

Influence Factors for Sharing Open Science and Open Educational Resources through Social Networking Services

Hendrik Kalb, Henri Pirkkalainen, Jan Pawlowski, Eric Schoop

hendrik.kalb@tu-dresden.de, henri.j.pirkkalainen@jyu.fi,
jan.pawlowski@jyu.fi, eric.schoop@tu-dresden.de

Abstract: In a knowledge society it is crucial to serve the need for accurate and up-to-date knowledge produced by scientists. The possibilities of electronic communication through the use of social software provides means for open discourse and offers easier ways to make scientific and educational resources available that can be used in knowledge management and e-learning. Within this paper, we describe how researchers share knowledge in the form of artefacts. These artefacts consist of open science and open educational resources. The focus will be on understanding the influence factors for sharing these artefacts with social networking services. Through the research, an improved understanding of the decision making and sharing habits of a researcher will be obtained for the use of social software for globally distributed and open scientific communication.

1 Introduction

The goal of this paper is to identify freely available resources provided by scientists and to understand some of the key influence factors for sharing these resources with social networking services. These resources are produced originally for the purposes of research or education and are manifested in the terms of open science and open educational resources. Open science resource (OSR) refers to freely public available research artefacts while open educational resources describe technology-enabled and open resources (such as learning object, didactical design etc.) used for educational purposes [UNE02]. The overall outcome of our research is to structure, understand and facilitate the use of OER and OSR by researchers. Our focus is on social software because of its potential for easy ways to spread, distribute, and disseminate information to a wide community as well as to encourage people to dialogue and discourse. Our research is on the one hand distinctive because it integrates influences of knowledge sharing with influences of technology acceptance in one model. On the other hand, we bring together the two key elements of academia in the tradition of Humboldt - research and teaching [SW00] - and focus on the open sharing of research artefacts as well as educational resources.

Nowadays, the up-to-dateness of knowledge is changing very fast and therefore, a refreshing and relearning of erstwhile gathered knowledge (e.g. during a study) is needed permanently. The demand is mostly driven by appearing problems, ideas, trends or similar triggering activities and therefore can hardly be planned. That's why the informal knowl-

edge exchange and self-reliant knowledge acquisition by employees is getting more and more important. Contrary to the pre-internet and pre-Web 2.0 era when the main knowledge resources were books and trainings, today an ad-hoc need for knowledge leads often to a query in Google or Wikipedia. As a matter of fact a lot of useful information or codified knowledge are available in the Web and often the most difficult decision is to separate the trustworthy information from rumors, meanings and opinions.

Due to the fact that reputation is one of the most important factors for the success of universities and scientists, we can assume that information officially provided by universities or scientists (e.g. through publications or university web pages) have a high quality compared to other available information in the internet. Hence, these pieces of information can be more easily trusted compared to other information sources and used to meet occurring needs. This means that the resources provided by reliable sources build an excellent foundation of external resources for the knowledge management and e-learning needs of a company. That applies as long as an adequate amount is freely available. Therefore, we focus our research on how to facilitate the sharing of these resources by the scientists.

The paper is structured as following: The second chapter describes the artefacts for open science and open education while the third chapter explains how social networking services as one type of social software can be used as an supporting infrastructure for knowledge sharing. In chapter four we introduce our research model which aims at the understanding of knowledge sharing via social software by scientists and disclose the model of influences that act as the basis for our current research. The last chapter shows our further steps, expected results and emphasizes the practical relevance.

2 Artefacts in open science and open education

In the following we explain the meaning of open science and open education and show exemplary the artefacts that can be shared. A scientist can communicate about her research in closed or open ways. In our research we concentrate on the public part of the communication. Beside research, most of the scientists (or scientific staff) in universities and academies are engaged as well in education and in some countries like Germany, the university system is explicitly based on the unity of research and teaching. Therefore, we include in our research the use of social software for educational purposes.

”In short, openness means ’shared’” [FSdB09, p. 8]. But there are difficulties for such a binary distinction between closed and open resources or behavior. Instead openness must be seen as a spectrum with the extreme of closed resources that are not accessible by anyone at the one end and the extreme of open resources that are available and modifiable by everybody at the other end [Max06, S. 122].

Today’s discussion about open science are mostly based on the sociology of science formulated by Robert King Merton [Mer79]. Science is described a system within the scientist act as an individual, her career is solely influenced by reputation and the scientist has to communicate openly about her research [Zim94]. The discussion about open science got a new stimulation through the phenomena of open source initiatives. Open source could

be seen as free available software with a free available open source code. Thereby, it facilitates the use and further development of software for all. Beside other "open" initiatives, the emergence of open source has influenced the understanding of open science and leads to initiatives which are aiming on the free availability of knowledge and artefacts to perform research processes [Sch07b]. The research artefacts - that we summarize in the following under the term of open science resources (OSR) - and related initiatives are **publications** that are open access [MS09, Pet10], open **data** [ASB⁺04, US07], open **workflows** [FSdB09], open **model** [FSK07, KSF06] and **ideas, experiences, etc.** that are shared e.g. in the personal blog of the scientist.

Contrary to the openness of research, ongoing discussions and past studies regarding open education are very often connected to a specific resource or an artefact [AF10]. Searching for a common definition for open education is therefore quite problematic. UNESCO has described OER as: "technology-enabled, open provision of educational resources for consultation, use and adaptation by a community of users for non-commercial purposes"[UNE02]. However, OER are not always altruistic or non-commercial. In principle, OER mean that they are freely accessible and re-usable in different licensing conditions. These resources include different objects, such as digital learning objects, articles, textbooks, software tools, simulations or animations, electronic textbooks, as well as syllabi, curricula and teachers' guides [UNE02, PP10]. The main aspect is that the object is usable to improve education.

Within this chapter we have given an understanding of open science and open education as well as the belonging artefacts. Because our research is addressing the sharing of these artefacts via social networking services, we clarify in the next chapter the concept before we integrate both aspects in one research model.

3 Social networking services as enabling infrastructure

In the following we explain our understanding of social networking services. While our overall research focuses on social software in general, due to the manifold kinds of social software and associated purposes we have to limit our inspection on one type.

Social networking services (SNS) facilitate an individual to represent themselves and to manage a network of contacts. Both are important aspects for scientific careers because a scientist on the one hand need to be identifiable to gain reputation and new contacts. On the other hand the scientist has to maintain her network of collaboration, research and discussion partners as well as other loose scientific contacts.

The core features of SNS are that individuals represent themselves to other users in a profile and build a network of contacts [GA05]. The profile can be public or semi-public within the system and the network of contacts is traversable so that possible paths between the own and other profiles are transparent [BE07]. One of the most popular social networking service is Facebook¹. Examples for social networking services that focus on the

¹www.facebook.com

needs of scientists are ResearchGate² and Academia.edu³.

Next to identity management and network maintenance, exchange functionalities are a typical basic feature of SNS and allow the user to share information directly (via message) or indirectly (e.g. publication list or photo album) [RK08]. Thereby, the scientist has the possibility to share scientific information and educational resources in and over the SNS. Moeslein, Bullinger and Soeldner [MBS09] examined 24 SNS with professional or academic target group regarding the categories identity and network, interaction and communication, information and content, topical focus, and degree of openness. The majority of the sample is free, open for everyone and has a generic topical focus. A personal profile, directory of and search for profiles, data or/and paper upload, and messages are typical functions [MBS09]. Hence, existing SNS provide an opportunity for scientists to enhance the maintenance of their network of contacts and to increase reputation through their shared information and resources.

With the description of social software and social networking services we have introduced the second foundation for our research beside OSR and OER. In the next chapter we will use these concepts to build a model that explains the influences in the decision process for sharing OSR and OER via social networking services.

4 Influencing the sharing behavior

After explaining foundations and relevant aspects of our overall research previously, now we describe how we inquire the influence factors for using social software to share scientific and educational artefacts. Our study aims at understanding motivations to share and also the level of decision support provided for the researchers. Therefore, we build a model that combines influence factors of technology acceptance and knowledge sharing. The study is part of our overall research that strives to structure, understand and facilitate the use of OER and OSR by scientists. Improved opportunities to share and (re-)use should increase the amount of high quality open resources and the number of scientists who are actively involved.

In order to understand the approach to our proposed research model presented within this chapter, the following describes how this is in line with our overall research: Our research ties together on one hand OSR/OER related sharing processes, identifying the relevant artefacts. Previously, we have taken initial steps to structure the OER related processes [PTP⁺10]. On the other hand, we strive to understand the needs and motivations of international researchers to share and exchange knowledge about the artefacts by using social software. To achieve this, we are analysing what types of social software are relevant for the tasks and studying what type of decision support is available for the researchers in technology selection. The focus of the proposed research model is to find out some of the key influence factors for sharing the aforementioned artefacts by SNS and to find out available decision support for the researchers.

²www.researchgate.net

³www.academia.edu

Due to our focus on the use of a technology on the one hand and a sharing behavior on the other, we have started with an literature review on technology acceptance and knowledge sharing especially with a focus on social software or the university context. Thereby, we have found some studies which are inquiring similar questions like using social software in lectures [AH08], sharing knowledge on conferences [RT09] or sharing knowledge in networks of practice [WF05]. But as far as we could see there exists no research that explains the sharing behavior of OSR and OER via social software or SNS. Hence, we have to build an own initial research model. Therefore, we examined existing studies for technology acceptance as well as knowledge sharing, chose the most promising constructs for our research and discussed these with different scientists. For the initial model we identified nine influence factors for the behavioral intention to share OSR and OER via SNS. Figure 1 illustrates the constructs and relationships of our influence model of open scientific knowledge sharing via SNS. Now all the constructs will be explained in detail and we argue why they are relevant in the context of our research.

The acceptance or adoption of a specific system is reflected in the use of this system and represented in the technology acceptance model (TAM) by the construct of the behavior. The intention to behave is a strong and in the TAM the only one predictor of the behavior [Dav85, DBW89, Dav89]. The latter is not measured as long as the system is not available and the aim of a study is to predict acceptance of a system. Because we do not want to predict the acceptance of a single system in our inquiry and focus instead on a software category we just include the measuring of behavioral intention and assume it as the main predictor of the actual use of social software by scientists.

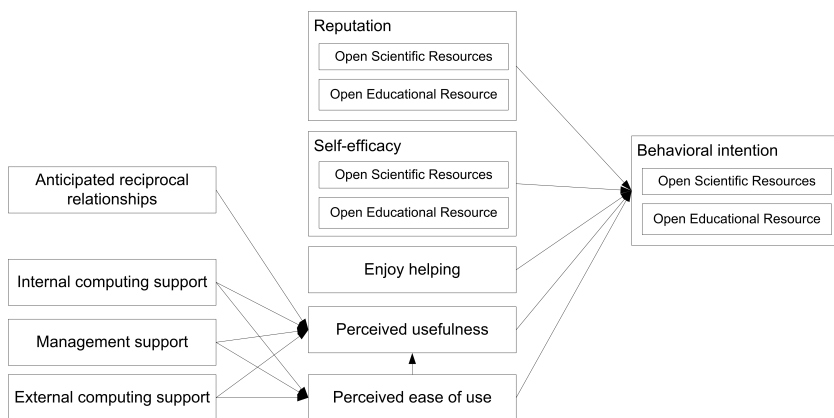


Figure 1: Influence model of open scientific knowledge sharing via SNS

Perceived usefulness and perceived ease of use are antecedents of behavioral intention but perceived ease of use determines perceived usefulness as well. Perceived usefulness is "the degree to which a person believes that using a particular system would enhance her job performance" [Dav89, S. 320]. In our context this means that the scientist sees the use of social software as an favourable activity to perform her job or career. On the other hand the ease of use is "the degree to which a person believes that using a particular system

would be free of effort” [Dav89, S. 320] and therefore, it refers to how easy the scientist estimates the use of social software. The assumption is now that the more useful and easy the scientists expect the system the higher is her intention to use the system. Beside the direct influence on behavioral intention the perceived ease of use determine as well the perceived usefulness and hence we hypothesize that a higher perceived ease of use leads to higher perceived usefulness.

Previous research on IS discipline and SMEs has indicated various exogenous factors influencing technology acceptance [DBW89, Igb93]. These include intra- and extraorganizational factors. We have selected from the intraorganizational factors internal personal computing support which describes the level of support from intraorganizational sources such as information center or similar computing support services. By offering the scientists with decision support for technology selection in the form of policies for use, best practices and recommendations what software to use, we can assume an influence on the acceptance of SNS. Another intraorganizational factor included in our study is management support which has been proven to have a strong influence for system’s success [Igb94, CS86]. Management support provides sufficient allocation of resources and acts as a change agent for more productive environment ensuring IS success [IZCC97]. By enabling scientists with necessary resources, support and also with good access to the appropriate software, management can strongly influence the acceptance of technology.

From the extraorganizational point of view we have selected external computing support which describes advice and support from external sources such as vendors, consultants or any other external entities [IZCC97]. As with the internal computing support, decision support offered to the scientist can have a strong influence in the acceptance of technology. Our hypothesis is that all of the three previously mentioned factors (internal personal computing support, management support and external computing support) have a direct influence on the perceived usefulness and perceived ease of use of SNS.

As we mentioned before, we combine the acceptance of a technology with intention to share information or knowledge. From the view of knowledge sharing we identified reputation [WF05], enjoy helping [WF05], anticipated reciprocal relationships [BZKL05] and self-efficacy [KKB10] as the most promising influencing constructs in our context. For reputation, self-efficacy and behavioral intention we distinguish explicitly between OSR and OER because the attitudes and intentions regarding sharing can depend on the type of knowledge that is shared. But furthermore, we assume that enjoy helping and anticipated reciprocal relationships will not be influenced by the knowledge type.

Former studies have shown that the possibility to increase reputation is a strong influence factor for knowledge sharing in networks of practice [WF05] and under the term image it determines the perceived usefulness [VB08]. For the career of a scientist her reputation is one of the most important factors. Therefore, we assume that the perceived capability of social networking services to increase reputation has a strong influence on the acceptance of such a system by scientists. We prospect a direct influence on the sharing intention via SNS. Because reputation that is supporting a scientific career is mainly achieved by research informations we distinguish between reputation earned by the sharing of scientific or educational resources.

Beside the extrinsic motivation of reputation individuals can gain intrinsic motivation from sharing. Former studies have shown that enjoy helping has a significant influence on the intention to share in electronic networks of practice even when the influence is not as strong as for the construct of reputation [WF05]. In our context, we assume as well that some scientists feel fun or satisfaction by sharing their knowledge. Therefore, we hypothesize that enjoy helping has a direct influence on the intention to share different artefacts via social networking services.

The motivation to share can be influenced as well by an expected improvement or maintenance of relationships with other individuals. If an individual believes that sharing information or knowledge will contribute to a maintenance of the relationships with other important persons he or she will be more inclined to behave openly. Hence, the anticipated reciprocal relationships has an influence on the attitude and intention to share [BZKL05]. Most scientists profit as well if they are able to maintain and extend their personal network. An SNS aims per definition on the maintenance of a personal network. Therefore, we hypothesize that higher anticipated reciprocal relationships will lead to higher perceived usefulness and increases indirectly the intention to share in the SNS.

Another influence factor for knowledge or information sharing is that an individual has something to share and believes that it is useful for someone other. Hence, the confidence in the ability to share useful knowledge encourages the intention to share. The corresponding construct is self-efficacy [KKB10]. A scientist has normally a lot of useful knowledge. Nevertheless the perceived self-efficacy could vary depending on the status or personality of the individual. Therefore, we hypothesize that a higher self-efficacy leads to a higher intention to share via SNS.

A whole picture of the constructs and relationships of our proposed model to explain sharing intention of OER and OSR via SNS is shown in figure 1. We have combined three constructs of the TAM (behavioral intention, perceived usefulness and perceived ease of use) with other technology acceptance related constructs (internal computing support, management support and external computing support) and influence factors taken from knowledge management (reputation, self-efficacy, enjoy helping and anticipated reciprocal relationships).

Our research model illustrates some of the key influence factors for sharing intention. We will use it as a tool to provide support to the researchers by understanding and structuring the potentials of social software in sharing of OER and OSR. It will be validated in the IS discipline and can finally be modified and extended to enable researching of sharing intention factors for SNS, other social software technologies, and across disciplines.

5 Conclusions

In this paper we have described the importance of public available scientific and educational resources and their sharing via social software by scientists. We have shown and theorized our model of hypothesis that structures and presents the key influence factors. It will be measured with an online questionnaire that is send to international scientists.

With an understanding of decision and acceptance processes in the use of social software by scientist for sharing knowledge and knowledge artefacts we are able to understand and structure the knowledge sharing behavior of a researcher, support the knowledge society to approach sharing of open resources and finally to bring the community closer together with common practices. When brought together, we can assume that thereby a bigger amount of up-to-date and high quality artefacts will be available and a critical mass to serve specific knowledge demands in companies can be reached. Hence, the acquisition and use of external resources will be much easier. With this initial study, an improved understanding towards the use of social networking services by scientists is acquired.

References

- [AF10] Panagiota Alevizou and Andrea Forte. Engaging with Open Education. In *WikiSym '10: the 6th International Symposium on Wikis and Open Collaboration*, Gdansk, Poland, 2010.
- [AH08] Haya Ajjan and Richard Hartshorne. Investigating faculty decisions to adopt Web 2.0 technologies: Theory and empirical tests. *Internet and Higher Education*, 11(2):71–80, 2008.
- [All04] Chris Allen. Tracing the evolution of social software, 2004.
- [ASB⁺04] Peter Arzberger, Peter Schroeder, Anne Beaulieu, Geof Bowker, Kathleen Casey, Leif Laaksonen, David Moorman, Paul Uhler, and Paul Wouters. Promoting Access to Public Research Data for Scientific, Economic, and Social Development. *Data Science Journal*, 3:135–152, Nov 2004.
- [BE07] Danah Boyd and Nicole Ellison. Social Network Sites: Definition, History, and Scholarship. *Journal of Computer-Mediated Communication*, 13(1):210–230, 2007.
- [Bjö04] Bo-Christer Björk. Open access to scientific publications - an analysis of the barriers to change? *Information Research*, 9(2), 2004.
- [BZKL05] Gee-Woo Bock, Robert Zmud, Young-Gul Kim, and Jae-Nam Lee. Behavioral Intention Formation in Knowledge Sharing: Examining the Roles of Extrinsic Motivators, Social-Psychological Forces, and Organizational Climate. *Management Information Systems Quarterly*, 29(1):87–111, 2005.
- [CS86] Robert Cerveny and G. Lawrence Sanders. Implementation and structural variables. *Information & Management*, 11(4):191–198, 1986.
- [Dav85] Fred D. Davis. *A technology acceptance model for empirically testing new end-user information systems: Theory and results*. PhD thesis, Sloan School of Management, Massachusetts Institute of Technology, Cambridge (USA), 1985.
- [Dav89] Fred D. Davis. Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. *Management Information Systems Quarterly*, 13(3):319–339, 1989.
- [DBW89] Fred D. Davis, Richard Bagozzi, and Paul Warshaw. User acceptance of computer technology: A comparison of two theoretical models. *Management Science*, 35(8):982–1003, 1989.

- [FSdB09] Jenny Fry, Ralph Schroeder, and Matthijs den Besten. Open science in e-science: contingency or policy? *Journal of Documentation*, 65(1):6–32, 2009.
- [FSK07] Ulrich Frank, Stefan Strecker, and Stefan Koch. Open Model - ein Vorschlag für ein Forschungsprogramm der Wirtschaftsinformatik. In Andreas Oberweis, Christof Weinhardt, Henner Gimpel, Agnes Koschmider, Victor Pankratius, and Björn Schnizler, editors, *eOrganisation: Service-, Prozess-, Market-Engineering. Tagungsband der 8. Internationalen Tagung Wirtschaftsinformatik*, volume 1, pages 217–234, Karlsruhe, 2007. Universitätsverlag Karlsruhe.
- [GA05] Ralph Gross and Alessandro Acquisti. Information revelation and privacy in online social networks. In *Proceedings of the 2005 ACM workshop on Privacy in the electronic society*, pages 71–80, New York, 2005.
- [Igb93] Magid Igbaria. User acceptance of microcomputer technology: An empirical test. *Omega*, 21(1):73–90, 1993.
- [Igb94] Magid Igbaria. An examination of the factors contributing to microcomputer technology acceptance. *Accounting, Management and Information Technologies*, 4(4):205–224, 1994.
- [IZCC97] Magid Igbaria, Nancy Zinatelli, Paul Cragg, and Angele L M Cavaye. Personal Computing Acceptance Factors in Small Firms: A Structural Equation Model. *Management Information Systems Quarterly*, 21(3):279–305, Dec 1997.
- [KBS09] Hendrik Kalb, Helena Bukvova, and Eric Schoop. The Digital Researcher: Social Software in the Research Process. In *Current Issues in Management of Business and Society Development*, Riga, Lettland, 2009.
- [KKB10] Minhyung Kang, Young-Gul Kim, and Gee-Woo Bock. Identifying different antecedents for closed vs. open knowledge transfer. *Journal of Information Science*, Jul 2010.
- [KR07] Michael Koch and Alexander Richter. Social Software - Status Quo und Zukunft. Technical Report 2007-01, Universitaet der Bundeswehr München, Fakultat fuer Informatik, February 2007.
- [KSF06] Stefan Koch, Stefan Strecker, and Ulrich Frank. Conceptual Modelling as a New Entry in the Bazaar: The Open Model Approach. In Ernesto Damiani, Brian Fitzgerald, Walt Scacchi, Marco Scotto, and Giancarlo Succi, editors, *Open Source Systems*, pages 9–20, Heidelberg, 2006. Springer.
- [Max06] Elliot Maxwell. Open Standards, Open Source, and Open Innovation: Harnessing the Benefits of Openness. *Innovations: Technology, Governance, Globalization*, 1(3):119–176, Jul 2006. doi: 10.1162/itgg.2006.1.3.119.
- [MBS09] Kathrin Moeslein, Angelika Bullinger, and Jens Soeldner. Open Collaborative Development: Trends, Tools, and Tactics. *Lecture Notes in Computer Science*, 5610:874–881, 2009.
- [Mer79] Robert K. Merton. *The Sociology of Science: Theoretical and Empirical Investigations*. The University of Chicago Press, Chicago, London, 1979.
- [MS09] Eric T. Meyer and Ralph Schroeder. The world wide web of research and access to knowledge. *Knowledge Management Research & Practice*, 7(3):218–233, 2009.
- [Pet10] Michael Peters. Three Forms of the Knowledge Economy: Learning, Creativity and Openness. *British Journal of Educational Studies*, 58(1):67–88, 2010.

- [PP10] Henri Pirkkalainen and Jan Pawlowski. Open Educational Resources and Social Software in Global E-Learning Settings. In Pertti Yliluoma, editor, *Sosiaalinen Verkko-oppiminen*, pages 23–40. IMDL, Naantali, 2010.
- [PTP⁺10] Henri Pirkkalainen, Stefan Thalmann, Jan Pawlowski, Markus Bick, Philipp Holtkamp, and Kyung-Hun Ha. Internationalization Processes for Open Educational Resources. In Pasi Tyrväinen, Slinger Jansen, and Michael A. Cusumano, editors, *Workshop on Competencies for the Globalization of Information Systems in Knowledge-Intensive Settings on the 1st International Conference on Software Business, ICSOB 2010*. Springer, 2010.
- [Ray99] Eric S. Raymond. *The Cathedral & the Bazaar: Musings on Linux and Open Source by an Accidental Revolutionary*. O'Reilly Media, Sebastopol, 1999.
- [RK08] Alexander Richter and Michael Koch. Functions of Social Networking Services. In P Hassanaly, A Ramrajsingh, D Randall, P Salembier, and M Tixier, editors, *Proceedings of the International Conference on the Design of Cooperative Systems 2008*, pages 87–98, Carry-le-Rouet, France, 2008.
- [RT09] Iris Reychav and Dov Te'eni. Knowledge exchange in the shrines of knowledge: The "how's" and "where's" of knowledge sharing processes. *Computer & Education*, 53(4):1266–1277, 2009.
- [Sch07a] Jan Schmidt. Social Software: Facilitating information-, identity- and relationship management. In Thomas N. Burg and Jan Schmidt, editors, *Blog Talks Reloaded. Social Software - Research & Cases*, pages 31–50. Books on Demand GmbH, Norderstedt, 2007.
- [Sch07b] Ralph Schroeder. e-Research Infrastructures and Open Science: Towards a New System of Knowledge Production? *Prometheus*, 25(1):1–17, 2007.
- [Shi03a] Clay Shirky. A Group Is Its Own Worst Enemy. Santa Clara: Keynote zur Emerging Technology Conference 2003, 2003. http://www.shirky.com/writings/group_enemy_old.html.
- [Shi03b] Clay Shirky. Social Software and the Politics of Groups., 2003. http://www.shirky.com/writings/group_politics.html.
- [SW00] Uwe Schimank and Markus Winnes. Beyond Humboldt? The relationship between teaching and research in European university systems. *Science and Public Policy*, 27(6):397–408, 2000.
- [Tuf08] Zeynep Tufekci. GROOMING, GOSSIP, FACEBOOK AND MYSPACE: What can we learn about these sites from those who won't assimilate? *Information, Communication & Society*, 11(4):544–564, 2008.
- [UNE02] UNESCO. UNESCO promotes new initiative for free educational resources on the Internet, 2002. http://www.unesco.org/education/news_en/080702_free_edu_ress.shtml.
- [US07] Paul F. Uhrlir and Peter Schröder. Open Data for Global Science. *Data Science Journal*, 6:36–53, Jun 2007.
- [VB08] Viswanath Venkatesh and Hillol Bala. Technology Acceptance Model 3 and a Research Agenda on Interventions. *Decision Sciences*, 39(2):273–315, 2008.
- [WF05] Molly McLure Wasko and Samer Faraj. Why should I share? Examining social capital and knowledge contribution in electronic networks of practice. *Management Information Systems Quarterly*, 29(1):35 – 57, 2005.
- [Zim94] John Ziman. *Prometheus Bound: Science in a dynamic steady state*. Cambridge University Press, Cambridge (UK), 1994.