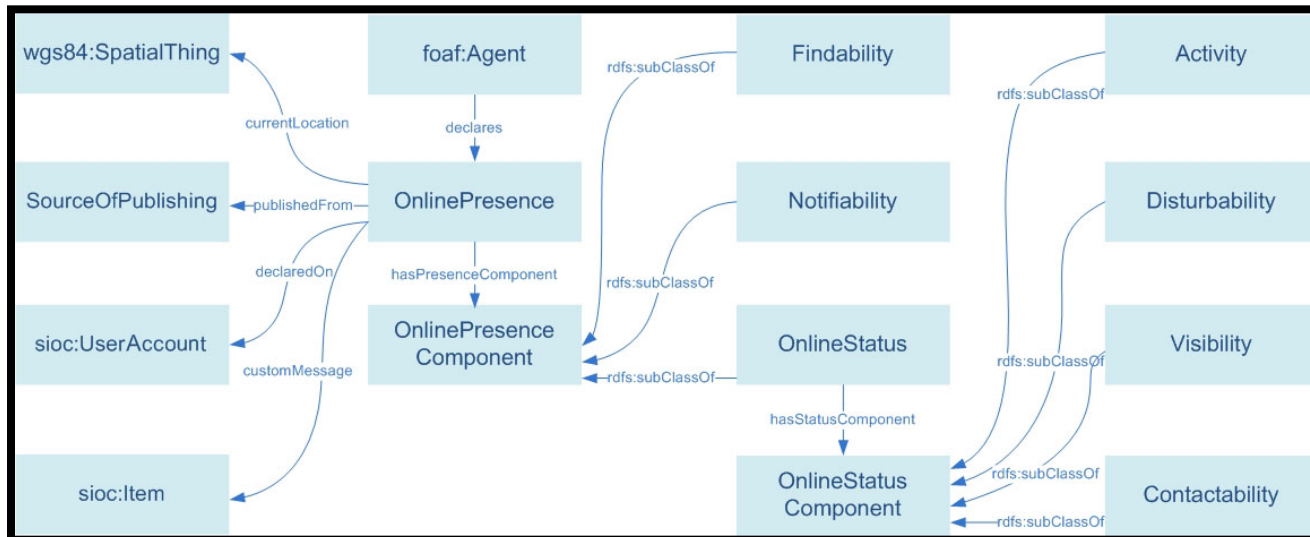
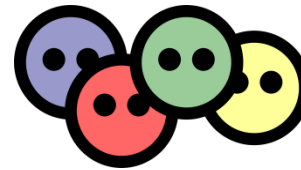
# ONTOLOGIES

FOAF (Friend-of-a-Friend)

SIOC (Semantically-Interlinked Online Communities)

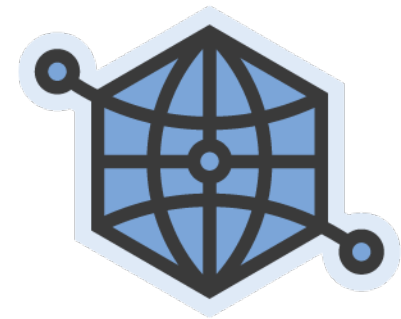
OPO (Online Presence Ontology)

Tagging ontologies





# OPEN GRAPH



<http://ogp.me/>

Represent Web content in a social graph in an interoperable way

Design decisions, see

<http://www.scribd.com/doc/30715288/The-Open-Graph-Protocol-Design-Decisions>

Used by Facebook ('stories'), Google (snippets), IMDb etc.

Facebook: actors, apps, objects with metadata to create stories

- Example: Elena has finished reading 'The Economist', an object of type Newspaper
- Types with attributes, extensions allowed
- Pre-defined and custom actions on objects

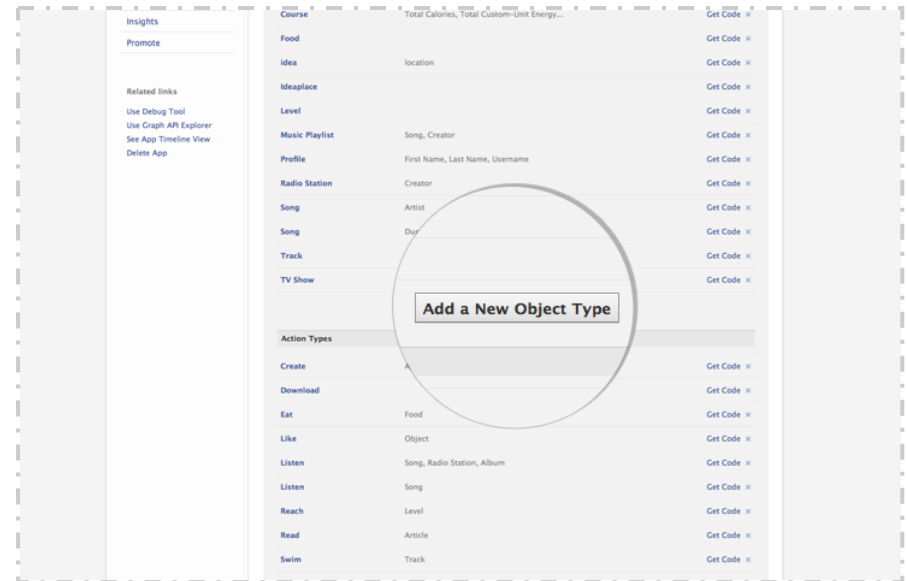


Image from

<https://developers.facebook.com/docs/opengraph/creating-custom-stories>

# SOFTWARE PLATFORMS

- Drupal (RDFa), <https://www.drupal.org/>
- Semantic MediaWiki, <https://semantic-mediawiki.org/>
- Semantic blogs, <http://www.zemanta.com/>

The image is a composite showing the integration of semantic data across different platforms. On the left, a Drupal blog post titled "Produce and Consume Linked Data with Drupal" is shown. Below the post, its RDF metadata is displayed in a code block. In the center, a diagram maps the RDF metadata to Semantic MediaWiki (SMW) properties: `sioc:Item` and `foaf:Document` are linked to `dc:title`, `dc:created`, `dc:date`, `content:encoded`, `dc:modified`, `sioc:num_replies`, and `sioc:last_activity_date`. `sioc:has_creator` is linked to `sioc:reply_of`. On the right, a screenshot of a Semantic MediaWiki page for "Zemanta" is shown, featuring a "Zemanta Demo" section with a "Your content enhanced!" heading and a "Content recommendations" sidebar. The sidebar includes a "Zemanta" logo, a search bar, a "MEDIA GALLERY" with image thumbnails, and "RELATED ARTICLES" with a list of items like "Watchmen" and "Dave Gibbons".

```
posted on October 22 by Stéphane

Produce and Consume Linked Data with Drupal! is the title of the paper I will be presenting next week at the 8th International Semantic Web Conference (ISWC 2009) in Washington, DC.

Drupal ISWC RDFa

Wow, that's rad!
```

```
posted on
<span property="dc:date dc:created"
content="2009-10-22T08:03:26-05:00"
datatype="xsd:dateTime">
October 22
</span>
by
<span rel="sioc:has_creator">
<span about="/user/6"
typeof="sioc:UserAccount"
property="foaf:name">
stephane
</span>
</span>
```

sioc:Item, foaf:Document

dc:title

dc:created, dc:date

content:encoded

dc:modified

sioc:num\_replies

sioc:last\_activity\_date

sioc:has\_creator

sioc:reply\_of

sioc:topic

SMW Semantic MediaWiki

Navigation

Main page

Introduction

User manual

Register your wiki

Recent changes

Links

Download SMW

Report a bug

Source code

Code documentation

MediaWiki

Toolbox

What links here

Related changes

Special pages

Log in / create account

Page Discussion

Read View source View history

Go Search

Semantic MediaWiki (SMW) is a free, open-source extension to MediaWiki – the wiki software that powers Wikipedia – that lets you store and query data within the wiki's pages. Semantic MediaWiki is also a full-fledged framework, in conjunction with many spinoff extensions, that can turn a wiki into a powerful and flexible "collaborative database". All data created within SMW can easily be published via the Semantic Web, allowing other systems to use this data seamlessly.

More about Semantic MediaWiki

Installation

User community

Zemanta

Download Demo

Zemanta Demo

Click on any picture or link to easily enhance the submitted text. Now imagine having this in your favorite blog yummy!

Your content enhanced!

Branded "unfilmable", Watchmen - the cult graphic novel about a group of retired, flawed superheroes - has finally made it to the big screen. From the second the opening credits roll, it is clear Watchmen is not your typical superhero movie. An ageing vigilante, The Comedian, is attacked in his high-rise apartment before being hurled 10 storeys to his death... In graphic slow motion. What follows is a two-and-three-quarter hour epic that centres on an outlawed group of deeply flawed former heroes as a Cold War Doomsday clock inches ever closer to midnight and nuclear apocalypse.

First published in 12 parts by DC Comics in 1986, Watchmen was written by the British team of Alan Moore and illustrator Dave Gibbons. Numerous attempts to film the book, included by Time magazine in its list of the Top 100 books of the 20th Century, failed to get off the ground. Respected directors like Terry Gilliam, Paul Greengrass and Darren Aronofsky were all involved at various stages. And legal wranglings between rival film studios over the adaptation rights threatened to wreck the project altogether. So it has fallen to Zack Snyder, the man who helmed 2007's surprise hit 300, to succeed where others have failed.

Content recommendations

Zemanta

REFINE

UPDATE

MEDIA GALLERY

RELATED ARTICLES

This is what happens when an owl crashes

2 HOURS AGO

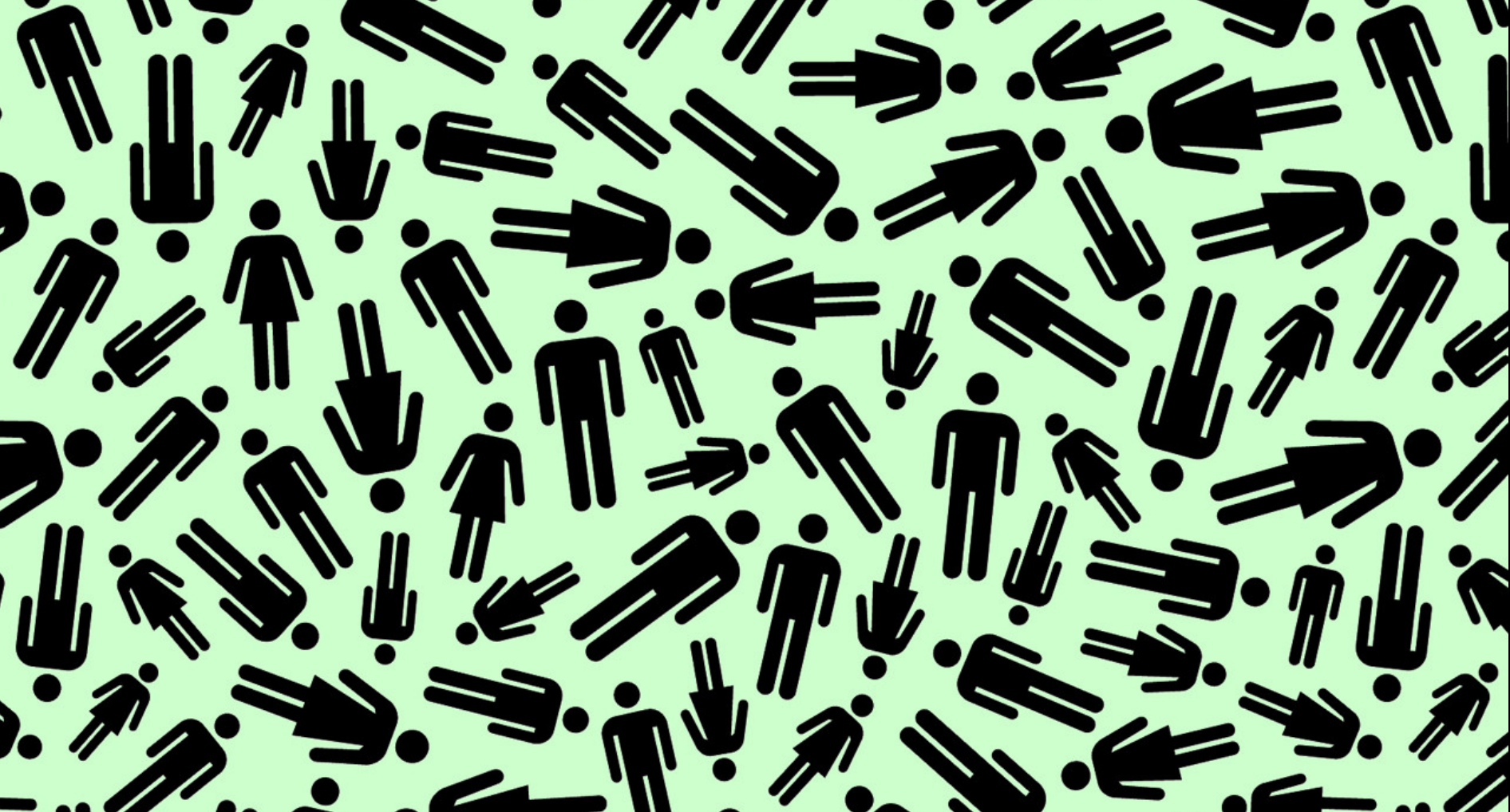
IOG.COM

IN-TEXT LINKS

Watchmen

Dave Gibbons

Zack Snyder



# **COLLABORATIVE TECHNOLOGIES FOR THE SEMANTIC WEB**

03.09.14

# BASICS

Idea: leverage Social Web technologies and platforms to create and manage Semantic Web content

Two classes of approaches

- Mining user contributions, e.g., turning folksonomies into OWL ontologies, not part of this tutorial
- Crowdsource Semantic Web tasks, e.g., GWAPs, paid microtasks, campaigns, contents

The screenshot shows the 'ontogame' interface. At the top, it says 'all data taken from wikipedia.org'. The main content area displays a Wikipedia snippet for 'Philippikos' (Eastern Roman emperor from 711 to 713). Below the snippet, there are two radio buttons for classification: 'single object or happening = instance' (selected) and 'set/type of objects = class'. A 'hint' box explains that '„Dog“ is a class' and '„Lassie“ is an instance'. At the bottom, there are 'SKIP' and 'OK' buttons.

The screenshot shows the 'Upload data to CrowdFlower' interface. It has a 'Create new job' button and a 'Create blank' button. Under 'Select template options', there is a dropdown menu for 'Entity type' set to 'book' and a 'Template' dropdown set to 'DBpedia reconciliation'. A 'Load template' button is also present. The 'New job details' section includes a 'Title' field with the text 'Find DBpedia profile page for book' and an 'Instructions' field with a detailed task description. A 'Jobs are loaded.' status bar is at the bottom.

The screenshot shows the Wikidata:Community portal. It features a 'Welcome' message and a 'Getting started' section. The 'Getting started' section includes links for 'Wikidata:Introduction', 'Wikidata:FAQ', 'Wikidata:Glossary', and 'Wikidata:News'. There is also a 'Requests for comment' section and a 'Wikidata:Contact the development team' link.

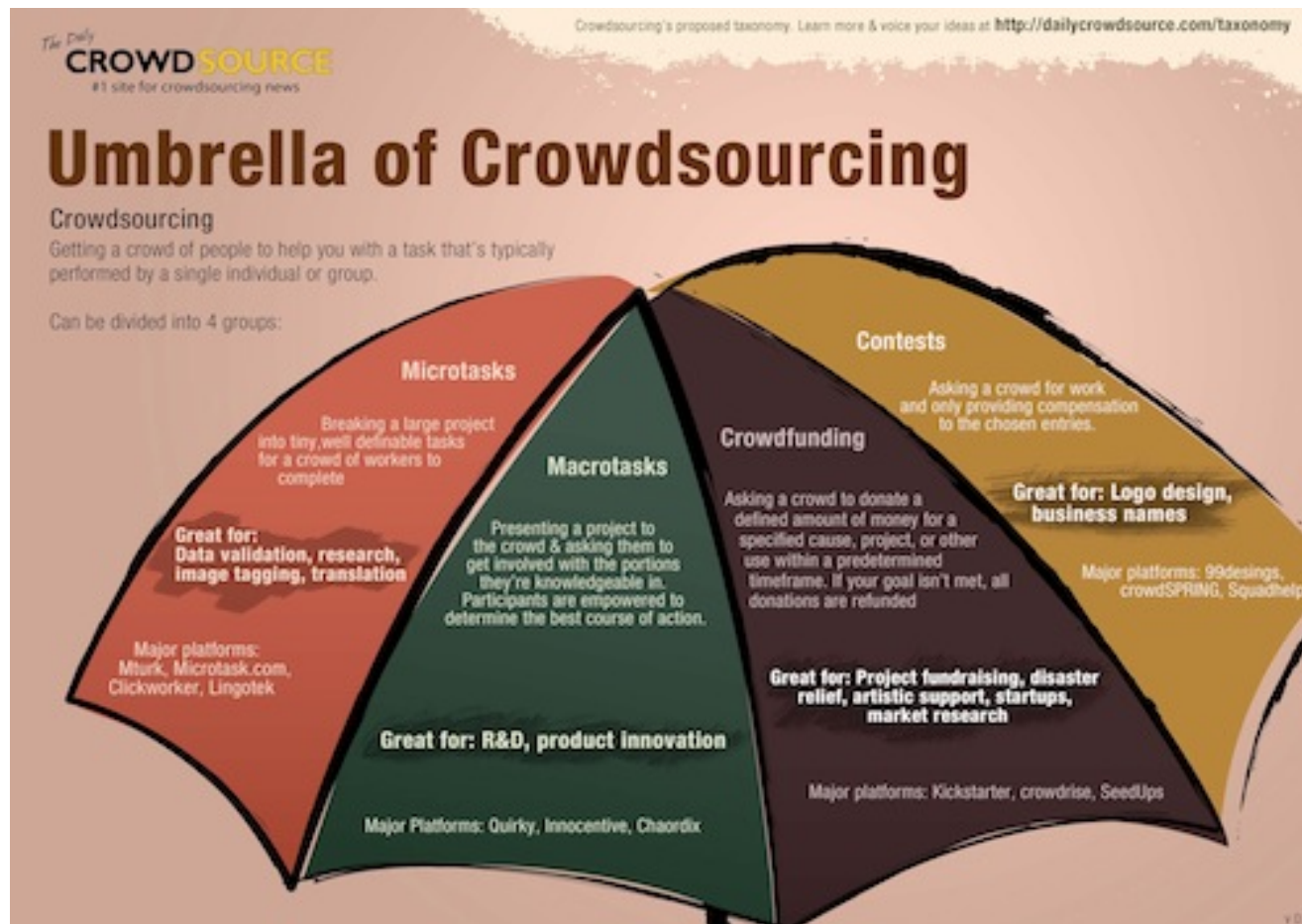
# CROWDSOURCING: PROBLEM SOLVING VIA OPEN CALLS

"Simply defined, crowdsourcing represents the act of a company or institution taking a function once performed by employees and outsourcing it to an undefined (and generally large) network of people in the form of an open call. This can take the form of peer-production (when the job is performed collaboratively), but is also often undertaken by sole individuals. The crucial prerequisite is the use of the open call format and the large network of potential .“

[Howe, 2006]

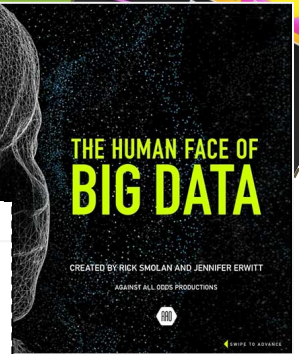
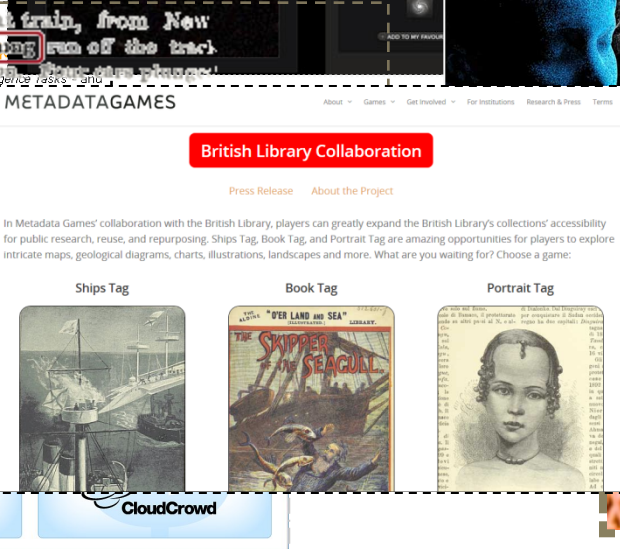


# THE MANY FACES OF CROWDSOURCING



# RELATED: HUMAN COMPUTATION

Outsourcing tasks that machines find difficult to solve to humans



**Make Money by working on HITs**  
HITs - Human Intelligence Tasks - are individual tasks you work on. [Find HITs now.](#)  
As a Mechanical Turk Worker you:  

- Can work from home
- Choose your own work hours
- Get paid for doing good work

- Have access to a global workforce
- Get thousands of HITs
- Pay only when you're done

Find an interesting task   Work   Earn money   Fund your account   Load your account



# IN THIS TALK: CROWDSOURCING DATA CITATION

<http://prov.usewod.org/>

## 'The USEWOD experiment'

- Goal: collect information about the usage of Linked Data sets in research papers
- Explore different crowdsourcing methods
- Online tool to link publications to data sets (and their versions)
- 1<sup>st</sup> feasibility study with 10 researchers in May 2014

USEWOD2014 - 4th International Workshop on Usage Analysis and the Web of Data

Workspace (using name: elena)

Connections

Publications

- User Modeling Combining Access Logs, Page Content and Semantics by Blaz Fortuna, Dunja Mladenic, Marko Grobelnik, 2011, [link](#)
- Towards an Automated Query Modification Assistant by Vera Hollink, Arjen De Vries, 2011, [link](#)
- Mining User Comment Activity for Detecting Forum Spammers in YouTube by Ashish Sureka, 2011, [link](#)
- U-Sem: Semantic Enrichment, User Modeling and Mining Usage Data on the Social Web by Fabian Abel, Iknur Celik, Claudia Hauff, Laura Hollink, Geert-Jan Houben, 2011, [link](#)
- From Linked Data to Relevant Data - Time is the Essence by Markus Kirchberg, Ryan Ko, Bu Sung Lee, 2011, [link](#)
- An Empirical Study of Real-World SPARQL Queries by Mario Anas Gallego, Javier D. Fernández, Miguel A. Martínez-Prieto, Pablo De La Fuente, 2011, [link](#)
- Characterizing Machine Agent Behavior through SPARQL Query Males by Amaldeo Dehnes, 2012, [link](#)

Datasets

- DBpedia (Generic)
- DBpedia 1.0
- DBpedia 2.0
- DBpedia 3.0 Release Candidate
- DBpedia 3.0
- DBpedia 3.1
- DBpedia 3.2
- DBpedia 3.3

Web Images More...

Google dbpedia

Scholar About 9,650 results (0.04 sec)

Articles

Case law

My library

[book] **DBpedia: A nucleus for a web of open data**  
[S Auer](#), [C Dizer](#), [G Kobilarov](#), [J Lehmann](#), [R Cyganiak](#)... - 2007 - Springer

Abstract **DBpedia** is a community effort to extract structured information from Wikipedia and to make this information available on the Web. **DBpedia** allows you to ask sophisticated queries against datasets derived from Wikipedia and to link other datasets on the Web to ...

Cited by 1419 Related articles All 30 versions Cite Save

9650 publications



# HOW TO CROWDSOURCE

What: Goal

Who: Contributors

How: Process

Why: Motivation and incentives

<http://sloanreview.mit.edu/article/the-collective-intelligence-genome/>

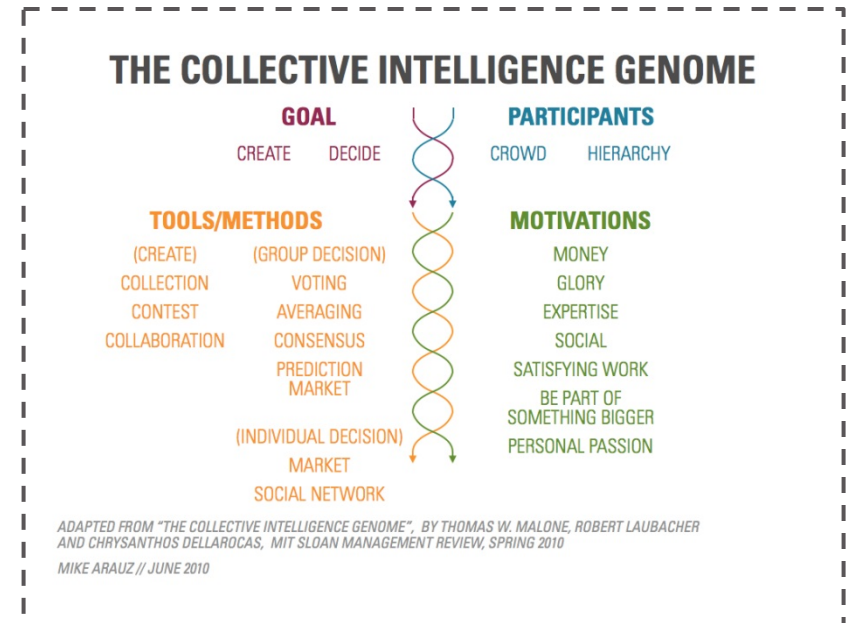


Image at  
[http://jasonbiv.files.wordpress.com/2012/08/collectiveintelligence\\_genome.jpg](http://jasonbiv.files.wordpress.com/2012/08/collectiveintelligence_genome.jpg)

# EXAMPLE: CITIZEN SCIENCE

## WHAT IS OUTSOURCED

- Object recognition, labeling, categorization in media content

## WHO IS THE CROWD

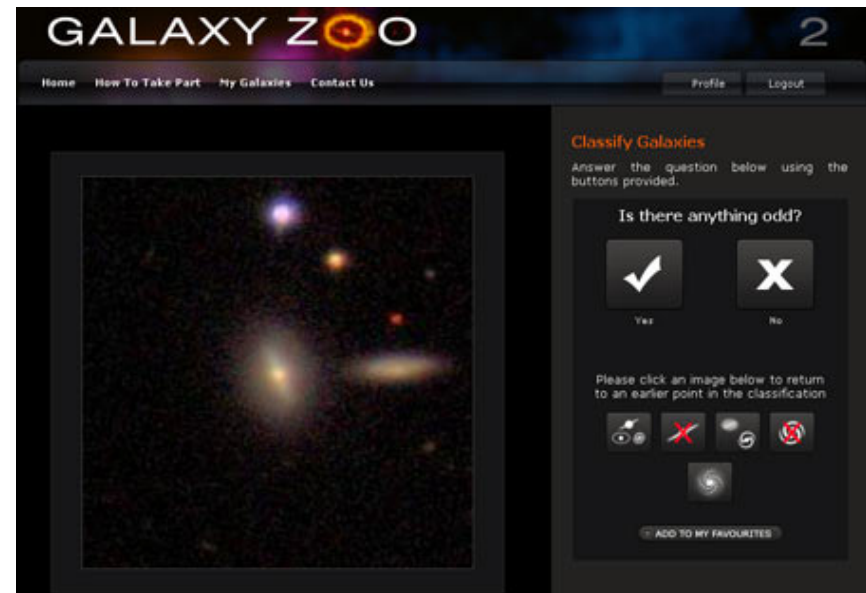
- Anyone

## HOW IS THE TASK OUTSOURCED

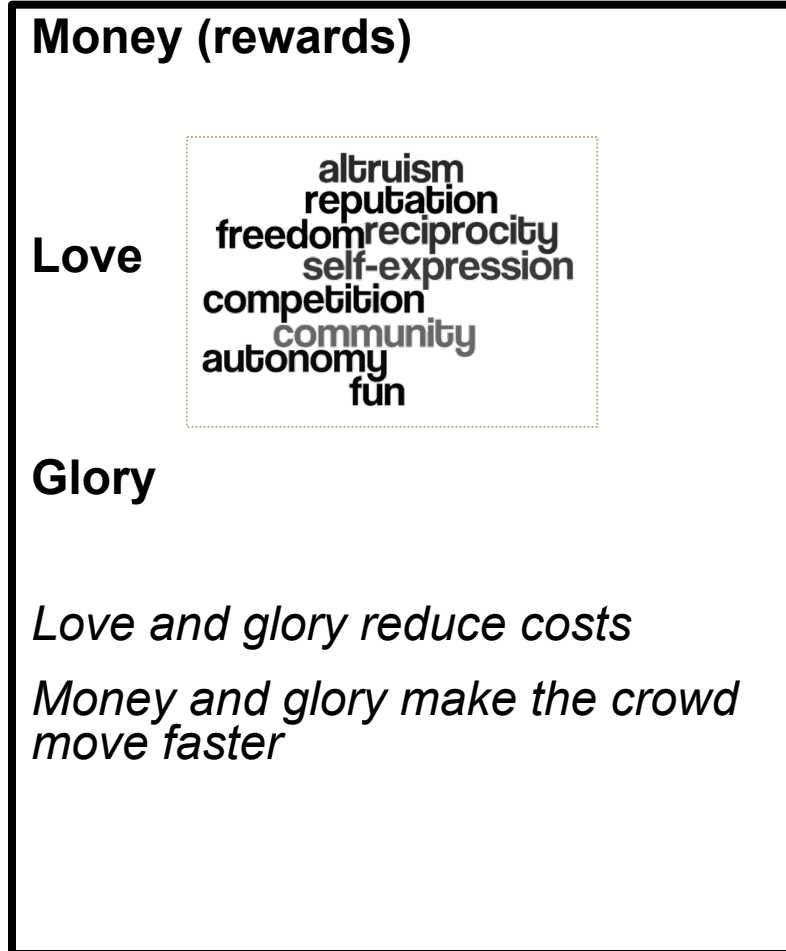
- Highly parallelizable tasks
- Every item is handled by multiple annotators
- Every annotator provides an answer
- Consolidated answers solve scientific problems

## WHY DO PEOPLE CONTRIBUTE

- Fun, interest in science, desire to contribute to science



# WHY



## Intrinsic vs extrinsic motivation

**Rewards/incentives influence motivation.**

- They are granted by an external 'judge'

**Successful volunteer crowdsourcing is difficult to predict or replicate**

- Highly context-specific
- Not applicable to arbitrary tasks

**Reward models often easier to study and control (if performance can be reliably measured)**

- Not always easy to abstract from social aspects (free-riding, social pressure)
- May undermine intrinsic motivation

# WHY (2)

In our example:

Who benefits from the results

Who owns the results

## Money

- Different models: pay-per-time, pay-per-unit, winner-takes-it-all
- Define the rewards, analyze trade-offs accuracy vs costs, avoid spam

## Love

- Authors, researchers, Dbpedia community, open access advocates, publishers, casual gamers etc.

## Glory

- Competitions, mentions, awards

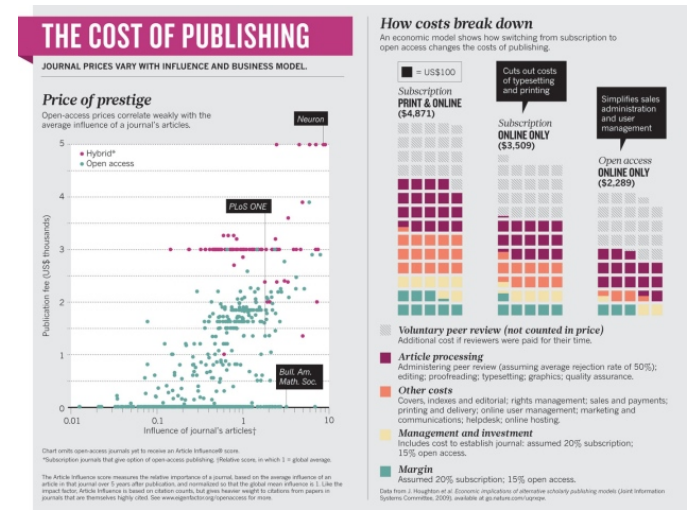


Image from Nature.com

# WHAT

**In general: something you cannot do (fully) automatically**

**In our example: annotating research papers with data set information**

- Alternative representations of the domain
- What if the paper is not available?
- What if the domain is not known in advance or is infinite?
- Do we know the list of potential answers?
- Is there only one correct solution to each atomic task?
- How many people would solve the same task?

# WHO

## In general

- An open ('unknown') crowd
- Scale helps
- Qualifications might be a pre-requisite

## In our example

- People who know the papers or the data sets
- Experts in the (broader) field
- Casual gamers
- Librarians
- Anyone (knowledgeable of English, with a computer/cell phone etc)
- Combinations thereof

# HOW: PROCESS

See also [Quinn & Bederson, 2012]

## In general:

- Explicit vs. implicit participation
  - Affects motivation
- Tasks broken down into smaller units undertaken in parallel by different people
  - Does not apply to all forms of crowdsourcing
- Coordination required to handle cases with more complex workflows
  - Sometimes using different crowds for workflow parts
  - Example: text summarization
- Task assignment to match skills, preferences, and contribution history
  - Example: random assignment vs meritocracy vs full autonomy
- Partial or independent answers consolidated and aggregated into complete solution
  - Example: challenges (e.g., Netflix) vs aggregation (e.g., Wikipedia)

# HOW: PROCESS (2)

## In our example:

- Use the data collected here to train a IE algorithm
- Use paid microtask workers to go a first screening, then expert crowd to sort out challenging cases
- What if you have very long documents potentially mentioning different/ unknown data sets?
- Competition via Twitter
  - ‘Which version of DBpedia does this paper use?’
  - One question a day, prizes
  - Needs golden standard to bootstrap and redundancy
- Involve the authors
  - Use crowdsourcing to find out Twitter accounts, then launch campaign on Twitter
  - Write an email to the authors...
- Change the task
  - Which papers use Dbpedia 3.X?
    - Competition to find all papers



# HOW: VALIDATION

## In general:

- Solutions space closed vs. open
  - Redundancy vs. iterations/peer-review
- Performance measurements/ground truth
  - Available and accepted
- Automated techniques employed to predict accurate solutions

## In our example:

- Domain is fairly restricted
  - Spam and obvious wrong answers can be detected easily
  - When are two answers the same?
  - Can there be more than one correct answer per question?
- Redundancy may not be the final answer
  - Most people will be able to identify the data set, but sometimes the actual version is not trivial to reproduce
- Make educated version guess based on time intervals and other features

# Ontology for microtask crowdsourcing V0.1

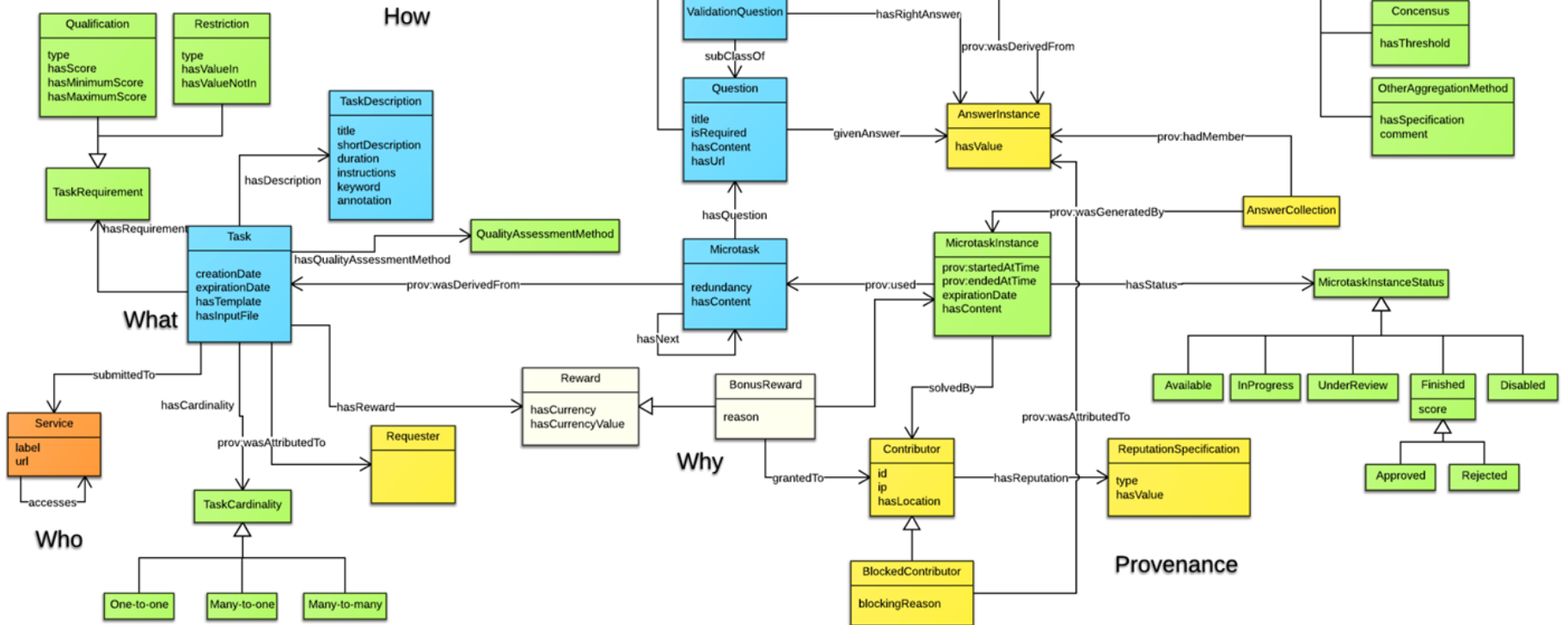


Image courtesy of M. Acosta

# EXAMPLES

# TASTE IT! TRY IT!

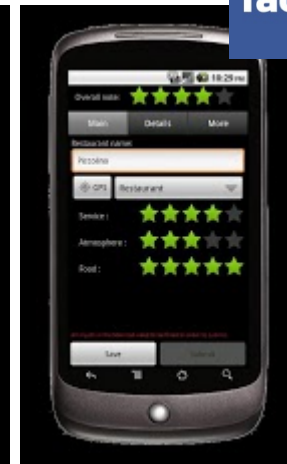
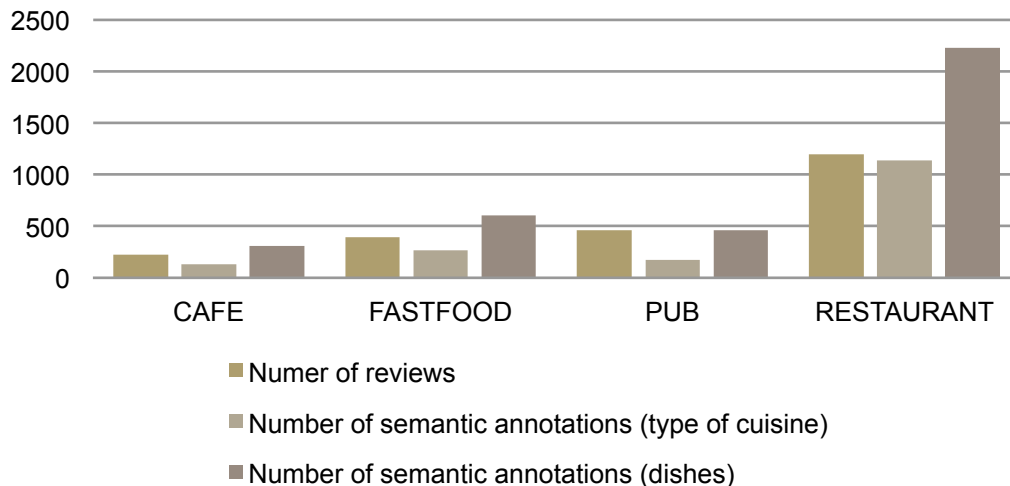
Restaurant review Android app developed in the Insemtives project

Uses Dbpedia concepts to generate structured reviews

Uses mechanism design/gamification to configure incentives

User study

- 2274 reviews by 180 reviewers referring to 900 restaurants, using 5667 DPpedia concepts



<https://play.google.com/store/apps/details?id=insemtives.android&hl=en>

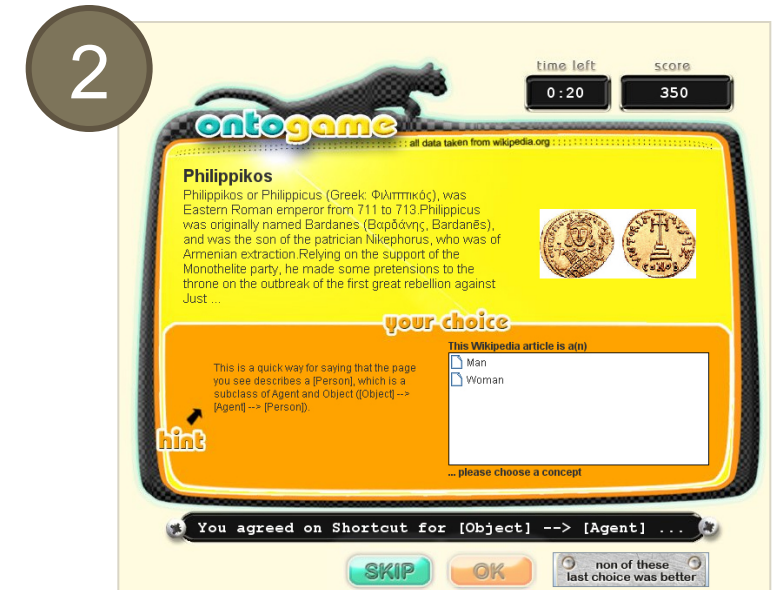
# ONTOPRANTO

GWAP ~ Game with a purpose

Players' contributions are used to improve the results of technically challenging tasks

## OntoPronto

- Task: map Wikipedia topics to classes of an ontology
- Selection-agreement game: players have to agree on answers
- Step 1: decide whether a topic is a class or an instance
- Step 2: classify topic in the ontology



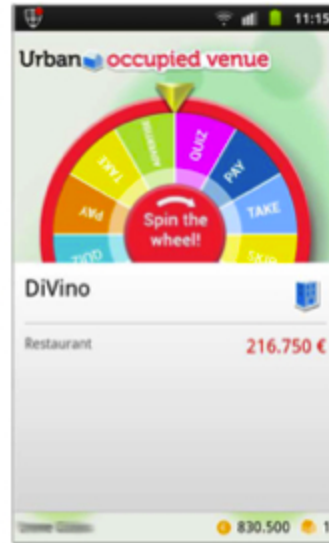
# URBANOPOLY



Urban my venues

Brico Center	125.250 €
Do-it-yourself store	
Posta	112.500 €
Post Office	
Punto Simply	107.500 €
Supermarket	
San Giovanni in Laterano	203.500 €
Place of worship	
Simply	175.000 €
Supermarket	

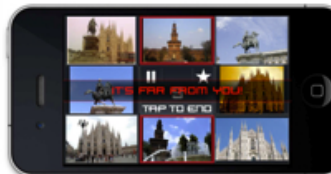
Irene Celino 86.785 5



Urban leaderboard

1. Dario Cerizza	1.282.771
82.771 5	
2. Irene Celino	793.620
69.870 5	
3. Emanuele Della Valle	623.133
116.133 4	
4. Sara Bombardieri	599.495
84.745 10	
5. Rosa Maria	591.907
71.407 3	
6. Orsetta Maria Vera Mangia	506.000
506.000 0	
7. Carlson Yap	500.000
500.000 0	
8. Joé Paulo Menezes	500.000
500.000 0	
9. Mirco Masa	500.000
500.000 0	

Dario Cerizza 82.771 6



03.09.14

<http://www.cefriell.com/en/urbanopoly-game/>

See also [Sarasua, Simperl, Noy, ISWC2012]

# CROWDMAP

Experiments using MTurk, CrowdFlower and established benchmarks

Enhancing the results of automatic techniques

Fast, accurate, cost-effective

**Concept A: Misc**  
*Definition (English):* Use this type when nothing else fits.

Misc is a kind of: Reference

Other elements that are of kind Reference: 'Academic' 'Informal' 'MotionPicture'

**Concept B: Misc.**  
*Definition (English):* Use this type when nothing else fits.

Misc. is a kind of: REFERENCE

Other elements that are of kind REFERENCE: 'Book' 'Academic' 'Motion\_picture'

**Is Concept A the same as Concept B? (required)**

yes

no

Please select only one of the answers

**Select the name of Concept A (required)**

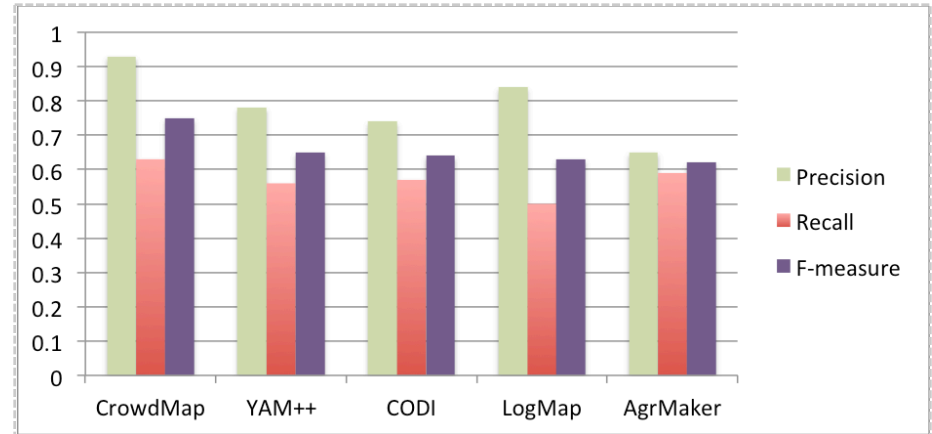
Misc

Misc.

Please select only one of the answers

**How many distinct words are in the name of Concept A? (required)**

Please write the number in the text box



	CartP 301-304	100R50P Edas-Iasted	100R50P Ekaw-Iasted	100R50P Cmt-Ekaw	100R50P ConfOf-Ekaw	Imp 301-304
PRECISION	0.53	0.8	1.0	1.0	0.93	0.73
RECALL	1.0	0.42	0.7	0.75	0.65	1.0

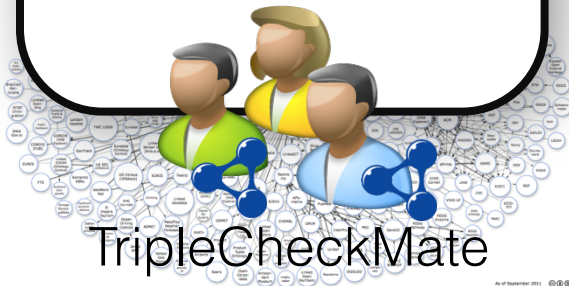
# DBPEDIA CURATION



Find

## Contest

Linked Data experts  
Difficult task  
Final prize



TripleCheckMate  
[Kontoskostas2013]



Verify

## Microtasks

Workers  
Easy task  
Micropayments



MTurk

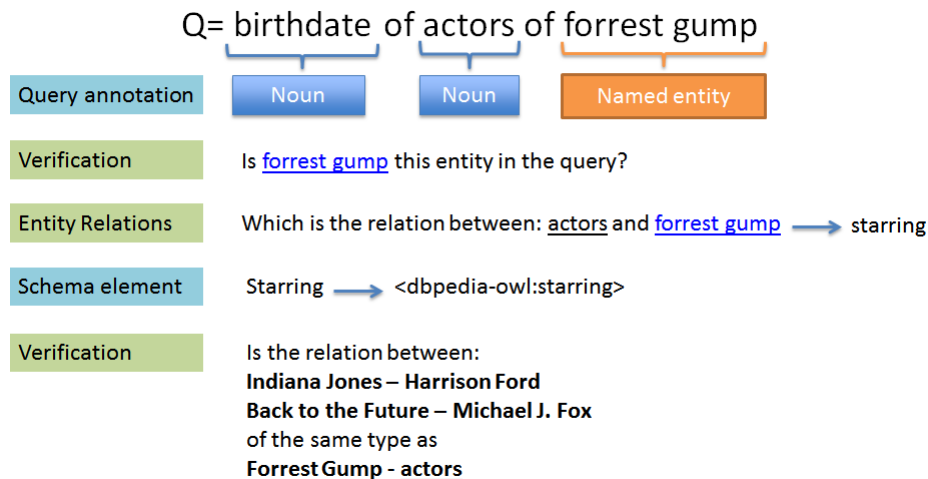
<http://mturk.com>

# CROWDQ

Understand the meaning of a keyword query

Build a structured (SPARQL) query template

Answer the query over Linked Open Data



Gianluca Demartini, Beth Trushkowsky, Tim Kraska, and Michael Franklin.  
**CrowdQ: Crowdsourced Query Understanding.** In: 6th Biennial Conference  
on Innovative Data Systems Research (CIDR 2013)



# LODREFINE

## Find Freebase profile pages for NHL players (reconcile with Freebase)

### Instructions Hide

Find a Freebase page - profile for specific NHL player, which matches data on player's NHL profile page. Check suggested options FIRST. If none of them matches, try to find player using [Freebase search page](#). Important: Pay attention to player's name, date, place of birth and current team, these information can help you distinguish between two players with identical or similar name.

Player: Adam Snyder  
 Player's profile on NHL page: <http://www.nfl.com/players/playername/profile?id=SNY081787>  
 Team: Arizona

#### FIRST check suggested links:

1. Suggestion 1: [Adam Snyder](#)
2. Suggestion 2: [Adam Snyder](#)
3. Suggestion 3: [Lum Snyder](#)
4. None of the above matches ([find page on your own](#))

Find Freebase page for this player and paste it in this field, e.g.: [http://www.freebase.com/view/en/bill\\_walsh\\_1931](http://www.freebase.com/view/en/bill_walsh_1931)

<http://research.zemanta.com/crowds-to-the-rescue/>

# PROBLEMS AND CHALLENGES

## •What is feasible and how can tasks be optimally crowdsourced, e.g., translated into microtasks?

- Examples: data quality assessment for technical and contextual features; subjective vs objective tasks (also in modeling); open-ended questions

## •What to show to users

- Natural language descriptions of Linked Data/SPARQL
- How much context
- What form of rendering
- How about links?

## •How to combine with automatic tools

- Which results to validate
  - Low precision (no fun for gamers...)
  - Low recall (vs all possible questions)

## •How to embed crowdsourcing into an existing application

- Tasks are fine granular, perceived as additional burden to the actual functionality

## •What to do with the resulting data?

- Integration into existing practices
- Vocabularies

# FURTHER READING

**MIT Sloan**  
Management Review

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INNOVATION STRATEGY LEADING YOUR TEAM OPERATIONS TECHNOLOGY MARKETING GLOBAL SUBSCRIBE

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## The Collective Intelligence Genome

Magazine: Spring 2010 • Research Feature • April 01, 2010 • Reading Time: 28 min  
Thomas W. Malone, Robert Laubacher and Chrysanthos Dellarocas

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A user's guide to the building blocks of collective intelligence: By recombining CI "genes" according to the work required

**SYNTHESIS LECTURES ON**  
*THE SEMANTIC WEB: THEORY AND TECHNOLOGY*

Series Editors: James Hendler, *Rensselaer Polytechnic Institute*  
Ying Ding, *Indiana University*

**Incentive-Centric Semantic Web Application Engineering**  
Elena Simperl, *University of Southampton, United Kingdom*  
Roberta Cuel, *University of Trento, Italy*  
Martin Stein, *University of Siegen, Germany*

While many Web 2.0-inspired approaches to semantic content authoring do acknowledge motivational incentives as the main drivers of user involvement, the amount of useful human contributions actually will always remain a scarce resource. Complementarily, there are aspects of semantic content authoring which automatic techniques have proven to perform reliably, and the added value of human (and collective) intelligence is often a question of cost and timing. The challenge that this book attempts to tackle is how these two approaches (machine- and human-driven computation) could be combined in order to improve the cost/performance ratio of creating, managing, and meaningfully using semantic content.

To do so, we need to first understand how theories and practices from social sciences and economic user behavior and incentives could be applied to semantic content authoring. We will introduce a methodology to help software designers to embed incentives-minded functionalities into semantic applications, a set of best practices and guidelines. We will present several examples of such applications, addressing tasks such as ontology management, media annotation, and information extraction, which have been built with these considerations in mind. These examples illustrate key design issues of incentivized Semantic Web applications that might have a significant effect on the success and sustainable development of the applications. We will discuss the suitability of the task and knowledge domain to the intended audience, and the mechanisms set up to encourage high-quality contributions, and extensive user involvement.

**ABOUT SYNTHESIS**  
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MORGAN & CLAYPOOL PUBLISHERS  
[www.morganclaypool.com](http://www.morganclaypool.com)

ISBN: 978-1-60445-795-7  
9 781604 457957

**Building Successful Online Communities**  
Evidence-Based Social Design

Robert E. Kraut and Paul Resnick

with Sara Kiesler, Mouni Barko, Yan Chen, Niko Kilian, Joseph Kientz, Yuchun Pan, and John Riedl

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