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1.1 Author

Author	Organisation	E-mail
Maria Xenitidou	University of Surrey	M.Xenitidou@surrey.ac.uk

1.2 Other contributors

Name	Organisation	E-mail
Nigel Gilbert	University of Surrey	n.gilbert@surrey.ac.uk
Camille Roth	CNRS	roth@ehess.fr
Matus Medo	University of Fribourg	matus.medo@unifr.ch
Hilary Woodard	ETH Zürich	hwoodard@ethz.ch
Alois Zistler	IRT	Zistler@irt.de
Michal Ziembowicz	UWAR	ziembowicz@gmail.com
Johan Pouwelse	TUDelft	j.a.pouwelse@tudelft.nl
Mark Jelasity	USZ	jelasity@inf.u-szeged.hu

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Consortium

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University of Surrey (Coordinator)
Department of Sociology/Centre for Research in Social Simulation
Guildford GU2 7XH
Surrey
United Kingdom
Contact person: Prof. Nigel Gilbert
E-mail: n.gilbert@surrey.ac.uk

University of Fribourg
Department of Physics
Fribourg 1700
Switzerland
Contact person: Prof. Yi-Cheng Zhang
E-mail: yi-cheng.zhang@unifr.ch

Technical University of Delft
Department of Software Technology
Delft, 2628 CN
Netherlands
Contact Person: Dr Johan Pouwelse
E-mail: j.a.pouwelse@tudelft.nl

University of Warsaw
Faculty of Psychology
Warsaw 00927
Poland
Contact Person: Prof. Andrzej Nowak
E-mail: nowak@fau.edu

ETH Zurich
Chair of Sociology, in particular Modelling and Simulation,
Zurich, CH-8092
Switzerland
Contact person: Prof. Dirk Helbing
E-mail: dhelbing@ethz.ch

Centre National de la Recherche Scientifique, CNRS
Paris 75006
France
Contact person: Dr. Camille ROTH
E-mail: roth@ehess.fr

University of Szeged
MTA-SZTE Research Group on Artificial Intelligence
Szeged 6720
Hungary
Contact person: Dr Mark Jelasity
E-mail: jelasity@inf.u-szeged.hu

Institut für Rundfunktechnik GmbH
Munich 80939
Germany
Contact person: Christoph Dosch
E-mail: dosch@irt.de

QLectives introduction

QLectives is a project bringing together top social modelers, peer-to-peer engineers and physicists to design and deploy next generation self-organising socially intelligent information systems. The project aims to combine three recent trends within information systems:

- **Social networks** - in which people link to others over the Internet to gain value and facilitate collaboration
- **Peer production** - in which people collectively produce informational products and experiences without traditional hierarchies or market incentives
- **Peer-to-Peer systems** - in which software clients running on user machines distribute media and other information without a central server or administrative control

QLectives aims to bring these together to form Quality Collectives, i.e. functional decentralised communities that self-organise and self-maintain for the benefit of the people who comprise them. We aim to generate theory at the social level, design algorithms and deploy prototypes targeted towards two application domains:

- **QMedia** - an interactive peer-to-peer media distribution system (including live streaming), providing fully distributed social filtering and recommendation for quality
- **QScience** - a distributed platform for scientists allowing them to locate or form new communities and quality reviewing mechanisms, which are transparent and promote quality.

The approach of the QLectives project is unique in that it brings together a highly inter-disciplinary team applied to specific real world problems. The project applies a scientific approach to research by formulating theories, applying them to real systems and then performing detailed measurements of system and user behaviour to validate or modify our theories if necessary. The two applications will be based on two existing user communities comprising several thousand people - so-called "Living labs", media sharing community tribler.org; and the scientific collaboration forum EconoPhysics.

Executive Summary

This deliverable reports the publication and dissemination activities of the QLectives project consortium during the project's fourth (and final) reporting period.

The deliverable is divided into four parts. The first part presents the strategic impact(s) of the project on science and innovation, and on supporting EU leadership in emerging areas of economic significance, as well as outlining the steps taken to achieve long-term potential impact.

The second part presents the dissemination plan of the project in terms of research and development, as well as management activities.

The third part outlines the collaborations in which consortium members have engaged in the context of the QLectives project.

The fourth part lists the publications produced by the consortium members: journal articles, peer-reviewed conference papers and compendiums, books and book chapters, and talks and presentations involving QLectives partners.

Contents

1. Introduction

This deliverable reports the publication and dissemination activities of the QLectives project consortium during the project's fourth reporting period.

The deliverable is divided into four parts. The first part presents the strategic impact(s) of the project on science and innovation, and on supporting EU leadership in emerging areas of economic significance, as well as outlining the steps taken to achieve long-term potential impact. The second part presents the dissemination plan of the project in terms of research and development, as well as management activities. The third part outlines the collaborations in which consortium members have engaged in the context of the QLectives project. The fourth part lists the publications produced by the consortium members: journal articles, peer-reviewed conference papers and compendiums, books and book chapters, and talks and presentations involving QLectives partners.

2. Strategic impact

2.1 Strategic impact on science and innovation

During the project's fourth reporting period QLectives' work on collaboration and peer-to-peer systems included the following:

Emergence of and dynamics of quality

The emergence and dynamics of quality has been one of the key themes of the QLectives project. To this end, research conducted during the fourth and final reporting period focussed on further analysis of the data previously collected, follow-up data collection and operationalisation in order to inform implementation in online collectives (QLectives platform).

Overall, this year data analysis relating to quality focused on how it is practiced in science (survey and focus groups) and the dynamics of quality collectives (in general contexts). Several iterations of data processing and analysis of this work have taken place in response to feedback from perspectives in social epistemology, social studies of science and social psychology.

In terms of online communities and quality, a validation of the QTR model (quality, trust, reputation) was conducted throughout the year, using various external datasets coming from platforms that exhibit similarities to QScience (such as bibliographical and scientific citation datasets) and QMedia (such as Anobii and Wikipedia). In terms of the *Algorithmic Foundation of Human Collaboration* in quality contexts see related section below.

Modelling self-organised emergence of human collaboration and peer production

Impact in this area was achieved through continuing to work on evolutionary, game-theoretical modelling of decision-making, enhancing our understanding of the ways in which biological and social mechanisms can modify the incentive structure in social dilemma situations in a way that counters "tragedies of the commons". It was discovered that success-driven mobility allows cooperation to emerge in a world dominated by defectors, even when challenged by different kinds of fluctuations.

Apart from evolutionary, game-theoretical modelling, agent-based simulation studies have explained the evolution of moral behaviour: spatial interactions with neighbours can promote cooperation and the sanctioning of non-cooperative

behaviour. This solves the long-standing ''second-order free-rider problem" – why individuals would invest into costly sanctioning of non-cooperative behaviour – and has also shown that the presence of a small number of defectors can accelerate the spreading of moral behaviour.

Simulations of utility-maximizing agents under evolutionary pressure have furthermore demonstrated the emergence of other-regarding behaviour, when "friendliness" may result from mutations and is inherited from one generation to the next. This discovery implies the evolution of a ``homo socialis'' under conditions where only a self-regarding "homo economicus" had been believed to exist. The interdependent decisions of the "homo socialis" establish a situation that may be characterized as ``networked minds'', which leads to a plausible forecast for Web 2.0 and social media, in particular, that it will eventually establish a new kind of market organization, an "economy 2.0'" or "participatory market society".

Finally, based on work within the 'Techno-social simulation of BitTorrent networks' project launched in year 3 with the aim to integrate different modelling efforts and use empirical data to inform model parameters of a simulation, user behaviour in BitTorrent systems in particular shows levels of cooperation that would not be expected for self-regarding agents. Furthermore, generalized Ultimatum Game experiments in highly anonymous web environments also produce results which can only be understood by assuming that a considerable fraction of agents decide in a fairness-oriented rather than self-regarding way.

Other research within this category includes:

- Analyses of citation dynamics: in citation networks, Time-Varying Graphs have been developed to adapt classical graph theory indicators to dynamic citation networks.
- The empirical relationships between online group involvement/participation and quality-related discussions in the process of referencing on Wikipedia articles have been described.
- Work focusing on hypernetworks (hypergraphs) rather than networks (graphs) as a relevant level to model collectives was continued, by looking especially at the intertwinement between social and semantic aspects of group formation (connecting hypergraphic measures of group properties with quality measures). In addition, a description of the content dynamics and the study of social network characteristics and evolution overall has been attempted by merging both types of dynamics into co-evolutionary, multi-level modelling frameworks, where social and semantic aspects are being jointly appraised.
- Finally, an ISI dataset was used to show that teams with the highest impact typically gather a large number of agents and concepts, have a moderately-aged and highly visible oldest author and keyword, with a strongly (yet not

absolutely) original combination of concepts. The observation of the maximally productive, visible and aged team member brings as much information as the observation of the same properties averaged over the whole team. This may be used as a predictive feature for the design recommendation modules. Additionally, a American Physical Society journals dataset was used to evaluate the QTR model developed in WP2.2 (see D3.3.1).

Trust in networks

Understanding the dynamics of networks is vital for the goals of the QLectives project. Research on trust networks concentrated mainly on the QTR (Quality-Trust-Reputation) algorithm aimed at online research communities. A general ranking method was developed to simultaneously evaluate users' reputation and objects' quality in an iterative procedure, and to exploit the trust relationships and social acquaintances of users as an additional source of information. This was tested on two real online communities, the EconoPhysics forum and the Last.fm music catalogue, and showed the benefits of considering trust relationships.

Algorithmic foundations of human collaboration

During this period research on algorithmic foundations of human collaboration involved adopting and operationalising theoretical and empirical investigations in design and implementation.

A meta-algorithm was proposed for the detection of communities in dynamic social networks. This meta-algorithm takes the dynamics of social networks into account and articulates different phases for the detection and the update of communities. Several solutions have been proposed for these different steps and evaluated on several datasets (scientific citations network, social animal networks, tags networks for recommendation application).

The concept of crowd-avoidance in recommendation has been introduced. Recommender systems typically recommend objects regardless of potential adverse effects of their overcrowding. This shortcoming was addressed by introducing crowd-avoiding recommendation where each object can be shared by only a limited number of users or where object utility diminishes with the number of users sharing it. Real data was used to show that contrary to expectations, the introduction of these constraints enhances recommendation accuracy and diversity even in systems where overcrowding is not detrimental. The observed accuracy improvements were explained in terms of removing potential bias of the recommendation method. As a result, a way to model artificial socio-economic

systems with crowd avoidance was proposed, and first analytic results were obtained.

The main lines of work on P2P algorithms included:

- moving self-organising algorithms to energy and computationally limited devices;
- a detailed analysis of collaboration between QMedia users by using an efficient implementation of the hierarchal edge-betweenness community algorithm of Newman.

Improvement of data mining algorithms

Research in information filtering and data mining algorithms is central in the QLectives project. In year 4, efforts were predominantly targeted towards the further development of the gossip learning framework (GOLF). In particular, the behaviour of the system in the presence of dynamically changing environments and changing underlying concepts has been studied. This is critical in a live P2P system, where GOLF has to run indefinitely continuously adapting to the changing environment. Efforts also included adapting GOLF for the specific application of spam detection in QMedia (see deliverable D2.3.1).

QMedia and QLectives Platform

During this period, work concentrated on producing a re-usable P2P platform infrastructure that facilitates peer-production, that is the QLectives Platform, and create an experimental next-generation user centric and social media distribution platform, QMedia.

In the newest version of the QLectives Platform significant incremental evolution through testing, performance and documentation included:

- Dispersy wire protocol specification to prepare for further usage, uptake and standardization of QLectives Platform: a detailed specification of all Dispersy messages was created.
- Platform for GUI evaluation using crowdsourcing: the efficiency of automatically testing a user interface can be significantly increased by using hundreds of paid Amazon MTurk workers.
- Faster video streaming engine incorporating Libtorrent which matured over the past year into the fastest Bittorrent-compatible streaming engine.
- Boosted performance: several months have been spend on understanding the Dispersy behaviour under various workloads, identification of bottlenecks and improving performance in general.

The release of the fourth version of QMedia included a smartphone version of QMedia, in line with the "mobile first" strategy emerging globally. This was achieved by moving self-organising algorithms to energy and computationally limited devices *plus* utilizing the novel QPlatform no-Internet-needed option. To improve the quality and performance of QMedia software an "automatic quality testing ecosystem" using Jenkins (a continuous integration tool) was created; it now creates daily reports. This allows our volunteers and researchers to spot weak points and make informed improvements. QMedia version 4.0 was released in early December 2012. This version of the software, named Tribler 6.0.4 was downloaded more than 25,000 times since its publication (see http://statistics.tribler.org).

QScience Platform

For QScience, QLectives work focused on implementing QScience in Drupal. In year 4 the majority of work has concentrated on the creation **of a Drupal distribution based on QScience**, the development of Drupal modules (*Patterns*, *D2D* and *Visual Science*) and related functionalities and add-ons, as well as the QTR implementation in the EconoPhysics Forum (EF). In addition, two other QScience instances are about to be installed: the CRESS (Centre for Research in Social Simulation) is currently migrating to Drupal-QScience and the forthcoming project P2P-value will be using the next release of the QScience distribution starting from September.

These efforts mainly involved the development and enhancement of three modules:

- **D2D:** Improved the algorithms for distribution of information among QScience instances using strong cryptography. The administrative UI was also overhauled.
- **Patterns:** The work here focused on improving an already functional module. Patterns has been extended to enhance the automatic export capabilities and to provide a new level of semantic validation in order to offer assistance in the task of solving the possible conflicts between the entities generated by the components. The Patterns module is now increasingly spreading among the Drupal community and detailed technical documentation in order to encourage the support from the Drupal community is under way (see Section 3).
- **VisualScience:** The visualization of knowledge graphs, productivity statistics and indexes have been improved, and the user interface made more intuitive.

The current development of the QScience Distribution is available at: drupal.org/project/qscience_profile. In addition, while the Econophysics Forum has been redesigned, implemented using QScience (available at http://www3.unifr.ch/econophysics/), and successfully launched, for the CRESS website, all the "back-end" tasks have been performed

(http://dev.cress.gotpantheon.com/) and the theming (appearance) will be finished in the forthcoming weeks.

Finally, our efforts to build an "Innovation Accelerator" focused on the creation, aggregation, distribution, and use of knowledge. Activities within QLectives and beyond have established the following platforms, and a landing page bringing all of them together (http://inn.ac):
Living Archive (http://www.livingarchive.eu): a platform collecting (links to) Open Data that are relevant for the work of scientists.
Living Science (http://www.livingscience.ethz.ch): evaluates scientific publication activities geographically and according to other criteria.
Virtual Journal (http://vijo.inn.ac/): offers each user a personalized journal, bringing together publications on a certain subject, that have appeared in different journals and disciplines.
Nanobrowser (http://nanobrowser.inn.ac): a browser and publishing interface for nanopublications.
QScience (http://qscience.inn.ac): a distributed platform tailored to support the needs of modern scholarly communities.

2.2 Strategic impact on media and content distribution

As well as the technological progress and achievements summarised above, the impact of QLectives' work on media and content distribution contributes to the formation of a more decentralized, flat and hence democratic media distribution landscape. QMedia version 4.0 is implemented without any centralized system restricting a peer from remaining in control, and with the aims to deliver a 'censorship-free' promise and achieve the "breaking the tragedy of the commons with one million people". With the experience gained within QLectives, approaches and insights from game theory, graph theory and cryptography can be brought together.

2.3 Supporting EU leadership in emerging areas of economic significance

Addressing the skills and training gap in P2P technology

The QLectives project continues to address the skill and training gap in P2P technology: for example the TUD group continues to train P2P programmers and researchers at MSc and PhD level and several PhD students are working with QLectives topic areas and contributing to the code base of QMedia. In addition, an MA module titled 'Hacking lab' based on QLectives has been accepted to run at TUD (module descriptor available).
Apart from the above, training across partners has been ongoing including collaboration between TUD and other partners (USZ and IRT) to work on skills and technology transfer – development of an AI engine using the QLectives Platform's Dispersy, called GOLF; integration of GOLF into QMedia for a user trial.

With regards to addressing the public and EU audience, all our source code, documentation and community interaction developed within QMedia/Tribler is located at http://Github.com. TUD represents QLectives at various P2P technology fora, including the ACM Workshop on Scalable Trusted Computing among others (see Section 5).

Building the EU complexity community

The UniS team (co-ordinator) addressed a keynote at the joint meeting of the four COSI-ICT projects, sponsored by FET Open Project European Commission titled 'HORIZONS IN SOCIAL SCIENCE 2013' on July 11, 2013 in Lucca, Italy.

QLectives partners have participated widely in the EU complexity community. Apart from the wide publicity that QLectives and the EU complexity community overall achieved through the workings of FutureICT project (http://www.futurict.eu), QLectives partners were also involved in the following:

- UWAR organized an Art Installation titled 'Ten Percent White', in December 2012 in Warsaw, Poland, with significant contribution from Jeff Johnson, the President of Complex Systems Society (see Section 3).

- CNRS delivered an invited talk on 'Socio-epistemic Hypergraphs' at the ASSYST Workshop, in Venice, Italy, on February 26-28, 2012.

- USZ participated at the Sixth IEEE International Conference on Self-Adaptive and Self-Organizing Systems (SASO 2012), in Lyon, France on 10-14 September 2012.

2.4 Potential long-term future impacts

The work done in the QLectives project was predicted to have potential future long-term impacts. The following have been achieved during the fourth reporting period of the QLectives project:

Techno-social inclusion

QMedia allows the creation of virtual communities in a completely decentralized setting. This user-controlled, censorship-free-in-the-making inclusion constitutes an appealing alternative for currently prevalent Web-based media-sharing communities. The new, smartphone version of QMedia is expected to add to its appeal to communities of mobile, busy users.

Techno-social operating system

The QLectives Platform provides the functionalities for a simple-to-use platform prioritizing built-in self-organizing and information-exchanging and providing improved scalability, message-handling and permission-altering mechanisms. These features and the additional spam detection mechanism, faster video streaming and boosted performance overall that have been advanced during year 4, are expected to popularize decentralized techno-social systems among not only communities of users but also system designers and developers.

Scientific collaboration

Communities of users, system designers and developers are also all targeted in advances in QScience. This is mainly done by developing existing (Patterns) as well as custom (D2D and VisualScience) modules in Drupal. The implementation and extension of the *Patterns* module – allowing for automatic configuration of Drupal web sites and, as regards QLectives, the creation and customization of QScience instances in 'one click' – is expected to attract attention not only by the community of users, but also achieve wider recognition of the contribution of the QLectives project to the development of Drupal itself.

As regards the community of users, a user manual is in preparation. As regards system designers and developers, and the Drupal community in particular, QLectives members have been actively involved in Drupal events (see Section 3).

The current version of the QScience Distribution is available at: drupal.org/project/qscience_profile. The Econophysics Forum implementation in QScience is available at http://www3.unifr.ch/econophysics/ and the current stage of migration of the CRESS website to Drupal as a start is available at http://dev.cress.gotpantheon.com/.

The potential exploitation for Horizon 2020 websites based on the EC project website guidelines has been started by implementing QScience for a website for the new FP7 project 'P2P Value' (see http://elio.surrey.ac.uk/p2pvalue/).

3. Dissemination plan

3.1 Research and development

The dissemination of QLectives results to the research community is one of the key goals of the consortium. To this end, the QLectives partners have engaged in publication and dissemination activities by submitting and publishing articles in international peer-reviewed journals, contributing to and participating in international conferences, workshops and summits. The publications and other dissemination activities of the QLectives project are listed in section 5.

In terms of research and development:

Our efforts to build an "Innovation Accelerator" focus on the creation, aggregation, distribution, and use of knowledge. Activities within QLectives and beyond have established the following platforms, and a landing page bringing all of them together (http://www.inn.ac):

- Living Archive
- Living Science
- Virtual Journal
- Nanobrowser
- QScience

In addition, software development and dissemination of the QLectives Platform and QMedia are maintained through an open repository and a Wiki site. The world-wide leading portal for Open Source software development is now Github.com. It is reported that over 3.5 million software developers are active there[1]. Both QMedia and QPlatform are hosted there and all documentation, source code, bug reporting, issue tracking and community interaction takes place there.

Organizing workshops, seminars and training events constitutes another important channel for developing ideas and disseminating results from the QLectives project. To this end, the following dissemination initiatives were taken during the fourth year of QLectives.

In terms of organizing dissemination events:

ETH Zurich organized an International Workshop on Agent-Based Models and Complex Techno-Social Systems at ETH Zurich, Switzerland, on July 2-4, 2012 (http://www.soms.ethz.ch/workshop2012). A selection of papers presented at the workshop was compiled into a Special Issue on Agent-Based Modeling and

1 https://github.com/blog/1470-five-years

Techno-Social Systems and submitted to Advances of Complex Systems (ACS), published by World Scientific.

The UWAR team organized the Art Exhibition (deliverable D5.2 Art Installation). The Art Installation took the form of a multimodal exhibition, held at the Centre for Contemporary Art (CCA) of Warsaw with the title 'TEN PERCENT WHITE'. The duration of the exhibition was approximately two months (December 18, 2012 – February 10, 2013) and the audience consisted of artists, local academics and scientists from the Institute for Social Studies at the University of Warsaw as well as members of the general public. The exhibition involved a dynamic and creative liaison between art curators, scientists and ultimately the audience. Artists were invited to participate and present artwork on the general theme of: Quality in Science, Art & Life. The exhibition was based on P2P principles: artists produced art, recorded their actions, and then all the material was subjected to scientific analysis. QLectives members were involved in suggesting sub-themes for artists to address with their work but also in analyzing the data recorded in artists' exchanges. The ultimate idea was that the 'DNA' of the exhibition as a process is made transferrable through QScience and that a video is produced by the end of the project that records the exhibition.

Another event where dissemination has taken place was the NEM Summit (Networked & Electronic Media), Istanbul, 16-18 October 2012, which is regarded as an important venue for presenting the outcomes of the QLectives project to major key European and global stakeholders. UniS, IRT and USZ participated in the summit, and demonstrations of QMedia and QScience were presented and pilot-tested. This constituted the first time QLectives was presented in an event with commercial extensions and the valuable lessons learnt included the further development of a market-oriented approach overall for the demonstration items. The development of a video demonstration of the conceptual-to-practical tour to the QLectives project has been discussed and assigned.

IRT gave a presentation of a prototypic High-Quality editor-system incorporating results from WP4.4 - self-learning algorithms to predict metadata quality - at RBB in January 2013. RBB ("Berlin-Brandenburg Broadcasting Corporation", http://www.rbb-online.de) is the regional public broadcaster for the federal states of Berlin and Brandenburg. RBB is part of ARD ("Arbeitsgemeinschaft der öffentlich-rechtlichen Rundfunkanstalten der Bundesrepublik Deutschland", http://www.ard.de), which is a joint organization of Germany's regional public-service broadcasters and also the world's second largest public broadcaster after the British Broadcasting Corporation. RBB is also maintaining the Play-Out Centre of ARD, so it is the central point of transmission of all ARD content being broadcasted.

The same HQ editor system has also been presented at a Symposium at IRT in June 2013, where the most important representatives of all ARD broadcasting stations were invited to join a 2-days workshop about "Quality in broadcasting".

In terms of participating dissemination events (apart from SASO 2012, ASSYST and ACM workshops reported in Section 2.3):

A significant effort has been made in terms of dissemination of the module Patterns in the Drupal community by participating in presentations and informal meetings at several Drupal events:

- DrupalCamp Spain 2012 (Madrid, October 2012): Automating Drupal Development with Patterns

(http://2012.drupalcamp.es/es/sesiones/automating-drupal-development-patterns-38)
The video of the first presentation in Madrid (October 2012) is available at http://vimeo.com/61432578.

- DrupalCamp North West UK 2012 (Manchester, November 2012).
- DrupalCamp London 2013 (March, 2013)

http://2013.drupalcamplondon.co.uk/session/automating-drupal-development-patterns
The video of the presentation of Patterns at DCLondon (March) is available at: http://www.youtube.com/watch?v=6FvLJTivMgs

We plan to promote QScience and the other Drupal modules developed by QLectives in the forthcoming DrupalCON Prague in September 2013. We have submitted a proposal for a talk, which is currently under review.

Finally, in terms of training activities, two coding meetings took place, one in July 2012 (Summer Coding Meeting) and one in February 2013 (Winter Coding Meeting), both in Fribourg.

Plans for Dissemination and Exploitation
Dissemination and exploitation activities under way for the demonstration and lasting legacy of QLectives to scientific and non-scientific audiences include (see also deliverable D4.5):
Short & longer term activities:

- IETF Internet standards demonstration of QMedia: a branding activity to take place in Berlin;
- Design and prototypic implementation of an HQ editor system, incorporating QL results (primary from WP4.4: self-learning algorithms to predict metadata quality) to achieve automatic quality prediction of metadata coming from linked open data clouds (DBPedia.org, IMDB.com,

Last.fm, Musicbrainz.org, etc.); optimization of the editor system to support standardized semantic web structures (RDF/OWL);

- Implementation of QScience:
  - CRESS website
  - QLectives website
  - FP7 project P2P Value
- User manual for QScience;
- Deliverable D5.7 consisting of critical contributions from all partners to constitute an e-book provisionally titled: 'Quality Collectives: evolving socio-technical systems to support quality';
- Video of Art Exhibition;
- Conceptual video of QLectives;
- Completion of the Occupy mobile version for users to be able to make friends, posts and other popular applications/functions;
- MA module titled 'Hacking lab' accepted to run at TUD in 2013-4.

Modification and Adjustment of Dissemination Plans

Broadcasters' reduced interest in Peer-to-Peer technology

When the QLectives-proposal was written, CDN costs for Video-On-Demand (VoD) delivery were very high (~30 eurocents / GB in 2007). This was the motivation for Broadcasters, such as IRT representing public Broadcasters in Germany, to watch out for alternatives offering the same level of quality CDN providers do. Therefore, IRT joined the EU projects P2P-Next and QLectives. However, CDN prices have fallen greatly since then. Currently, the price per GB is below 3 ct/GB[2], and the cost savings, especially when also taking into account the effort in adapting mediatheques to offer torrent links, now approach zero.

In parallel, there is another hurdle that would need to be circumnavigated when applying P2P technology for content distribution: the "Interstate Broadcasting Agreement" law ("Rundfunkstaatsvertrag" - see http://en.wikipedia.org/wiki/Rundfunkstaatsvertrag). This was revised in October 2010 by the EU, and included a condition that content made available online needs to safely be removed from the network 7 days after the initial offering. This is given by law, so Broadcasters have to follow it. To solve this technically, mediatheques simply remove the links to "outdated" files on their webservers after 7 days, and things are fine. However, for

[2] See:

http://www.cachefly.com/custom_plans.html

http://aws.amazon.com/en/cloudfront/pricing/

http://www.cdn77.com/pricing

P2P transmission, things are a bit more complicated. Algorithms in combination with e.g. DRM implementations ensuring removal of content after 7 days, need to be in place, which currently is not the case. DRM is also not an option for public broadcasters, since they are constrained (by the Interstate Broadcasting Agreement law) to transmit "free to air & clean to air".

Subsequent Plans for Exploitation, Maintenance and Data Re-use

The key results from WP4.4 consist of a set of self-learning algorithms that allow for the dynamic prediction of metadata quality. *Dynamic* in this case means, the underlying features can be adapted to any use case, any content, and any context – not only to the QMedia and P2P related one.

Since Quality as such became more and more an issue of high relevance for the public European broadcasters in recent years, IRT is heavily involved in helping its associates to maintain and increase the quality of their offerings – this covers reliability, scalability, quality of audio / video encoding, but also metadata quality.

Therefore IRT will reuse results from QLectives, WP4.4, by adapting the self-learning algorithms towards integration into a High-Quality editor system. Based on a definition of quality as satisfying broadcasters' needs, the goal of this is to create features, integrate them into an editor system, and finally *automatically rate* the metadata entered by their editors. Additionally, the system could be used to also allow quality prediction for data coming from linked open data clouds, such as DBPedia.com, thereby assisting the editor in their enquiry efforts.

So far, IRT has finished both the design and the prototypic implementation of such an HQ editor system, and presented this prototype to ARD (Arbeitsgemeinschaft der öffentlich-rechtlichen Rundfunkanstalten der Bundesrepublik Deutschland), which is a consortium of public broadcasters in Germany. Currently, the system is being extended in order to allow semantic enquiry based on the broadcasters' metadata format BMF (Broadcast Metadata Exchange Format), in combination with automatic metadata quality prediction. Tests with editors, as planned for 2014, shall lead to a final concept and a set of requirements for a next-generation editor tool to be developed by external partners and finally introduced within ARD.

3.2 Management

In order to facilitate the visibility of the QLectives project, the project team has continues to engage in the following activities:

It maintains the QLectives Website located at www.qlectives.eu, including the QLectives Wiki located at http://www.qlectives.eu/wiki/.

The website has had over 77,215 page hits and top pages (an increase of more than 40,000 since year 3 reporting) continued to be: Project Overview, Consortium and Publications, especially Deliverables (top page).

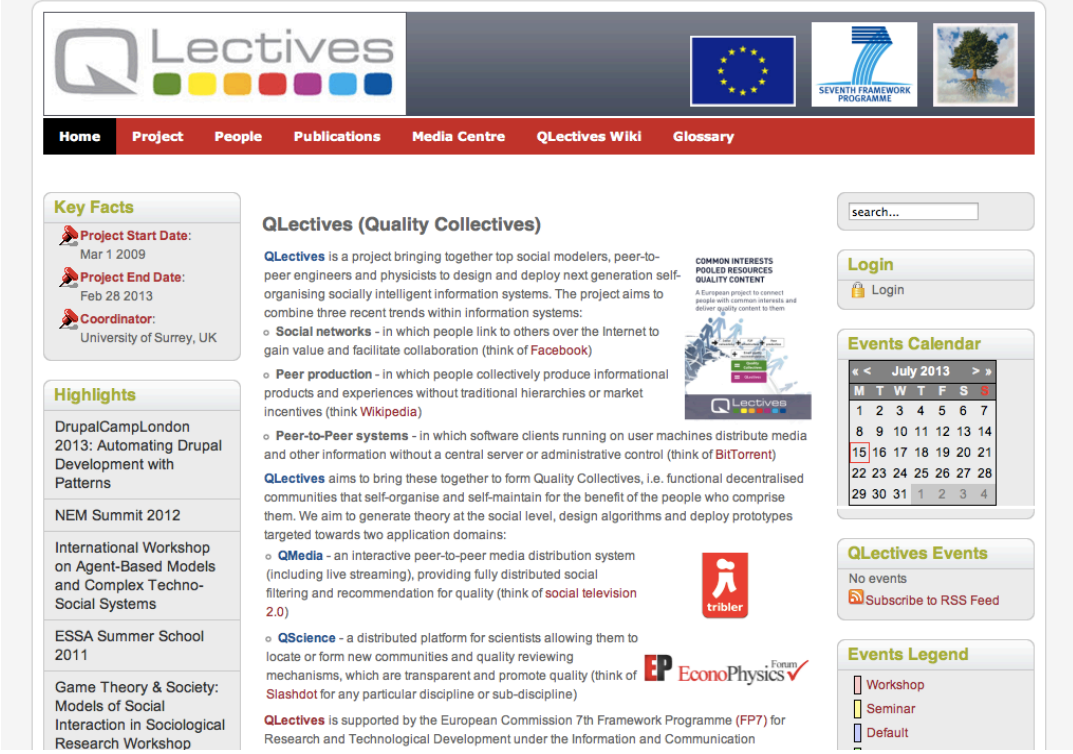

Figure 1: QLectives Website (Homepage)

4. Collaboration(s)

QLectives partners engage in various forms of collaborations, some of which are outlined below:

ETH Zurich
In year 4, ETHZ engaged in the following collaborations:

- With UniFr, USZ and UniS on the development of QScience.

University of Warsaw (UWAR)
In year 4, UWAR engaged in the following collaborations:

- With UniS on using empirical data to identify the dynamics of agents' roles and quality negotiations;
- With UniS on the P2P simulation;
- With UniS and CNRS on the analysis of external databases;
- With Fabio Cavallucchi, the head of Warsaw's Centre for Contemporary Art, Warsaw, on the organization of the Art Exhibition.

University of Fribourg (UniFR)
During the fourth year of QLectives, the UniFR team collaborated with:

- USZ and ETHZ on the development of QScience;
- UniS on QScience instances;
- ETHZ and CNRS on data validation.

CNRS
During the fourth year of QLectives, CNRS team members engaged in collaborations with:

- UniFr and UniS on the QTR model calibration and validation, specifically in the case of scientific communities;
- ETHZ and Universidad de Los Andes on quality collectives as socio-semantic networks and hypernetworks;
- Drexel University on the study of referencing and quality in Wikipedia.

TUDelft (TUD)

- TU Delft has been collaborating with USZ on development of an AI engine using the QLectives Platform's Dispersy, called GOLF;
- TU Delft with IRT and USZ have integrated GOLF into QMedia and made it ready for a user trial.

USZ
During the fourth year of QLectives, USZ collaborated with:

- TUD in the area of modeling P2P systems and in P2P algorithms, in particular the implementation of the gossip learning framework in the

QLectives platform. There has been a continuous contact and interaction between the two groups throughout the year;

- IRT in WP4.4, with USZ providing an implementation for the quality metadata algorithms;
- UF and ETHZ as USZ plays an important part in the development of the QScience platform, in cooperation with UF and ETHZ. There is a continuous and intensive communication between the developers via all sorts of channels, including face-to-face meetings, in particular, the coding weeks in the Summer and in the Winter organized by ETHZ.

IRT

During the fourth year of QLectives, IRT collaborated with:

- USZ on evaluating prepared (manually labeled) teaching and training datasets with the self-learning system;
- TUD and USZ on optimizing the stability and performance of the SPAM detection system;
- UniS, TUD and USZ in the preparation for NEM (e.g. booth layout, live demos of QScience and QMedia, posters).

5. Collection of publications

During the fourth year of the QLectives project, the QLectives partners have completed a series of publications, and engaged in the following dissemination activities.

5.1 Journal articles

Berset, Y., Medo, M. (2013) The effect of the initial network configuration on preferential attachment. European Physical Journal B, 86: 260

Cazabet, R., Takeda, H., Hamasaki, M., Amblard, F. (2012) Using dynamic community detection to identify trends in user-generated content. *Social Network Analysis and Mining*, 2(4): 361–371.

Chen, D., Zeng, A., Cimini, G., Zhang, Y.-C. (2013) Adaptive social recommendation in a multiple category landscape. European Physical Journal B, 86: 61

Cimini, G., Chen, D., Medo, M., Lü, L., Zhang, Y.-C., Zhou, T. (2012) Enhancing topology adaptation in information-sharing social networks. Physical Review E, 85: 046108

Cimini, G., Zeng, A., Medo, M., Chen, D. (2013) The role of taste affinity in agent-based models for social recommendation. Accepted in Advances in Complex Systems

Conte, R., Gilbert, N., Bonelli, G., Cioffi-Revilla, C., Deffuant, G., Kertesz, J., Loreto, V., Moat, S., Nada, J. -P., Sanchez, A., Nowak, A., Flache, A., Miguel, M. San and Helbing, D. (2012) Manifesto of computational social science. *Eur. Phys. J. Special Topics*. Vol. 214, pp. 325-346 DOI: 10.1140/epjst/e2012-01697-8

Cederman L.E., Conte R., Helbing D., Nowak A., Schweitzer F., Vespignani A. (2012). *Exploratory of Society*. *The European Physical Journal Special Topics, 214* (1), 347-360

Conte, R., Gilbert, N., Bonelli, G. and Helbing, D. (2011) FuturICT and Social Sciences: Big Data, Big Thinking. *Zeitschrift Fur Soziologie*. Vol. 40, No. 5, pp. 412-413

Conte, R., Gilbert, N., Bonelli, G., Cioffi-Revilla, C., Deffuant, G., Kertesz, K., Loretto, V., Nadal, J.P., Sanchez, A., Nowak, A., Flache, A., San Miguel, M., Helbing, D. (2012). Manifesto of Computational Social Science. *European Physical Journal Special Topics 214* (1), 325–346.

Deffuant, G., Alvarez, I., Barreteau, O., Vries, B. de, Edmonds, B., Gilbert, N., Gotts, N., Jabot, F., Janssen, S., Hilden, M., Kolditz, O., Murray-Rust, D., Roug, C. and Smits, P. (2012) Data and models for exploring sustainability of human well-being in global environmental change. *Eur. Phys. J. Special Topics.* Vol. 214, pp. 519-545 DOI: 10.1140/epjst/e2012-01704-2

Elsenbroich, C., Xenitidou, M. and Gill, A. J. (*submitted*) Norms, Quality and Dissonance: Theory and Practice of Science According to Scientists. *QLectives Working Paper*

Elsenbroich, C. (2012) Explanation in Agent-Based Modelling: Functions, Causality or Mechanisms? *Journal of Artificial Societies and Social Simulation*. Volume 15, Issue 3, page 1

Ferscha A., Farrahi K., van den Hoven J., Hales D., Nowak A., Lukowicz P., Helbing D. (2012). Socio-inspired ICT. *The European Physical Journal Special Topics 214* (1), 401-434

Grund, T., Waloszek, C., Helbing, D. (2013) How Natural Selection Can Create Both Self- and Other-Regarding Preferences, and Networked Minds. Scientific Reports 3, 1480.

Gualdi, S., Medo, M., Zhang, Y.-C. (2013) Crowd Avoidance and Diversity in Socio-Economic Systems and Recommendation. EPL, 101: 20008

Hegedűs, I., Ormándi, R. and Jelasity, M. (2013) Massively distributed concept drift handling in large networks. *Advances in Complex Systems*, 2013. in print. (doi:10.1142/S0219525913500212)

Kuhn, T., Barbano, P. E., Nagy, M. L., and Krauthammer, M. (2013) Broadening the Scope of Nanopublications. In Proceedings of the 10th Extended Semantic Web Conference (ESWC).

Liao, H., Cimini, G., Medo, M. (2012) Measuring quality, reputation and trust in online communities. In Chen, L., et al. (Eds.): ISMIS 2012/Lecture Notes in Artificial Intelligence 7661: 421, Springer-Verlag

Lü, L., Medo, M., Yeung, C. H., Zhang, Y.-C., Zhang, Z.-K., Zhou, T. (2012) Recommender Systems. Physics Reports, 519: 1-49

Mazloumian, A., D. Helbing, D., Lozano, S., Light R. P. and Börner, K. (2013) Global multi-level analysis of the 'Scientific Food Web'. Scientific Reports 3**,** 1167.

Naranjo, J.A.M., Casado, L.G. and Jelasity M. (2012) Asynchronous privacy-preserving iterative computation on peer-to-peer networks. *Computing*, 94(8–10): 763–782, (doi:10.1007/s00607-012-0200-5)

Nokkala, T., and Gill, A.J. (2012) Different Technologies for Different Collaborations: Adoption of Social Tools for Scientific Practice. *Journal of The European Higher Education Area,* 02, 2012

Nowak, A., Bartkowski, W., Samson, K., Rychwalska, A., Kacprzyk, M., Roszczyńska – Kurasińska, M., Jagielska, M. (in press) No need for speed: modelling trend adoption in a heterogeneous population. *Advances in Complex Systems*.

Ormándi, R., Hegedűs, I. and Jelasity, M. (2013) Gossip learning with linear models on fully distributed data. *Concurrency and Computation: Practice and Experience*, 25(4): 556–571, 2013. (doi:10.1002/cpe.2858)

Perelló, J., Murray-Rust, D., Nowak, A., & Bishop, S. R. (2012). Linking science and arts: Intimate science, shared spaces and living experiments. *The European Physical Journal Special Topics*, *214*(1), 597-634.

Quattrociocchi W., Amblard F., Galeota, E. (2012) Selection in scientific networks. *Social Network Analysis and Mining*, 2(3): 229–237.

Roth, C. (to appear) Socio-Semantic Systems. *Advances in Complex Systems*.

Xenitidou, M. (*in preparation*) Managing dogmatism in scientists' talk about quality in science. *To be submitted to Sociological Research Online*

Xenitidou, M., Lisiecka, K., Ziembowicz, M. and Samson, K. (*in preparation*) But would you hang it on your wall?' Evaluative practices in interaction. To be submitted to *Mind & Society*

Zeng, A., Cimini, G. (2012) Removing spurious interactions in complex networks. Physical Review E, 85: 036101

Zeng, A., Gualdi, S., Medo, M., Zhang, Y.-C. (2013) Trend prediction in temporal bipartite networks: the case of Movielens, Netflix, and Digg. Accepted in Advances in Complex Systems

Zhang, Z.-K., Zhou, T., Zhang, Y.-C. (2011) Tag-Aware Recommender Systems: A State-of-the-Art Survey. Journal of Computer Science and Technology, 26: 767-777

5.2 Peer reviewed conference papers and compendiums

Capotă, M., Nazareno, A., Pouwelse, J., Epema, D. (2013*) Investment Strategies for Credit-Based P2P Communities*. In 2013 21st Euromicro International Conference on Parallel, Distributed, and Network-Based Processing, pp. 437-443.

Chen, C.-C., Roth ,C. (2012) {{Citation needed}}: *The dynamics of referencing in Wikipedia*. WikiSym'12, 8th Intl Symposium on Wikis and Open Collaboration, Linz, Austria, Aug 27-29, 2012.

Chen, X., Chu, X., Lu Jia, A. and Pouwelse, J. (2012) *Inequity of Sharing Ratio Enhancement in Darknet: Measurement and Improvement*. In IEEE HPCC 2012, Liverpool, UK.

Chiluka, N., Andrade, N. Gkorou, D., Pouwelse, J. and Sips, H. (2012) *Leveraging Trust and Distrust for Sybil-Tolerant Voting in Online Social Media.* In World Wide Web (WWW 2012), Workshop on Privacy and Security in Online Social Media.

Chiluka, N., Andrade, N. Gkorou, D. and Pouwelse, J. (2012) *Personalizing EigenTrust in the face of Communities and Centrality Attack*. In Advanced Information Networking and Applications, IEEE.

Delaviz, R., Zeilemaker, N., Pouwelse, J. and Epema, D. (2013) *A Network Science Perspective of a Distributed Reputation Mechanism*. IFIP Networking 2013.

Delaviz, R., Pouwelse, J. A and Epema D.H.J (2012) *Targeted and scalable information dissemination in a distributed reputation mechanism.* In Proceedings of the seventh ACM Workshop on Scalable Trusted Computing (ACM STC), pp. 55-66.

Delaviz, R., Andrade, N., Pouwelse, J.A and Epema D.H.J. (2012) *SybilRes: A Sybil-resilient Flow-Based Decentralized Reputation Mechanism*. In IEEE 32nd International Conference on Distributed Computing Systems (ICDCS), pp. 203-213.

Gill, A.J., Brockmann, C., and Oberlander, J. (2012) *Perceptions of Alignment and Personality in Generated Dialogue*. Proceedings of the 7th International Natural Language Generation Conference (INLG 2012), 40–48, Utica, IL, May 2012.

Gkorou, D., Vinkó. T., Chiluka, N., Pouwelse, and Epema, D. (2012) *Reducing the History in Decentralized Interaction-Based Reputation Systems*. In IFIP Networking.

Hegedűs, I., Ormándi, R. and Jelasity M. (2012) *Gossip-based learning under drifting concepts in fully distributed networks*. In Sixth IEEE International Conference on Self-Adaptive and Self-Organizing Systems (SASO), pp. 79–88. IEEE Computer Society, 2012. (doi:10.1109/SASO.2012.13)

Lu Jia, A., Pouwelse. J. and Epema, D. (submitted) *Estimating user interaction strength in online networks*. IEEE Infocom.

Lu Jia, A., Chen, X., Chu, X., Pouwelse, J. and Epema, D. (2013) How to survive and thrive in a private BitTorrent community. *In the 14th International Conference on Distributed Computing and Networking (ICDCN '13),* Mumbai, India.

Lu Jia, A., Rahman, R., Vinko, T., Pouwelse, J. and Epema, D. (2012) *Systemic Risk and User-Level Performance in Private P2P Communities*. IEEE Transactions on Parallel and Distributed Systems Online.

Petrocco, R., Pouwelse, J. and Epema, D. (2012) *Performance Analysis of the Libswift P2P Streaming Protocol*. In 12-th IEEE International Conference on Peer-to-Peer Computing (P2P12).

Szörényi, B., Busa-Fekete, R., Hegedűs, I., Ormándi, R., Jelasity, M. and Kégl, B. (2013) *Gossip-based distributed stochastic bandit algorithms*. In Proceedings of the 30th International Conference on Machine Learning (ICML). <http://jmlr.org/proceedings/papers/v28/szorenyi13.pdf>

5.3 Books and book chapters

Gilbert, N., Xenitidou, M., Dosch, C., Helbing, D., Jelasity, M., Nowak, A., Pouwelse, J., Roth, C. and Zhang, Y-C. (Eds) (forthcoming) *Quality collectives: evolving socio-technical systems to support quality*. EPub

Hegedűs, I., Busa-Fekete, R., Ormándi, R., Jelasity, M. and Kégl B. (2012) *Peer-to-peer multi-class boosting*. In Christos Kaklamanis, Theodore Papatheodorou, and Paul G. Spirakis, editors, *Euro-Par 2012*, number 7484 in Lecture Notes in Computer Science, pp. 389–400. Springer-Verlag, (doi:10.1007/978-3-642-32820-6_39)

5.4 Talks and presentations

Cazabet, R., Leguistin, M., Amblard, F. (2012) Automated community detection on social networks: useful? efficient? asking the users. Proceedings of the 4th International Workshop on Web Intelligence & Communities, p.1-6.

Elsenbroich, C. (2013) Situational Analysis of Games, Social Path, AISB, April 2013.

Elsenbroich C. (2013) Agent-based modelling as a tool for theory exploration, Formal Methods in an Informal World, Lorenzcentre, Leiden, Netherlands, March 2013.

Elsenbroich, C. and Verhagen, H. (2012) Going Beyond Atomism: Intentionality, Sociality and (the Modelling of) Normative Behaviour. First European Network for the Philosophy of the Social Sciences Conference, Copenhagen, Sept 2012.

Elsenbroich, C. and Gilbert, N. (2012) An Agent-based Model of Situational Action Theory. European Social Simulation Association Annual Conference, Salzburg, Sept 2012.

Helbing, D. (2012) The FuturICT Knowledge Accelerator: Exploring and Managing our Future, BCAM. - Basque Center for Applied Mathematics, Bizkaia Technology Park, Bilbao, Spain, 3 Feb, 2012.

Helbing, D. (2012) FuturICT – Global Participatory Computing for Our Complex World., Out Of The Box Conference 2012, Maribor, Slovenia, 17 May, 2012.

Helbing, D. (2012) FuturICT - New science and technology for a more resilient and sustainable future., Annual Convention Association for Psychological Science., Chicago, Illinois, USA, 24 May, 2012.

Helbing, D. (2012) Keynote Talk: FuturICT – Global Participatory Computing for Our Complex World, Keynote Talk at International Conference on Computational Science, Omaha, Nebraska, USA, 5 June, 2012.

Helbing, D. (2012) FuturICT – Global Participatory Computing for Our Complex World., Swissnex, San Francisco, 12 June, 2012.

Helbing, D. (2012) Spontaneous Outbreak and Breakdown of Social Coordination and Cooperation., International Workshop on Agent-Based Models and Complex Techno-Social Systems, Zurich, Switzerland, 4 July, 2012.

Helbing, D. (2012) FuturICT – Global Participatory Computing for Our Complex World., Keynote Talk at Blankensee-Colloquiums 2012: Neighborhood Technologies. Media and Mathematics of Dynamic Networks, Berlin, Germany, 30 August, 2012.

Helbing, D. (2012) FuturICT – Global Participatory Computing for Our Complex World., Swissgrid, Frick, Switzerland, 12 September, 2012.

Helbing, D. (2012) FuturICT – Global Participatory Computing for Our Complex World., Workshop: Rational Choice Sociology: Theory and Empirical Applications, Venice, Italy, 27 November, 2012.

Helbing, D. (2013) The FuturICT Flagship Project - A response to the challenges of the future., European Futurists Conference, Lucerne, Switzerland, 30 November, 2012.

Helbing, D. (2013) FuturICT – Global Participatory Computing for Our Complex World, Nanyang Technological University, Singapore, 18 Jan, 2013.

Kuhn, T. (2013) Broadening the Scope of Nanopublications. 10th Extended Semantic Web Conference (ESWC), Montpellier,. 29 May 2013. - Kuhn, T. (2013) Designing a System for the Future of Scholarly Communication. SOMS Colloquium, ETH Zurich,. 27 March 2013. - Kuhn, T. (2013) Hash-URIs. Beyond the PDF 2 Conference, Amsterdam,. 20 March 2013.

Roth, C. (2012). Socio-epistemic Hypergraphs. ASSYST Workshop, Venice, Italy, Feb 26- 28, 2012.

Roth, C. (2012). The public space as a socio-semantic system. Humboldt Universitat, Berlin Graduate School Social Blockseminar, Apr 27, 2012.

Roth, C. (2012) Socio-semantic frameworks for techno-social systems. Keynote at 3d MASHS 2012, Paris, Jun 4-5, 2012.

Roth, C. (2012) Socio-semantic frameworks for techno-social systems, Keynote at SOMS 2012-Agent-Based Models in Socio-Technical Systems, Zurich, Switzerland, July 2-4, 2012.

Roth, C. (2012) Social dynamics of topical communities, Workshop "Graph Dynamics", U. Paris VI, Jul 10, 2012.

Roth, C., Wu, J., Lozano, S., Taramasco, C., Cointet, J.-P., Bucheli, V. (2013) Appraising scientific impact from local dynamics of citation and socio-semantic networks, Sunbelt 33rd Intl Conf on Social Networks, Hamburg, Germany, May 22.

Verhagen, H. and Elsenbroich, C. (2012) Putting the agent back together again: Needs for integrating social and behavioural sciences for agent-based social simulation. NorMAS 2012, Dagstuhl, Germany, Mar 2012.

Xenitidou, M. (2013) *Managing Dogmatism in Scientist's Talk about Quality in Science*. Paper presented in CRESS, February, 2013.

Pouwelse, J. (2012) "4th generation peer-to-peer technology", **Stanford University**, Invited talk for course EE380, http://www.stanford.edu/class/ee380/Abstracts/120530.html,

http://www.youtube.com/watch?v=JQiLaKdzD0E

Pouwelse, J. (2013) "Protecting your privacy in a networked world", IDEA Summer School, 15 – 17 July 2013

http://ethicsandtechnology.eu/news/protecting-your-privacy-in-a-networked-world-idea-summerschool-2013-15-17-july-2013/

Pouwelse, J. (2012) "Value sensitive design for social networking". IDEA Summer School, 27-29 August, 2012

https://edit.ethz.ch/idea/education/summerschools/index/edit/Social_Networking-TU_Delft-2012

Jelasity M. (2012) Gossip Learning, CSL Conference, Swedish Institute of Computer Science (SICS), Lejondals slott, Sweden, invited talk.

Jelasity M. (2012) Learning in networks of millions of nodes, Seminar of Departamento de Arquitectura de Computadores y Electrónica, Universidad de Almería, 11:00am, May 23, 2012, Almería, Spain, invited talk.