# Online communication beyond the scientific community

## Scientists' use of new media in Germany, Taiwan and the United States to address the public

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Yin-Yueh Lo

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Supervisor: Prof. Dr. Hans Peter Peters

Second examiner: Prof. Dr. Alexander Görke

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# 1 Introduction and overview

The diffusion of the Internet has been celebrated in the last decades, and the popularization of mobile devices and new online media has greatly changed human communication in modern societies. E-mail, instant messaging, Skype and many other online communication applications broke down space barriers and enabled virtual real-time communication. Bulletin board systems, personal websites, blogs and social network sites have broadened opportunities of creating and disseminating information and increased the speed of mediated communication. This development has also had a strong impact on traditional media. Experts and scholars are still exploring and assessing the consequences of the rise of the Internet and its new online communication tools for journalism and public communication (Gerhards & Schäfer, 2010; Newman & Levy, 2013; O'Sullivan & Heinonen, 2008; van Eimeren & Frees, 2013).

The increasing complexity of societies and the increasing specialization within professions make communication between different parts of society more important than it was previously (Gibbons et al., 1994). The social development towards knowledge societies requires more emphasis on the relationship between science and society and on the enhancement of communication about science and technology with the public (e.g., Deutsche Akademie der Technikwissenschaften - acatech, 2014; House of Lords, 2000; UNESCO World Report, 2005). At present, the Internet has become one of the first places for people to search for specific information in many countries (e.g., Busemann, 2013; Center for General Education/Research Center Promoting Civic Literacy, 2012). The increasing relevance of online sources for information and communication create urgent research demands to explore communication about science in the online environment (Brossard & Scheufele, 2013).

Public polls prove that the Internet and the new media are now part of the everyday life of most people (Bernhard, Dohle, & Vowe, 2014; Pew Research Center, 2014; van Eimeren & Frees, 2013). This is equally true for scientists (e.g., Moran, Seaman, & Tinti-Kane, 2011; Pscheida, Albrecht, Herbst, Minet, & Köhler, 2013). Surveys of scientists show that scientists all over the world are participating in the online environment and have used it in many ways, both privately and professionally (Dzeyk, 2013; Pscheida et al., 2013). For example, scientists have used new media to facilitate their research and teaching activities (e.g., Calvi & Cassella, 2013), to enhance their communication with peers (e.g., Van Eperen & Marincola, 2011), and to reach out to people outside science as public science communicators (e.g., Wilkinson & Weitkamp, 2013), adapting their communication channels to their target audiences (e.g., Buckler, 2012). As Peters (2013a) argues, scientists distinguish internal scientific communication quite clearly from public science communication. It is thus necessary to differentiate the functions of new online media for (1) scientists' communication with their scientific peers and (2) scientists' communication with non-scientists.

The extent to which the new online media alter internal scientific communication or even transform the science system itself is still debated (e.g., Byrnes, Ranganathan, Walker, & Faulkes, 2014; Dinsmore, Allen, & Dolby, 2014). While there is little doubt that peer-reviewed articles and scientific conferences remain essential for the communication between scientists and for evaluating scientists' scientific performance, opinions differ with respect to the new media's effect on the visibility and impact of publications. Ijab Madisch, a Berlin-based former physician and virologist, argued in the prominent scientific journal *Nature* in an interview that the new online media are "changing science in a way that's not entirely foreseeable" (Van Noorden, 2014, p. 126). Others doubt a striking influence on internal communication but address the importance of the "online presence" of individual scientists (Tachibana, 2014), and still others think that the new media will play a significant role in scientific collaboration or in the establishment and maintenance of professional networks (Wolinsky, 2011). The most popular science network for scientists is ResearchGate, nicknamed "Facebook for science"; other equivalent sites are Academia.edu and Mendeley (Van Noorden, 2014). A significant function of this kind of online networking sites is that scientists can post their publications and can easily track who cites their publications. It is assumed that these networking platforms increase the visibility of scientific publications among colleagues (e.g., Liang et al., 2014). Not all scientists share the enthusiasm for these sites and doubt that it is worth investing time to manage one's online appearance (e.g., Dzeyk, 2013). Yet, including presence in new online media in the measurement of research impact has been discussed (Dinsmore et al., 2014). Within science, the rise of the new online media may thus lead to a reconsideration of scientific impact of individual scientists and scientific publications.

In the current discussion of science communication, two approaches are often contrasted: "Public Understanding of Science" (PUS) and "Public Engagement with

Science and Technology" (PEST) (e.g., Haywood & Besley, 2014). The two approaches differ in their assumptions about the public and about the adequate ways of how scientists should communicate with the public. According to the PUS approach, the main task of science communication is to close or narrow the knowledge gap between science and the public (The Royal Society, 1985). Disagreements between science and the public are mainly attributed to that knowledge gap and are consequently to be resolved by educating the public. That belief is often referred to as "deficit model." The communication style of the PUS approach is characterized by "one-way" communication from scientists to laypersons (e.g., Irwin, 2014). The public engagement approach emerged as an alternative to the PUS approach and sees the source of conflicts between science and the public in public mistrust of science and technology (e.g., concerning the safety of nuclear power and genetically modified food) (Bauer, Allum, & Miller, 2007; Stilgoe, Lock, & Wilsdon, 2014; Wynne, 2007). Accordingly, the PEST approach emphasizes the importance of public participation, discourses and consensus building (Trench, 2008). It is argued that the public should not only passively receive information about science and technology; rather it should have the right to actively participate in decisions on science and technology and even in the production of knowledge (e.g., Joly & Rip, 2007). The engagement approach reflects ideas of a "democratization of science" (e.g., Kleinman, 2005), leading to demands for information transparency and openness for public participation in decision-making.

The new online media enable virtual interactions between scientists and non-scientists and are expected to foster the dialog between science and society (e.g., Brossard, 2013b). Scientists could take a more active role in disseminating their results instead of depending on journalists to disseminate their messages. Furthermore, the new media usually offer means to users to give feedback by comments, or even enable "two-way" communication between scientists and their audiences. The new media may thus have a particularly affinity to the public engagement approach which emphasizes the need for dialog. Few studies (e.g., Besley, 2014) so far have looked at the relationship between scientists' use of the new media and their communication approach, however.

With regard to communication between science and society, journalism – specifically science journalism – has traditionally been very important. The role of journalists in the relationship of science and public has been described as that of a "translator," "cheerleader," "watchdog" (Rensberger, 2009), or "observer"

(Kohring, 2005), for example. The science-media relationship has extensively been studied (e.g., Friedman, Dunwoody, & Rogers, 1986; Kohring, 2005; Nelkin, 1995; Peters, 1995).

The rise of new media has opened a new market for journalism on the one hand, and on the other hand it has put established journalism under pressure, in terms of new competitions and profit marginalization. For example, fewer media organizations employ science journalists and this situation increases their dependency on free-lancers who write about science and technology (e.g., Brumfiel, 2009). In the online environment, science journalism loses its monopoly as dominant public source about science and technology. Alternative online media such as blogs became another source for science stories (Brumfiel, 2009; Fahy & Nisbet, 2011). Partly because of a perceived decline of science journalism and partly because of the increasing use of new online media by audiences, there are calls for scientists to "fill the void" in order to reach out to the public using the new media (Buckler, 2012; Cro, 2013) since science journalism seems to be in the decline (Fil, 2009). Even somewhat older studies of scientists' participation in public communication show a diversity of forms of public activities beyond media interactions (e.g., Jensen & Croissant, 2007; Kyvik, 2005). The rise of the new media creates even more possibilities for public communication activities such as online image- and video-sharing, creating or editing entries in online encyclopedias, communicating via blogs and in social networks. Only recently did the online media landscape attract the attention of scientists as a means for public communication and science communities began to explore their possibilities (Pew Research Center, 2015; Research Information Network, 2010). Among the variety of new online media, "science blogs" are a new, widely discussed paradigmatic communication form of direct public communication by scientists (Bonetta, 2007; Butler, 2005; Kjellberg, 2010; Kovic, Lulic, & Brumini, 2008; Mahrt & Puschmann, 2014; Pikas, 2008; Rockey, 2013; Walejko & Ksiazek, 2010; Walker, 2007; Wolinsky, 2011). The new online media imply a role change for scientists, though. In the traditional journalism-mediated communication with the public the role of scientists was that of an information source, and the role of journalists was that of a communicator. In the online environment however, scientists can now take on both roles: as information sources and as science communicators (Peters, Dunwoody, Allgaier, Lo, & Brossard, 2014).

As research on the professionalization of science communication and the medialization of science shows, one of the important motivations behind scientists' striving for media visibility is their conviction that scientific research cannot be funded without support from the public, and that public communication is likely to ensure public support for science (MORI, 2000; Pew Research Center, 2009; Weingart, 2012).

A consequence of this motivation is the professionalization of public science communication, which becomes obvious, for example, in the public communication departments of research institutions, the development of professions specializing on science public relations or science communication more generally, and the organization of communication trainings for scientists (Marcinkowski, Kohring, Fürst, & Friedrichsmeier, 2014; Peters, Heinrichs, Jung, Kallfass, & Petersen, 2008a; Trench & Miller, 2012). Weingart (1998) cautions that the increasing coupling of science and media would blur the difference between individual scientist's media prominence and their scientific reputation, and that media visibility might be misused to advance scientists' careers. He sees the coupling between science and the media as a threat to the autonomy of science in the long run (Weingart, 2012). Consequences of the science-media coupling on the side of science have been empirically investigated (e.g., Rödder, Franzen, & Weingart, 2012; Schäfer, 2007). The studies did indeed find indications of scientists' use of media criteria in conducting and presenting science (Fraser & Martin, 2009; Jasienski, 2006; Peters, 2012). The findings therefore confirm Weingart's (1998) "medialization of science" hypothesis. However, Peters et al. (2013) conclude from an analysis of medialization in the field of neuroscience that these effects do exist but are mostly peripheral and indirect.

So far, the medialization of science hypothesis was studied in the context of the interdependency between science and journalistic media; it remains an open question whether it can be extended to the context of science and new online media. One might expect, for example, that scientists preferring being active in the new online media are more sensitive towards media feedback and thus more susceptible to medialization effects than those preferring interactions with the traditional journalistic mass media.

An interesting question is whether results of previous studies regarding involvement of scientists with journalism have become obsolete or whether similar basic orientations and motivations also apply in the online environment. For example, studies have frequently found that scientists tend to distinguish clearly between communication within science (scientific communication) and communication with external audiences (public communication of science) (e.g., Felt & Fochler, 2012; Peters, 2013a). It is an open question whether the rigidity of the demarcation between the two kinds of communication will change as the consequence of the new online communication system in which laypeople have easy access to information addressed to peers. With regards to the science-media relationship, the issue whether science journalism will be substituted or supplemented by increased direct science communication is yet unanswered. Also, the opinions about whether scientists should make more use of the new online media (e.g., science blogs) for public communication and whether their online participation is sufficient to replace science journalist differ widely. Brossard and Scheufele (2013), for instance, argue that scientists should be more involved in public discourses about science and technology. They expect an increase of the quality of online information by direct participation of scientists and an increase of the influence of science in public discourses. The public also seems to prefer scientists as sources of information about science. A Eurobarometer (2007) survey shows that scientists enjoy higher credibility than journalists. Because new online media enable scientists to interact directly with their audience, without detour via journalists' mediation, the public may have access to more credible information about science via new online media. Brossard (2013b) therefore argues that in times when the Internet becomes the first place for the public to seek information about science, scientists cannot ignore that medium.

Peters et al. (2014) show skepticism towards the high expectations with respect to the rise of new media, however. They propose that new online media might become a marketing tool for science communicators: If the new media are exploited as marketing tools, the science presented there will comprise only what science communicators would like to convey. According to Peters et al. (2014), the replacement of science journalism by direct communication efforts of scientists may even endanger the assessment and surveillance function of professional media which is the core value of journalism.

As numerous public polls have shown for the general population that younger generations more frequently use social network sites than older generations (Bernhard et al., 2014; Pew Research Center, 2014; van Eimeren & Frees, 2012, 2013), one could similarly expect age differences between scientists who prefer to talk to journalists and those who prefer to communicate online with the public. With respect to contacts with journalists, previous studies have demonstrated that scientists with a leadership position are more likely to have contacts with journalists than those without (Dunwoody & Ryan, 1985; Peters, Brossard, et al., 2008). According to Rödder (2012), young scientists often perceive that scientific communities expect them to avoid media publicity. Public science communication in the new media environment is different from mediated media, though: the former enables scientists to take more initiative action, while contacts with traditional media are mostly initiated by journalists (Peters, 2013a). It is therefore very likely that leadership position plays a less pronounced role for scientists' online public communication activities than for contacts with journalistic media. Furthermore, because young scientists are members of the "netizen" generation, one should expect that young scientists are more active in online public communication than older scientists.

Public science communication in the new online environment, particularly in the so-called blogosphere and in social-networking media, has only rarely been investigated in the form of cross-country comparisons. Nielsen (2012) reports that the development of the new media and its consequences for journalism differ by country. The Reuters report (Newman & Levy, 2013) suggests that the general trend towards new online media is similar across most countries, but that the pace of diffusion in each country is different. Allgaier, Dunwoody, Brossard, Lo, and Peters (2013a) found that scientists' perception of the influence of new online media in science communication differs between Germany and the US. Y.-Y. Lo and Peters (2015) argue that scientists' communication priorities differ by the development state of science journalism and by culture. For example, they point to differences in the degree of materialism vs. postmaterialism between countries. Hofstede (2001) and Hall (1976) point to differences between communication behaviors and styles in Asian and Western cultures. For example, they conclude that the Western style is rather direct and reason-orientated, while the Asian style is less direct and relation-orientated.

Focusing on the perspective of scientists, the study presented in this thesis aims at understanding the current practice of public science communication in the online environment and how it differs from that in journalistic media. It focuses on science blogging as a prototype example of scientists' activities in the online environment. The general research goal is differentiated into different directions, leading to research questions about the role of new media (in particularly blogging) in public science communication, the motivation of scientists to participate or reject participation in public online communication, and the effects within science the new media may bring about.

Empirically, the study is based on an online survey of scientists, using representative samples of researchers in Germany, the United States and Taiwan. The questionnaire consists of two parts: the first part focuses on the diffusion of blogging and other media use among scientists and their assessment, and the other part on the practice of science blogging, presented only to respondents indicating that they are actively blogging.

The structure of this thesis is as follows: After a description of key features of the new media landscape and its implications for public science communication in chapter 2, chapter 3 introduces science communication paradigms, provides an overview of the increasing strategic orientation of science communication and the medialization of science concept. Chapter 4 then deals with scientists' expectations of the new media, their motivations to participate in online communication and how scientists' uses of new media are believed to change the science-media relationship. Chapter 5 reviews the existing literature on science blogging, focusing on bloggers, blog content and blog audiences. Furthermore, the relationship between science blogs and science journalism is discussed. In chapter 6 possible cultural influences on science communication are discussed, considering factors such as variations in the professionalization of journalism, communication styles and knowledge concepts. Part of the chapter deals with the impact of the Confucian culture which is dominant in Taiwan as one of the three countries included in the study.

The empirical part of the thesis is introduced in chapter 7 which lays out the research questions and hypotheses, explains the methodological design and the implementation of the survey. The next five chapters (chapters 8-12) describe the empirical findings of the survey dealing with the research questions and hypotheses: scientists' use of new online media in general (chapter 8), their perceptions of blogging (chapter 9), their practice of blogging (chapter 10), their beliefs about public communication (chapter 11) and, finally, country differences between scientists in the three countries (chapter 12). The final chapter (chapter 13) summarizes the key findings and discusses implications for science communication in the changing communication environment.

## 2 Changing media landscape

The new online media have gradually shaped the media landscape and have become one of the most important information sources for many people (e.g., Nielsen, 2012). In many ways, the new online media are different from the old media such as newspaper, magazines, television or radio, in terms of individual users' impact on shaping and spreading information content (e.g., Fuchs et al., 2010; O'Reilly, 2007). Their influence among the younger generation can be observed in several social and political outbreaks, for example in the "Occupy Wall Street" action in 2011, the "Arab Spring" in 2012, or the "Umbrella Revolution" in Hong Kong in 2014. Noticing the change of the media landscape, many media organizations also make use of the new online media and extend their influence to the online communication environment (Newman & Levy, 2013).

After clarifying the definition of the new online media used in this study, this chapter describes the emergence of the new media, in particular their diffusion among media users. Furthermore, different opinions about their implications for science communication are sketched that result from the expansion of scientific self-presentation as alternative to traditional science journalism.

### 2.1 The rise of the new media

The use of popular media such as Facebook, Twitter or blogs has become more and more common. These media are labeled as "Web 2.0," "social media" or "new media." Each label indicates a different approach to provide a suitable definition of these media.

The pioneering label of these media as elements of a "Web 2.0" stems from O'Reilly who compared the traditional and new media in an online text in 2005[1]; two years later he published his characterization in a peer-reviewed journal (O'Reilly, 2007). The term "Web 2.0" was chosen by him to provide a contrast to the page-like "Web 1.0." O'Reilly understands Web 2.0 as,

> "the network as platform, spanning all connected devices; Web 2.0 applications are those that make the most of the intrinsic advantages of that platform: delivering software as a continually-updated service that gets better

[1] http://www.oreilly.com/pub/a//web2/archive/what-is-web-20.html [last accessed 23 December 2014].

> the more people use it, consuming and remixing data from multiple sources, including individual users, while providing their own data and services in a form that allows remixing by others, creating network effects through an 'architecture of participation', and going beyond the page metaphor of Web 1.0 to deliver rich user experiences" (p. 17).

O'Reilly values the collective intelligence of users for creating impulses in the Web and "turning the web into a kind of a global brain" (p. 26). According to O'Reilly, there are various web-platforms fitting into the category of Web 2.0 applications, for example Google AdSense, Flickr, Wikipedia, blogging etc. (p. 18).

Other scholars take approaches differing from O'Reilly in understanding the new online communication tools. For example, media scholars such as Fuchs et al. (2010) or Trottier and Fuchs (2014) emphasize the "sociality" of the new online communication tools and argue that they are *social* media because "individuals have certain cognitive features that they use to interact with others so that shared spaces of interaction are created" (Trottier & Fuchs, 2014, p. 5).

These popular media are labeled "new media" by scholars who refer to a number of social and cultural transformative developments that these media potentially bring about. They are called *new* online media in contrast to television, films, and paper-based publications. Lister, Dovey, Giddings, Grant, and Kelly (2009, p 10) argue that,

> "the term 'new media' emerged to capture a sense that quite rapidly from the late 1980s on, the world of media and communications began to look quite different and this difference was not restricted to any one sector or element of that world (…)."

They consider the rise of the new media as "epoch-making phenomena" (p. 11) which relates to broader social and cultural changes. Despite the different approaches toward characterizing the new communication tools, it is generally agreed that the concept of "Web 2.0," "social media" or "new media" is an aggregated concept which is difficult to be clearly defined (Fuchs, 2014; Lister et al., 2009; O'Reilly, 2007). The three approaches mentioned above all recognize and emphasize the possibility of user-generated content as the key characteristic: individual users can be passive information receivers but also active information providers or disseminators. Emphasizing possibilities of presenting creativity, a report of the Organisation for Economic Co-operation and Development (2007, p. 8) summarizes three central characteristics of user-generated content and introduces various platforms for user-generated content (table 2.1). The report underlines the greater degree of individualism and ways to become active for addressing issues and expressing opinions in platforms of user-generated content by the characteristics and demands of these platforms:

- Publication requirements: Materials are published in online locations which are at least to some extent publicly accessible, for example on a social network site.
- Creative effort: Merely copying content is not considered as user-created content. Materials published are expected to show "a certain amount of creative effort."
- Creation outside of professional routines and practices: Contributions often "do not have an institutional or a commercial market context."

According to examples presented in the OECD report, blogs, Wikipedia and Facebook are currently recognized as platforms for user-generated content. Furthermore, the OECD report expects an increasing competition of content in the online environment, for instance between professional content and amateur-created content. For users, this creates a challenge to assess the quality of content and to differentiate between good and bad information. At the time the report was published (2007), the OECD considered the platforms for user-created content mostly "outside of professional routines and practices," but noted that this character of the platforms "is getting harder to maintain" (p. 9).

Each of the various platforms for user-generated content – blogs, Facebook, Twitter and ResearchGate – is optimal regarding certain aspects (e.g., Bik & Goldstein, 2013). According to review articles about scientists' use of the new online media (e.g., Van Eperen & Marincola, 2011), the dissemination of content via blogs may not be as efficient in terms of audience reach as via Facebook or Twitter. However, one might acknowledge the advantages of blogs in three respects:

1. *Publicity*: compared with Facebook, posts in the blogosphere are more easily available for the general public;
2. *Information completeness*: unlike Twitter which restricts the length of each message to 140 characters, blog posts can be much longer and allow more detailed descriptions, explanations, arguments etc.;

3. *Public orientation*: different from ResearchGate[2] which considers itself a professional networking site for scientists, blogging enables information sharing and opinion exchange with broader and multiple audiences.[3]

| Type of Platform | Description | Examples |
|---|---|---|
| Blogs | Web pages containing user-created entries updated at regular intervals and/or user-submitted content that was investigated outside of traditional media | Popular blogs such as BoingBoing and Engadget; Blogs on sites such as LiveJournal; MSN Spaces; CyWorld; Skyblog |
| Wikis and Other Text-Based Collaboration Formats | A wiki is a website that allows users to add, remove, or otherwise edit and change content collectively. Other sites allow users to log in and cooperate on the editing of particular documents | Wikipedia; Sites providing wikis such as PBWiki, JotSpot, SocialText; Writing collaboration sites such as Writely |
| Sites allowing feedback on written works | Sites which allow writers and readers with a place to post and read stories, review stories and to communicate with other authors and readers through forums and chat rooms | FanFiction.Net |
| Group-based aggregation | Collecting links of online content and rating, tagging, and otherwise aggregating them collaboratively | Sites where users contribute links and rate them such as Digg; Sites where users post tagged bookmarks such as del.icio.us |
| Podcasting | A podcast is a multimedia file distributed over the Internet using syndication feeds, for playback on mobile devices and personal computers | iTunes, FeedBruner, iPodderX, WinAmp, @Podder |
| Social Network Sites | Sites allowing the creation of personal profiles | MySpace, Facebook, Friendster, Bebo, Orkut, Cyworld |
| Virtual Worlds | Online virtual environment. | Second Life, Active Worlds, Entropia Universe, and Dotsoul Cyberpark |
| Content or Filesharing sites | Legitimate sites that help share content between users and artists | Digital Media Project |

*Source: OECD document, nr. DSTI/ICCP/IE(2006)7/FINAL (p.16)*

**Table 2.1** Different platforms of user-generated content.

[2] http://www.researchgate.net/.

[3] Research and discussions in the literature focusing on science blogs will be reviewed in chapter 5.

With respect to information, the Internet has become a very important platform (van Eimeren & Frees, 2013) although television remains the most important one (e.g., Bernhard et al., 2014; Eurobarometer, 2007). Yet, the role of Internet as source of science news and information is already significant (e.g., Eurobarometer, 2013; National Science Board, 2014; Pew internet & American life project, 2006). About one third of Americans said that online news is their primary source for information about science and technology (National Science Board, 2014). In a public opinion survey 28% of the European citizens indicated that they "regularly" or "occasionally" search online for this kind of information (Eurobarometer, 2007). In Asia, 32% of the Taiwanese population said that the Internet serves as their major information source about science and technology (Center for General Education/Research Center Promoting Civic Literacy, 2012). However, it is necessary to note here that the Internet (or online environment) is a technical platform that supports both old and new media and merges individual and public communication. For example, traditional journalism has found its way into the Internet and old media brands are still of relevance in the online environment (e.g., Newman & Levy, 2013). Media organizations use new communication tools like Twitter and Facebook to disseminate their media stories (e.g., Skoler, 2009). Peters (2014) thinks that the differentiation between technical media (for example, old vs. new media) is less crucial, and instead the most important differentiation is whether an information source is journalism-based or non-journalism-based and whether science stories are produced in the context of scientific self-presentation or through journalistic surveillance of science.

Survey questions are rare which ask about online sources of information about science and technology and differentiate sources according to self-presentation or surveillance. An US survey from the year 2014 suggests that people consuming science information online are mostly using traditional media sources; less than 10% reported that they use blogs or social media (National Science Board, 2014, pp. 7-16). Other studies which do not specifically look at the reception of information about science and technology but at information reception more generally show that journalistic media remain important information sources also in the Internet. For example, a German study suggests that journalistic media serve as primary sources for political information in the Internet, whereas new online media play merely a marginal role (Bernhard et al., 2014). A global survey on consumption of online journalism shows that the brands of traditional media remain influential in the online environment as well, for example the New York Times in the United States (Newman & Levy, 2013).

The use of terms to characterize the new media in the scholarly discussion shows different emphases and reflects different perspectives. For the purposes of this study, the term "new online media" (or "new media") is used in contrast to the "old" journalistic media such as newspapers (in print and online), television and radio. That the content in the new media is created decentralized by many communication participants rather than by media organizations is seen as the key feature of the new media.

The online environment is essential for the new online media such as blogs, Twitter or Facebook. Worldwide there is a trend of an increasing population of Internet users.[4] Statistics often show that the younger generations more frequently use the Internet than the older generations (Bernhard et al., 2014; van Eimeren & Frees, 2012, 2013). More specifically, the use of the new media is more frequent among younger than older generations (BITKOM, 2011; van Eimeren & Frees, 2012).

Despite the frequent use of new media, their assessment in terms of information quality is lower than the assessment of journalistic media. A German survey showed that youths between 12-19 years perceive information provided by newspaper, television and radio to be more authentic and more credible than information provided by blogs and other non-journalistic sources; only a small percentage of the respondents felt that new media such as Facebook are trustworthy information sources (Medienpädagogischer Forschungsverbund Südwest, 2014).

Also in terms of perceived impact, the old media seem to have an advantage over the new media. A study of German and American neuroscientists' use and their perceived impact on public opinion and political decision-making of various old and new media showed that in both countries journalistic media were still more often used and rated more influential by the scientists. However, scientists in the two countries differed in their assessment of media impact: American neuroscientists perceived the new media to be more influential than German neuroscientists (Allgaier, Brossard, Dunwoody, Lo, & Peters, 2012).

[4] http://www.internetworldstats.com/stats.htm [last accessed 16 December 2014].

This points to the finding that the role of the new media differs across countries. According to Nielsen (2012) the diffusion of new online media is a worldwide trend but the resulting challenges for journalism differ across countries. In Germany, traditional media such as newspaper, television and radio remain dominant information sources and the role of the online media is yet less significant compared with other European countries, the United States and Japan (Newman & Levy, 2013). Scholars find explanations for such differences in the established media infrastructures and cultures. Hasebrink and Hölig (2013) explain the lower consumption of digital news in Germany compared to the United Kingdom and the United States by differences in the media infrastructure (e.g., the importance of regional television and regional information) and by Germans' critical attitudes toward new technologies that may affect their digital news consumption behavior.

Because of the unlimited space for content in online environment, the broad spectrum of available information provided by the new media, and the opportunities to participate actively in public communication, many scholars expect that the new online media will increase public engagement, and believe that the new online media will contribute to the democratization of public discourses and society (Bertot, Jaeger, & Grimes, 2010; Clark & Aufderheide, 2009). Several political issues and movements are mentioned as examples for the democratic potential of the new media, like the US presidential election in 2008 (Cogburn & Espinoza-Vasquez, 2011) and the Arab Spring in Egypt (Eltantawy & Wiest, 2011; Howard et al., 2011). Other scholars have more reserved opinions about the potentials of the new online media. Barnett (1997, p. 213), for example, argues that "new media could turn out to be little more than a form of technological time-saving for the political active or politically interested," but that a long-term reformation of political culture cannot depend on new media alone.

## 2.2 Science communication in the new media landscape

The development of communication technologies, especially the increase in the speed of information dissemination, is expected to facilitate communication among scientists (internal scientific communication) and also the communication between scientists and the public (public science communication). Science communication scholars expect that direct access to the public will encourage scientists to actively communicate with the public and decrease scientists' dependency on science journalism for public communication (Nisbet & Scheufele, 2009).

According to a survey, many scientists think that the new online media will change their research routines in the next few years.[5] Various online tools have been developed for managing bibliographic data and research materials, for sharing lab data or co-editing of experiment protocols via wiki (e.g., O'Dell, 2010). Several social online networks, such as ResearchGate, specifically target researchers. A rough estimation based on an international survey (Van Noorden, 2014) suggests that about one third of scientists worldwide regularly participate in these professional networks. Among these networks, ResearchGate seems to dominate. The number of the regular visitors of ResearchGate is much larger than the number of visitors of competing networks such as Academia.edu[6] and Mendeley[7].

The new online media in general are expected to enhance the intensity of communication among scientists (e.g., Batts, Anthis, & Smith, 2008), although it is hardly possible to distinguish clearly between scientists' private use of such networks, their use for career purposes, or their use for public communication. Scholars assume a broad spectrum of possible uses of new media by scientists. This can be seen by the answer categories used in their surveys. A British survey of scientists' media use for internal scientific communication lists the following six options (Research Information Network, 2010, p. 20):

1. Write a blog
2. Comment on other peoples' blogs
3. Contribute to a private wiki
4. Contribute to a public wiki (e.g., Wikipedia)
5. Add comments to online journal articles
6. Post slides, text, video etc. publicly.

Other studies intend to provide a more elaborate overview of scientists' media use. Moran et al. (2011) explored American academics' use of new online media by asking about their uses of nine platforms: Facebook, Twitter, YouTube, Blogs, Myspace, Wikis, LinkedIn, Flicker, and SlideShare. A German survey of scientists' new media use provides the following, rather long list of online activities (Dzeyk, 2013, p. 30):

[5] http://www.prnewswire.co.uk/news-releases/2collab-survey-reveals-that-scientists-and-researchers-are-all-business-with-social-applications-154852575.html [last accessed 23 December 2014].
[6] https://www.academia.edu/.
[7] https://www.mendeley.com/.

1. Wikipedia
2. Video / Photo community portals
3. Online archive/ database
4. Mailing list
5. Content sharing / Cloud storage
6. Video conference
7. Chat / Instant message
8. Internet forum
9. Social network sites
10. Other Wikis[8]
11. Scientific / occupational networks
12. Learning management systems
13. Bibliographic data management software
14. Weblogs
15. Online text editor
16. Microblogs
17. Social bookmarking services.

Traditionally, the evaluation of research impact is based on the quality of scientific publications indicated by the impact factor of scientific journals. The rise of new media has opened the possibility to use the online presence of publications – even outside the scientific publication system – as indicator of their impact. New ways and metrics are proposed which include citations in new online media; they are supposed to give a feedback to research funders about the impact of the research they have funded (Dinsmore et al., 2014; Shema, Bar-Ilan, & Thelwall, 2014). Furthermore, online presence may increase the chances of crowdfunding of research (Byrnes et al., 2014). However, the new emphasis on online presence also raises concerns. Some scientists are worried that it may lead to exaggerations in the presentations of scientific results (e.g., Fun, 2014).

Only little is known about cross-national differences in the frequency of using the new online media by scientists as the existing studies have been conducted in one country only and these national studies are not fully comparable because of different question designs and sampling strategies. German surveys (Dzeyk, 2013; Pscheida et al., 2013) found a different level of diffusion of new media among re-

[8] For example, Wiktionary.

searchers than an American survey (Moran et al., 2011): While most American scientists tend to use new media and online tools for teaching or for other professional activities, fewer German scientists use such tools. Another study – more limited in its scope – confirmed the country difference. Aiming to determine whether and how neuroscientists' use of new online media differs between the United States and Germany, Allgaier et al. (2013a) surveyed neuroscientists in the two countries. The results showed that blogs or social online networks were not frequently used as sources of information about scientific issues in either country. The authors thus concluded that personal accounts (blogs and social networks) play a marginal role in scientists' assessment of information about science. However, American neuroscientists tended to use new media more often than German neuroscientists, although this difference was not statistically significant, and perceived by them to be more influential.

Scholars have directed their attention to a wide variety of science communication activities beyond interacting with journalists such as science cafés (Mayhew & Hall, 2012), science music festivals (Leão & Castro, 2012), popular science publishing (Bentley & Kyvik, 2011), and consensus conferences (Einsiedel, 2013). A survey to analyze scientists' participation in public communication in the United Kingdom used a list of 11 possible outreach activities (The Royal Society, 2006, p. 26):

1. Worked with teachers/schools
2. Participated in an institutional open day
3. Given a public lecture, including being part of a panel
4. Taken part in a public dialogue event / debate
5. Been interviewed on radio
6. Been interviewed by a newspaper journalist
7. Written for the non-specialist public
8. Engaged with policy-makers
9. Engaged with non-Governmental organizations (NGOs)
10. Worked with science centres/museums
11. Judged competitions.

The annual reports of the Centre National de la Recherche Scientifique (CNRS) document scientists' popularization activities using a list of 10 categories (Jensen & Croissant, 2007, p. 5):

1. Conference/Public debate
2. Exhibitions
3. Actions aimed at associations
4. Actions in schools
5. Books/CD-Rom/Software
6. Open doors
7. Newspapers and magazines
8. Radio/TV/Movies
9. Popularization website
10. Other.

And finally, a survey of the Pew Research Center in the United States asks about scientists' public outreach activities using four categories (Pew Research Center, 2009, pp. 23-24):

1. How often scientists talked with non-scientists or
2. talked with reporters
3. How often scientists wrote for a science blog
4. How much the scientists have heard about "town hall or other public meetings designed for scientists to discuss controversial issues related to scientific research."

The mentioned lists of activities still focus on face-to-face interactions and journalistic mediation. However, the new media are a new form of communication between science and the public that combines elements of direct interaction and dialog such as in face-to-face encounters but at the same time has the potential to involve a larger audience or community of communication participants.

The information availability in the online environment may attract people using the Internet as the first place for searching information. According to surveys in several countries the Internet is an important source of news about science and technology, particularly of information about specific scientific and technological issues (e.g., Butt, Clery, Abeywardana, & Philips, 2009; National Science Board, 2014; Research Center Promoting Civic Literacy, 2011). The most recent relevant U.S. public opinion survey shows that about 42% of the Americans said the Internet is their primary source of news about science and technology. Asked about the preferred Internet sources, the majority (63%) mentioned online newspapers and another 11% mentioned online magazines. The report concludes that "[a]ll other potential online sources – which might include blogs and other forms of social media – were chosen by less than 10% of respondents who indicated they went online for S&T news" (National Science Board, 2014). However, the pattern of sources may be different for specific scientific issues and specific online inquiries. Science communication scholars have therefore argued that an increasing number of people search for information about science and technology primarily in the Internet and that scientists should be encouraged to participate in online communication – or at least that scientists should not look away from the online environment (Brossard, 2013b; Brossard & Scheufele, 2013; Nisbet & Scheufele, 2012).

Empirical studies on scientists' use of new media for public communication are rare while the use of new media in education or teaching is broadly discussed (e.g., Bull et al., 2008; George & Dellasega, 2011). With regard to public communication, some scientists have commented on the importance of the online tools for communication among scientists as well as for public communication. Bik and Goldstein (2013) discussed the pros and cons of online tools – Blogs, Twitter, Facebook and Google+ – for science communication. Editorials of prestigious science journals encourage scientists to use new media for public communication of science (e.g., Fil, 2009; Francl, 2011). Some studies discuss the effects of the new media such as Wikipedia (e.g., Bremer, 2012), YouTube (e.g., Allgaier, 2013), Twitter (e.g., Ben-Ari, 2009) and blogs (e.g., Bar-Ilan, 2005) in communication about science. However, empirical studies focusing on how scientists use the new media to communicate with the public are very rare.

Perhaps the most discussed issue regarding the rise of the new online media concerns the consequences on the relationship between science and the media. The science-media relationship has received a lot of scholarly interest in the past (for an overview see, e.g., Friedman et al., 1986; Kohring, 2005; Nelkin, 1995; Peters, 2013a; Rödder et al., 2012). Empirical studies show that most interactions between scientists and journalists are relatively "smooth" and to the satisfaction of scientists (Peters, Brossard, et al., 2008). However, scientists in other surveys (MORI, 2000; Pew Research Center, 2009) reported negative opinions about the quality of journalistic coverage of science. Many scholars, scientists and even journalists blame the mass media for a poor quality of science coverage - for inaccuracies, oversimplifying, sensationalizing, exaggerating and polarizing science in journalistic narratives (e.g., Boykoff & Boykoff, 2004; Gonon, Konsman, Cohen, & Boraud, 2012; Kepplinger, 1989; Post, 2008). Studies show that scientists and journalists have different expectations about how science should be presented in the mass media (Y.-N. K. Chen, 2011; Gunter, Kinderlerer, & Beyleveld, 1999; Peters, 1995; Salomone, Greeberg, Sandman, & Sachsman, 1990).

The new online media have blurred the boundaries between science journalists and other science communicators (such as scientists) (Colson, 2011) and science journalists sometimes rely on information in the new media provided by individual scientists for their stories (Brumfiel, 2009). Media scholars point to the fact that the new online media enable scientists to take the initiative in communication instead of depending on journalistic selection. Furthermore, they have more control over content and can avoiding errors and inaccuracies that scientists see so often in journalistic coverage (Nisbet & Scheufele, 2012). Consistent with this argument, in a study by Bonetta (2007) scientists who run their own blogs said that it is important for them to present science themselves in the online environment. Although they welcomed the use of new media for public science communication, Nisbet and Scheufele (2012) thought that the rise of the new media may lead to the "death of science journalism."

Science blogs provide an opportunity for scientists to present science themselves; however, science blogs may not be sufficient to carry out the function of science journalism. Peters et al. (2014) note that the new online media compete with science journalism for information about science and technology; yet, they argue that the role of science journalism in science communication cannot be fully replaced by the new media, and that the function of science journalism is not limited to dissemination of information about science for a lay audience. Kohring (2005) points out that the function of science journalism consists of professional observation of science based on a multiplicity of perspectives. For example, journalists contextualize science and make scientific knowledge relevant to society; furthermore, journalism plays a role in the political governance of science.

Scientists' opinions about using new online media for public communication differ. Some scientists refuse using the new online media for public communication and feel a lack of required communication skills (Bonetta, 2007). The concern of lacking communication skills on the side of scientists is actually reflected in respective expectations of the public. According to a Eurobarometer (2007) survey, part of the European population prefers journalists as sources of information about science because they assume them to be more comprehensible, although other respondents feel that scientists are more trustworthy and precise. With regards to communication with the public, scientists consider new online media to have less impact than journalistic coverage. For example, Allgaier et al. (2013a) show that scientists perceive journalism to have a stronger impact on public opinion and science policy than blogs and social media. However, blogging scientists report that they sometimes address journalists in their blog posts - to signify important scientific findings, for example (Bonetta, 2007; Colson, 2011).

Direct communication in the online media is relevant to the idea of "Public Engagement with Science and Technology" (e.g., Bubela et al., 2009; Nisbet, Hixon, Moore, & Nelson, 2010; Regenberg, 2010). The widespread "comment" option in the online environment may be seen as contributing to public engagement with science, for example. Referring to the public discourse on climate change, Nisbet et al. (2010, p. 329) propose that the new online media could possibly serve as one of the "bridges" connecting science and society. They think that the use of the new media in scientific communities enables direct communication between scientists and the public, and makes communication more effective. An issue related to the public engagement idea in the online context concerns the quality of such engagement. Anderson, Brossard, Scheufele, Xenos, and Ladwig (2013) demonstrate that exposure to online incivility has impact on readers' perceptions. Brossard (2013b) suggests a management of readers' comments in order to avoid online uncivil behavior and to improve the quality of online discourses. Another concern is about the comprehensive representation of the heterogeneity of opinions in the online environment (e.g., Scheufele, Hardy, Brossard, Waismel-Manor, & Nisbet, 2006). Gerhards and Schäfer (2010) demonstrate that debates in the online environment do not differ from the debates in the print media, in terms of the actors presented, evaluations and frames.

The development of the new online media has increased chances of laypeople to become involved in research or to influence the research agenda. Chafe (2011) describes a Canadian initiative in which relatives of patients with multiple sclerosis – a chronic neurological disease causing several functional disabilities – used social media to gain influence on the research agenda related to that disease. "Crowd funding," i.e., raising funds for certain scientific or technical projects from a large number of people, has recently found much attention (Byrnes et al., 2014). And finally, the "citizen science" movement tries to integrate laypeople into professional research projects by delegating certain tasks to them such as gathering environmental data (Hsu, 2014).

# 3 Changing science communication paradigms

While there is broad agreement that science should communicate with the public (Deutsche Akademie der Technikwissenschaften - acatech, 2014; House of Lords, 2000), empirical and normative models of public communication of science differ among science communicators, science managers and science communication scholars. The traditional popularization of science approach assuming a cognitive "deficit" of the public and a hierarchical relationship between scientists as communicators and laypeople as audience has been criticized as empirically too simplistic and as normatively inadequate. For example, Hilgartner (1990) and Bucchi (1996) have pointed to the diversity of science communication settings. Among others, Nelkin (1995) has highlighted the strategic character of today's science communication, which focuses less on audience learning and more on effects in terms of public image of science. Kohring (2005) and many others (e.g., House of Lords, 2000; Schäfer, 2008a) have criticized the normative assumptions underlying "popularization" or "public understanding of science" as dominated by science and based on one-way communication rather than dialog. And Weingart (1998, 2012) has pointed to a possible harmful "medialization of science" as consequence of the increasing strategic motivations of scientific communicators who aim at addressing the legitimization of science problem. This chapter illustrates recent developments in the concepts, practices and theory of science communication.

## 3.1 From "Public Understanding of Science" to "Public Engagement with Science and Technology"

Several scholars have suggested classification schemes for approaches to public communication of science (e.g., Bauer et al., 2007; Bucchi, 2008; Haywood & Besley, 2014; Rowe & Frewer, 2005; Trench, 2008). For example, Cloître and Shinn (1985) identify four main stages in the process of science communication, namely the "intra-specialist exposition," "inter-specialist exposition," "pedagogic practice" and "popular stage," as knowledge is spread among scientific communities, and is transferred to a heterogeneous scientific audience and to the general public. They further distinguish four types of scientific text related to this process: specialist, inter-specialist, pedagogical and popular articles. Hilgartner (1990, p. 519) disagrees with the concept of popularization of science if understood in the way that "scientists develop genuine scientific knowledge" and "popularizers disseminate simplified accounts to the public" and proposes a continuity concept according to that "scientific knowledge is constructed through the collective transformation of statements, and popularization can be seen as an extension of this process, rather than an entirely different one" (p.524). Hilgartner furthermore argues that communication of scientific knowledge should consistently accustom to different audiences and circumstances and, therefore, "appropriate simplification" of scientific knowledge is inevitable (p. 529). Bucchi (1996, 2008) argues that there are cases of "deviation" from Hilgartner's ideas, cases in which the public discourse plays an important role in attracting political attention to scientific issues. And in these cases public communication of science does not fit into Hilgartner's "trajectory" model. Rowe and Frewer (2005) differentiate communication types by the direction of the flow information between science experts and the public and distinguish three paradigms: public communication (information flows from "sponsor"[9] to "public representatives"), public consultation (information flows from "public representatives" to "sponsor") and public participation (information exchange between these two parties). And Bucchi (2008) characterizes three types according to how knowledge is communicated: (1) Transfer, popularization, one-way, one time – e.g., dissemination of scientific knowledge, (2) consultation, negotiation, two-way, iterative – e.g., discussion of implications of scientific research, (3) knowledge co-production, deviation, multi-directional, open-ended – e.g., science experts and the public setting the agenda of research.

In an attempt to summarize the discussion, Haywood and Besley (2014) reconstruct two general patterns: "public understanding of science and technology" and "public engagement with science and technology." Public understanding essentially means the connection of scientists and scientific experts with nonscientists and the general public by means of (public) science education. Public engagement in contrast is influenced by the concept of participatory democracy and emphasizes transparency, negotiation and deliberation in decision-making.

While these two models are ideal types rather than clear alternatives in science communication and further differentiations are possible, the distinction between public "understanding" and "engagement" forms an important dimension to categorize beliefs and preferences regarding public communication of science. Generally, a trend is recognized from PUS (public understanding of science) to PEST (public engagement with science and technology) and the report of the UK House

[9] For the sake of convenience, Rowe and Fewer (2005) use the term "sponsor" to designate a "policy-setting organization" (pp. 254-255).

of Lords Select Committee on Science and Society (House of Lords, 2000), confirming the need for dialog and participation and propagating the engagement model, marks a turn in the dominant orientation of professional science communicators. However, as several authors note, public understanding and public engagement approaches continue to coexist (e.g., Trench, 2008).

An older report promoting the PUS movement, published in 1985 by the Royal Society, explicitly addresses the urgency of improving the public's understanding of science and highlights the roles of individual scientists and scientific communities in disseminating scientific knowledge among a lay audience. For example,

> "Scientists must learn to communicate better with all segments of the public, especially the media. […] It is clearly a part of each scientist's professional responsibility to promote the public understanding of science." (The Royal Society, 1985, p. 24)

Initially the logic of PUS is that science and technology have strongly affected individuals and society, and have become part of culture. According to the report, a better understanding of scientific knowledge on the side of the public thus may advance societal development and decision-making on public issues. The report furthermore argued that better knowledge may induce attitude change. The PUS movement has been expected to decrease public mistrust of science and technology and gain societal support for science and research.

According to Bauer et al. (2007) and Lewenstein (1992), even before the raise of the PUS movement studies were done measuring the public's scientific knowledge ("scientific literacy") and policy measures were initiated aiming to improve public knowledge about science. The PUS movement adopted the basic assumption of the science literacy approach, known as "deficit model": a lack of scientific knowledge on the side of the public as the cause of a lack of public support and acceptance for science and technology. Borchelt and Hudson (2008) describe that the PUS movement assumes "a linear progression from public education to public understanding (of science) to public support, and that this progression – if followed – inevitably cultivates a public wildly enthusiastic about research" which means that if the public understands science better, it will lead to public support of science. An international survey of scientists by Peters et al. (2009) shows that still the majority of scientists believe in the deficit model, i.e., expect that increasing the scientific knowledge level of the public would lead to more positive attitudes towards science.

The PUS type of science communication is usually characterized as "one-way" or "top-down" communication (Bucchi, 2008; Trench, 2008) and is considered as extension of education for the public, in which scientists, scientific communities and the (journalistic) media play significant roles (The Royal Society, 1985).

The PUS movement, especially the deficit model, has been criticized for that this movement ultimately seeks public support for science rather than public "understanding" of science (Bauer et al., 2007; Lewenstein, 1992). Furthermore, the assumption of a knowledge deficit among the general public is often criticized (e.g., Irwin & Michael, 2003). It is argued that scientific findings and knowledge are not value free and often intertwined with the social context, and that the public has the right to participate in decision-making related to science (Dietz, 2013; Joly & Rip, 2007). Others argue that the insufficient public support may not only be due to a lack of understanding of science, but by a lack of trust in science (Wynne, 2006, 2007).

A more open form of communication between science and the public is therefore called for and calls for dialogue or interactive communication emerged as well around that time (Einsiedel, 2008; Joly & Rip, 2007). The rise of the PEST movement is viewed as an introspection of the PUS movement and a reflection on participatory democracy in which transparency, negotiation and tolerance of diverse opinions are valued (Einsiedel, 2013; Nisbet & Scheufele, 2007). In PEST the emphasis on science communication moves from educating the public to engaging the public in scientific research (e.g., Irwin & Michael, 2003). Numerous documents and working papers such as "Taking European Knowledge Society Seriously" (Felt et al., 2007) or the report published by the Woodrow Wilson International Center for Scholars (Sclove, 2010) have specified the need for engaging the public in decision-making and governance, especially when it comes to the application of (potentially) controversial science and technology. Major international scientific journals published several editorials propagating the idea of engaging the public. For example, *Nature* (2004, p. 883) published an editorial "Going Public" which claims that the consequence of including the public into science governance is "nothing to fear," and an essay in the "Science & Politics" section of *Nature* stated that "public consultations in science and technology should be undertaken at a point early enough in the development process when it is still feasible to change course" (Joly & Rip, 2007).

The PEST paradigm emphasizes that citizens have the right to participate in decision-making affecting their life. Scientific expertise and facts are important to decision-making, as was already correctly assumed in the PUS movement. Yet, the PEST paradigm adds the insight that decision-making requires a mutual understanding between science and society, in which facts, values, and differences in facts and in values will be considered inclusively (Dietz, 2013). The PEST movement demands scientific experts not only to discuss and to negotiate the implications of science research with the public, but to engage the public in decision-making and scientific agenda setting (Bucchi, 2008; Schäfer, 2008a). A variety of PEST activities have been proposed and implemented, for instance citizens' juries/panels, consensus conferences and public hearings (Rowe & Frewer, 2005). In Denmark, the Netherlands, India, and Japan, consensus conferences were conducted on the controversial issues of safety of GMO food (Einsiedel, 2013). In Taiwan, consensus conferences were organized on surrogate motherhood (D.-S. Chen & Deng, 2007). And in German consensus conferences were conducted on stem cell research and genetic diagnosis (Tannert & Wiedemann, 2004; Zimmer, 2002). These activities are usually conducted with a small group of laypeople and several experts in the participation process and aim to include a greater variety of positions into the deliberative process dealing with controversial issues. However, critics have noted that in the implementation of PEST activities scientific institutions place their own interests in the frame of public engagement (Wooden, 2006; Wynne, 2006).

The importance of engaging the public in science is empirically supported by public opinion surveys showing that the public has a positive attitude toward science when science is presented as an abstract concept, but that it has a less positive attitude when it comes to specific issues. According to the World Value Survey, a majority of respondents across continents and in developed as well as in developing countries agrees that science will produce benefits for human life and the next generation.[10] An overwhelming American majority says that science has positive effects on society (Pew Research Center, 2009). More than 80% of the respondents of the Eurobarometer survey on "Social values, science and technology" reported that developments in science and technology have improved their life quality (Eurobarometer, 2005, p. 54). However when it comes to specific science issues, the level of optimism about science varies. As the same Eurobarometer survey showed, 94% of European citizens believe that medicines and new medical

[10] Own analysis of item V192 of the sixth wave of the World Value Survey, using the online interface of the dataset: http://www.worldvaluessurvey.org/WVSOnline.jsp.

technologies will have positive effects in the next 20 years, but only two thirds of the citizens hold positive attitudes about biotechnology and only about half of them about nanotechnology (p. 74).

Public confidence in science and scientists shows the same pattern – in general positive, in particular cases diverse. Public opinion surveys show that the population prefers a crucial influence of experts on decision-making in general; however, in some specific cases the public feels uncomfortable leaving the decision to experts (Eurobarometer, 2010, 2013; Gaskell et al., 2005). The low public confidence in science in specific cases is seen as demand to engage the public into decision-making, for instance in the application of nanotechnology (Toumey, 2007), in the implementation of biotechnology (Einsiedel, 2013) or in setting priorities in health care (Bruni, Laupacis, & Martin, 2008).

Despite the critique of the PUS movement, especially its assumption concerning knowledge deficits of the public, it seems to be a strong motivation for most scientists to participate in public activities. Because they perceive a knowledge deficit of the public, many scientists see the main function of public science communication to enlighten and inform the public (S. R. Davies, 2008; The Royal Society, 2006). Surveys of scientists show that many scientists perceive that it is their obligation to communicate with non-scientist publics or with policy makers (MORI, 2000). The majority of scientists say that it is their responsibility to explain their research and its social implication to the public (e.g., Allgaier, Dunwoody, Brossard, Lo, & Peters, 2013b). Scientists with experience in public participation said that the perceived knowledge deficit of the public drives them to communicate with non-scientist audiences (Bentley & Kyvik, 2011). They think that if the public understands science better, they will tend to stronger support science in terms of, for example, public funding of scientific research. Scientists' belief in the assumption that more scientific knowledge of the public will lead to greater support for science is obvious in a number of surveys in Western and Eastern countries (Y.-Y. Lo & Peters, 2015; MORI, 2000; Peters et al., 2009; Pew Research Center, 2009).

Scientists' attitudes toward the PEST movement seem to be rather ambivalent, however. On the one hand, scientists seem to be in favor of dialogic communication; on the other hand, scientists feel uncomfortable to allow the public having a say in the regulation of science (e.g., Peters et al., 2009). For some scientists this idea of public participation in the governance of science even seems to be "a nightmare" (Graur, 2007). In a survey, scientists in France, Germany and the US reported mild disagreement on the statement that "the public should have a say in the regulation of scientific activities and applications" (Peters, 2013a, Table S1). Peters (2013b) assumes that scientists' concerns regarding public participation are based on the belief that public participation might endanger the autonomy of science. Peters summarizes and generalizes the results of his surveys by claiming that scientists expect "a society supporting science and respecting its autonomy." Furthermore, scientists' motivation to participate in PEST activities seems to reflect the classical motives derived from the deficit model, e.g., to disseminate scientific knowledge or to win the public on science's side (Watermeyer, 2012). The ultimate goal of accepting participation in such activities is often to promote science. When dialogue is implemented to avoid societal dissent on scientific issues, Felt and Fochler (2010) consider the concept of dialogue to be used just as another way of education. Besley and Nisbet (2011), conducting a secondary analysis of two surveys (Pew Research Center, 2009; The Royal Society, 2006), identified an increase of science literacy and reduction of the scientific deficit of the public as primary motivations for scientists' public engagement. I.e., the assumption of a deficit model may also be a motivator for activities labeled "public engagement."

### 3.2 Strategic orientation of public science communication

At the 2007 Annual Meeting of the American Association for the Advancement of Science (AAAS) Larry Page, the Google founder and CEO, claimed that science has "a serious marketing problem." In his keynote, Page thought "a better ‘sell' of science's possibilities to policymakers, business leaders and the public" will improve the applications of science and technology in society.[11] Peters, Heinrichs, Jung, Kallfass, and Petersen (2008b) think that strategic communication about science is a requirement for legitimating science and for science becoming effective in politics. Both the PUS movement and the PEST movement can been seen as strategies of public communication. The Royal Society (1985) highlights communication between science and the mass media as an important strategy, for example. Dialogic communication or engaging with the public is just another communication strategy (van der Sanden & Meijman, 2008).

[11] See the press release of the AAAS, 17 February 2007, http://www.aaas.org//news/releases/2007_ann_mtg/127.shtml.

For quite some time, the journalistic media have been in the focus of public science communication studies. Some publications diagnose a changing yet not unproblematic science-media relationship (Brown, 2012; Rensberger, 2009). Empirical studies have demonstrated that expectations between scientists and journalists differ (e.g., Dunwoody, 1992; Nelkin, 1995; Peters, 1995; Salomone et al., 1990). These studies point out different expectations of communication actors and such differences may induce conflicts. For example, scientists want to have control about journalistic coverage of their own research, but journalists perceive this demand as threat to the professional autonomy of journalism (Dunwoody, 1992; Nelkin, 1995). There are many complaints about journalistic reporting of science based on the claims of "simplification," "contextualization," "sensationalism" or "personalization," for example. Not all scientists accept that journalists also in the field of science, technology and medicine select their stories according to news values (Badenschier & Wormer, 2012) in order to maximize public attention . Other studies try to provide explanations for the discrepancies between scientists and journalists. In an essay about selling science to the public, Highfield (2000) wrote that "journalists think carefully about their audience and communicate accordingly" more than most scientists do. According to Dunwoody (1992), researchers have a stronger desire to educate the public than journalists who see their function as information providers rather than educators. Peters (1994) thinks that scientists play different roles in public science communication depending on the respective scientific issue. For instance, he considers scientists as educators when popularizing new scientific findings and thinks that coverage about this kind of issues is "science-oriented" and related to the concept of popularization of science. In other contexts, journalists demand scientific expertise to explain practical problems; in these instances scientists serve as experts in "problem-oriented" communication.

Organizations such as science media centers or public relation (PR) departments are specialized in managing the public relation of scientific organizations and creating a long-term relationship with journalists and the public. Promoting the interests of scientific institutions and creating a positive public image of them is the priority of organizational PR (e.g., Nelkin, 1995). Peters (2012) writes that the involvement of scientific actors in science communication is increasingly characterized by "professionalization" and "strategic utilization." A "spin control" initiated by public relation offers is referred to "[…] making sure the public knows a lot about science or the scientists, but only the ‘right' things the organization thinks the public should know" (Borchelt, 2008, p. 149). According to Peters (2012, p. 227), PR officers of scientific organizations anticipate journalistic criteria in their work but use them to achieve organizational goals such as "legitimating the (scientific) organization by means of publicity and branding, […] marketing, political communication, and public education."

PR departments have affected scientists' outreach activities and visibility of scientific findings in the mass media. Developing media strategies is only one focus of the PR departments; another is to organize various public activities such as open days or science cafés thus inviting the public to gain insights into science (Kallfass, 2009). Furthermore, they offer their scientists training courses for communication skills, in particular about how to talk about science with nonscientists (Russo, 2010). As stated by Marcinkowski et al. (2014), demands from public relation officers of research organizations affect scientists' media efforts. Scientists who internalize goals of their research organization such as a higher visibility may make an effort to have more contacts with journalists. Many studies show a strong impact of science PR on journalistic coverage of science and medicine (e.g., Göpfert, 2007; Peters, 1984). According to Sumner et al. (2014), press releases sometimes even seem to trigger the exaggerations of research findings which are later found in journalistic reports.

With regard to the implementation of a communication strategy, studies show that a science communicator's image of the public is associated with their selection of a communication strategy. Maranta, Guggenheim, Gisler, and Pohl (2003) argue that images of laypeople are necessary for a science communicator in providing science-based advises. Scientists tend to have an unfavorable image of the public and perceive knowledge deficits among the public (MORI, 2000; Pew Research Center, 2009). As a consequence, scientists may deliberately reduce complexity and avoid controversy when communicating with the public in order to get their message across (Felt & Fochler, 2012; Nisbet & Mooney, 2007; Tosse, 2013).

Contextualization of science, an approach often used by journalists to make a link between science and society (Watts, 2014; Weingart, Salzmann, & Wormann, 2008), has been empirically identified in science communication and its importance is acknowledged by communication scholars. In a study of Felt and Fochler (2012) Austrian life scientists reported that they link their research with important problems in society when preparing grant proposals. Scheufele (2013) highlights scientists' participation in ongoing social debates about science and technology. Nisbet and Scheufele (2009) argue that it is important for scientists to connect their research topics to ethics and to focus on general information for the public rather than provide information about technical details. Nisbet and Mooney (2007) present a provoking idea about how scientists should communicate with the public. They claim that scientists should frame their central ideas to "pare down complex issues by giving some aspects greater emphasis" (p. 56). Speaking frankly, they suggest "scientists should strategically avoid emphasizing the technical details of science when trying to defend it" (p. 56). In an interview, Paul Myers, a blogging scientists and an associate professor of biology, criticized this suggestion, calling it "a formula for disaster," however (Bonetta, 2007, p. 444).

Most scientists accept a responsibility to communicate about science and their research with the public. Having a positive public image is important to individual scientists – for their career and the chances of receiving funding, for example (Nelkin, 1995). In its careers section, *Nature* published an article encouraging scientists to "meet the press" and provided tips to scientists about how to successfully get their message across (Russo, 2010). Felt and Fochler (2012) observed that scientists strategically use the (journalistic) media to attract public attention and to downplay scientific controversy. They point out that "the media is seen (in scientists' view) as a space to win societal support" and "as an arena where precautionary measures are necessary to avoid societal conflict on potentially controversial issues" (p. 141).

The new online media enable scientists to disseminate science stories without journalistic mediation. Scientists' use of the new media can be considered a strategic decision already, in terms of reaching a broader audience (e.g., Bonetta, 2009). However, it is unclear which communication strategy the scientists will apply in the new media, whether they use the new media to popularize science and foster public understanding of science or whether they use new media according to the public engagement approach as a means to have a dialog with non-scientists.

### 3.3 Repercussions and medialization of science

There are also warnings about unintended consequences of the increasing trend of scientists' orientation towards the public and particularly towards the media. Peter Weingart (1998, 2012) observes repercussions of public communication of science on science itself and expects that increasingly closer scientist-journalist collaborations may have consequences for science. According to Weingart (1998), the increasing "science-media-coupling" (p. 869) results from science's dependency on the journalistic media in gaining public support and the crucial role of the media in legitimizing scientific research in the public. He mentions three indicators of for the increasing science-media-coupling: (1) a priority shift from internal scientific communication to public communication, (2) increasing influence of media prominence on scientific reputation, and (3) anticipation of journalistic criteria in science communication. Weingart calls the process that science anticipates media criteria and uses them in its operations "medialization of science" (p. 871). Elaborating the concept of medialization of science, Rödder (2009) mentions two dimensions of the medialization: (1) increasing attention to science by the mass media and (2) increasing orientation of science towards the media. This section focuses on Rödder's second dimension of medialization.

According to Weingart (2012, pp. 26-30), consequences of science's orientation toward media can be observed on three levels: on the interactional, organizational and program level.

1. Effects on the interactional level describe scientists' adaption of journalistic criteria in their communication strategies, and the interdependency between media prominence and scientific reputation. Empirical findings actually show that many scientists perceive a positive impact of media visibility on their careers (e.g., Allgaier et al., 2013b; Peters, Brossard, et al., 2008). Y.-Y. Lo and Peters (2015) assume that scientists who have more frequent journalist contacts are more prepared to accept journalistic criteria. With regard to effects on internal scientific communication, the language used in scientific publications seems to change under the influence of medialization. For example, Jasienski (2006) found an increase in the frequency of phrases such as "unexpected" findings in natural science articles, and Fraser and Martin (2009) observed an increased frequency of "biased words" and "value-laden terms" (e.g., "vital" or "unique") in fundamental research journals. However, Peters (2013a) argues that scientists still attempt to maintain a clear boundary between internal scientific communication and public communication. Scientists are prepared to cooperate with journalists and to conform to journalist's expectation, but only to

certain degree, however. For example, natural and medical scientists frequently reject to talk about their research with the media prior to scientific publications (Peters, Spangenberg, & Lo, 2012). Other studies demonstrate that medialization at the interactional level differs across scientific disciplines (Pansegrau, Taubert, & Weingart, 2011; Peters et al., 2012) or scientific issues (Schäfer, 2007, 2008b; Weingart et al., 2008). For example, researchers in the humanities and social sciences have more frequent contacts with journalists than researchers in the hard sciences (Peters et al., 2012). However, according to Peters (2013a) the different frequency of interactions with the media in different fields results mainly from journalists' selective interests rather than from different media-orientation of researchers. Furthermore, Peters et al. (2013) argue that if a research field (such as neuroscience) is interesting for the public in several ways, this may actually reduce the need to anticipate media criteria to gain public visibility and thus limits direct repercussions.

2. On the organizational level, the adaption of scientific organizations to the mass media environment, several authors recognize a trend of institutionalizing media relations in scientific organizations and professionalize their public relations in order to maximize the organization's media visibility and public image (e.g., Blöbaum, Scheu, Summ, & Volpers, 2013; Friedrichsmeier, Laukötter, & Marcinkowski, 2015; Jung, 2012; Kallfass, 2009; Kohring, Marcinkowski, Lindner, & Karis, 2013; Marcinkowski et al., 2014; Peters, 2012). Peters, Heinrichs, et al. (2008a) and Peters (2012) argue that the medialization of scientific organization is the consequence of an increasing media influence on (science) policy. As scientific organizations want to influence science policy they try to increase their impact on the media. Focusing on the scientific publication system, Franzen (2012) shows the tendency of prominent science journals to use possible media attention as one of the criteria in their decisions on manuscript acceptance.

3. Medialization at the program level means influence of media criteria on scientific knowledge and knowledge production – the core of science. This would directly affect scientific values and thus the professional autonomy of science. Weingart (2012) assumes that consequences of medialization on the program level are least likely. There are some empirical indications

of such effects, though. For example, Heinemann (2012) shows some evidence that neuroscientists' aim to gain public attention for their research may well influence their choice of methodologies. Peters et al. (2009) surveyed biomedical scientists (epidemiologists and stem cell researchers) in France, Germany, Japan, the United Kingdom and the United States. In this survey about two thirds of the respondents claimed to know that a colleague had modified some decision in the research and publication process because of anticipated media publicity. While there was only little evidence of cross-country differences with respect to medialization, such differences were found in a cross-disciplinary comparison. In another study, Peters et al. (2012) compared medialization on the program level across 16 disciplines using eight indicators (table 3.1). The results showed that decisions on research and scientific publication in the humanities and social sciences are more sensitive to anticipated public responses than those in the hard sciences. Empirical evidence of medialization reported in Peters et al. (2009) and Peters et al. (2012) as well as results from qualitative studies (Heinemann, 2012) and anecdotal evidence (Allgaier et al., 2013b) lead to the conclusion that the autonomy of science is possibly endangered by the medialization of science. However, a survey in the field of neuroscience, based on semi-structured interviews with neuroscientists in Germany and the United States, suggests that the medialization influences on the program level are usually subtle compared to the effects of other external factors such as funding (Allgaier et al., 2013b; Peters et al., 2013).

This brief review of studies on the medialization of science shows that repercussions of media orientation of science have been observed in surveys of scientists (Allgaier, Dunwoody, Peters, Brossard, & Lo, 2012; Peters et al., 2013), in laboratory studies (Heinemann, 2012), and in the manuscript selection pattern of a prestige scientific journal (Franzen, 2012), for example. However, how fundamental and frequent such repercussions are remains an open question and probably varies across scientific disciplines.

| Index of research | Index of publication |
| --- | --- |
| (1) Choosing or avoiding certain research questions | (5) Speeding up or delaying a scientific publication |
| (2) Choosing or avoiding certain research methods | (6) Presenting or not presenting a paper at a scientific conference |
| (3) Selecting or avoiding certain sources of funding | (7) Emphasizing certain conclusions or interpretations in scientific publication or not mentioning them |
| (4) Choosing or avoiding certain collaborators | (8) Using or avoiding certain kinds of wording in scientific publications |

**Table 3.1** Two indices of medialization at the program level (Peters et al. 2012).

# 4 Scientists and the new online media

Many science communication scholars consider it important for scientists to use the new media to communicate with the public (e.g., Brossard, 2013b; Brossard & Scheufele, 2013). The online media are expected to facilitate the relationship between science (i.e., scientists and scientific organizations) and society (Scheufele et al., 2006). Their actual impact on science and the public remains controversial, however. For example, there is a dispute whether the new online media are more influential than journalistic media (Liang et al., 2014; Wilkinson & Weitkamp, 2013).

Regarding the use of new media by scientists there is still little empirical evidence. Previous surveys focused mainly on scientists' contacts with journalists or scientists' participation in public events. Compared to these studies, the empirical evidence from studies dealing specifically with scientists' online engagement is rather limited (e.g., Kyvik, 2005). However, previous findings on scientists' motivations to participate in public communication activities may nevertheless provide some relevant insights (e.g., Dudo, 2013; Dunwoody & Scott, 1982; Poliakoff & Webb, 2007). It remains unclear, however, whether such findings can be generalized to the online environment.

## 4.1 Scientists' use of the new media

The online environment comprises various communication platforms and each has particular features as Bik and Goldstein (2013) point out. According to them, blogs are optimal for building an online reputation, but managing blogs is time-demanding. Twitter requires low time investment and is ideal for breaking news, but it is not well-suited for online searches. Surveys of scientists' use of new online media show that scientists are familiar with them and use them for a variety of purposes. Moran et al. (2011) showed that US scientists frequently use new media for teaching and for other professional activities. Pscheida et al. (2013) found that also German scientists implement new media in their working routines, for example in their research, teaching, science administration and science communication. However, the use of new media proved to be less important for science communication than for other activities. According to a British survey, hardly one in five scientists uses new media, such as blogs or Wikipedia, for science communication (Research Information Network, 2010).

Depending on the characteristics of each medium, scientists have different expectations and develop different usages. Surveys show scientists' purpose-specific use of the new media. For example, according to Dzeyk (2013) and Pscheida et al. (2013), Wikipedia and online archives/databases are important for scientists' teaching and research activities. The two German studies are not completely consistent, however. While the survey of Dzeyk (2013) showed that blogs and social networks play only a marginal role in science communication, the results of Pscheida et al. (2013) showed quite the opposite. The differences between the two results are probably caused by the different sampling strategies. Mortensen and Walker (2002) and Kjellberg (2010) characterize researchers' blogging as an informal research tool – a kind of digital notebook for new ideas or writing practices. Comparing scientists' use of Twitter and Facebook, Yeo, Cacciatore, Brossard, Scheufele, and Xenos (2014) found that US scientists more frequently use Twitter than Facebook for sharing their work; Facebook was primarily used for private purposes.

The new media promise scientists a more active role in science communication than that as information sources for journalistic media. Already several decades ago scientists expressed a preference for a TV channel produced by science rather than reliance on programs produced by journalists (Peters & Krüger, 1985). The convenience of the new media now enables scientists to act as science communicators according to their long-existing preferences.

The new media may serve scientists as information sources for scientific issues. Bonetta (2009) describes how scientists scan tweets to follow the latest news or interesting publications. Twitter thus serves as a kind of alert service. Allgaier et al. (2013a) found that scientists follow "news and information about scientific issues" both in new media and journalistic media. Journalistic media proved to be clearly more important than new media, though.

The evidence about the effect of new media on scientists' visibility within their scientific communities or on the impact of their scientific publications is ambivalent. Shema et al. (2014) found that posting or announcing scientific publications in the new media increased the volume of citations, but other empirical studies did not confirm this. According to a study by Haustein, Peters, Sugimoto, Thelwall, and Larivière (2014), the correlation between the frequency of being mentioned in new media – in their case the number of "tweets" – and the number of citations in scientific publications is weak. An analysis of citation counts of academics before and after their talks on TED, a prominent disseminator of science-related videos, did not reveal a significantly increase of citations (Sugimoto et al., 2013).

Within science, online media have already become an alternative to traditional peer-reviewed journals. Scientists can put their manuscripts on online preprint servers (e.g., arXiv[12] and bioRxiv[13]) without previous peer review and citing from preprint manuscripts is legitimate and required. Scientists with experience in using online preprint servers confirm that preprint servers accelerate internal scientific communication (Bernstein, 2015). Another use of new media is the reporting of scientific conferences via microblogging (Saunders et al., 2009).

Several cases studies showed that public discourses about science in the new media had consequences for internal science communication and caused corrections or even withdrawal of papers. For example, Brookes (2014) demonstrated that Internet publicity enhances corrections in published articles. However, scientists interviewed by *Nature*[14] also perceived that scientific discourses in the new online media caused unexpected public attention distracting them from their work (Pain, 2015). According to Dinsmore et al. (2014), online presence potentially serves as an indicator to inform funders about research impact. Not without critique, some scientists are worried that the implementation of online presence as an impact indicator may "pressure researchers to ‘over hype' their results."[15]

Van Noorden (2014) argues in an editorial feature in *Nature* that the potential of new online media to create professional networks is a valuable advantage. Surveys on scientists' use of social online networks indicate their frequent use for career and professional activities (Dzeyk, 2013; Moran et al., 2011; Pscheida et al., 2013). Duque, Shrum, Barriga, and Henríquez (2009) demonstrated that for the international networking of researchers in developing countries online networks are very important while their local networks continue to rely on face-to-face communication. The new media also create spaces where scientists can discuss issues which would not be suitable for scientific journals. As an example, Woolston (2015) reported a discussion in new online media among researchers, initially triggered by Twitter, whether scientific writing should be more comprehensible and elegant.

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[12] http://arxiv.org/.
[13] http://biorxiv.org/.
[14] http://sciencecareers.sciencemag.org/career_magazine/previous_issues/articles/2015_01_28/caredit.a1500026 [last accessed 10 April 2015].
[15] John Gilleard, a veterinary parasitologist, expressed this concern in a tweet (quoted by Fun, 2014).

The new media promise to reach a broader audience than scientific journals. Online communication is seen as inevitable for scientists if they want to improve their communication with the public about science (Brossard & Scheufele, 2013). Yet, scientists' motivations to participate in online communication may be affected by other factors than the wish to communicate with the public, for example by their familiarity with the new online media and their working environment (Poliakoff & Webb, 2007).

Previous studies on predictors of scientists' participation in various forms of public communication provide a good basis for studies dealing specifically with scientists' motivations for online communication – even if they focus largely on scientists' contacts with journalistic media or popularizing publications (Bentley & Kyvik, 2011; Dudo, 2013; Dunwoody & Ryan, 1985). The study results indicate complexity in scientists' motivations to participate in public communication and the predictors identified – for example, demographic factors, position in the scientific community, discipline and scientific norms – all play a part in scientists' decision-making. So far, online communication is rarely a focus of these studies, pointing to a need for more research exploring scientists' motivators for online communication.

As recognized in several studies, time requirements are among the greatest impediments for scientists' participation in public activities, including their online activities, for senior and junior scientists alike (Mewburn & Thomson, 2013, p. 1106). Many scientists are afraid that online activities may distract them from "research" as their first priority and reduce their productivity (Buskes, 2011). However, contra-intuitively several studies show a positive relation between scientists' productivity and frequency of their engaging activities (e.g., Jensen, Rouquier, Kreimer, & Croissant, 2008). I.e., scientists being more successful in research also tend to participate in public activities more frequently. Scientists' perception of new online media may de-motivate some of them who think that the poor image of blogging would damage their career (Butler, 2005). Scientists have ambivalent perceptions about the safety in the online environment: some think that it is unsafe to talk about their ideas or about unpublished studies online (Bonetta, 2007); yet, this concern does not prevent other scientists from sharing their ideas in the Internet (Bernstein, 2015).

According to the assumptions of the PUS movement, an increase in scientific knowledge on the side of the general public enhances social support for science. That this belief in the utility of public communication for science is a motivation for scientists' participation in science communication activities has been confirmed in several empirical studies (e.g., Besley, Oh, & Nisbet, 2013; MORI, 2000; Peters, Brossard, et al., 2008). Furthermore, scientists' participation in those activities has been framed as their social duty (The Royal Society, 1985). Indeed, many scientists perceive participation in public communication as their responsibility (e.g., Allgaier et al., 2013b).

What role do demographic factors, such as age and gender, play in scientists' decision on engagement activities? Study results on the gender effect are inconclusive. Some found that male scientists are more active than their female colleagues (Besley, 2014), while some found female more active (Jensen et al., 2008; Johnson, Ecklund, & Lincoln, 2014). Also the effect of age on scientists' willingness to engage with the public is not clear. Besley (2014) analyzed variables related to scientists' motivations of participating engagement activities and found that younger scientists were more willing to participate in various public engagement activities than older scientists. Another study did not find significant age differences between junior and senior scientists' attitudes toward public communication, however (e.g., Peters, 2013a).

Public opinion surveys on media use consistently show that the use of new media is higher among younger than older age groups (e.g., Bernhard et al., 2014; van Eimeren & Frees, 2013). Age could also be a crucial factor for scientists' use of new online media. With respect to online public communication of science, one would thus expect that scientists who are active online are younger on average than those who are not. Indeed, according to a survey conducted by BioInformatics (2008), young scientists (20-40 years) use the new media more extensively than older scientists (60+ years). Furthermore, the study found age differences in the main purposes of new media use. For example, "younger scientists use social media to access objective feedback and services from multiple sources while older scientists use it to stay on top of trends and news."

Several studies suggest that a scientist's position in the organizational hierarchy is a better predictor for frequency of media interactions than his or her age. Scientists with a higher status are more frequently contacted by journalists (Dunwoody, Brossard, & Dudo, 2009). In her interviews with life scientists, Rödder (2012) found that scientific norms expect junior scientists to be "shy" and keep a low profile in public. Her findings suggest that scientific communities expect junior scientists to keep some distance from the public. Since junior scientists are very likely to have more exposure to new online media than senior scientists, the online environment may challenge that feature of the science culture, however. Furthermore, young scientists are encouraged to establish their own online presence (Tachibana, 2014). Thus, the assumed "shyness" of junior scientists may be less strict for online activities. Leadership position of scientists may thus be a less important predictor of scientists' online activities than for interactions with journalists.

Another factor that may be associated with scientists' motivations to participate in public communication is their scientific discipline. Several studies found the scientific discipline to be relevant for the likelihood of scientists' public participation. According to Peters et al. (2012), German researchers from the humanities and social sciences tend to have more frequent media contacts than their colleagues from life sciences, natural sciences or engineering. This is also true for other countries such as Norway (Kyvik, 2005), Sweden (Vetenskap & Allmänhet, 2003), and Argentina (Kreimer, Levin, & Jensen, 2011). Dunwoody and Ryan (1985) argue that the scientific norms in each discipline are crucial for scientists' public communication and they considered the norms for public communication to be less strict in social sciences than in natural sciences. Apart from humanities and social sciences, it remains open whether the frequencies differ between scientific disciplines such as life science, natural science and engineering and technology. Besley et al. (2013) conducted a secondary data analysis of two surveys conducted in the United States and the United Kingdom and found that chemists participated less frequently in activities of public communication than scientists in other disciplines, for example. However, the relationship between participation frequencies and scientific disciplines was weak. Jensen and Croissant (2007) analyzed annual reports of CNRS with respect to researchers' popularization activities. Their analysis showed that – apart from social scientists – life scientists reported more frequent participation in popularization activities than natural scientists and engineers.

Scientific discipline is not only a predictor of frequency of scientists' public communication activities but also a predictor of the thematic focus of media interviews. Results of the mentioned German survey of scientists from 16 scientific disciplines show that media interviews in the hard sciences tended to focus on concrete scientific research while interviews in the social sciences and humanities more often focused on general expertise (Peters et al., 2012). The authors explain the difference in the science-media relationship between social sciences and hard sciences by arguing that

> "research topics of the humanities and social sciences more often refer to situations and developments that are port of the everyday world. (...) The hard sciences have a quasi-monopoly in generating knowledge about their research objects. (...) This monopoly in defining truth may be a power resource for hard sciences in their relations with the media, but less so for the humanities and social sciences" (p. 261).

It is interesting to note that even within a broad scientific discipline such as biomedicine different topics of research may affect scientists' chance of having contact with journalists. Research topics which are directly related to the everyday world of the public are more likely to draw public attention than topics without such a reference. For example, the international survey of epidemiologists and the stem cell researchers by Peters et al. (2009) showed that in all five countries epidemiologists – explaining the relationship between diseases and life style, for example – had more frequent contacts with the media than stem cell researchers.

The type of research – applied vs. basic research – may have an effect on scientists' motivation in public participation, although the relevance of the type of research a scientist is devoted to and how strong he or she is motivated in public participation is unclear. Results of a survey of the US scientists show that scientists working in applied science are more eager to work for the public good than scientists in basic science (Pew Research Center, 2009). The survey results also show that for scientists working primarily in applied fields a financially rewarding career is more important than for scientists in basic research who put more emphasis on scientific challenges and breakthroughs (pp. 45-47). The study does not show how scientists' research field (applied or basic science) relates to their motivation of participating in public communication and the frequency of such activities. Two competing arguments are possible. One argument is to assume that applied research is closer to the everyday world of the public which would lead to a greater demand for public communication. According to this argument, scientists in applied research would be more involved in public discourses than scientists in basic science. The alternative argument is that scientists in applied science are more guided by cost-benefit calculations or considerations of utility for their own career. They may be less likely to communicate with the public because the benefits for their career are not obvious. This alternative would lead to the expectation that scientists in applied research participate in public communication less frequently than scientists in basic research.

Universities and other research organizations are usually interested in publicity. Their public reputation and visibility increases their competitiveness in fundraising and their influence in policy. Research suggests that scientists' perceptions of the attitude of their organization's management play an important role. Evidenced by Marcinkowski et al. (2014), demands from public relation officers of research organizations affect the employed scientists' media efforts. It is therefore not surprising that scientific organizations attempt to influence their employees' public communication activities, for example by expecting scientists to consult the public information department or superiors before talking to journalists (Peters & Lo, 2013). According to an article published by *Nature*, Harvard Medical School tried to rule that students "could only talk to the media after approval from administrative officials," but quickly rescinded that rule after criticism from students (May, 2009). The type of institution – for example private or public university – may have consequences for the degree of this control (Dunwoody & Ryan, 1985). The rise of the new online media causes some organizations to release regulations for their scientists regarding the use of new media and to build own platforms for new media (Batts et al., 2008).

Findings of the studies on scientists' motivations in participating in activities of public communication, which were mentioned in this subchapter, focus on the motivations of being in contact with the journalist-mediated media. Study results show several factors having effects on scientists' motivations to have media contacts and on the frequency of media contacts. For example, scientists with management role in their organization are more likely to be contacted by journalists than those who do not have a management role; or scientists in the humanities or social sciences have more frequently media contacts than scientists in hard sciences. Surveys dealing with scientists' new media use show that scientists do actually use them – as means of online networking with other scientists, for example. But these surveys do not particularly focus on scientists' new media use for public communication. With few exceptions, these studies hardly deal with questions of how often scientists use new media for public communication and what their motivations are in using new media for public communication.

## 4.2 Effects of scientists' use of new media for public communication

Although studies on the role of new online media in science communication are rare, several possible effects are discussed such as a change in the public representation of science, increasing availability of information, changes in the way reputation is built, repercussions on the style of scientific writing and more effective crowd funding.

Peters et al. (2014) speculate that scientists' use of new media for public science communication could alter the public representation of science because of increasing weight of scientists' self-presentation compared to journalistic observation of science. Some journalists express worries about this "less questioning approach" of science news and differentiate between science communication and science journalism (Watts, 2014).

The German blogger and former researcher Florian Freistetter clearly distinguishes between the roles of blogger and journalist: the blogger may communicate individual perspectives and opinions while the journalist has to remain neutral and to keep a distance to the topics (Bojanowski, 2014). Advice for scientists who want to run successful blogs will recommend them to "take a stand" (Costello, 2012) or to "be radical" on certain topics (Gewin, 2011). Personal views are like flags of blogs to attract an audience. Scientists who blog do not sharply distinguish opinions from evidence (Bonetta, 2007; Coombes, 2007; Wolinsky, 2011). The blurring of personal opinions and scientific evidence is controversial and several authors are worried that the general public may lack the ability to distinguish between opinions and scientific evidence (Schmidt, 2008).

Similarly, the sources of information are not always transparent to audiences. In 2010 the blog "Food Frontiers" launched in the reputable science blog network ScienceBlogs. It did not take a long time to reveal that authors of this blog were paid by PepsiCo. The science writers in this blog network protested sharply, fearing that being neighbor of a commercial company in ScienceBlogs would damage their own credibility and confuse the audience by not clearly differentiating between advertisements and science stories.[16] In the end, ScienceBlogs responded to the criticism and closed down the blog "Food Frontiers" (Wolinsky, 2011).

[16]http://www.theguardian.com/science/blog/2010/jul/07/scienceblogs-blogging-pepsi [last accessed 26 January 2015].

One possible effect concerns the visibility and image of scientists in their research community and in the general public. The online environment creates a new arena and stimulates scientists to present themselves there (Bukvova, 2011; Gewin, 2011; Reich, 2011). An increasing number of scientists expect advancement of their career if their research is covered by news media or is presented in new media (Pew Research Center, 2015). A survey of scientists conducted by *Nature* (Reich, 2011) led to interesting results about scientists' use of new media, although it has to be noted that the sampling is methodologically questionable. A majority of the respondents showed concern about their online presence, but only a marginal proportion said that they use optimization strategies to improve the visibility of their research in online searches. Respondents indicated that they use a variety of new online media such as Twitter, Facebook, blogs or Wikipedia biographies to increase their online visibility. It is not surprising that younger respondents of that survey were more concerned about their online presence than older respondents.

Weingart's "medialization of science" hypothesis suggests that science's orientation toward the mass media to increase public legitimization influences how scientists present and conduct their research. Such effects are also likely in the online world. For example, Ebner and Maurer (2009) showed that university students' blogging activities had an impact on their scientific writing in terms of presenting more personal statements and critical opinions.

A study demonstrates that presence in the new media is critically important for scientists who intend to campaign for crowd funding – a funding strategy requiring scientists to motivate nonscientists to invest money into their research (Byrnes et al., 2014).

Another study proposes that new online media may serve as an indicator for measuring the impact of scientific research (Dinsmore et al., 2014). Yet, some scientists are worried that the emphasis on online impact may seduce scientists to "over hype" their research (Fun, 2014).

Will the new media address science's "serious marketing problem"[17] in terms of increasing science's publicity? Empirical studies have not resulted in conclusive findings about the impact of new online media on the public visibility of science.

[17] See the press release of the AAAS, 17 February 2007, http://www.aaas.org//news/releases/2007_ann_mtg/127.shtml.

According to Liang et al. (2014), scientists' research being mentioned in new media has positive effects on scientists' interaction frequency with journalists and the general public. However, Wilkinson and Weitkamp (2013) compared dissemination via journalistic media with that via social media, and their results suggest that coverage in journalistic media brings about more contacts with a variety of actors (researchers, journalists and the general public) than presence in the new media.

# 5 Science blogs

Zivkovic (2012) points to difficulties in defining science blogs and thinks that identifying a science blog by the occupation of its author is not flawless. He writes:

> "Usually it is meant to be a blog that satisfies one or more of these criteria: blog written by a scientists, blog written by a professional science writer/journalist, blog that predominantly covers science topics, blog used in a science classroom as a teaching tool, blog used for more-or-less official news and press releases by scientific societies, institutes, centers, universities, publisher, companies and other organizations. But is a blog written by a scientist that never covers science really a science blog? Is a blog by a PhD in dentistry who spews climate denialism in every post a science blog?"

Furthermore, he argues that the development of technology extends the concept of blogs (e.g., blogging about text, photoblogging, videoblogging or podcasting) and that it is difficult to draw a clear line between what counts as a blog, and what does not.

For the purpose of this study a science blogs is defined as a blog dealing with scientific research, scientific knowledge, events and processes within science and the relationship of science and society. As the survey presented in this thesis focuses on scientists and their blogging activity, the focus is on a (important) subset of science blogs, namely those operated by scientists.

Science blogs are studied by various approaches, in particular by content analyses of blogs and by interviews with science bloggers (e.g., Colson, 2011; Fausto et al., 2012; Jarreau, 2015; Mahrt & Puschmann, 2014; Mewburn & Thomson, 2013; Puschmann & Mahrt, 2012; Ranger & Bultitude, 2014a). Such studies provide an overview about the characteristics of bloggers and their motivations, about blog audiences and blog contents.

## 5.1 Science Bloggers

Puschmann and Mahrt (2012) found that the typical science blogger in their sample was male and between 30 and 50 years old. A British survey of about 200 bloggers who mainly write about health issues came to a similar result (Kovic et al., 2008). The majority of bloggers in that survey were male, highly educated and between 30 and 49 years old. The respondents in a survey of US science bloggers conducted by Jarreau (2015) also were generally young. However, about 40% of the bloggers in her survey were female.

According to Puschmann and Mahrt (2012) and Colson (2011), science bloggers come from a diversity of professions: among them are scientists, journalists and PR officers, for example. A survey of bloggers from the German science blog network (scilogs.de) found that a large proportion of respondents has a scientific training (Puschmann & Mahrt, 2012). A large proportion of respondents in the survey of Jarreau (2015) mentioned academic research as their professional field, and very few of them identified themselves as journalists.

Mewburn and Thomson (2013) took a different approach. They defined a "science blog" by the blog authors' academic affiliation and composed a sample of 50 British science blogs. According to their analysis, the blogs were written by academics, PhD students and "para-academic" staff (p. 1109). With "para-academic" staff, they meant science managers or administrators and policy-makers. With a similar approach, Kjellberg (2009) found that the majority of bloggers in the Swedish academic blogosphere consists of PhD students.

Studies exploring science bloggers suggest multiple motivations for blog writing. Intrinsic personal motivation plays an important role for scientists' participation in public communication activities in general (e.g., Dunwoody & Ryan, 1985). That motivation is also relevant for people who blog about science (e.g., Masters, 2013). According to the report "State of the Blogosphere 2011" from Technorati (2011), a primary reason for a great number of the bloggers they surveyed for the report is to "share expertise and experience with others." According to Ranger and Bultitude (2014b), science bloggers are driven by a passion for writing and for sharing their enthusiasm for science. Similarly, Mahrt and Puschmann (2014) conclude that enjoying writing is a major motivation for science bloggers.

A majority of science bloggers are also motivated by the prospects of reaching a broader audience and sharing information with it. For example, most science bloggers in a German survey mentioned as their main motivation to discuss and exchange ideas with a broader audience (Puschmann & Mahrt, 2012). Kjellberg (2010) interviewed 12 scientists who write science blogs in Sweden, Denmark and the Netherlands about their motivations. She identified "sharing, room for creativity and feel connected with others" as main motivations. Ten French-speaking science bloggers, interviewed by Colson (2011, p. 899), said they were mostly motivated by the need to communicate with a broader audience.

Although the new online media allow disseminating information and expressing own opinions, science bloggers have different opinions about expressing their opinions. The blogging scientists interviewed by Kjellberg (2010) appraised that blogs allow to express own views. Survey results of Puschmann and Mahrt (2012) draw a somehow different picture as only one third of German science bloggers see expressing their opinions as their blogging goal.

Some scholars expect that the new online media shape a new interface between science and the public, and play a dominant role in science's public engagement (Adams, Lomax, & Santarini, 2011; Laslo, Baram-Tsabari, & Lewenstein, 2011). So far, empirical evidence does not conclusively support this expectation. According to Kovic et al. (2008), most bloggers intend to influence others by their blog posts. Yet, Colson (2011) interviewed 10 French-speaking science bloggers and found that – contrary to the cases reported in Bonetta (2007), Coombes (2007), and Waldrop (2008) – the interviewed bloggers did not intend to affect public opinion as a goal of their blogs. A quantitative content analysis of German blog posts from six blogs indicates that the bloggers are more likely to share knowledge and scientific information rather than expressing their opinions (Leidinger, Quiring, & Schäfer, 2015). According to Puschmann and Mahrt (2012), only part of the bloggers they surveyed emphasized the importance of blogs as a forum for debates and opinions. Some blogging scientists seem to be aware that the topics of their blogs will hardly attract broad public attention (Kjellberg, 2010).

### 5.2 Contents and audiences of science blogs

Topics covered in science blogs are diverse (Fausto et al., 2012; Mewburn & Thomson, 2013). The majority of science bloggers said that they blogged for a broader audience (Colson, 2011; Puschmann & Mahrt, 2012), but content analyses of blog comments suggest that science blogs attract mostly like-minded people (Kouper, 2010).

Previous studies exploring blogging concluded that blogs serve as a place for recording ideas or as a digital diary (e.g., J. Davies & Merchant, 2007; Mortensen & Walker, 2002; Walker, 2007). Studies show that a blog usually contains heterogeneous contents. Mewburn and Thomson (2013) analyzed 100 academic blogs and identified nine types of blog content: self-help, description of academic practices, technical advice, academic culture critique, research dissemination, career advice, personal reflections, information and teaching advice (pp. 1110-1111). According to the results of their content analysis, personal reflections on the science system or on academic institutions (academic culture critique) and sharing research findings in a plain language (research dissemination) are the two most frequent science blog topics. Another content analysis of blogs by Ranger and Bultitude (2014a) also showed that science blogs usually cover diverse topics; besides science, topics like politics or religion are sometimes dealt with, for example. According to Kjellberg (2009), Swedish researchers predominantly use their blogs to report or share information about research or information related to their scientific discipline. Fausto et al. (2012) showed that issues related to health and medicine are a dominant topic in the science blogosphere. Bukvova, Kalb, and Schoop (2010) analyzed blog posts of 12 German blogging scientists whose blogs focused on research-related information. They found three basic types of contents (p. 92):

1. Expertise: information about topics related to science.
2. Activity: information about activities the blogger participated in such as teaching or conference visits.
3. Identification: personal reflections or information revealing the author's individuality.

Often, the blog content reflects the daily life of bloggers and covers up-to-date events. Mortensen and Walker (2002) assume that researchers use blogs to record their thoughts. Yet, in the survey on science bloggers (Puschmann & Mahrt, 2012) about one third of science bloggers reported that they blogged mainly about research from their own field but not conducted by themselves, while about 12% said that they blogged mainly about their own work. Another third said they blogged about own and colleagues' research. The relative low proportion of bloggers focusing on their own work in their blogs seems to contradict the concept of blogs as digital notebooks. One of the reasons preventing scientists to blog about their own research may be concerns that their ideas may be scooped if made available in the Internet before scientific publication (Bernstein, 2015). Shema, Bar-Ilan, and Thelwall (2012b) found that science bloggers often cite own publications in their blog posts. Yet the number of studies dealing with this question is small, and content-analytical approaches face the difficulty of identifying whether research reported in blogs is the authors' own research or not.

The selections of blog post topics may be part of strategies to reach a broader audience. According to Ranger and Bultitude (2014a), topic diversity plays a key role, besides update frequency and inclusion of multimedia content (pictures and videos) in popularizing science blogs. In their interviews with blogging scientists, Bonetta (2007) and Coombes (2007) found that many bloggers covered a variety of topics in their blogs. These topics were not limited to research but extended beyond science. The blogging scientists were aware that a large proportion of "science heavy" posts (Bonetta, 2007, p. 445) may scare their audiences, and believed that keeping a diversity of topics in a blog would attract diverse audiences. Leidinger et al. (2015) think that topic diversity results from the individual blogger's style rather than from a well-calculated strategy of addressing audiences, though.

Addressing a broader audience compared to the audience of scientific publications is one of the significant purposes of blogging. Empirical studies of science bloggers show that science bloggers have a strong motivation to communicate with the general public and other audience groups such as amateur scientists, practitioners, colleagues and students (Mewburn & Thomson, 2013; Puschmann & Mahrt, 2012). Some blogging scientists indicate that they blog to address opinion leaders such as policy makers (Bonetta, 2007). However, a more representative study of science bloggers draws a different picture about the relevance of decision-makers as audience. Puschmann and Mahrt (2012) found that science bloggers do not consider funding bodies, decision-makers and people from industry an important audience.

Writing styles too reflect science bloggers' public communication strategies, comparable to the science-media relationship where scientists were found to "press-packaging research" for journalists, i.e., "to communicate one's research in a brief form adapted to and attractive for a specific public" (Felt & Fochler, 2012, p. 142). Ranger and Bultitude (2014a) interviewed prominent science bloggers about their communication strategies in blogs, and the bloggers repeatedly mentioned strategies like reducing jargon, simplification, analogies and metaphors and appealing to audience. Yet, Mewburn and Thomson (2013) analyzed researchers' blog contents and found that the majority of blogging scientists were writing for people similar to them. The popular science bloggers interviewed in the study of Ranger and Bultitude (2014a) perceived their blogs to be attractive to an audience who, like them, is interested in science. There is hardly any solid evidence about the composition of audience groups of science blogs; it thus remains an open question whether blog posts are reaching the intended target groups.

It is quite clear that the writing style in science blogs can be more creative and individual than the writing style in scientific publications. According to a content analysis of Mewburn and Thomson (2013) who studied the writing style in science blogs written by researchers, most blog posts covered information and sources, as well as opinions and reflections, in a single post. Yet, despite a more relaxed tone many posts still basically used the style of scientific writing. Mewburn and Thomson (2013) therefore conclude that researchers' blogging is an extension of their academic identity.

There is a discussion about the Internet as a new type of public sphere with easier access of a larger number of communicators and a more dialogic mode of communication (e.g., Gerhards & Schäfer, 2007). In principle, comments enable interactions between authors and audiences and promise to advance public engagement with science and technology. According to Puschmann and Mahrt (2012), science bloggers perceive a strong interactive relationship between them and their audience, supported by audience feedback and requests for more information, for example.

Only few studies deal with the audiences of science blogs. However, estimations about the size of science blog audiences suggest that for only few people science blogs are the main information resource about science and technology (National Science Board, 2014). Littek (2012) conducted a survey of German science blog users. Her survey results show that blog users are typically between 20 to 39 years old. With respect to the type of blog users, the survey distinguished between scientists, science journalists and laypersons. A survey of visitors of the science blog of the National Institute for Occupational Safety and Health (NIOSH) showed that the survey participants were mostly about 40-59 years old and that they visited the science blog mostly occasionally (Sublet, Spring, & Howard, 2011). According to Littek (2012), blog users perceive science blogs as informative and entertaining but also as rather informal information sources. Furthermore, blog users with academic backgrounds perceived science blogs as semi-professional information sources relevant to their career. On the one hand, similar to other blog users such as science journalists and laypersons they confirmed the entertaining role of science blogs; on the other hand they reported more frequent attempts to network with scientific peers via blogs than the other two groups. Not specifically for science blogs, a survey of blog users shows that information seeking and cross-checking with mainstream media are among the most important motivations, compared with other motivations such as information seeking, entertainment and satisfaction of individual needs (Kaye, 2005).

Whether blogs or other new online media help to advance the quality of public discourses remains under debate. Online discourses do not seem to have a general advantage to discourses in traditional media regarding their deliberative character. Studies on online public discourse show a trend of homogenizing opinions and connecting participants with similar background (Kouper, 2010). Rather than leading to sensible debates among participants, online discourses occasionally derail in verbal attacks and irrational responses (Anderson et al., 2013). Furthermore, it is disputed how inclusive the public in the online environment is. Kouper (2010) analyzed audiences' comments in 11 science blogs and found highly homogeneous knowledge background of blog authors and audiences. Mahrt and Puschmann (2012) found out that the type of responses to a blog post depends on its topics and writing style. For example, a blog post written in plain language is more likely to receive comments in everyday language. Furthermore, many communication scholars think that public discourses in an online environment may be more diverse than the discourses covered in traditional journalistic media. Yet, an empirical study could not confirm this. Comparing online discourses and discourses in print media, Gerhards and Schäfer (2010) found less differences than they had expected.

### 5.3 Boundaries between science blogs and science journalism

The exact nature of the relationship between blogging and journalism is unclear, but they effect each other without doubt (Andrews, 2003). With regard to science communication, Brumfiel (2009) claims an interdependency between blogging and journalism. Colson (2011) sees a competition between the two forms of communication in disseminating science. Others diagnose a decreasing influence of science journalism and an increasing of influence of science blogs (Nisbet & Scheufele, 2009).

The new media promise scientists a more active role in science communication, overcoming their dependency on journalists as mediators. A survey of American scientists shows that a considerable number of them uses the new media to engage with the public (Pew Research Center, 2015). Even before the rise of the new online media, scientists expressed the preference to communicate directly with the general public, not just as information sources of journalists (Peters & Krüger, 1985).

However, it remains unclear whether scientists' use of the new media would lower their role as information sources for journalism. A survey of science journalists showed that scientists' blogs are important sources for journalists in preparing science news (Brumfiel, 2009). And one of purposes of scientists' blogging, identified by Bonetta (2007), was to signify for journalists what the important science stories are. These examples show that scientists' use of new online media increases their visibility to journalists and their chance of becoming information sources for the journalistic media. The relationship between scientists' use of new media and journalism may thus be more complex than just being competing alternatives. Comparing journalism and blogging, Lowrey (2006) speculates that blogging outplays journalism in terms of its capability to cover highly specialized contents. According to him, the quality of blog posts about science made available by blogging scientists might advance science journalism. Proponents of science blogging are thus optimistic that science communication could significantly profit from the rise of blogging by individual scientists (Brossard, 2013b).

Science bloggers are struggling about the reputation of blogs compared to traditional media. On the one hand, science bloggers are often dissatisfied with the quality of (journalistic) coverage of science and think they can do better (Colson, 2011; Puschmann & Mahrt, 2012). On the other hand, science bloggers perceive that blogging is viewed as an amateur activity rather than being part of the professional media (Ranger & Bultitude, 2014a). The survey of German science bloggers by Puschmann and Mahrt (2012) shows that bloggers have critical views of mainstream science journalism; in particular they criticize the sensational style in reporting science by journalists. Even before the new media became popular, expectations of media coverage of science differed between scientists and journalists (Y.-N. K. Chen, 2011; Peters, 1995). The blogosphere is expected to be an alternative for those who are unsatisfied with the quality of science journalism and a possibility for scientists to produce their own content and to disseminate it to the public without mediation by journalists (Brossard & Scheufele, 2013; Nisbet &

Scheufele, 2007). However, in contrast to the expectation that blogs are an alternative to science journalism, a majority of science bloggers do not perceive blogging as supplanting science journalism (Puschmann & Mahrt, 2012). Blogging scientists do not seem to adopt a role similar to that of science journalists. Interviews with science bloggers indicate that they do not wish to remain neutral in science stories as science journalists are supposed to do but rather that they want to express themselves and take a stand in debates (Bojanowski, 2014; Colson, 2011). This is further confirmed by content analyses of science blogs showing that only a marginal percentage of blog posts is written in a journalistic style (Mewburn & Thomson, 2013).

Peters et al. (2014) are cautious regarding the possibility that new media, such as blogs, can replace science journalism. They doubt that science blogs can perform core functions of journalism such as professional surveillance of science and selection of topics based on a broad concept of social relevance. They argue that science blogs are another opportunity for science's self-presentation but that science blogs may not take over the function of science journalism.

Nevertheless, as shown above, science blogs are interdependent with science journalism. On the one hand, they serve as information sources for science journalism. Survey results show an increasing number of science journalists searching for ideas for media stories in science blogs (Brumfiel, 2009). On the other hand, science bloggers frequently refer to journalistic mainstream media in their blog posts. For example, a content analysis of hyperlinks in science blogs demonstrated that the blog posts often contain links to articles of journalistic online media (Walejko & Ksiazek, 2010).

# 6 Cross-cultural variations of communication

Cross-cultural differences in communication patterns have been investigated from different perspectives. Hallin and Mancini (2004) as well as Hanitzsch et al. (2011) distinguish different types of journalism; other authors describe general features of cultures (e.g., Hall, 1976; Hofstede, 2001; Inglehart & Carballo, 1997; Inglehart & Welzel, 2005; Yum, 1988) which can be linked to media preferences, communication goals and thematic interests. Empirical evidence about the relationship between culture and communication patterns specifically in the field of science communication is rather limited, though. Because the empirical survey of this study compares Germany, the United States and Taiwan, the discussion of cultural differences and their consequences for (science) communication focuses on these countries where possible.

This chapter discusses three aspects of cross-cultural differences: professionalization of journalism, culturally rooted communication preferences, and concepts of science. The emphasis of this discussion is on the implications of cross-cultural differences for scientists' involvement in public science communication.

## 6.1 Professionalization of journalism

Hallin and Mancini (2004) distinguish three main types of media systems in North America and Europe and argue that the journalistic culture differs with political and historical contexts. Based on their observation of newspaper industries, they distinguish between the *Mediterranean or polarized pluralist model*, the *Northern European or democratic corporatist model* and the *North Atlantic or liberal model*. Each model implies a different form of professionalization of journalistic media, i.e., a specific combination of professional orientations on three dimensions: autonomy, distinct professional norms (e.g., ethical principles and obligation to protect confidential sources) and public service orientation.

According to the authors, journalism in the democratic corporatist model (e.g., Germany) and liberal model (e.g., the United States) is generally stronger professionalized than in the polarized pluralist model (e.g., France and Italy). That means that journalists in the corporatist and liberal models have more autonomy in their work (e.g., perceive less pressure from management on their work), follow more distinct professional norms governing the practice of journalism, and are more orientated towards public service and self-regulation than journalists in the Mediterranean or polarized pluralist model. Hallin and Mancini (2004) consider the professionalization of journalism in the Mediterranean model as weak; for example, they expect the journalistic media in these countries to be more influenced by outside actors from the political or economic field, for example.

Hallin and Mancini (2004) constructed their models on the basis of case studies in European and North American countries; they did not explicitly include Asian countries. Yet, characteristics of the journalistic media in Taiwan reflect the main characteristics of the Mediterranean model, in particular weak professionalization of journalism. Rawnsley (2007, p. 64) observed that the mass media in Taiwan "are political polarized, leaving little space for political independence and causing relations among politicians, the media, and their audiences to deteriorate." S.-S. Huang (2010) analyzed the press history in Taiwan and found that the press organizations in Taiwan are rarely an autonomous institution and have been ruled by forces from politics and economics.

Other studies show that while some ethical rules are worldwide respected by journalists, journalists in different cultural contexts react differently when facing ethical dilemmas (Hanitzsch et al., 2011; V.-h. Lo, Chan, & Pan, 2005). Hanitzsch (2007) distinguishes three attributes of journalism culture, namely institutional roles, epistemologies and ethical ideologies. Institutional roles refer to the "normative responsibility" of journalism and to its "functional contribution to society" (p. 371). The attribute "epistemologies" is defined as "the study of knowledge and the justification of belief" (p. 375) and refers to predisposition to knowledge and truth. For his attribute "ethical ideologies," Hanitzsch (2007) adapted Forsyth's (1980, 1981) concept which assumes two basic continuous dimensions of ethical ideologies: relativism and idealism. Relativism refers to individuals' beliefs in universal moral rules and idealism refers to individuals' moral attitudes in ethical dilemma. For example, a relativist individual tends to deny the existence of universal moral rules and an idealist individual believes that desired consequences could be obtained by right actions (Forsyth, 1980). Using that concept, Hanitzsch et al. (2011) conducted a survey of journalists in 18 countries. Their survey showed that journalists worldwide highly regard their normative responsibility and agree with the importance of factual information and reliability of information. Yet, while Western journalists adhered to universal moral rules, non-Western journalists had relativist ethical views. Although ethics codes in all analyzed countries demanded from journalists to reject any benefits from the people they write about, survey responses of journalists from non-Western contexts (China, Hong Kong and Taiwan) showed that journalists in these countries held more differentiated views than journalists in the West. For example, they perceived that receiving gifts, free trips and free meals from sources was acceptable, but not cash (V.-h. Lo et al., 2005).

Comparative studies on science journalism are rare; exceptions are Bauer, Howard, Ramos, Massarani, and Amorim (2013) and Lehmkuhl, Karamanidou, Mora, Petkova, and Trench (2014), for instance. According to the global survey conducted by Bauer et al. (2013), science journalists worldwide perceive their role as reporters to inform the public, and they agree with the importance of facts and objectivity in science stories. Shanahan (2005) assumes that science journalists in developing countries face more challenges in producing stories with good quality than science journalists working in industrial countries, due to the lack of science training, scarcity of scientific information sources and mistrust by scientists.

Some studies compare journalism in media systems with public service vs. market orientation. A media system with public service orientation is more likely to provide a larger volume of public knowledge than the system with a market model (Curran, Iyengar, Lund, & Salovaara-Moring, 2009). An empirical study of TV science programs in 11 European countries showed that TV channels with low market pressure are more likely to provide a broader picture of science than those with high market pressure (Lehmkuhl et al., 2014). Hallin and Mancini (2004) characterize German media system as strong public service oriented and the US media system as market dominated. S. Y. Chen (1998) described the Taiwanese media system as previously state intervened and recently becoming market-orientated, but not public service orientated. The German media system seems to have a strong public service orientation, thus it could be well assumed that German media are more likely to cover information about science than the media in the United States and Taiwan.

Y.-Y. Lo and Peters (2015) used two indicators to compare the prevalence of professional science journalism in Taiwan and Germany. In a survey of scientists in both countries, they asked about the type of journalist (specialized in covering science/not specialized) scientists had contact with, and about the main topic of interviews (research/general expertise). In Germany, scientists more often had contact with science journalists than in Taiwan and the topic of the interviews in Germany was more often focused on research. They conclude that the state of science journalism is more in advanced in Germany than in Taiwan.

Peters (2013a) assumes that differences in the media audience's interest in science and in the competitive character of the research system can both lead to cross-country differences in the science-media relationship. For example, science journalists in a country with a less competitive research system may prefer sources from countries with strong research system, for example the United States (Massarani, Buys, Amorim, & Veneu, 2005). Y.-Y. Lo and Peters (2015) found that scientists in Taiwan, a country with a less competitive research system, have less frequent contacts with journalists than those in German, a country with a competitive research system. C.-J. Huang and Jian (2006) make the complementary argument that Taiwanese science journalism heavily depends on media coverage of science in Western (English-speaking) countries and that the Western media are one of the most important sources for Taiwanese science journalism. C.-J. Huang (2013) criticizes this import of science stories which he thinks suffers from "double media distortions": one distortion taking place in the translation from a scientific publication to a science story, the second in the translation from English into Chinese language.

Domingo and Ari (2008) suggest a typology of the relationship between blogs and journalism with respect to the degree of institutionalization. They distinguish "media blogs" (provided and supported by media organizations), "journalist blogs," "(media) audience blogs" and "citizen blogs" assuming that these four types form a continuum with "media blogs" as most institutionalized form at one end and "citizen blogs" as least institutionalized form at the other end. In many cases the new online media have only limited impact on journalistic media (Abbott, MacDonald, & Givens, 2013; Nielsen, 2012; O'Sullivan & Heinonen, 2008) or the influence of new media would be low without journalistic media picking up their content (Rutherford et al., 2013). However, in several current occasions, such as in the Arab Spring in 2012 (Howard et al., 2011) and in the Umbrella Revolution in Hong Kong, 2014, new online media played a significant role in carrying on the protests. Comparing the coverage of vaccination issues in China and the United Kingdom, Ren, Peters, Allgaier, and Lo (2014) assume that if audiences do not find information they consider important in journalistic media, they may seek further information in "alternative media" and blogs may become relatively more important.

Nielsen (2012) concludes that the increasing popularity of the Internet does not essentially shake professional journalistic work and that journalistic media remain most important in disseminating information in countries such as Brazil, Finland, France, Germany, India, Italy, the United Kingdom and the United States. A survey of European journalists shows that blogs play only a marginal role for journalism in general (O'Sullivan & Heinonen, 2008). However, surveys of science journalists suggest that science journalists actually use blogs to get ideas for stories (Brumfiel, 2009; Colson, 2011).

Observing the political effect of the new online media in China and Malaysia, Abbott et al. (2013) find only limited impact of new media in both countries, in terms of the impact on democratization and creating of public sphere despite the different political systems. According to Lin (2013) who analyzed references to new media in Taiwanese TV news, new media are used as information sources for topics such as society and entertainment, but not for topics about science or medicine. Journalists interviewed in this study reported that they were expected to monitor the new media for potential media stories.

A conclusive picture about cross-cultural differences in the relevance of new media as information sources either for traditional journalism or as an alternative to it does not evolve from the mentioned studies. It seems clear that the journalistic media remain important in all countries but that – dependent on topic, professionalism (autonomy) and selectivity of the mainstream media – blogs and other social media can become an alternative both for sources and audiences.

### 6.2 General communication patterns and preferences

Several theoretical approaches postulate differences in the styles of communication. This subchapter uses three approaches to discuss possible cultural differences with relevance to science communication: the media richness theory (Daft, Lengel, & Trevino, 1987; Leonard, Van Scotter, & Pakdil, 2009), the concept of low- and high-context cultures (Hall, 1976) and the general characterization of cultures on five dimensions by Hofstede (2001).

In their media richness theory, Daft et al. (1987) postulate that the selection of communication media (in a broad sense) by individuals depends on their perception of these media and their expectations of whether these media match the demands of the respective communication task. The theory proposes that each medium has different characteristics and argues that communication performance can be optimized by matching media characteristics to the demands of communication tasks. The volume of a medium's "richness" is related to its information variety, its multiplicity of cues (e.g., tones of voice), its capability of personalizing the message and its speed of processing feedback (Dennis & Kinney, 1998; Dennis & Valacich, 1999). According to the definition of "richness," face-to-face communication is recognized as a richer medium than a document, for example. In this theory, media choice is based on communication purpose, capacity of information channels and personalization. The volume of media richness is determined by the medium's capacity of immediate feedbacks and availability of (facial and vocal) cues. In an empirical study Daft et al. (1987) showed that success of communication is related to how well the task demands match the selected media (e.g., face-to-face, telephone, personal documents and impersonal written documents). However, Dennis and Kinney (1998) could not replicate that finding.

Media richness theory itself does not consider cultural variations, but it is quite plausible that media preferences with respect to their "richness" are culturally rooted (Leonard et al., 2009; Ross, 2001). Several studies demonstrate that cultural variations matter in the perception of a medium's richness and for people's communication preferences. For example, Rice, D'Ambra, and More (1998) found that people in collectivist countries perceive telephone as less rich than people in individualist countries. Lee (2000) showed that for people in a Confucian cultural context appropriateness with regard to social relations has higher priority in choosing a medium than optimal communication.

Hall (1976) proposed a theory characterizing forms of communication along a continuum ranging from "low-context" to "high-context" orientation. High context communication is "one in which most of the information is either in the physical context or internalized in the person, while very little is coded, explicit, transmitted as part of the message" (p. 91). In contrast, low context communication means that "the mass of the information is vested in the explicit code" (p.91). According to Hall, communication with low-context orientation avoids indirect and ambiguous meanings, and messages tend to be as precise as possible. Table 6.1 summarizes characteristics of high vs. low context communication following several review articles (Korac-Kakabadse, Kouzmin, Korac-Kakabadse, & Savery, 2001; Peng

& Nisbett, 1999; Yum, 1988). The prevalence of low vs. high context communication can be interpreted as a cultural feature. Hall (1976) sees Asian cultures, e.g., Taiwan, characterized by high context orientation, whereas he considers Germany and the United States as examples of low-context countries.

| Characteristics of communication with low- vs. high-context orientation | |
|---|---|
| Attributes of low-context communication (e.g., United States, Germany) | Attributes of high-context communication (e.g., China, Japan, Taiwan) |
| Explicit, clear information | Implicit, ambiguous information |
| Abstractive | Associative |
| Direct, rational argumentation | Indirect, emotional exchange |
| End product fundamental to interaction | Harmony fundamental to interaction |

**Table 6.1** Characteristics of low-context vs. high-context communication.

In an extension of the concept of low- vs. high-context communication Peng and Nisbett (1999) showed that countries differ not only with respect to communication but also regarding approaches to resolve confrontations. A series of psychological experiments comparing the reasoning of Taiwanese and American undergraduates by Peng and Nisbett (1999) revealed different argumentation preferences of students from the two countries. Taiwanese students preferred dialectical thinking assuming that concepts and rules are relative and indefinite, while American students preferred logical and analytic reasoning.

Differences in low- and high-context orientation also influence corporate communication strategies. In their analysis of public relation strategies, Men and Tsai (2012) showed that Chinese companies are more likely to use high-context communication and an indirect communication style than American companies. For example, Chinese companies are more likely to provide information which intends to maintain interaction with their network members such as greetings and jokes than American companies, while American companies more frequently provide information directly related to the company or their products.

A widely used classification of cultures is based on Hofstede's work identifying six main dimensions that are thought to characterize national cultures and differences between them. His analysis is based on survey responses of employees from different countries in an international corporation (IBM). Between 1967 and 1973 more than 116,000 questionnaires were completed by participants from 72 countries (Hofstede, 2001).

Three of his six dimensions – individualism vs. collectivism, power distance and uncertainty avoidance – are used by several authors to explain cultural variations in communication (Leonard et al., 2009; Massey, Hung, Montoya-Weiss, & Ramesh, 2001; Richardson & Smith, 2007). The dimension of individualism-collectivism refers to "the relationship between the individual and the collectivity that prevails in a given society" (Hofstede, 2001, p. 209). In an individualistic culture, individuals tend to have rather loose interpersonal relationships, whereas in collectivism culture the bonds within the in-group are clear and intensive. Yum (1988) argues that Hofstede's concept of collectivism is not precise enough to adequately describe the type of interpersonal relationships in East Asian. Instead of focusing on collective identity as characteristic, Yum (1988) thinks that the East Asian culture puts emphasis on "proper social relationships" and relation maintenance (p. 375), whereas the North American culture emphasizes outcome orientation, a rather definite linguistic code and direct communication (p. 381). Communication in Asia thus aims to initiate and develop relationships, and is seen as a process of infinitive interpretation because the communication codes tend to be vague and indirect. She regards this process-orientation of communication as a specific characteristic of communication in Confucian cultures. Both Hofstede's dimension of individualism vs. collectivism and Yum's contrasting of East Asian and North American orientations are quite compatible with Hall's distinction between low- and high-context orientations described above.

Compatible with the description of differences between East Asian and Western (European and North American) culture, Y.-Y. Lo and Peters (2015) concluded from their empirical survey of Taiwanese and German life scientists that Taiwanese scientists in their orientations towards public communication put more weight on social relations than on rational arguments. For example, they found that expectations of Taiwanese scientists towards journalists more frequently referred to "social relationship between science and the media and the social status of science" than those of their German colleagues (p. 17).

Hofstede's dimension of power distance is expected to have impact on communication with regard to media selectivity. Power distance refers to the way societies deal with inequality among people. In a high power distance society, there is an acceptance of "a hierarchical order in which everybody has a place and which needs no further justification," whereas in a low power distance society, "people strive to equalize the distribution of power and demand justification for inequalities of power."[18] Linking Hofstede's concept of power distance to media richness theory, Leonard et al. (2009) propose that people in a high-power-distance culture may consider rich communication media more effective than people in a low-power distance culture (pp. 860-862). Richardson and Smith (2007) compared communication preferences between Japanese (high context and high power distance) and American (low context and low power distance) students, when they have to contact their professors. They found that Japanese students preferred media such as face-to-face communication, telephone and letters. American students were more likely to use e-mail to contact their professors.

The dimension of uncertainty avoidance refers to how a society copes with future uncertainty and ambiguity. According to Hofstede (2001), uncertainty avoidance is "the degree to which the members of a society feel uncomfortable with uncertainty and ambiguity."[19] Again, Leonard et al. (2009) combine this dimension with the media richness theory and propose that "individuals in societies with higher uncertainty avoidance will consider rich media more effective for organizational communication than will individuals in societies with lower uncertainty avoidance" (p. 864). Massey et al. (2001) merge the related concepts of individualist, low context and lower uncertainty avoidance cultures, and collectivist, high context and higher uncertainty avoidance cultures, respectively, into a dichotomous typology of cultures. Then they consider the consequences of the two types of culture for communication preferences when dealing with disagreements in collective decision-making. According to their research, individualist, low-context and lower uncertainty avoidance cultures prefer to "reach decisions through a direct, more linear and exacting communication process that values forthrightness, debate and confrontation" (p. 211), while collectivist, high-context and higher uncertainty avoidance cultures prefer "indirect, subtlety-laden communication processes that value hierarchical relationships and a calculated degree of vagueness to avoid conflict" (p. 211).

To summarize, the review of the literature points to several cultural variations in communication preferences and communication styles contrasting communication patterns between Western cultures and East Asian cultures. In Hofstede's international comparison differences between European cultures (e.g., Germany),

[18] http://geert-hofstede.com/national-culture.html [last accessed 4 September 2015].
[19] http://geert-hofstede.com/national-culture.html [last accessed 4 September 2015].

American cultures (e.g., the United States) and East Asian cultures (e.g., Taiwan) are clearly recognizable on the dimensions of individualism, power distance and uncertainty avoidance (figure 6.1). Especially striking are the differences between Germany and the US on one side and Taiwan on the other side on the dimension of individualism-collectivism.

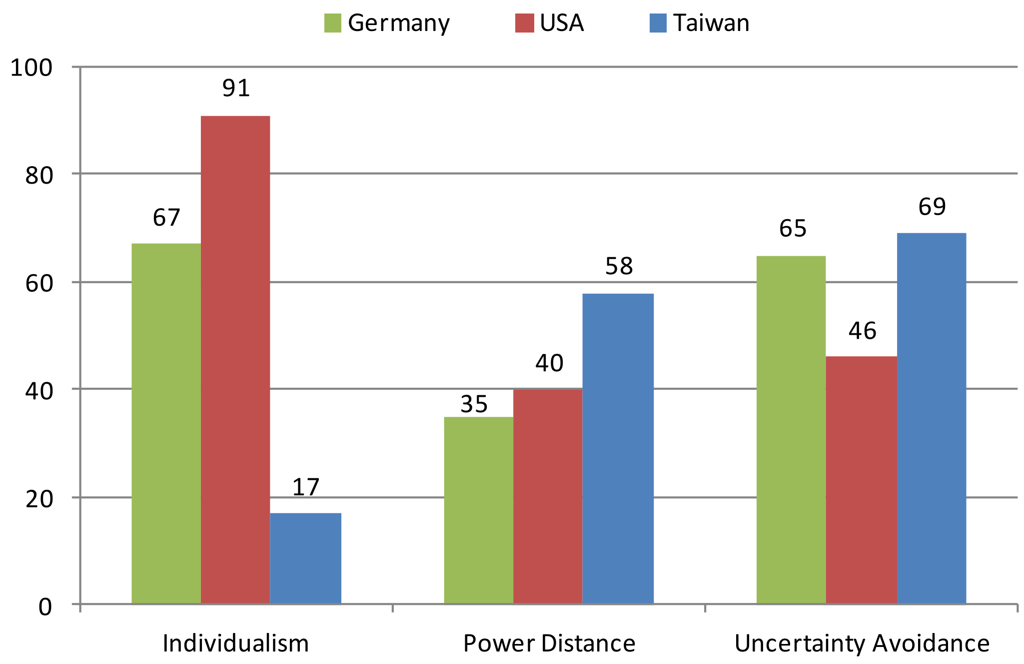


**Figure 6.1** Comparison of Germany, the United States and Taiwan regarding three dimensions of Hofstede's system of characterizing cultures. The scores are based on Hofstede's indexes for the cultural dimensions. (Data source: Hofstede Centre, http://geert-hofstede.com/ [last accessed 16 September 2015])

## 6.3 Science in society

Besides variations in the style of communication, the normative concept of science, its place in society and the main expectations regarding its performance may differ across cultures. Scholars in the field of sociology of science think that science communication strategies may reflect differences of concepts of knowledge (Gibbons et al., 1994). In this subchapter three theoretical concepts are used to discuss possible cultural differences in the perception (and self-perception) of science: the mode 1 vs. mode 2 distinction by Gibbons et al. (1994), the materialism vs. post-materialism distinction by Inglehart (1977), and the impact of the Confucian tradition on research culture (e.g., Marginson, 2010).

The concept of mode-1 vs. mode-2 knowledge production and the claim of a transformation of the dominant form of knowledge production from mode-1 to mode-

2 was initially introduced in the influential book "The New Production of Knowledge" published by Gibbons et al. (1994). In comparison to the traditional mode-1 science, in which scientific knowledge is first created and then applied, knowledge in mode-2 is produced in "the context of application." It is characterized by "transdisciplinarity" in contrast to the discipline-based knowledge production of mode-1. Gibbons et al. (1994) expect mode-2 knowledge to better reflect social demands and concerns. Consequently they think that the importance of traditional peer-review mechanisms as quality control decreases, and that other quality criteria and considerations will become more important. They speculate that the shift from mode-1 to mode-2 requires more social reflexivity and thus will lead to more discourses on issues of science and technology, and more communication involving different parties (Nowotny, Scott, & Gibbons, 2001).

Gibbons and his colleagues further argue that the importance of the role of external actors in science management or science communities increases, as well as influences from outside the scientific communities (Gibbons et al., 1994; Nowotny et al., 2001). They also expect an increase of the context-sensitivity of science (Gibbons, 2000) and a shift from traditional academic-based to problem-orientated knowledge production. The change of knowledge production will, in turn, bring about changes in the science system and its mechanisms of quality control. In contrast to academic-based and theory-focusing traditional knowledge production (mode-1), mode-2 type of knowledge production, as Gibbons et al. (1994) proposed, is a strong problem-solving approach and demands intensive collaboration across disciplines. Knowledge production in mode-2 becomes heterogeneous and the places in which knowledge is produced will not be confined to universities but include other branches such as industries, government agencies or research centers. As it partly belongs to the context of application, the new type of knowledge production must include considerations of social accountability such as health of patients or environmental sustainability. Traditional mechanisms of quality control are insufficient and will be complemented by criteria reflecting social demands.

The change of knowledge production is assumed to have an impact on communication between science and society. With increasing importance of the role of diverse external actors in the genesis of knowledge, Gibbons et al. (1994) assume that communicative interactions will become more frequent and intensive. Furthermore, they expect a change of communication models from one-way communication to engagement discourses, and a shift of the goals of communication between science and society from popularization of scientific knowledge to enhancing its social accountability.

The frequent and dense communication further implies a change in the boundary between science and society, as Gibbons et al. (1994) note. They argue that the frequent communicative interactions make it "no longer possible to contain scientific and technical experiments in the laboratories properly speaking and that society itself has become a laboratory for experiments that ought to be controlled in a more societal and tighter way" (p. 36). Furthermore, "communication between research and society increasingly takes the form of diffusion processes that carry scientific and technological knowledge into society while social norms and expectations held by different institutions and communities are brought home more forcefully to the research communities" (p. 37). Their argument implies that mode-2 knowledge production opens a demand for scientists to communicate across disciplines and with laypeople, and this further leads to a less clear defined boundary between science and other social systems (e.g., industry, politic).

Others criticized the distinction of mode-1 v. mode-2 knowledge production and the claim of a general shift from one to the other form. Hansen (2009) criticizes an ignorance of (political) cultural variations in the relationship between science and society, and demands cross-country comparisons. Furthermore, empirical findings do not confirm the consistency of characteristics of each type of knowledge (Heimeriks, van den Besselaar, & Frenken, 2008).

The theory of postmaterialism claims that in advanced industrial societies, "people's value priorities were shifting from materialist goals, which emphasize economic and physical security, toward postmaterialist goals, which emphasize self-expression and the quality of life" (Inglehart, 1977). According to Inglehart and Welzel (2005), the development of postmaterialist values requires a society in which primary human needs such as the material sustenance and physical security are satisfied.

While the theory itself does not directly refer to science or knowledge production but claims a change from materialist to postmaterialist values as societies modernize, it is quite plausible to assume that shifting values may change societal expectations towards science and – as a consequence – also may change audience expectations in public communication of science. Inglehart and Carballo (1997) speculate that postmaterialist societies – perceiving the downsides of advanced industrialization such as environmental damage – are more skeptical about science and technology than materialist societies. When comparing Taiwan and Germany, Y.-Y. Lo and Peters (2015) hypothesize that the appraisal of different kinds of science and knowledge reflect the dominant social values: In materialist countries, science and technology are mainly expected to solve materialist deficits or increase the standard of living, while in postmaterialist countries science is also appraised as an endeavor leading to enlightenment. They speculate that science communication in a materialist society tends to address scientific research from a utilitarian point of view (e.g., increasing technical innovation and improving medical treatment), while in a postmaterialist society knowledge also is perceived as "a source of enlightenment" (p. 13).[20]

Furthermore, as Inglehart and Abramson (1994) hypothesize, postmaterialism implies increased weight on self-expression, which is further associated with democratic demands, in particular freedom of speech. A positive correlation between postmaterialism and democracy is often assumed, based on the argument that postmaterialist societies demand more justification of the power distribution, requiring public discourses about decision-making and public participation (Inglehart, 1997). In other words, postmaterialist societies are likely to prefer the public engagement model of science communication based on dialog and participation.

Characteristics of nations have been mapped in the World Value Survey, a worldwide investigation of social-cultural and political change. The World Value Survey started in 1981 and so far six waves of surveys were conducted. According to the methodological description of the survey's website, a "stratified random sampling" approach including adults (18+ years) was used to "obtain representative

[20] The assumption of postmaterialist appraisal of the enlightenment function of science seems to contradict the assumption of Gibbons et al. (1994) and Nowotny et al. (2001) who expect a shift of knowledge production goals towards application and problem-solving. However, we should bear in mind that the two hypotheses refer to different contexts. The mode-1 vs. mode-2 distinction is based on the sociology of science while Inglehart's postmaterialism index measures a change of general social values. Nevertheless, there seems to be a tension between the implications of both approaches which needs to be addressed by empirical research. However, both approaches point to changes in audience expectations in public science communication in the course of modernization of societies.

national samples."[21] For each country at least one thousand citizens were surveyed. Among other indicators, the World Value Survey included a version of Inglehart's postmaterialism index based on 12 items.

Using results of the 1990-1991 World Value Survey, Inglehart and Carballo (1997) analyzed cross-cultural similarities and differences among countries and identified cultures such as the Confucian, Northern European or North American culture. East Asian countries such as China, Japan, Taiwan and South Korea have a long Confucian tradition. Inglehart and Carballo (1997) characterize the Confucian culture as "a relatively secular cultural system" with a rather strong "bureaucratic authority" (p. 42). They also notice a lack of "emphasis on science and technology" in the Confucian tradition. After going through modernization, with an emphasis on science and technology as a core element of the modernization, the downsides of modernization became an issue in the Northern European societies (e.g., West Germany). Criticism of the modernity is reflected in the values of Inglehart's postmaterialism index. In general, Northern European societies show more postmaterialist values than Northern American and Confucian societies. A comparison of Germany, the United States and Taiwan shows that Germany has the strongest postmaterialist orientation and Taiwan the lowest. About 25% of the German population is postmaterialist compared to only 9% of the American and 6% of the Taiwanese population (table 6.2).[22]

Confucian thoughts have had strong impact in East Asia – in particular in countries such as China, Korea, Japan and Taiwan – and the results of the World Value Survey actually confirm the cultural similarity of these countries. In Confucian culture, the science-society relation is well defined. Confucian traditions emphasize "authority" which is believed to maintain social stability and sustainability (Ho & Ho, 2008; Inglehart & Carballo, 1997). Science and technology cannot claim autonomy but are guided by government. In addition and with regard to interpersonal relations, Confucian culture underlines the need for harmony and reciprocity (Yum, 1988). A survey in countries belonging to the Confucian culture analyzing priorities

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[21] http://www.worldvaluessurvey.org/WVSContents.jsp (last accessed 25 August 2014).

[22] The proportion of materialists and postmaterialists in the three countries were calculated using the online data analysis tool of the World Value Survey's website. The variable analyzed was the "materialist/postmaterialist 12-item index" (Y001). Values 0-1 of the 6-step scale were grouped to indicate a "materialist" value orientation, values 2-3 were grouped to indicate a "mixed orientation" and values 4-5 were grouped as indicator of a "postmaterialist" orientation. The German data (n=1,966) were collected in 2013, the American data (n=2,138) in 2011, and the Taiwanese data (n=1,164) in 2012 (http://www.worldvaluessurvey.org/WVSOnline.jsp last accessed 25 August 2014).

in interpersonal communication demonstrated that harmony is given a higher priority than protecting social hierarchy (e.g., respectful of tradition and obedient of social hierarchy) in China, Korea, Japan and Taiwan (Zhang, Lin, Nonaka, & Beom, 2005).

| Materialist/postmaterialist 12-item index | | | |
|---|---|---|---|
| | Germany | USA | Taiwan |
| Materialist | 13.3% | 37.2% | 45.9% |
| Mixed orientation | 58.1% | 49.2% | 42.2% |
| Postmaterialist | 24.7% | 9.4% | 6.0% |
| N= | 1,966 | 2,138 | 1,164 |

**Table 6.2** Proportion of materialists vs. post-materialists in the population of Germany, USA and Taiwan. (Data source: World Value Survey Wave 6 [Y001], own calculation)

Chow, Deng, and Ho (2000) showed that high collectivism leads to less frequent knowledge sharing with out-group members. In their study, Chinese were less open about knowledge sharing than Americans. Siau, Erickson, and Nah (2010) compared Chinese and American virtual communities with respect to the messages circulating within them. The analysis showed that the messages less frequently referred to "knowledge" in Chinese than in American communities. Furthermore, they found that Chinese messages focused on maintaining and improving social relations. Siau et al. (2010) attribute the difference between Chinese and American virtual communities to their different tendency of individualism and degree of power distance. They argue that in a collectivist society building relationship is important, and "where a high power-distance culture prevails, experts may limit their participation in sharing knowledge with others in order to maintain the power distance" (p. 299). With regard to scientists' participation in science communication activities, the results may suggest that scientists in Confucian cultures may be more reluctant to share scientific knowledge openly to an anonymous group of respondents, but rather prefer sharing knowledge with the public in settings that involve social relations between them and the audience.

The preference for dialectic reasoning in Confucian cultures has had an impact on the history of science in Asian. Compared to the emphasis on logical argumentation and fundamental principles in the West, knowledge in Confucian thought is strongly experience-based and Confucianism has difficulties dealing with abstract analysis (Peng & Nisbett, 1999). Furthermore, the Confucian culture emphasizes the orientation of science toward society (Marginson, 2010), and the Confucian ideal of knowledge production may be closer to "mode 2" than to "mode 1" science.

In Marginson's review paper (2010) on Asia-Pacific higher education and university research, he recognizes a characteristic of the "Confucian Model" that is crucial for the application-oriented approach in science, namely the strong influence of nation-state policy on science. In Confucian cultures, central governments have direct influence on the research agenda; for example, they can directly decide where the funding goes to (Sun & Cao, 2014). Consequently, in those cultures governments rather directly shape the research proprieties. The strong influence of governments implies less autonomy for science. Policy strongly favors applied research over basic research because the latter is usually "academically controlled" and impacts of government policy is limited (Marginson, 2010, p. 601). The emphasis on experience-based knowledge in the Confucian cultures and the government-driven research agenda may also have an influence on scientists' communication strategies (e.g., the contextualization of science) and their acceptance of external influences on science.

Ironically, the evolution of models of knowledge production in Confucian countries seems to contrast with what Gibbons et al. (1994) have supposed for the Western world. Based on their analysis of science in Western countries, Gibbons and his colleagues postulate a change from academic-based to application-oriented research. However, In Confucian countries, science and technology are traditionally utilitarian and application-oriented and scholars nowadays are struggling to implement basic science as part of the research systems in Asian countries (Sun & Cao, 2014).

# 7 Research design and methods

## 7.1 Detailed research questions

The emergence of new online media changes the landscape of public science communication. It is expected that the new online media will become an important source of information about science and technology for the interested public. Furthermore, their potential for direct communication between scientists and the public might reinforce public engagement. With regards to the science-media relationship, the new online media challenge the dominant role of science journalism in science communication. Some observers predict a decline of science communication mediated by traditional journalism, and consequently expect an increasing significance of science communication based on new online media among scientists (e.g., Brumfiel, 2009). So far this prediction has not been checked in a comprehensive empirical study.

My study aims to contribute to our understanding of the role the new online media play for public science communication compared to traditional science communication in journalistic mass media. The focus of this study is on scientists' involvement in both old and new forms of science communication and on how this involvement differs in different cultural contexts. The general research questions of this study are:

1. How do scientists perceive, evaluate and use the "new online media" in public science communication? (*Patterns of new media involvement*)
2. What characterizes scientists who prefer or use new media in comparison to scientists who don't? (*Characteristics of new media users among scientists*)
3. How does the use of new online media vary between scientists in countries with different science-society and media contexts? (*Cross-cultural variation*)

From the variety of new online media, "blogs" were chosen for this study because unlike social networks (such as Facebook, ResearchGate and Twitter) they are normally generally accessible without membership, because blog posts usually provide substantial and original content rather than only short references and comments (such as Twitter), and because they are not marked as being mainly directed to scientists' colleagues (such as ResearchGate).

The United States, Germany and Taiwan were selected as countries for the cross-cultural comparison for a number of reasons (table 7.1). Firstly, these countries represent different states of the science-public relationship and different degrees of diffusion of new online media, as shown in chapter 6.1. With respect to differences in the relationship of science and the public, such as the existence of professional science journalism, the US and Germany as countries with a well-developed science journalism are in contrast to Taiwan in which professional science journalism is virtually non-existent (chapter 6.1). With regard to the diffusion of new online media the United States and Taiwan are ahead of Germany (chapter 2.1). Secondly, the three countries are characterized by different communication priorities according to Hall (1976) and Hofstede (2001). For example, the communication style in Germany and the United States is rather direct and explicit, while it is rather indirect and implicit in Taiwan. Thirdly, with regards to different degrees of materialist/postmaterialist orientation of the three countries, they may have different concepts of scientific knowledge. Pragmatically, the choice of countries matches my language abilities – English, German and Mandarin – and my familiarity with the cultures.

| | Germany | USA | Taiwan |
|---|---|---|---|
| State of science journalism (Hallin and Mancini, 2004; Lo and Peters, 2015) | High professionalization | | Low professionalization |
| Diffusion of the new online media | Low | Rather high | Rather high |
| Communication priority (Hall, 1976; Hofstede, 2001) | Low-context, individualism and low power distance | | High-context, collectivism and high power distance |
| Materialist/Post-materialist (Ingelhart, 1997) | Post-materialist | Mixed | Materialist |

**Table 7.1** Characteristics of the three countries.

The three general research questions regarding *patterns of new media involvement*, *characteristics of new media users among scientists* and *cross-cultural variation* were differentiated into a number of more specific research questions and hypotheses that guided the design of the questionnaire and the operationalization of variables.

(1) Research questions related to *patterns of new media involvement* concern scientists' actual practice of blogging and their use of other new media. Furthermore, the detailed questions ask about the significance for public communication ascribed to various media, opinions about blogging, and scientists' perception of their colleagues' attitudes toward blogging:

- RQ 1.1 What proportion of scientists does use different types of online media for public communication?
- RQ 1.2 Which advantages, disadvantages, effects and perceived expectations of relevant social environments (peers, research organizations) do scientists associate with blogging?
- RQ 1.3 Which factors do predict/explain whether scientists blog or not?
- RQ 1.4 How do scientists blog (frequency, expenditure of time, type of blog etc.)?
- RQ 1.5 Which topics do blogging scientists address in their blog posts?
- RQ 1.6 Which kind of audience do scientists intend to address in their blogs and what kind of feedback do they get?
- RQ 1.7 How does the blogging of scientists relate to their research (i.e., repercussions as expected by Weingart's "medialization of science" thesis)?

(2) With respect to the *characteristics of new media users among scientists*, I expect that scientists preferring the use of new media differ from "journalism"-affine scientists in terms of their career status, age and beliefs about communication:

- RQ 2.1 How do the groups of scientists differ who interact with journalism or who are active online?

As previous studies have shown, scientists with a leadership position have more frequent contacts with journalists than those without a leadership position (e.g., Dunwoody et al., 2009). The online environment is generally open to everyone with proper technical equipment and know-how. I therefore state the hypothesis:

- H 2.1 Leadership positions of scientists are related to more frequent interaction with journalists but not with more online activities.

Furthermore, several public surveys (e.g., Bernhard et al., 2014; BITKOM, 2011; van Eimeren & Frees, 2013) show that the media use patterns generally vary with age. As shown in chapter 2.1, younger generations use new media more frequently than older generations. It is thus plausible that scientists' online communication activities differ between age groups:

H 2.2 Because of their media socialization, younger scientists are more often active in online forms of public science communication than older scientists.

Scientists' beliefs about communication may have consequences for the ways of interacting with laypeople:

RQ 2.2 How do communication models differ between groups of scientists who prefer communication with the public via new media or mediated by journalism?

The study of Besley (2014) does not support the expectation that scientists' views about the public correspond with their online engagement. Nevertheless, I intend to check the actual practice in the light of the suggestion by Nisbet and Scheufele (2009) that scientists who would like to influence public discourses about science should use new media to facilitate dialog with the public:

H 2.3 Scientists who prefer new online media more often hold beliefs consistent with the engagement model (dialog, participation) than scientists who prefer journalistic mass media or who do not want to communicate with the public at all.

Weingart (1998) assumes that an increasing science-media coupling may have repercussions on science. Previous studies of medialization focused on journalistic media. Repercussions of scientists' use of new online media remain unexplored so far:

RQ 2.3 Is there a difference in the degree of "medialization" between scientists preferring or being active in the new media and those preferring or interacting with the journalistic mass media?

(3) Scientists' public science communication activities vary across countries (e.g., Y.-Y. Lo, 2014). Their use of the media may reflect cultural differences such as different professional states of science journalism, diffusion of the new media, or communication priorities as discussion in chapter 6. The specific research questions with regard to *cross-cultural variation* are:

RQ 3.1 How does the proportion of blogging scientists vary by country?

RQ 3.2 How does the practice of science blogging vary by country?

RQ 3.3 Do "state of science journalism" and "diffusion of new media" explain the relative significance of blogging in the three countries?

In a country with less-developed science journalism but wide-spread new media use, scientists' use of new media may fill a market gap in comparison to countries where science communication via new media has to compete with established science journalism:

H 3.1 Scientists in Taiwan with less developed science journalism and high diffusion of new media tend to use blogs most frequently than scientists in Germany with developed science journalism and low diffusion of new media, whereas scientists in the USA are in a middle position.

### 7.2 Survey

As the research questions and hypotheses concern perceptions, assessments and practices of scientists in public communication, a survey of scientists is the most suitable approach of dealing empirically with the research questions and hypotheses. Several authors have conducted international surveys of scientists either as mail survey (Bentley & Kyvik, 2011; Peters, Brossard, et al., 2008) or as online survey (e.g., Post, 2014; Schäfer, Ivanova, Schlichting, & Schmidt, 2012). Both methods have advantages and disadvantages.

It is unclear whether online surveys or mail surveys have a higher response rate. However, the implementation of a mail survey requires more resources in terms of manpower and cost than an online survey. For example, not only the e-mail addresses but also the postal addresses have to be found, invitations, questionnaires and reminders have to be printed and mailed, and manual data entry of the answers is necessary. The resources available for this thesis did rule out the possibility of an international mail survey with the required large sample sizes. Because of the advantages in terms of cost-effectiveness, most surveys of scientists even in well-funded projects nowadays are carried out online (e.g., Peters et al., 2012; Post, 2014; Schäfer et al., 2012). This study follows the present methodological default practice and is conducted as web-based survey. The survey was implemented with SoSci Survey, an online survey platform provided by Dominik Leiner, Munich, Germany.[23]

The survey was conducted in English. As English is the prevalent language for publications and conferences in science and engineering, an English questionnaire was used in all three countries. On the one hand, a potential disadvantage of using an English questionnaire is the possibility of underestimating cultural differences. Sanchez-Burks et al. (2003) demonstrate that "cultural cues" (i.e., survey language) could induce different degrees of cultural salience among participants with different mother tongues. On the other hand, the main advantage of using the same language version of a questionnaire is that it is easier to ensure the equivalence of survey questions in cross-cultural comparisons than by using different language versions (Davidov & De Beuckelaer, 2010). After considering the advantages and disadvantages, I regarded the equivalence of survey questions being more important than the risk of underestimating cultural differences, a risk that may be less pronounced in a field of professional activity, and conducted this survey in English in all countries.

### 7.3 Questionnaire

At the very beginning of the questionnaire two questions checked the eligibility of the respondents for the survey, i.e., whether they met the definition criteria of the sample population (see below). The first question asked respondents to confirm that they are indeed scientists; the second question asked about the country in which they work (Q01-Q02, appendix A). Respondents not eligible, i.e., indicating that they do not consider themselves to be a scientist or do not work in the respective country (Germany, USA or Taiwan), were filtered out. They were led to a screen explaining why they are not member of the target group of the survey and they were thanked for their readiness to participate in the survey. Then the interview was terminated.

As the study addresses scientists' use of new online media for public communication and takes a special interest in science blogging, the questionnaire comprises two modules: a general module (GM) and a blogging module (BM). The general

[23] For academic purposes, the SoSci Survey software and server can be used free of charge, see https://www.soscisurvey.de/. Gratefully, I acknowledge the help of my colleague Petra Degen in the programming of the questionnaire and the technical implementation of the survey.

module was designed to be applicable to all scientists, regardless their personal use of the new online media. The questions in the general module allow answering research questions RQ 1.1-1.3 about the diffusion of blogging and other new media use among scientists and their assessment. Responses to these questions are furthermore used in the two kinds of comparisons required to answer research questions RQ 2.1-2.3 and RQ 3.1-3.3 and test the hypotheses H 2.1-H 3.1, respectively:

1. Comparison of "new media"- vs. "journalism"-affine scientists (RQ 2.1-2.3, H 2.1-2.3)
2. Cross-country comparison (RQ 3.1-3.3, H 3.1).

The blogging module was only presented to respondents indicating that they blog actively, i.e., write blog posts. It aims at describing the practice of science blogging in detail and is used to answer research questions RQ 1.4-1.7 and, in part, RQ 3.2.

Each module comprises several topic areas, measured by indicators and operationalized by survey questions (table 7.2). The purpose of these topic areas and their operationalization are described in this section.

| Modules | Topic areas | Questions |
|---|---|---|
| General module (GM) | 1. Involvement in different forms of public science communication | Q03 |
| | 2. Preferred form of public science communication | Q04 |
| | 3. Motivators for blogging | Q12-Q15, Q18-Q22, Q24 |
| | 4. Agreement with the "public engagement" concept | Q17 |
| | 5. Media-orientation of scientists | Q16 |
| | 6. Socio-demographic, career- and job-related variables | S01-S11 |
| Blogging module (BM) (answered only by active bloggers among respondents) | 7. Frequency of blogging by scientists | B05-B06 |
| | 8. Ownership of blog used for blogging | B01-B04 |
| | 9. Contents of blog posts | B07-B09 |
| | 10. Target audiences of blogging scientists | B10 |
| | 11. Feedback by audience | B11-B13 |
| | 12. Comments by blogging scientists | B14-B17 |
| | 13. Perceived effects of blogging on scientific work | B18-B20 |

**Table 7.2** Overview of questionnaire modules and relevant topic areas. The questionnaire is provided as appendix A.

1. *Involvement in different forms of public science communication (GM)*

   There is a broad spectrum of public science communication activities ranging from face-to-face interactions to online activities. This topic area aims to record scientists' various kinds of involvement in public communication, the relative importance of these activities and the specific purposes of each activity for them.

   The operationalization of this concept starts with a question about the frequencies of involvement in different public communication activities in the last 12 months (Q03, appendix A). Because of the particular interest in scientists' use of online media in this study, further questions were included about scientists' use of social online networks, blogs and personal websites and the purposes they use each medium for (Q05-Q11, appendix A). Scientists' use of blogs was differentiated into active blogging and passive blog use. Active blogging refers to writing own blog posts or leaving comments on blog posts published by somebody else; passive blog use refers to just reading blog posts of other people. Survey participants mentioning active or passive use of blogs were further asked to indicate how frequently they use blogs for different purposes. A similar question about purposes was asked with respect to social network use. The questions about the main purposes of blog and social network use provide information on how important these channels are for the communication of scientists with the general public compared to other possible uses (e.g., communication with peers).[24]

2. *Preferred form of public science communication (GM)*

   This topic area "preferred form of public science communication" is relevant for research questions RQ 2.2 and RQ 2.4 about how implicit communication models and degrees of medialization of scientists differ between scientists preferring journalistic mediation, self-initiated online communication or face-to-face interactions. The topic area is operationalized by a single question explicitly asking about scientists' preferred channels of public communication: contacts with journalists, writing online or face-to-face interactions (Q04, appendix A).

[24] The questions used in the operationalization of this concept were adopted – with a minor modification in the answer categories of one question – from a module developed by Peters and the author of this thesis for a series of surveys of scientists in China, Brazil and Israel.

3. *Motivators for blogging (GM)*

This topic area aims to identify the reasons why scientists do blog or do not blog. It consists of questions about perceived prospects of blogging and possible concerns, perceived expectations of the relevant social environment (peers, organization and audience) and normative assumptions about communication.

Question items related to perceived prospects and concerns of blogs were developed based on statements of scientists summarized or quoted in studies or reports. For example, the statement of David Colquhoun, professor of pharmacology at University College London, about the importance of scientists' online presence for science[25], led to the items "Scientists must not leave the blogosphere to self-appointed 'experts' and pseudo-scientists." Similarly, other items were adapted from scientists' opinions arguing for or against use of blogs (Bonetta, 2007; Coombes, 2007; Waldrop, 2008; Wolinsky, 2011). Items cover perceived prospects with regards to individual intrinsic rewards, engagement of the public, the science-media relationship and the online presence of science (Q12, appendix A). Items about perceived concerns refer to possible disadvantages for scientific publications and to missing communication skills (Q13, appendix A). For each item, respondents indicated its importance for making them feel more positive about blogging or making them more reluctant to blog.

The launch of the blog platform "MIT Technology Review"[26] by the Massachusetts Institute of Technology exemplifies the research organizations efforts to motivate scientists for online engagement (Batts et al., 2008). With regards to the impact of the social environment on the motivation to blog, two questions ask about how scientists perceive the attitudes of the management of their organization and of their colleagues toward blogging (Q14 and Q18, appendix A). Another question asks about how many blogging scientists they know (Q15, appendix A). This question is a modified version of a question used by Poliakoff and Webb (2007) who showed that scientists believing that their colleagues

[25] "Blogs are an enormous step towards real democracy, though the price for that is that every madman and quack can do the same. Indeed, that is what makes it so important for people with knowledge, expertise, and honesty to fight back and draw a line in the sand at the tide of nonsense that engulfs us" (David Colquhoun, quoted by Coombes 2007, p. 645).

[26] http://www.technologyreview.com/views/ [last accessed 01 October 2015].

participate in public communication are more likely to join in as well. They interpret this effect as the consequence of "descriptive norms." In addition to the perception of attitudes of the management of scientific organizations, awareness of formal regulations and guidelines by the organization was asked (Q19, appendix A). Such guidelines may be perceived as an indicator of the organization's encouragement or discouragement of scientists' public communication activities. Another set of question asks about communication training offered by the scientific organizations and received by the respondents (Q20-Q22, appendix).

Two questions about possible motivators are not specific for blogging, but refer to public communication in general. The first of these questions includes an item about scientists' perception of the public's interest in science (Q17.07, appendix A). Public polls often show that although many members of the public express an interest in science, they tend to feel not well informed (e.g., Durant, Evans, & Thomas, 1989; Eurobarometer, 2013, p. 4). Scientists' perception of a high public interest in science could be a motivator for them to engage in public communication. Furthermore, scientists' participation in public communication could be motivated by the perception of a moral duty or by utilitarian reasoning considering positive outcomes of public communication (MORI, 2000). Another question therefore asks about the normative assessment of scientists' participation in public communication (Q24, appendix A).

4. *Agreement with the "public engagement" concept (GM)*

The idea behind the topic area "public engagement" is to contrast two approaches towards public science communication: the older "public understanding of science" approach and the more recent "public engagement with science and technology" approach. A series of items was constructed with the aim to measure the degree to which respondents agree with the public engagement approach in science communication (chapter 3.1). In brief, the public understanding approach is based on the assumption that the general public is characterized by a knowledge deficit compared to scientists and that the main goal of public communication is to reduce that knowledge deficit and improve public understanding of science. In contrast, the public engagement approach argues that the relationship between science and society can only be improved by dialog between science and an "engaged" public. In that view, the public has a more important role than just being a learning audience; rather it is expected to actively participate in science policy and research processes.

Nine items were used to measure approval or rejection of the two approaches (Q17[27], appendix A). Some of the items were taken from the survey of Peters et al. (2012). Other items are inspired by the reviews of Nisbet and Mooney (2007), and Joly and Rip (2007). The items used in this survey are listed in table 7.3.

| Public understanding/deficit approach | Public engagement approach |
| --- | --- |
| • Scientists should strategically frame their messages to guide the public's attitudes.<br>• The public is not well educated enough to really understand scientific findings.<br>• Scientists and laypeople have different levels of knowledge, which makes a true dialog between them impossible.<br>• The public should be discouraged from interfering with the regulation of scientific activities and applications. | • Scientists should share internal differences of opinion with the general public.<br>• The public may lack scientific knowledge, but it possesses a lot of relevant common sense and good judgment.<br>• Scientists should collaborate with non-scientists as “lay researchers” to make scientific knowledge more compatible with social expectations.<br>• Editors of scientific journals should demand from authors that their articles are comprehensible to interested laypeople.<br>• Blogging invites the public to take a more active role in science & technology |

**Table 7.3** Items indicating agreement with two public communication approaches (Q17, appendix A).

Responses to the nine items are the basis for answering research question RQ 2.2 which asks about the relationship between the preferences for communication models and for communication channels, and for testing hypothesis H 2.3 stating that scientists preferring online communication tend to hold beliefs congruent with the public engagement approach more strongly than scientists who prefer communication mediated by journalists.

5. *Media-orientation of scientists (GM)*

This concept refers to Weingart's (1998, 2012) "medialization of science" theory which in the current study is assumed to apply not only to journalistic media but to public communication in general. Two aspects of medialization were

[27] Item Q17.07 has no relevance for the differentiation between the two approaches but was part of the "Motivators for blogging" topic area.

operationalized in this survey: the anticipation of journalistic criteria in public communication as an indicator of medialization at the interactional level, and the use of public attention as criterion in the scientific research and publication process as an indicator of medialization at the program level (chapter 3.3).

Question items indicating anticipation of media criteria in public communication were adapted from various surveys in which they were used with respect to interaction with journalists. The items refer to important journalistic criteria for media stories: comprehensibility, relevance to the media audience, entertainment, personalization and attention, for example (Q16, appendix A). 5-point rating scales were used to record agreement or disagreement with these items.

To measure medialization at the program level, a question used by Peters et al. (2012) was adapted to the present study. This question includes eight items in two sub-indices referring to decisions in the research process and in scientific publication, respectively (table 7.4).

| |
|---|
| **Index of research** |
| [1] Choosing or avoiding certain research questions |
| [2] Choosing or avoiding certain research methods |
| [3] Selecting or avoiding certain sources of funding |
| [4] Choosing or avoiding certain collaborators |
| **Index of publication** |
| [5] Speeding up or delaying a scientific publication |
| [6] Presenting or not presenting a paper at a scientific conference |
| [7] Emphasizing certain conclusions or interpretations in scientific publication or not mentioning them |
| [8] Using or avoiding certain kinds of wording in scientific publications |

**Table 7.4** Items as indicators of medialization at the program level (Q23, appendix A).

Peters et al. (2012) have asked scientists whether it has happened that they have modified their decisions because of expected media publicity. Because the present study does not focus on (journalistic) media and is more interested in respondents' attitudes towards anticipating public criteria in research, the wording was modified into "To what extent do you find it justified or not justified for scientists to take the public response into account when making the [following] decisions?" Answer options were "never justified," "justified in some situations," "always justified," or "don't know" (Q23, appendix A). The question in the present study thus asks about the normative acceptability of certain aspects of medialization, rather than the actual degree of medialization.

Responses to questions regarding medialization provide a basis for answering research question RQ 2.3 which asks whether there is a difference in the degree of "medialization" of scientists preferring or being active in the new media and those preferring or interacting with the journalistic mass media.

6. *Socio-demographic, career- and job-related variables (GM)*

   Previous studies have identified a number of factors influencing the frequency of scientists' involvement in public communication such as scientific discipline, management position, scientific productivity, country and age. For example, the frequency of interactions with journalists differs across research areas and scientists with a senior position interact more frequently with the media than those at the beginning of their scientific career (Peters, 2013a).

   At the end of the questionnaire, a series of questions was asked to characterize respondents in terms of age, gender, country, research field, career status, approximate number of scientific publications and affiliation. Some of these variables are crucial for answering the research questions and testing the hypotheses regarding cross-country differences (RQ 3.1-3.3, H 3.1), the different impact of career status on the frequency of blogging and interviews with journalists (H 2.1), and the hypothesis that younger scientists prefer blogging as means of public communication more than older scientists (H 2.2).

7. *Frequency of blogging by scientists (BM)*

   The purpose of the blogging module is to investigate in depth the actual praxis of blogging by scientists. "Frequency of blogging," a key concept for this study and required for answering several research questions, is interpreted and measured in two ways: The initial question in this module serves to identify passively and actively blogging scientists (B01, appendix A). The answers are used to compare the proportion of blogging scientists in the three countries. They are further used for several comparisons between blogging and not blogging scientists, and identify respondents in the interviews who are asked to answer more detailed questions about blogging. In the second meaning of the concept, the amount of effort that blogging scientists invest in their blogs is studied. One question is about how often blogging scientists post new information; the other question asks them to provide an estimation of their weekly time expenditure for blogging (B05-B06, appendix A).

8. *Ownership of blog used for blogging (BM)*

Scientists can blog in various forms. They can operate their own blog or share one with others. The blog can be part of a blog network or can be independent. Scientists can blog under their real name or use a pseudonym. The latter information is related to the discussion about credibility of online information sources. An important credibility indicator for blog readers might be the blogger's identity (Charlton, 2008) such as his/her real name and information about career and profession. Shema, Bar-Ilan, and Thelwall (2012a) argue that scientists blogging under their real name do not perceive their blogs as a threat to their scientific career. Several questions ask whether a blogging scientist has his or her own blog and publishes under real name or pseudonym, what blogging platform a blogging scientist uses and whether their blog belongs to a blog network such as "SciLogs" or "ScienceBlogs" (B01-B04, appendix A). Answers to these questions are important to understand whether blogging scientists are typically independent or part of an online network, and whether their identity is transparent to blog readers. The information gained in this topic area is crucial for answering research question RQ 1.4.

9. *Contents of blog posts (BM)*

A main focus in the blogging module is on the contents of blogs operated by scientists. Science bloggers often have idiosyncratic ways to categorize their posts. They usually use composite tags featuring relevant disciplines (e.g., biology, chemistry and physics), issues (health and climate change) and activities (research, conference, advices) of each post (see e.g., Greg Laden's blog[28] or Pharyngula[29]). Each blog has its own category system. In contrast, this study needs a category system that can be applied to all blogs.

Studies developing typologies of blog contents are rare. Bukvova et al. (2010) qualitatively analyzed topics of blog posts written by scientists (excluding posts irrelevant to science-related issues). They identified three general types of content essential for blogs written by scientists, labeled "expertise," "activity"

[28] http://scienceblogs.com/gregladen/author/gregladen/ [last accessed 1 October 2015].
[29] http://scienceblogs.com/pharyngula/author/pharyngula/ [last accessed 1 October 2015].

and "identification." They found out that blogging scientists provide information on particular issues which are usually related to their research area, report career-related activities (i.e., participating in a conference, research and teaching), or reflect their role as researcher (p. 92). Surprisingly, the typology from Bukvova et al. (2010) does not include a category for new research findings. Although a survey of science bloggers shows that only small group of bloggers write primarily about their current research in their blogs (Puschmann & Mahrt, 2012), including such a category is important from a theoretical point of view because blogs are discussed as possible substitution of science journalism (Brumfiel, 2009). Furthermore, blogging about research findings is not necessarily confined to the authors' own research.

Surveying science bloggers, Mewburn and Thomson (2013) identified nine broad types of blog posts related to self-help, descriptions of academic practices, technical advice, academic culture critique, research dissemination, career advice, personal reflections, information and teaching advice. The category system from Mewburn and Thomson (2013) puts an emphasis on the differentiation of various types of advice.

For purposes of this survey, the nine types of Mewburn and Thomson were regrouped and simplified, leading to six content categories. Table 7.5 provides an overview of the categories from the two mentioned studies, linked to the categories used in the present study. These six content categories with examples were presented as items in a question asking respondents to indicate how often their blog posts deal with these topics ("never," "rarely," "sometimes" or "often") (B07, appendix A).

| Bukvova et al., 2010, p. 92 | Mewburn & Thomson, 2013, pp. 1110-1111 | Typology of blog content used in this study |
|---|---|---|
| Expertise: Information on particular topics related to author's research area | Self help: Advice for students or research practitioners<br>Technical advice: Instructions about how to use technical tools<br>Career advice: Advice for undergraduates, graduates and academics<br>Teaching advice: Summaries of research about pedagogic psychology, or descriptions of teaching techniques and methods | Comments about public issues: Scientific viewpoints on health, environment, risks, and other public issues<br>Consulting: Advice and tips for colleagues, students, policy-makers, patients, or the public |
| Activity: Activities related to research and teaching, or reporting from conference and workshops | Information: Notifications of conferences, events or briefings about publications | Reviews and references: Information on and discussion of events or publications within and outside of science |
| Identification: Descriptions of personal interests, personal information or purely reflexive posts | Descriptions of academic practices: Reflections of academic work<br>Academic culture critique: Reflections on issues related to academy<br>Personal reflections: Reports about the author's experience or daily life | Reflections on academic culture and practices: Issues in science regarding the publication system, careers, or research ethics, for example<br>Reflections on science and society: Issues such as science policy, funding, public acceptance, public communication, or pseudoscience |
| | Research dissemination: Summaries of research findings in plain language | Research and outcomes: Research results, discoveries, experiments, applications, and methods |

**Table 7.5** Comparison of different typologies of blog content.

*10. Target audiences of blogging scientists (BM)*

Bloggers may have certain target audiences in mind when writing their blog posts. These audiences can be rather specific, such as students or colleagues, or rather unspecific – including several types of people within or outside science. There is certainly a relationship between the topics of blog posts and the intended blog audience. Bloggers will write about topics that they perceive to be attractive or relevant to their target audiences. For example, blog posts on purely scientific issues may be less attractive for a broader audience (Bonetta, 2007).

A question was designed with a list of possible audiences science bloggers may want to address. A survey of science bloggers about their target audiences (Mahrt & Puschmann, 2014; Puschmann & Mahrt, 2012) and a survey of science blog readers (e.g., Littek, 2012) categorize groups of audience differently. The list used in this survey includes 14 target audiences ranging from groups within science to groups outside science (table 7.6). For each group, respondents were asked to rate the priority they assign the respective group as a possible audience of their blog posts (B10, appendix A). For the purpose of our study, we are particularly interested in the priority science bloggers assign to target audiences outside science such as "members of the general public."

| Mahrt & Puschmann, 2014, p. 7 | Littek, 2012 | List of target groups used in this study |
|---|---|---|
| [01] The public in general<br>[02] People with an interest in my discipline<br>[03] Colleagues from my field<br>[04] Students from my field<br>[05] High school students<br>[06] Policy maker<br>[07] People from my field who could decide my future career (e.g., with regard to job applications or grant proposals) | [01] People with an academic background<br>[02] science journalists<br>[03] laypersons | [01] Colleagues in <u>your own specific field</u><br>[02] Scientists in <u>other research fields</u><br>[03] Amateur scientists<br>[04] College/university students<br>[05] Science managers and science administrators<br>[06] Members of the general public<br>[07] Teachers and pupils<br>[08] Patients and their family members<br>[09] Journalists<br>[10] Practitioners using scientific knowledge<br>[11] Business people<br>[12] Public administrators and politicians<br>[13] Members of NGOs (e.g., environmentalists)<br>[14] Other groups |

**Table 7.6** Possible target audiences of science bloggers.

*11. Feedback by audience (BM)*

Many expect that blogs will enhance public engagement and dialogic communication between scientists and the public (e.g., Nisbet & Scheufele, 2009). One indicator of such an effect on engagement or scientist-public interaction is the frequency of comments to blog posts from blog audiences, and the frequency with which blogging scientists respond to these comments from their audience.

The "feedback by audience" concept includes three questions about the frequency of comments by audience members, the groups from which these comments come (same list as in the question about target audiences, table 7.5), and the positive or critical assessment expressed in these comments (B11-B13, appendix A). Answers to these questions provide an account of the feedback, blogging scientists receive from their readers as asked in research question RQ 1.6. Furthermore, the results can be interpreted with respect to the degree of public engagement and dialog initiated by blogging scientists.

*12. Comments by blogging scientists (BM)*

The comment function is essential for online interactions in the blogosphere. This function allows blog users to participate in public discourses about science and scientific issues. Besides publishing blog posts themselves, scientists can contribute by comments on other people's blog posts to the online discourse. Or they can comment on comments of readers of their own blog posts. The questions related to this topic area ask about the frequency of commenting and scientists' motivations to comment (B14-B17, appendix A). These questions contribute to answer research question RQ 1.4.

*13. Perceived effects of blogging on scientific work (BM)*

Consistent with Weingart's (1998, 2012) "medialization of science" theory, large-scale surveys as well as semi-structured interviews with scientists show that scientists expect benefits from public visibility (e.g., Allgaier et al., 2013b). While this has been clearly demonstrated for journalistic media, it is less clear whether scientists expect or experience similar benefits from visibility in the new online media (Allgaier et al., 2013a).

The topic area "perceived effects of blogging on scientific work," intended to answer research question RQ 1.7, includes three questions about respondents' assessment of influences of blogging with respect to publications, resources, contacts, criticism and ideas. The first question asks about the existence and strength of such an influence. Scientists indicating that they had perceived influences of blogging on their scientific work were further asked whether these influences were positive or negative and were encouraged to describe them in their own words in an open question (B18-B20, appendix A).

### 7.4 Sampling

The present study is designed to analyze blogging by active scientists – not science blogging by university students, (semi-)professional bloggers, science journalists, scientific outsiders or public relations professionals of scientific organizations, for example. The construction of the sample for the survey reflects that goal. A "scientist" in this meaning is defined as someone who conducts scientific research and publishes the results in scientific publications. To reduce the complexity of the study and keep the required effort for the construction of the samples manageable, the study is confined to scientists in the Anglo-Saxon meaning of the word, i.e., to academic researchers from STEM (Science, Technology, Engineering, and Mathematics) disciplines, including medicine. In this group of researchers, peer-reviewed journals are the most important platform for scientific communication and a scientist's productivity is often measured by his/her publications in such journals. As in a number of previous surveys (e.g., Peters, Brossard, et al., 2008; Peters et al., 2012), the sampling of scientists in this study is based on their authorship of scientific publications.

In the STEM field, English is the dominant language for publications, and articles in international peer-reviewed journals, indexed by Web of Science, are the principal form of scientific publication in all three countries included in this study. In order to maximize the equivalence of country samples, the survey population was stratified by research area ("life sciences & biomedicine," "physical sciences" and "technology") and country (Germany, Taiwan, United States) and nine random samples of equal size were drawn from the nine strata.

The samples of scientists were compiled by searches the database of the Science Citation Index Expanded (SCI-Expanded). This database is an online subscription-based scientific citation indexing service maintained by Thomson Reuters. This database provides access to articles published in a comprehensive list of peer-reviewed scientific journals (and some other publication types). Journals covered by SCI-Expanded are categorized into five research areas: "arts & humanities," "social sciences," "life sciences & biomedicine," "physical sciences" and "technology." The last three research areas were included in the sampling. The areas are further divided into many research subjects. For each area, I randomly selected 10 research subjects and considered the sample of subjects sufficiently representative for each area (table 7.7). Each sample is comprised of "popular" research subjects (with larger number of publications) and "unpopular" ones (with smaller number of publications) and is not dominated by a few specific research subjects.

To identify and download scientific articles with (co-)authors from the selected research fields and countries, I conducted separate queries for the 30 research subjects in SCI-Expanded. Only articles published in 2013 and including at least one author from Taiwan, Germany or USA were considered. For example, the following search string was used for the subject "infectious diseases" in the "life sciences & biomedicine" area:

> ((AD=Taiwan OR AD=Germany OR AD=USA) AND SU=(Infectious Diseases)) AND LANGUAGE: (English) AND DOCUMENT TYPES: (Article) Indexes=SCI-EXPANDED Timespan=2013

Similar queries were done for the other 29 research subjects. The searches resulted in lists of articles published in the relevant journals of the research subjects which had at least one (co-)author with an address in Germany, Taiwan or United States. Since the queries were done in August 2013, the samples consisted of articles published from January to August 2013. The article lists were downloaded and the names and – if available – the e-mail addresses of the (co-)authors with an address in one of the countries were extracted from them. This procedure resulted in 9 separate lists of researchers (3 countries x 3 research subjects). Many researchers showed up several times in the author lists if they had (co-)authored more than one publication. In those cases, double entries were removed. Then a subsample of 500 names was drawn from each list. The combined stratified sample thus includes 4,500 researchers, 1,500 from each country (table 7.8). Missing e-mail addresses were identified by online searches.

| Life sciences & Biomedicine | | Physical Sciences | | Technology | |
|---|---|---|---|---|---|
| Infectious Diseases | 2,460 | Thermodynamics | 1,219 | Construction & Building Technology | 795 |
| Mathematical & Computational Biology | 1,721 | Mathematics | 9,083 | Imaging Science & Photographic Technology | 524 |
| Biodiversity & Conservation | 907 | Chemistry | 20,499 | Metallurgy & Metallurgical Engineering | 1,374 |
| Agriculture | 4,008 | Astronomy & Astrophysics | 5,060 | Materials Science | 13,486 |
| Obstetrics & Gynecology | 2,007 | Geochemistry & Geophysics | 2,053 | Transportation | 1,105 |
| Behavioral Sciences | 1,505 | Oceanography | 1,091 | Microscopy | 174 |
| Anatomy & Morphology | 299 | Physics | 23,469 | Science & Technology Other Topics | 16,029 |
| Public, Environmental & Occupational Health | 4,169 | Mineralogy | 355 | Computer Science | 7,466 |
| Food Science & Technology | 2,046 | Crystallography | 728 | Automation & Control Systems | 923 |
| Dermatology | 1,315 | Water Resources | 2,098 | Instruments & Instrumentation | 2,076 |

**Table 7.7** Composition of sample of articles identified in the queries in Web of Science by research subjects.

| | Germany | USA | Taiwan | Total |
|---|---|---|---|---|
| Life sciences & Biomedicine | 500 | 500 | 500 | 1500 |
| Physical sciences | 500 | 500 | 500 | 1500 |
| Technology | 500 | 500 | 500 | 1500 |
| Total | 1500 | 1500 | 1500 | 4500 |

**Table 7.8** Composition of the constructed sample of article authors.

## 7.5 Implementation of survey, response rate and realized sample

The web-based survey was implemented using SoSci Survey, a German software/server for online surveys[30]. Design and mailing of the invitation and reminders were guided by the Total Design Method (Dillman, Smyth, & Christian, 2009).

Searching for missing e-mail addresses lasted from August to November 2013. The field time began 15 January and ended 18 March 2014. The initial invitation to participate in the survey by e-mail was followed by up to four reminders in Germany and the United States and by up to six reminders in Taiwan. Mailings were scheduled taking national holidays (e.g., the Lunar New Year at the end of January in Taiwan) and academic schedules into account. Invitations were e-mailed successfully to 1,366 German, 1,432 American and 1,438 Taiwanese scientists (effective sample size). As suggested by Dillman et al. (2009, p. 242), the reminders used different appeals to motivate scientists to participate. The response curve shows that each reminder indeed led to an increase of the response rate (figure 7.1). The final response rates were 21.5% (Germany), 23.1% (USA) and 22.8% (Taiwan), calculated as ratio of valid responses to effective sample size.

The results presented in the following chapters are based on the valid responses of eligible members of the sample. Responses were considered valid if the participant reached the final questionnaire screen and did not skip more than 10% of the questions. Respondents were eligible if they confirmed that they were scientists, active in "life sciences & biomedicine," "physical sciences" or "technology," and were working in one of the three countries. 846 scientists completed the questionnaire (missing less than 10% of questions and items). After excluding some social scientists and some respondents who did not carry out research, 815 valid responses remained for the statistical analysis – 240 from Germany, 303 from the United States and 272 from Taiwan.

The composition of the three country samples with respect to the research areas is somewhat differently, probably as the consequence of variations in the response rates and different shares of non-eligible respondents (table 7.9). For example, physical scientists are particularly frequent in the German sample, life and medical scientists in the US sample, and technology scientists in the Taiwanese sample. The different compositions hinder conclusive cross-country comparisons

[30] https://www.soscisurvey.de/.

as one always has to take the possibility into account that differences between countries are indirect effects of differences between research areas.

To compensate for the different composition of the country samples by research areas, I have used case weights in (almost) all statistical analyses. The weights were calculated to emulate country samples composed of equivalent proportions of the three areas and to correct the imbalance in the original samples (table 7.9). The weighting ensures that the country differences identified in the analyses are not affected by the different area composition of the original samples. In the following chapters all results are calculated and reported on the basis of weighted data (unless otherwise noted).[31]

In all three countries our sample mostly consists of male researchers with a Ph.D. degree in advanced stages of their careers (table 7.10). More than 75% of the respondents describe their career level as "mid-career" or "senior." About 70% hold a leadership position as principal investigator, group leader or head of institute etc. On average, the surveyed scientists are 48 years old.

[31] Results based on weighted and original data differ only slightly, however. Significant tests for country differences based on weighted data and original data lead to the same result in almost all cases.

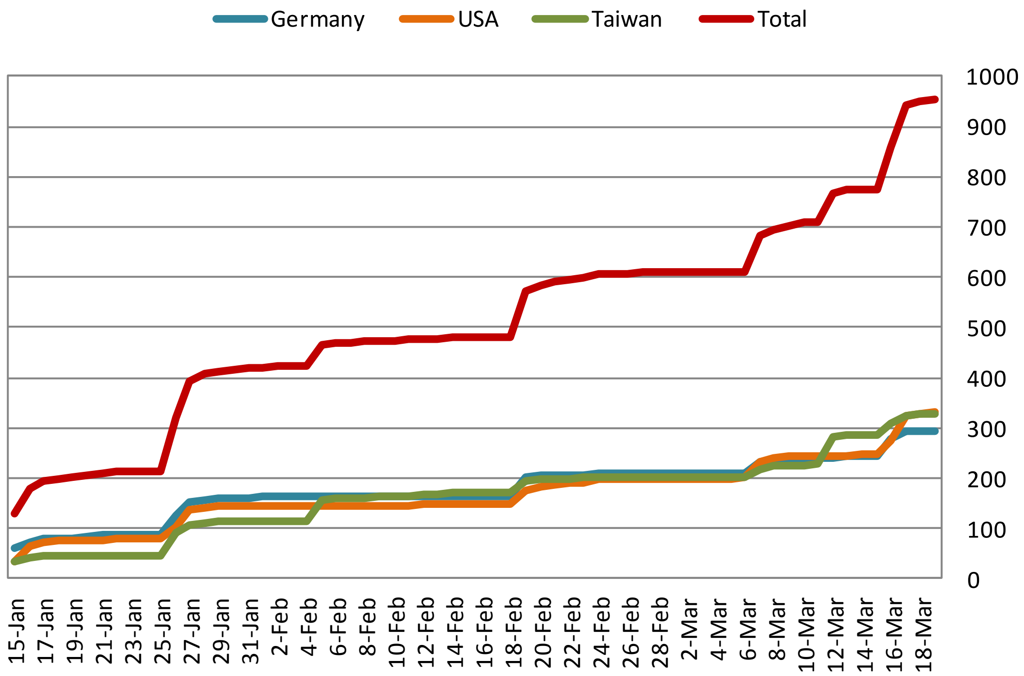


**Figure 7.1** Development of number of responses during the field time (15 January-18 March 2014).

| | Original sample | | | Weighted sample | | |
|---|---|---|---|---|---|---|
| | Germany | USA | Taiwan | Germany | USA | Taiwan |
| Life sciences & biomedicine | 36.7% | 45.9% | 37.9% | 40.5% | 40.5% | 40.5% |
| Physical sciences | 49.6% | 33.0% | 23.2% | 34.6% | 34.6% | 34.6% |
| Technology | 13.8% | 21.1% | 39.0% | 24.9% | 24.9% | 24.9% |
| Total | 100.0% (n=240) | 100.0% (n=303) | 100.0% (n=272) | 100.0% (n=240) | 100.0% (n=303) | 100.0% (n=272) |

**Table 7.9** Composition of original and weighted sample by research areas.

| | | Germany | USA | Taiwan |
|---|---|---|---|---|
| Average age [years] | | 44.3 | 49.9 | 48.3 |
| Age | <36 years | 28.2% | 14.6% | 7.0% |
| | 36-45 years | 27.8% | 28.1% | 31.0% |
| | 46-55 years | 25.1% | 24.1% | 39.5% |
| | 56-65 years | 15.0% | 20.1% | 19.0% |
| | >65 years | 4.0% | 13.0% | 3.5% |
| | total | 100.0% (n=227) | 100.0% (n=274) | 100.0% (n=258) |
| Gender | Female | 20.8% | 23.2% | 10.3% |
| | Male | 79.2% | 76.8% | 89.7% |
| | Total | 100.0% (n=234) | 100.0% (n=293) | 100.0% (n=269) |
| Ph.D. or doctoral degree | Yes | 88.2% | 93.5% | 95.5% |
| | No | 11.8% | 6.5% | 4.5% |
| | Total | 100.0% (n=239) | 100.0% (n=301) | 100.0% (n=268) |
| Career level | Junior | 19.0% | 24.5% | 15.8% |
| | Mid-career | 43.8% | 30.9% | 37.8% |
| | Senior | 37.1% | 44.7% | 46.4% |
| | Total | 100.0% (n=239) | 100.0% (n=302) | 100.0% (n=270) |
| Management role ("Which term best describes your current management role in your unit?") | Dean, head of institute, director, head of department, CEO, chair | 14.6% | 17.1% | 17.7% |
| | Group leader, principal investigator | 47.6% | 48.1% | 55.0% |
| | Other management position | 12.0% | 4.4% | 7.4% |
| | No management position at this time | 25.9% | 30.3% | 19.9% |
| | Total | 100.0% (n=238) | 100.0% (n=301) | 100.0% (n=270) |

**Table 7.10** Composition of (weighted) samples by social demographic characteristics of respondents.

# 8 The new media and science communication

In chapter 2 the rise of the new media and its consequences for public science communication was discussed. This chapter presents empirical findings from my survey about how frequently scientists in Germany, the United States and Taiwan participate in traditional and new forms of public science communication. The presentation of results starts with findings about scientists' general views of public science communication. Furthermore, the impact of factors such as leadership position and age on the frequency of involvement in public communication activities is analyzed. This chapter answers research questions RQ 1.1 about scientists' use of different types of online media for public communication and RQ 2.1 about differences between the groups of scientists interacting with journalism or being online active, and checks the corresponding hypotheses H 2.1 and H 2.2.

## 8.1 Scientists' general views about public communication

Scientists' motivation to devote to public communication of science may differ. It could be based on perceived moral obligations, perceived benefit or demands from funders or employers. Previous public opinion surveys have shown that the public is in general interested in science (e.g., Eurobarometer, 2013). This survey of scientists suggests that scientific communities in the three countries do recognize the public's interests in science. Scientists were asked to what extent they agree with the statement that "the public is strongly interested in science." Respondents of all countries reported mild agreement on this item on average.

The majority of scientists consider public communication a good thing to do. This belief in the utility of public communication prevails is particularly strong in the United States, and least strong in Taiwan ($\chi^2$=27.7, $df$=4, p<0.01) (table 8.1). In Germany, the utility belief was prevalent, but still there were nearly 30% of the German scientists who saw public communication of science a moral duty. Taiwanese scientists generally regarded public communication a good thing to do or even a moral duty, but there was a larger proportion of Taiwanese scientists (7.6%) than German and US scientists (1.3% each) who considered public communication "neither a moral duty, nor a good thing."

| | Germany | USA | Taiwan |
|---|---|---|---|
| Public communication is a moral duty for scientists | 27.5% | 20.0% | 26.6% |
| It is not a moral duty, but nevertheless a good thing for scientists to do | 71.1% | 78.6% | 65.8% |
| It is neither a moral duty nor a good thing to do | 1.3% | 1.3% | 7.6% |
| Total | 100.0% (n=239) | 100.0% (n=301) | 100.0% (n=271) |

**Table 8.1** Opinions about utility and responsibility regarding public communication (Q24, appendix A).

## 8.2 Overview of scientists' public communication activities

Previous studies on scientists' participation in science communication show that many scientists participate in such activities. For example, 70% of biomedical researchers in five major research countries – the United States, Japan, Germany, the United Kingdom and France – reported that they had had at least one contact with journalists in a three year period (Peters, Brossard, et al., 2008). Similar results were found in Brazil (F. Ren et al., 2014) and Taiwan (Y.-Y. Lo & Peters, 2012), for example. Many scientists also write popular science articles. A survey of scientists across all disciplines in 13 countries revealed that about one third of respondents had published at least one popular article in 2005-2007 (Bentley & Kyvik, 2011). Although different sampling strategies make it difficult to compare the figures from the mentioned studies directly, the available evidence suggests that scientists interact with journalists more often than they write popular articles.

The questionnaire of the present study included a question asking respondents to indicate how frequently they were involved in a number of public communication activities in the past 12 months (Q03, appendix). Figure 8.1 shows that in each of the three countries – Germany, United States and Taiwan – many scientists are involved in a broad spectrum of public communication activities. More than 85% of the respondents reported at least one activity of public communication "in the past 12 months."

Traditional ways of public communication for scientists – contacts with journalists, writing popular articles, cooperation with public relation officers or public events – are still very frequent activities. With the exception of article writing by US scientists, for each of the activities and in each country more than 40% of the respondents reported that they had at least once been involved in that activity in the past year. This finding suggests that today's science communication still strongly depends on these traditional ways of communication.

Surprisingly, in all three countries participation in public events is the most frequent way for scientists to communicate with the general public. This is particularly obvious for Taiwan. While about half of the German respondents reported their active participation "in an event for the general public such as a talk, panel discussion, science exhibition, science festival, or science café" at least once "in the past 12 months," the respective proportions of American and Taiwanese respondents were even 61% and 74%, respectively.

Although these media are very popular among the public as possible users, relatively few scientists provide content in Wikipedia or YouTube. Only about 10% of all respondents, with no significant difference between countries ($\chi^2 = 11.0$, $df=6$, $p>0.05$), said that they had "contributed to a Wikipedia article or another online encyclopedia for the general public" at least once in the past 12 months. In all countries, contributing to an online-encyclopedia is the least popular science communication activity for scientists of the list provided in the question. Uploading information to YouTube or another video-, picture-, or podcast-sharing website is somewhat more popular among scientists in the US and Taiwan, but less so in Germany. Little more than 10% of the German scientists but more than 20% of the American and Taiwanese scientists said that they had uploaded "a video, picture, or audio file related to my work to YouTube or another video-, picture-, or podcast-sharing website for public use." The difference between German scientists on one hand and US and Taiwanese scientists on the other hand with respect to uploading videos, pictures or audio files is statistically significant ($\chi^2=23.0$, $df=6$, $p<0.05$).

Not all of the new online media are as unpopular as Wikipedia or YouTube, however. Scientists use websites, blogs and social networks much more frequently than Wikipedia, YouTube or similar services to provide information to the public. About 40% of German scientists, 58% of the American scientists and 55% of the Taiwanese scientists said that in the past 12 months they had put information related to their research or professional expertise "on a website, blog, or social network site aimed at the general public." Again, German scientists seem to be more reluctant in using these online channels than American and Taiwanese scientists ($\chi^2=26.3$, $df=6$, $p<0.01$).

Public events are the most frequent way of scientists to communicate with the public in all three countries, but otherwise the rank order of channels varies by country. In Germany, scientists are less frequent active in direct online communication via websites, blogs and social networks than they interact with "a journalist from a newspaper, magazine, online news provider, radio or TV channel" or cooperate "with a public information officer" from their research institution. In the United States and Taiwan scientists communicate directly online with the general public more frequently than they talk to journalists or a public relation professional. Participation in online public communication is thus more popular among scientists in the United States and in Taiwan than among scientists in Germany (figure 8.1).

Previous studies found a positive association between scientists' participation in public communication and their scientific productivity, i.e., scientists having authored many scientific publications also tended to be more active in public communication (Jensen et al., 2008). This survey generally shows a similar trend but the statistical associations between frequencies of scientists' of use of public communication channels and their scientific productivity, in terms of number of peer-reviewed journal articles (Q29, appendix A), differ across countries and types of communication channels (table 8.2).

With few exceptions, significant associations between public communication activities and scientific productivity are confined to traditional channels of public communication, for example being contacted by journalists, writing stories for journalistic media or cooperating with public information officers. Across countries, moderate but significant positive relations exist between scientific productivity and frequency of activities such as "talked to a journalist from a newspaper, magazine, online news provider, radio or TV channel, or participated as an expert in a radio or TV program" (Tau-b=0.23, $p<0.01$), "wrote an article about [their] field of expertise for a newspaper, magazine or online news provider as an invited guest author" (Tau-b=0.16, $p<0.01$), or "cooperated with a public information officer from [their] university or another institution to prepare a press release or participate in a press conference" (Tau-b=0.25, $p<0.01$).

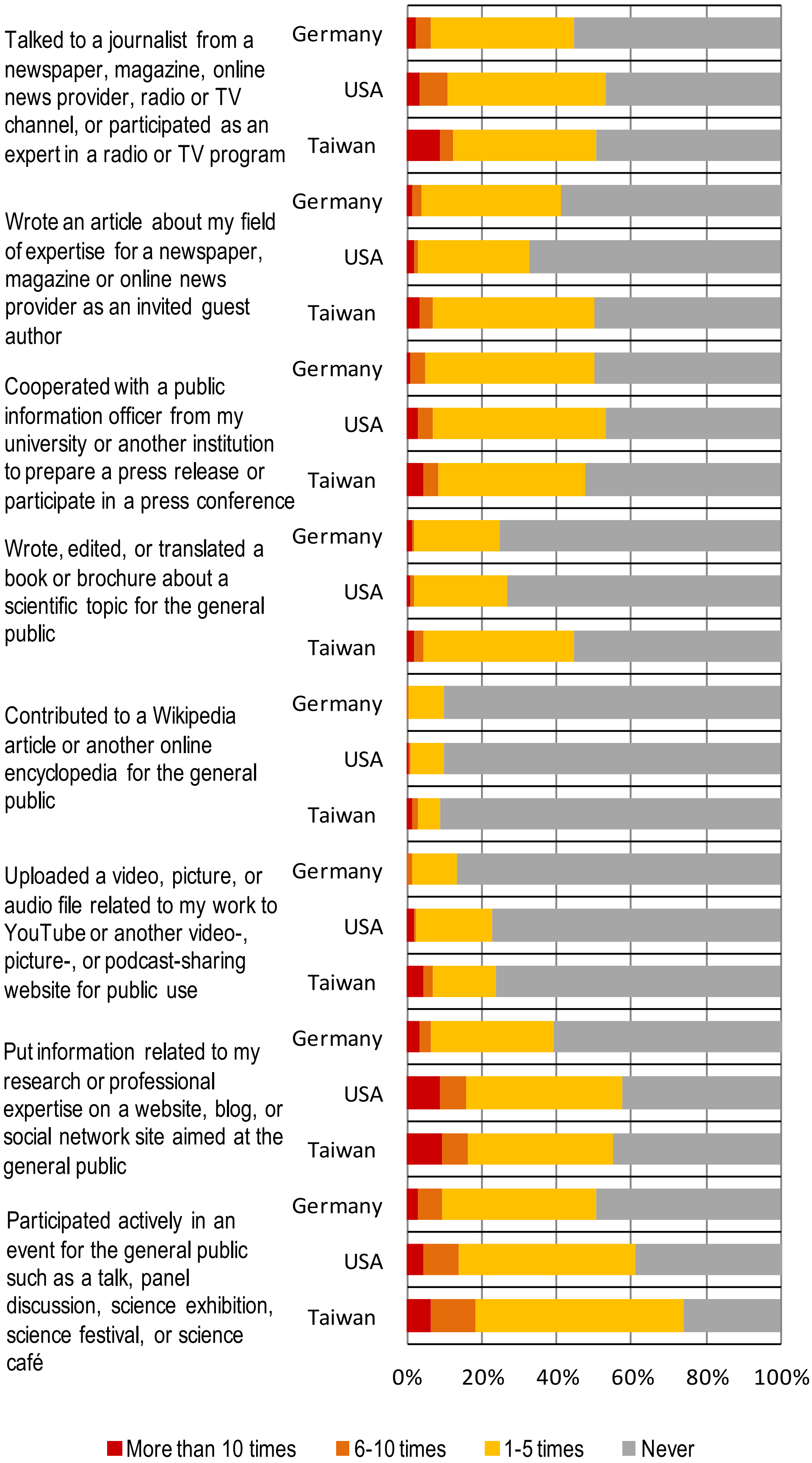


**Figure 8.1** Scientists' participation in several activities of public science communication "in the past 12 months" (Q03, appendix A).

The positive association between productivity and frequency of journalistic contacts may partly reflect the norm of the scientific community that scientists interacting with the mass media should have an excellent professional reputation (Peters, 2013a), which is related to the number of peer-reviewed scientific publications. Another important factor may be that experienced and productive scientists are more often asked by journalists or public information officers to cooperate with them than less experienced (younger) scientists and those with lower productivity.

It is noticeable that only few significant positive associations with scientific productivity exist for other kinds of public communication such as participating in an event, contributing to Wikipedia or putting information on a website, blog or social network site.

A significant positive association between how often scientists "wrote, edited, or translated a book or brochure about a scientific topic for the general public" and scientific productivity exists only in Taiwan (Tau-b=0.21, $p<0.05$). It reflects the fact that the Taiwanese research system strongly depends on knowledge imported and translated from countries with a high competitive research system like Germany or the United States, and the same is true for popularized science. A significant positive association between scientific productivity and active participation "in an event for the general public such as a talk, panel discussion, science exhibition, science festival, or science café" was found for the United States (Tau-b=0.10, $p<0.05$) and Taiwan (Tau-b=0.09, $p<0.01$), although the association is rather weak.

It is quite surprising that in Germany a significant positive association exists between frequency of having "uploaded a video, picture, or audio file related to my work to YouTube or another video-, picture- or podcast-sharing website for public use" and scientific productivity (Tau-b=0.14, $p<0.01$).

Besides scientific productivity, previous studies confirmed a positive association between scientists' participation in public communication and their leadership position. Scientists with a leadership position tended to participate more frequently in public communication than those without such a position (Dunwoody et al., 2009).

| | Germany | USA | Taiwan | Total |
|---|---|---|---|---|
| Talked to a journalist from a newspaper, magazine, online news provider, radio or TV channel, or participated as an expert in a radio or TV program | 0.25** | 0.26** | 0.16** | 0.23** |
| Wrote an article about my field of expertise for a newspaper, magazine or online news provider as an invited guest author | 0.14** | 0.21** | 0.19** | 0.16** |
| Cooperated with a public information officer from my university or another institution to prepare a press release or participate in a press conference | 0.34** | 0.24** | 0.14** | 0.25** |
| Wrote, edited, or translated a book or brochure about a scientific topic for the general public | 0.02 | 0.05 | 0.21** | 0.09** |
| Contributed to a Wikipedia article or another online encyclopedia for the general public | -0.03 | 0.01 | 0.00 | 0.00 |
| Uploaded a video, picture, or audio file related to my work to YouTube or another video-, picture-, or podcast-sharing website for public use | 0.14** | 0.03 | 0.08 | 0.09** |
| Put information related to my research or professional expertise on a website, blog, or social network site aimed at the general public | 0.00 | 0.03 | 0.06 | 0.05 |
| Participated actively in an event for the general public such as a talk, panel discussion, science exhibition, science festival, or science café | 0.03 | 0.10* | 0.12* | 0.09** |

*p<0.05; **p<0.01

**Table 8.2** Statistical associations (Kendall's Tau-b) between frequency of public activities and scientific productivity (number of publications). The number of publications was determined by the question "So far in your career, how many articles have you published in peer-reviewed scientific journals as author or coauthor?" (Q29, appendix A).

Results of this survey show a similar trend (table 8.3). All associations between public communication activities via traditional channels and leadership position (Q25, appendix A) are positive and significant, for example being contacted by journalists (Tau-b=0.28, p<0.01), writing stories for journalistic media (Tau-b=0.19, p<0.01), cooperating with public information officers (Tau-b=0.33, p<0.01) or participating in a public event (Tau-b=0.15, p<0.01).

Again, the positive association between leadership position and frequency of journalistic contacts may partly reflect the norm of the scientific community that scientists interacting with the mass media should have an excellent professional reputation, which is partly related to their role in scientific organization. Scientists who have a leadership position may be more often asked by journalists or public information officers to cooperate with them than those without a leadership position.

A significant positive association between how often scientists "wrote, edited, or translated a book or brochure about a scientific topic for the general public" and leadership position exists both in the United States (Tau-b=0.11, p<0.05) and in Taiwan (Tau-b=0.25, p<0.01). Another special feature of the Taiwanese sample is the positive, but moderate association between leadership position and participation in online communication, such as "putting information related to [their] research or professional expertise on a website, blog, or social network site aimed at the general public" (Tau-b=0.17, p<0.01).

| | Germany | USA | Taiwan | Total |
|---|---|---|---|---|
| Talked to a journalist from a newspaper, magazine, online news provider, radio or TV channel, or participated as an expert in a radio or TV program | 0.33** | 0.24** | 0.26** | 0.28** |
| Wrote an article about my field of expertise for a newspaper, magazine or online news provider as an invited guest author | 0.23** | 0.14** | 0.18** | 0.19** |
| Cooperated with a public information officer from my university or another institution to prepare a press release or participate in a press conference | 0.46** | 0.32** | 0.22** | 0.33** |
| Wrote, edited, or translated a book or brochure about a scientific topic for the general public | 0.14 | 0.11* | 0.25** | 0.18** |
| Contributed to a Wikipedia article or another online encyclopedia for the general public | 0.05 | 0.01 | 0.03 | 0.03 |
| Uploaded a video, picture, or audio file related to my work to YouTube or another video-, picture-, or podcast-sharing website for public use | 0.17** | 0.05 | 0.24** | 0.15** |
| Put information related to my research or professional expertise on a website, blog, or social network site aimed at the general public | 0.09 | 0.06 | 0.17** | 0.11 |
| Participated actively in an event for the general public such as a talk, panel discussion, science exhibition, science festival, or science café | 0.14* | 0.11* | 0.18** | 0.15** |

*p<0.05; **p<0.01

**Table 8.3** Statistical associations (Kendall's Tau-b) between frequency of public activities and leadership position. Leadership position was determined by the question "Which term best describes your current management role in your unit?" (Q25, appendix A).

It is quite surprising that a positive association between the frequency of having "uploaded a video, picture, or audio file related to my work to YouTube or another video-, picture- or podcast-sharing website for public use" and leadership position is found among German scientists (Tau-b=0.17, p<0.01) and among Taiwanese scientists (Tau-b=0.24, p<0.01).

With regards to the association between scientists' age and their participation, contrary to the expectation that young scientists are more online active for public communication, survey results do not confirm it. In all three countries, there is no association between age and the participation frequencies of online activities (table 8.4), such as contributing to a Wikipedia article (Tau-b=-0.02, p>0.05), uploading a video, picture, or audio file to YouTube (Tau-b=0.03, p>0.05) or putting information on a website, blog, or social network site for the general public (Tau-b=-0.04, p>0.05).

| | Germany | USA | Taiwan | Total |
|---|---|---|---|---|
| Talked to a journalist from a newspaper, magazine, online news provider, radio or TV channel, or participated as an expert in a radio or TV program | 0.23** | 0.13* | 0.07 | 0.17** |
| Wrote an article about my field of expertise for a newspaper, magazine or online news provider as an invited guest author | 0.13* | 0.12* | 0.01 | 0.09** |
| Cooperated with a public information officer from my university or another institution to prepare a press release or participate in a press conference | 0.35** | 0.12* | 0.05 | 0.18** |
| Wrote, edited, or translated a book or brochure about a scientific topic for the general public | 0.03 | 0.02 | 0.12* | 0.07** |
| Contributed to a Wikipedia article or another online encyclopedia for the general public | -0.03 | 0.04 | -0.07 | -0.02 |
| Uploaded a video, picture, or audio file related to my work to YouTube or another video-, picture-, or podcast-sharing website for public use | 0.04 | 0.02 | -0.05 | 0.03 |
| Put information related to my research or professional expertise on a website, blog, or social network site aimed at the general public | -0.13 | -0.05 | -0.09 | -0.04 |
| Participated actively in an event for the general public such as a talk, panel discussion, science exhibition, science festival, or science café | 0.06 | 0.05 | 0.02 | 0.07* |

*p<0.05; **p<0.01

**Table 8.4** Statistical associations (Kendall's Tau-b) between frequency of public activities and age group (< 36 years, 36-45 years, 46-55 years, 56-65 years, > 65 years).

In Germany and in the United States, positive associations exist between scientists' age and how often they participate in traditional communication activities, such as "talked to a journalist," "wrote an article" for news provider, or "cooperated with a public information officer," while such an association does not exist in Taiwan except with respect to "wrote, edited, or translated a book or brochure"

(Tau-b=0.12, p>0.05). Older Taiwanese scientists reported more frequent participation in that activity than their younger colleagues.

Previous studies did not show a conclusive relationship between gender and participation in public communication (Besley, 2014; Jensen & Croissant, 2007). Also in this survey there is no association between gender and frequencies of communication activities – with only one exception that female German scientists are more active in writing, editing or translating "a book or brochure about a scientific topic for the general public" than their male colleagues (Tau-b=0.23, p<0.01) (table 8.5).

Reflecting on RQ 2.1 about differences between the groups of scientists who interact with journalism or are online active, the analyses show a positive association between scientific productivity and frequency of contacts with a journalist (table 8.2) and also a positive association between leadership position and frequency (table 8.3). The results are congruent with previous studies showing that leadership position is an important predictor of scientists' contacts with journalists (Dunwoody & Scott, 1982; Peters, Brossard, et al., 2008). The results further suggest that scientific productivity and leadership position are less predictive for scientists' online activity than for their contacts with journalists. The associations presented in table 8.3 mostly confirm the hypothesis that:

H 2.1 Leadership positions of scientists are related to more frequent interaction with journalists but not with more online activities.

Significant positive associations between frequencies of interaction with journalists and leadership positions exist in all three countries. With regards to scientists' online activities, significant positive associations do not consistently exist in the all countries and for all kinds of online activities. For example, leadership position is mildly related to Taiwanese scientists' frequency of putting information on "a website, blog, or social network" for the general public, but it is not related to the respective frequencies of German and the US scientists.

Considering the relationship between scientists' age and their frequency of online activities, the survey results presented in table 8.4 do not confirm hypothesis H 2.2:

H 2.2 Because of their media socialization, younger scientists are more often online active in public science communication than older scientists.

In all three surveyed countries, there is no significant positive association between age and frequency of online activities, such as "contributed to a Wikipedia article," "uploaded a video" to YouTube and "put information" in the new online media.

| | Germany | USA | Taiwan | Total |
|---|---|---|---|---|
| Talked to a journalist from a newspaper, magazine, online news provider, radio or TV channel, or participated as an expert in a radio or TV program | 0.00 | -0.10 | 0.02 | -0.04 |
| Wrote an article about my field of expertise for a newspaper, magazine or online news provider as an invited guest author | 0.10 | -0.05 | 0.02 | 0.00 |
| Cooperated with a public information officer from my university or another institution to prepare a press release or participate in a press conference | 0.04 | -0.04 | 0.06 | 0.02 |
| Wrote, edited, or translated a book or brochure about a scientific topic for the general public | 0.23** | -0.06 | 0.06 | 0.04 |
| Contributed to a Wikipedia article or another online encyclopedia for the general public | -0.02 | -0.03 | 0.05 | 0.00 |
| Uploaded a video, picture, or audio file related to my work to YouTube or another video-, picture-, or podcast-sharing website for public use | -0.08 | 0.04 | 0.06 | 0.00 |
| Put information related to my research or professional expertise on a website, blog, or social network site aimed at the general public | 0.04 | 0.03 | -0.06 | 0.00 |
| Participated actively in an event for the general public such as a talk, panel discussion, science exhibition, science festival, or science café | 0.02 | 0.07 | 0.05 | 0.03 |

**p<0.01

**Table 8.5** Statistical associations (Kendall's Tau-b) between frequency of public activities and gender.

## 8.3 Scientists' use of personal websites, blogs and social online networks

Based on a number of questions (Q05-Q11, appendix A), the use of online media by scientists can be analyzed in more detail. Most popular among scientists in the three countries is membership in a social network, followed by having a personal website. Active as well as passive blog use is less common (table 8.6). The use of online media differs clearly between countries. About 70% of German scientists said they were a member of a social network and 39% said they had a personal website. The proportions of German scientists who reported use of blogs were rather small: only about 6% reported active use and about 21% said that they use them passively. 80% of the American scientists said they were members of a social online network and more than half (57%) mentioned a personal website. About

33% of the American scientists said that they read online blogs and 10% said they were blogging actively. The diffusion of these media in Taiwan shows a pattern between that of Germany and that of the United States. A majority (77%) of Taiwanese scientists were members of a social online network and almost half (48%) had a personal website. About 32% of Taiwanese scientists read online blogs, while only about 7% write blog posts or commented on blog posts. For a more detailed discussion of country differences regarding the use of online media see chapter 12.

| | Germany | USA | Taiwan |
|---|---|---|---|
| Scientists who have a personal website | 38.9% | 56.9% | 47.7% |
| Scientists who are members of a social online network | 70.1% | 80.1% | 76.9% |
| Scientists who blog actively (write blog posts or comment on blog posts by other people) | 6.3% | 10.0% | 7.3% |
| Scientists who use blogs passively (read blogs) | 21.3% | 33.0% | 31.7% |
| n= | 240 | 303 | 272 |

**Table 8.6** Use of personal websites, social online networks, and blogs by scientists (Q05, Q07, Q09 and Q10, appendix A).

It is not only interesting to know whether scientists use the different media in general, but also to recognize which online media they used for public communication. Scientists, who had a personal website, were a member of a social online network or used blogs – actively or passively – answered further questions about their goals of using these online channels. Their responses suggest that scientists assign each channel different goals and target groups.

*Scientists' use of personal websites to communicate with interested laypeople*

The 98 German, 168 American and 128 Taiwanese participants reporting that they had a personal website answered a question about "which groups of users are targeted by the information" on their website. Their responses suggest that personal websites of scientists are not mainly created for public communication of science but for internal scientific communication with peers and students (table 8.7). Almost three quarters of the respondents said that the information on their websites targeted "mainly scientists or college/university students." Only about one quarter reported that their websites took a broader audience into account, i.e., "people who are not scientists or students." However, very few run their personal websites "mainly" for such broader audiences – less than 5% of the American and Taiwanese scientists and no one from Germany. The purposes of personal websites do not differ significantly between countries ($\chi^2$=4.6, *df*=4, p>0.05).

| | Germany | USA | Taiwan |
|---|---|---|---|
| Mainly scientists or college/university students | 72.2% | 71.0% | 73.1% |
| Mainly people who are not scientists or college/university students | 0.0% | 3.3% | 4.5% |
| Both scientists or students and people who are not scientists or students | 27.8% | 25.6% | 22.4% |
| Total | 100.0% (n=98) | 100.0% (n=168) | 100.0% (n=128) |

**Table 8.7** Target audiences of personal websites of scientists (only respondents indicating that they have a personal website) (Q08, appendix A).

*Scientists' use of social online networks to communicate with interested laypeople*

The majority of respondents were members of a social network. 165 German, 241 American and 212 Taiwanese respondents said they were "a member of a social online network such as Facebook, Google+, Twitter, ResearchGate, or LinkedIn." Asked about the purposes for which they use social online networks, more than 70% of German, 80% of the Americans and 90% of the Taiwanese network members said that they use the networks occasionally or frequently "for private purposes, to stay in contact with [their] friends and relatives" (figure 8.2). Social media are furthermore used professionally "to keep informed about public issues related to science or own area of expertise" and to communicate with colleagues and students. Of the six possible uses mentioned in the question, "to communicate about my research or area of expertise with interested laypeople" is the least mentioned use of social networks in all three countries.

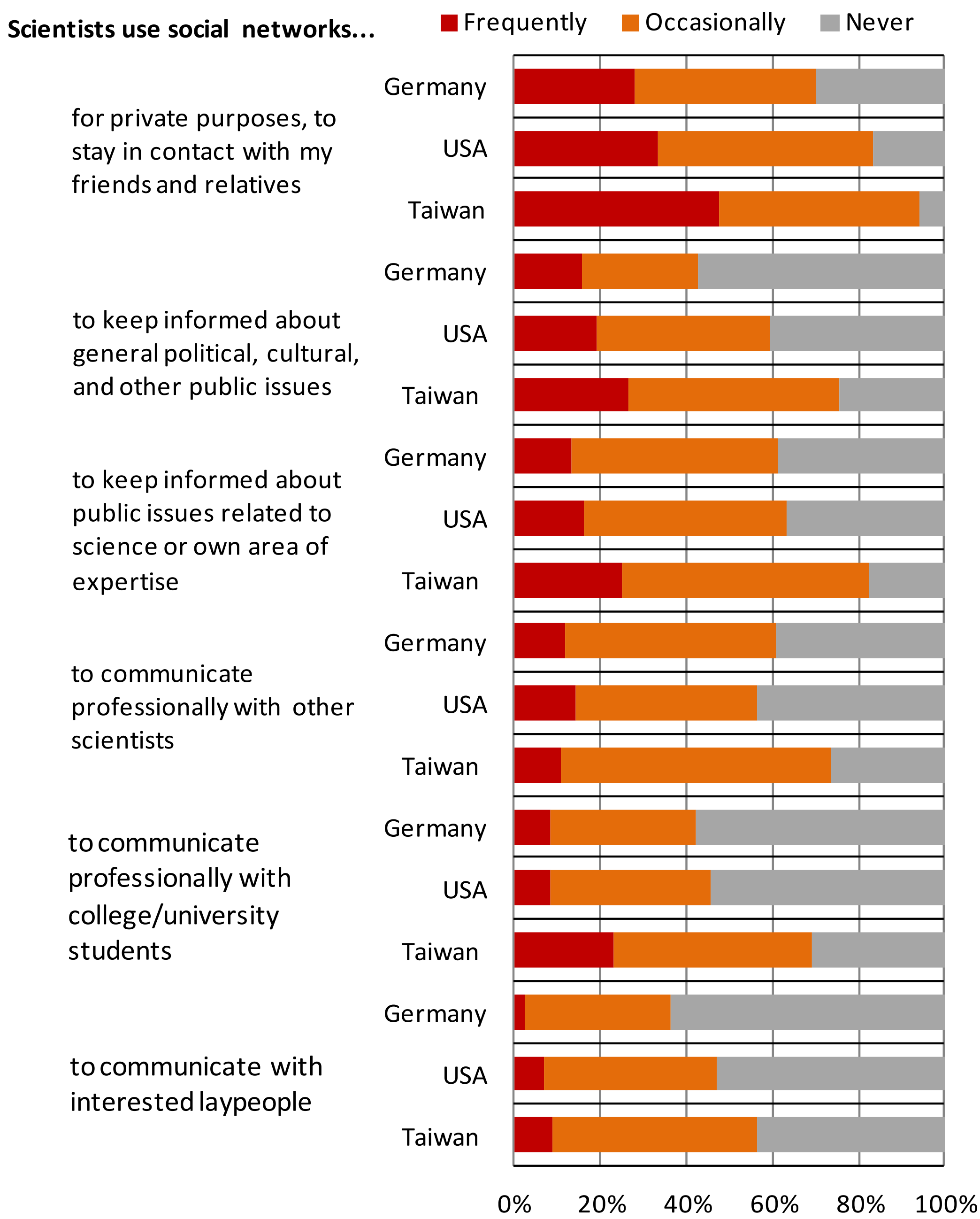


**Figure 8.2** Purposes of using social online networks (Q06, appendix A).

*Blogging to communicate with interested laypeople*

Blogging is not widespread among scientists, compared to membership in social network sites or maintaining personal websites. 60 German, 107 American and 98 Taiwanese participants reported that they either passively or actively use blogs, i.e., read blogs posted by others, write blog posts themselves or comment on blog posts.

The majority of scientists who use blogs only read blog posts but do not post themselves (table 8.6). Primarily, scientists use blogs as a channel of information about general and scientific public issues (figure 8.3). Averaged across countries, about 80% of the scientists who use blogs said that they occasionally or frequently used blogs "to keep informed about general political, cultural, and other public issues." In the United States, this percentage even reaches 90%, significantly higher than in Germany and Taiwan ($\chi^2$=15.9, *df*=4, p<0.01). More than 70% of blog users among all respondents reported occasional or frequent blog use "to keep informed about public issues related to science or own area of expertise."

The characteristics of communication in blogs or social network sites are less essential for scientists' media use. Scientists' usage of these channels is rather passive, than active. The usages of social online networks and blogs are mainly "to keep informed" or "stay in touch with my friends" rather than to "communicate."

The analysis of the relation between scientists' age and their frequency of use of online channels, such as websites, blogs or social networks shows that young scientists are no more online active than their elder colleagues (table 8.4), which is not congruent with the general expectation that younger scientists are more active online than their elder colleagues. It is worth to analyze age differences in detail looking at the purposes of scientists' use of different channels.

With respects to scientists' purposes of using personal website and social network, the results show age differences between scientists who use the online channels for public communication, those who do not use for public communication and those who do not use at all, except in one item (table 8.8). In Germany and the United States, but not in Taiwan, scientists addressing a broader audience with their websites tend to be older than those confining the use of their websites for communication with peers and students. There is no significant age difference between Taiwanese scientists who use personal websites for public communication, those who do not use for this purpose and those who do not have a personal website. In Germany and in the USA, members of social networks indicating that they use these networks to communicate about their "research or area of expertise with interested laypeople" are younger on average than those who do not use social networks for that purpose. Taiwanese scientists who are members of a social network – regardless their purposes of use – are younger than those who are not members.

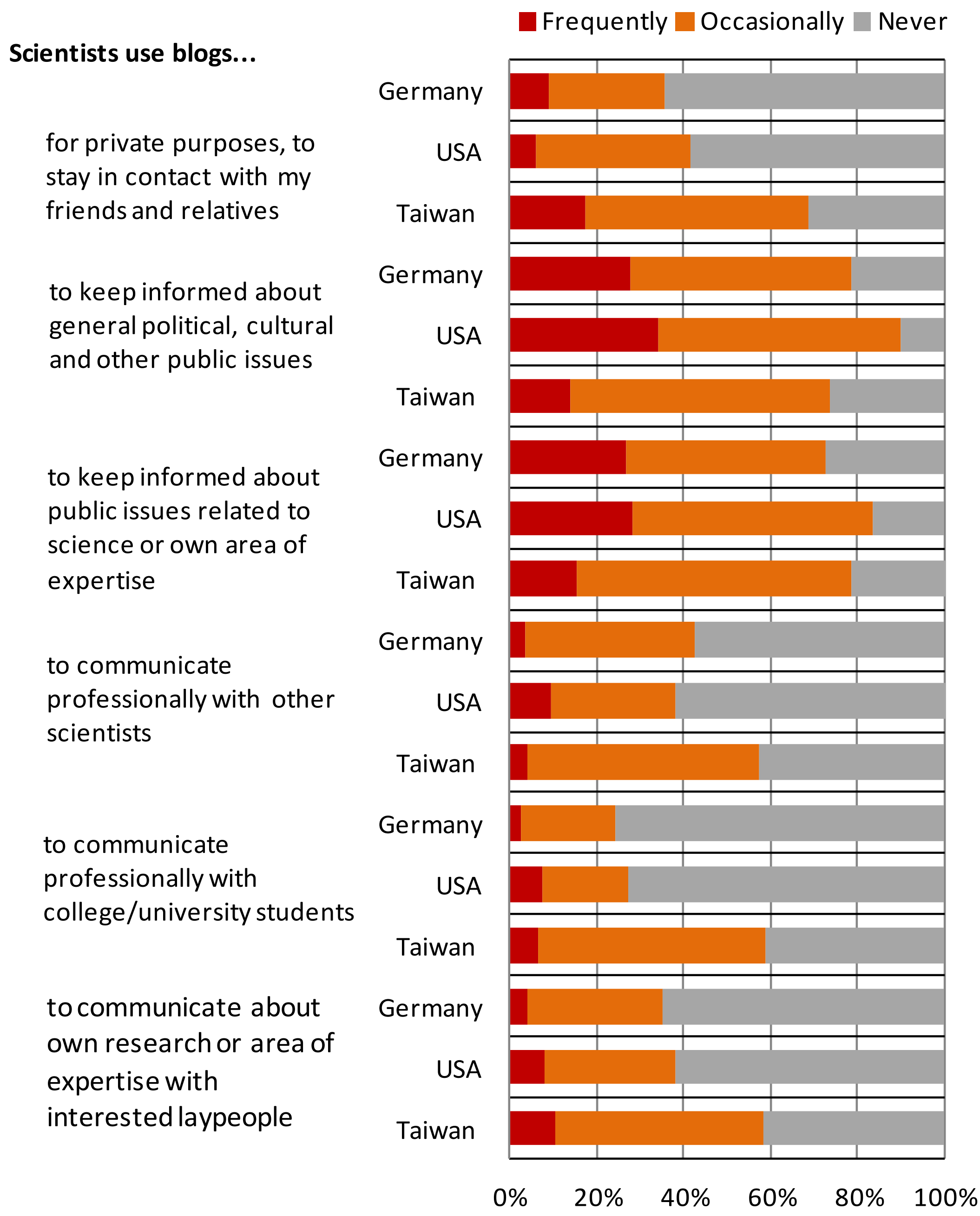


**Figure 8.3** Purposes of using blogs (Q11, appendix A).

In the three countries, the difference in age does not reach statistical significance between scientists who write blog posts or comments on blogs and those who do not use blogs at all. With regard to scientists' passive blog use the results show statistical significance of age differences between scientists who read blog posts and those who do not read blog posts at all, however (table 8.8). In all three countries, scientists who read blog posts are younger than those who do not.

Reconsidering hypothesis H 2.2, the above analysis provides a more complex picture of the relation between age and online activity. For example, German and the

US scientists who address their personal website to the public are older than scientists who do not; and younger scientists in Germany and the United States tend to use their social network to reach a broader audience. With regards to blog use, a significant age difference between scientists who actively use blogs for public communication, those who actively use them for other purposes or those who do not use them at all are not found in the three countries. Scientists in all countries who use blogs passively are generally younger than those who do not, however.

Similar to the analysis of associations between gender and frequency of online activities, a more detailed analysis of gender-specific use of new media for different purposes, looking at each online channel separately, does not find significant differences between female and male scientists, except for one item (table 8.9).

The relationship between scientists' leadership position and their purposes of using online channels vary across countries, but scientists' active blog use is not related with their leadership position in any of the countries (table 8.10 and table 8.11). Scientists' leadership position is related with their communication purposes of using personal websites in Germany, as well as in the United States, but not in Taiwan. German and American scientists who are group leaders or principal investigators tend to address their personal websites for specific groups of audiences, but not for the public (table 8.10). Taiwanese scientists who position as "dean, head of institute, director, head of department, CEO, chair" tend to use their social networks to reach a broader audience, while this tendency is not found among German and the US scientists. Leadership position is related to German scientists' passive blog use. German scientists who are "dean, head of institute, director, head of department, CEO, chair" or "group leader, principal investigator" hardly read blog posts to relate to a broader audience.

*Conclusions*

The results show that scientists tend to use different online media for different purposes. Personal websites are mainly used for internal scientific communication, the private use dominates in social networks and blogs mainly serve as an information source about public issues in general and those related to science. However, to some extent each of the three online media is also used by scientists to communicate with broader audiences.

| | Germany | | | USA | | | Taiwan | | |
|---|---|---|---|---|---|---|---|---|---|
| | Use for public communication | Not use for public communication | No use at all | Use for public communication | Not use for public communication | No use at all | Use for public communication | Not use for public communication | No use at all |
| Personal website[1] | 49.19 | 46.55 | 42.53 | 53.20 | 47.39 | 50.80 | 46.17 | 48.06 | 49.07 |
| | $p<0.05$[5] | | | $p<0.05$ | | | $p>0.05$ | | |
| Social network[2] | 39.50 | 44.53 | 48.69 | 45.59 | 49.09 | 58.09 | 47.23 | 46.44 | 52.90 |
| | $p<0.01$ | | | $p<0.01$ | | | $p<0.01$ | | |
| Active blogging[3] | 38.42 | 40.00 | 44.75 | 50.49 | 46.49 | 49.91 | 46.31 | 43.41 | 48.48 |
| | $p>0.05$ | | | $p>0.05$ | | | $p>0.05$ | | |
| Passive blog use[4] | 38.79 | 39.05 | 45.73 | 45.62 | 46.58 | 51.65 | 47.78 | 42.11 | 49.52 |
| | $p<0.01$ | | | $p<0.01$ | | | $p <0.01$ | | |

[1] Defined by answers to Q07 and Q08 (appendix A): *Use for public communication* comprises the answers "both scientists or students and people who are not scientists or students"; *not use for public communication* comprises the answers "mainly people who are not scientists or college/university students" (Q08); *no use at all* comprises respondents indicating that they have no personal website (Q07).

[2] Defined by answers to Q05 and Q06 (appendix A): *Use for public communication* comprises the answers "to communicate about my research or area of expertise with interested laypeople"; *not use for public communication* comprises the other answer options (Q06); *no use at all* comprises respondents indicating that they are not a member of a social online (Q05).

[3] Defined by answers to Q09 and Q11 (appendix A): *Use for public communication* comprises the answers "to communicate about my research or area of expertise with interested laypeople"; *not use for public communication* comprises the other answer options (Q11); *no use at all* comprises respondents indicating that they did not write blog posts or comment on blog posts (Q09).

[4] Defined by answers to Q10 and Q11 (appendix A): *Use for public communication* comprises the answers "to communicate about my research or area of expertise with interested laypeople"; *not use for public communication* comprises the other answer options (Q11); *no use at all* comprises respondents indicating that they did not read online blog (Q10).

[5] Statistical significances are calculated by F-test.

**Table 8.8** Average age (in years) of scientists using personal websites, social networks and blogs to communicate with the public compared to those who use these media channels for other purposes only and to those who do not use the channels at all.

| | Germany | | | USA | | | Taiwan | | |
|---|---|---|---|---|---|---|---|---|---|
| | Use for public communication | Not use for public communication | No use at all | Use for public communication | Not use for public communication | No use at all | Use for public communication | Not use for public communication | No use at all |
| Personal website[1] | 29.0% | 15.5% | 21.8% | 24.4% | 17.0% | 28.7% | 10.9% | 3.5% | 14.7% |
| | $X^2$=2.23, *df*=2, p>0.05 | | | $X^2$=4.70, *df*=2, p>0.05 | | | $X^2$=7.57, *df*=2, p<0.05 | | |
| Social network[2] | 18.3% | 18.6% | 24.0% | 22.9% | 26.4% | 16.4% | 9.8% | 11.4% | 9.5% |
| | $X^2$=0.92, *df*=2, p>0.05 | | | $X^2$=2.23, *df*=2, p>0.05 | | | $X^2$=0.18, *df*=2, p>0.05 | | |
| Active blogging[3] | 29.0% | 12.2% | 20.8% | 10.3% | 16.2% | 24.5% | 10.3% | 20.0% | 10.0% |
| | $X^2$=0.60, *df*=2, p>0.05 | | | $X^2$=2.59, *df*=2, p>0.05 | | | $X^2$=0.57, *df*=2, p>0.05 | | |
| Passive blog use[4] | 11.4% | 22.5% | 20.8% | 14.9% | 29.4% | 22.4% | 9.2% | 12.1% | 10.2% |
| | $X^2$=0.91, *df*=2, p>0.05 | | | $X^2$=2.77, *df*=2, p>0.05 | | | $X^2$=0.19, *df*=2, p>0.05 | | |

[1, 2, 3, 4] *Notes see table 8.8*

**Table 8.9** Proportions of female scientists using personal websites, social networks and blogs to communicate with the public compared to those who use these media channels for other purposes only and to those who do not use the channels at all.

| | | Germany | | | | USA | | | | Taiwan | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Use for public communication | Not use for public communication | No use at all | Total | Use for public communication | Not use for public communication | No use at all | Total | Use for public communication | Not use for public communication | No use at all | Total |
| | | % | % | % | % | % | % | % | % | % | % | % | % |
| Personal websites[1] | Dean, head of institute, director, head of department, CEO, chair | 29.2 | 32.0 | 38.7 | 100 (n=35) | 17.5 | 37.1 | 45.4 | 100 (n=51) | 21.8 | 35.5 | 42.7 | 100 (n=48) |
| | Group leader, principal investigator | 7.6 | 34.4 | 58.0 | 100 (n=113) | 19.6 | 47.8 | 32.5 | 100 (n=145) | 10.7 | 34.9 | 54.4 | 100 (n=147) |
| | Other management position | 2.4 | 17.5 | 80.0 | 100 (n=29) | 7.9 | 21.1 | 71.1 | 100 (n=13) | 10.6 | 36.2 | 53.2 | 100 (n=20) |
| | No management position at this time | 10.6 | 18.3 | 71.1 | 100 (n=62) | 12.7 | 34.4 | 52.9 | 100 (n=91) | 11.3 | 31.7 | 57.0 | 100 (n=53) |
| | Total | 10.9 | 27.9 | 61.2 | | 16.6 | 40.8 | 42.6 | | 12.8 | 34.5 | 52.7 | 7 |
| | n= | 26 | 66 | 146 | 238 | 50 | 123 | 128 | 301 | 34 | 93 | 142 | 269 |
| | | $\chi^2$=24.48, *df*=6, p<0.01 | | | | $\chi^2$=14.72, *df*=6, p<0.05 | | | | $\chi^2$=5.03, *df*=6, p>0.05 | | | |
| Social networks[2] | Dean, head of institute, director, head of department, CEO, chair | 22.8 | 48.0 | 29.2 | 100 (n=34) | 33.1 | 37.3 | 29.6 | 100 (n=48) | 64.0 | 14.0 | 22.1 | 100 (n=47) |
| | Group leader, principal investigator | 24.1 | 40.9 | 34.9 | 100 (n=112) | 34.6 | 41.7 | 23.7 | 100 (n=143) | 40.0 | 38.5 | 21.5 | 100 (n=149) |
| | Other management position | 30.6 | 50.5 | 18.9 | 100 (n=29) | 56.6 | 28.9 | 14.5 | 100 (n=13) | 30.8 | 38.3 | 30.8 | 100 (n=20) |
| | No management position at this time | 25.6 | 47.7 | 26.8 | 100 (n=60) | 41.8 | 46.7 | 11.4 | 100 (n=90) | 38.5 | 25.3 | 26.2 | 100 (n=54) |
| | Total | 25.1 | 44.9 | 30.1 | | 37.6 | 41.9 | 20.5 | | 43.2 | 33.5 | 23.2 | |
| | n= | 59 | 106 | 71 | 235 | 111 | 123 | 60 | 294 | 117 | 91 | 63 | 270 |
| | | $\chi^2$=3.53, *df*=6, p>0.05 | | | | $\chi^2$=10.15, *df*=6, p>0.05 | | | | $\chi^2$=13.66, *df*=6, p<0.05 | | | |

[1, 2] *Notes see table 8.8*

**Table 8.10** Proportion of scientists by leadership position using personal websites and social networks to communicate with the public compared to those who use these media channels for other purposes only and to those who do not use the channels at all.

| | | Germany | | | | USA | | | | Taiwan | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Use for public communication | Not use for public communication | No use at all | Total | Use for public communication | Not use for public communication | No use at all | Total | Use for public communication | Not use for public communication | No use at all | Total |
| | | % | % | % | % | % | % | % | % | % | % | % | % |
| Active blogging[3] | Dean, head of institute, director, head of department, CEO, chair | 0.0 | 2.0 | 98.0 | 100 (n=35) | 12.3 | 4.0 | 83.7 | 100 (n=51) | 7.6 | 2.2 | 90.2 | 100 (n=48) |
| | Group leader, principal investigator | 4.4 | 1.2 | 94.3 | 100 (n=113) | 7.2 | 2.1 | 90.6 | 100 (n=145) | 5.5 | 0.7 | 93.8 | 100 (n=149) |
| | Other management position | 0.0 | 6.3 | 93.7 | 100 (n=29) | 13.2 | 0.0 | 86.8 | 100 (n=13) | 0.0 | 0.0 | 100.0 | 100 (n=20) |
| | No management position at this time | 5.9 | 3.0 | 91.1 | 100 (n=61) | 4.7 | 2.3 | 93.0 | 100 (n=91) | 5.2 | 6.0 | 88.9 | 100 (n=54) |
| | Total | 3.6 | 2.4 | 94.0 | | 7.6 | 2.4 | 90.0 | | 5.4 | 2.0 | 90.7 | |
| | n= | 9 | 6 | 223 | 238 | 23 | 7 | 270 | 300 | 15 | 5 | 251 | 271 |
| | | $\chi^2$=6.05, *df*=6, p>0.05 | | | | $\chi^2$=4.32, *df*=6, p>0.05 | | | | $\chi^2$=7.69, *df*=6, p>0.05 | | | |
| Passive blog use[4] | Dean, head of institute, director, head of department, CEO, chair | 0.0 | 16.1 | 83.9 | 100.0 (n=34) | 13.5 | 15.8 | 70.8 | 100.0 (n=51) | 24.0 | 6.2 | 69.8 | 100.0 (n=48) |
| | Group leader, principal investigator | 8.2 | 5.6 | 86.1 | 100.0 (n=113) | 10.3 | 22.8 | 66.8 | 100.0 (n=145) | 18.5 | 15.1 | 66.4 | 100.0 (n=149) |
| | Other management position | 14.1 | 23.8 | 62.1 | 100.0 (n=29) | 13.2 | 7.9 | 78.9 | 100.0 (n=13) | 11.7 | 12.7 | 75.6 | 100.0 (n=20) |
| | No management position at this time | 5.2 | 24.0 | 70.8 | 100.0 (n=62) | 11.0 | 23.5 | 65.5 | 100.0 (n=89) | 16.7 | 13.5 | 69.8 | 100.0 (n=54) |
| | Total | 7.0 | 14.1 | 78.9 | | 11.2 | 21.2 | 67.7 | | 18.6 | 13.0 | 68.4 | |
| | n= | 17 | 33 | 187 | 237 | 33 | 63 | 202 | 299 | 50 | 35 | 185 | 271 |
| | | $\chi^2$=19.34, *df*=6, p<0.01 | | | | $\chi^2$=3.04, *df*=6, p>0.05 | | | | $\chi^2$=3.84, *df*=6, p>0.05 | | | |

[3, 4] *Notes see table 8.8*

**Table 8.11** Proportion of scientists by leadership position using blogs to communicate with the public compared to those who use blogs for other purposes, and to those who do not use blogs at all.

# 9 Scientists' perceptions of blogging

The theory of planned behavior (Ajzen, 1991) suggests that an individual's decision about how to behave reflects on their intentions. According to the theory three factors influence the intention to engage in a particular behavior: evaluation of outcomes of that behavior, perception of a specific reference group's encouragement or dis-encouragement toward the behavior, and perceived control. Findings of various studies on scientists' motivations to participating in public science communication suggest that the theory of planned behavior is helpful in predicting scientists' participation (Poliakoff & Webb, 2007).

My study does not intend to test the theory of planned behavior, but several survey questions are based on the theory to understand what might relate to scientists' decisions to engage in a particular form of public science communication, namely blogging. For example, one of the questions asks about respondents' perception of their colleagues' attitudes toward blogging.

This chapter answers research questions RQ 1.2 and RQ 1.3 about possible factors related to scientists' decision to blog or not to blog. The first part of this chapter presents the results about scientists' perceptions of advantages and disadvantages of blogging and how the perceptions associate with their decision whether they blog or not. The second part focuses on scientists' perception on their social environment, for example the views of their colleagues and their management about blogging.

## 9.1 Scientists' perceptions of disadvantages and advantages of blogging

The overview of the various motivations (Q12 and Q13, appendix A) for scientists' blogging shows that the survey participants in the three countries perceived that whether they had enough time for blogging activities and whether blogs were serious communication platform for scientists are the most important considerations (figure 9.1). The other motivations, such as whether blogging is fun or whether they have the skills for blogging, seem less important to the participants. Some disadvantages and some advantages are more important to scientists in one country, but less important to scientists in the other countries. The reminder of this section focuses on differences in the perception of disadvantages and advantage between scientists in the three countries.

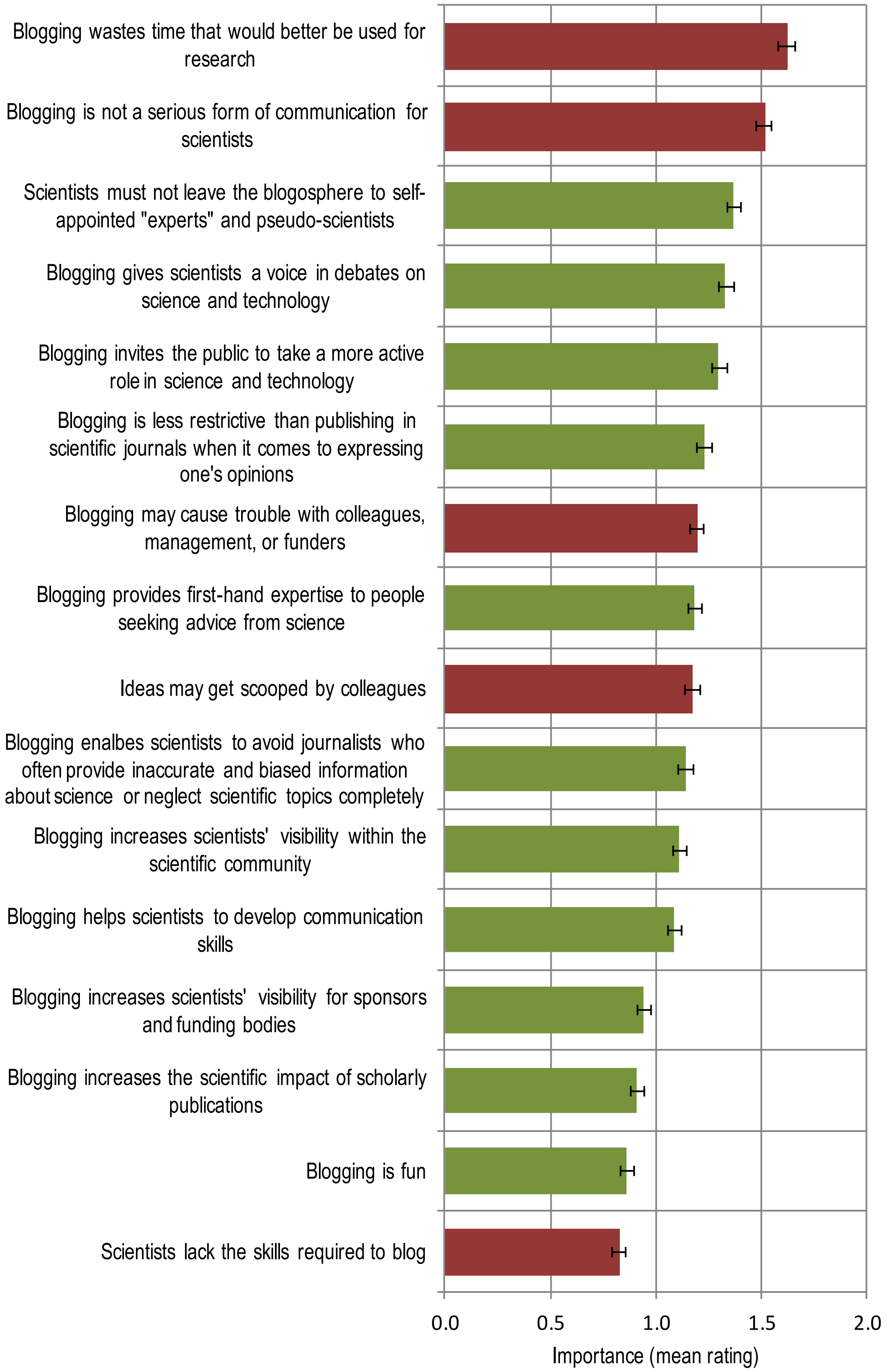


**Figure 9.1** Scientists' perception of the importance of various concerns (red) and positive outcomes (green) of blogging (Q12 and Q13, appendix A). Bars represent mean values of a rating scale ranging from 0 (not important) to 3 (very important).

Perceptions of disadvantages of blogging differ across the three countries, but scientists in all three countries similarly thought that blogging "wastes time that would better be used for research" (F=1.4, *df*=2, p>0.05). Compared with the responses of German and US scientists, Taiwanese scientists were more concerned that by blogging "ideas may get scooped by colleagues" (F=11.1, *df*=2, p<0.01), "scientists lack the skills required to blog" (F=20.8, *df*=2, p<0.01) and "blogging may cause trouble with colleagues, management, or funders" (F=5.2, *df*=2, p<0.01) (figure 9.2).

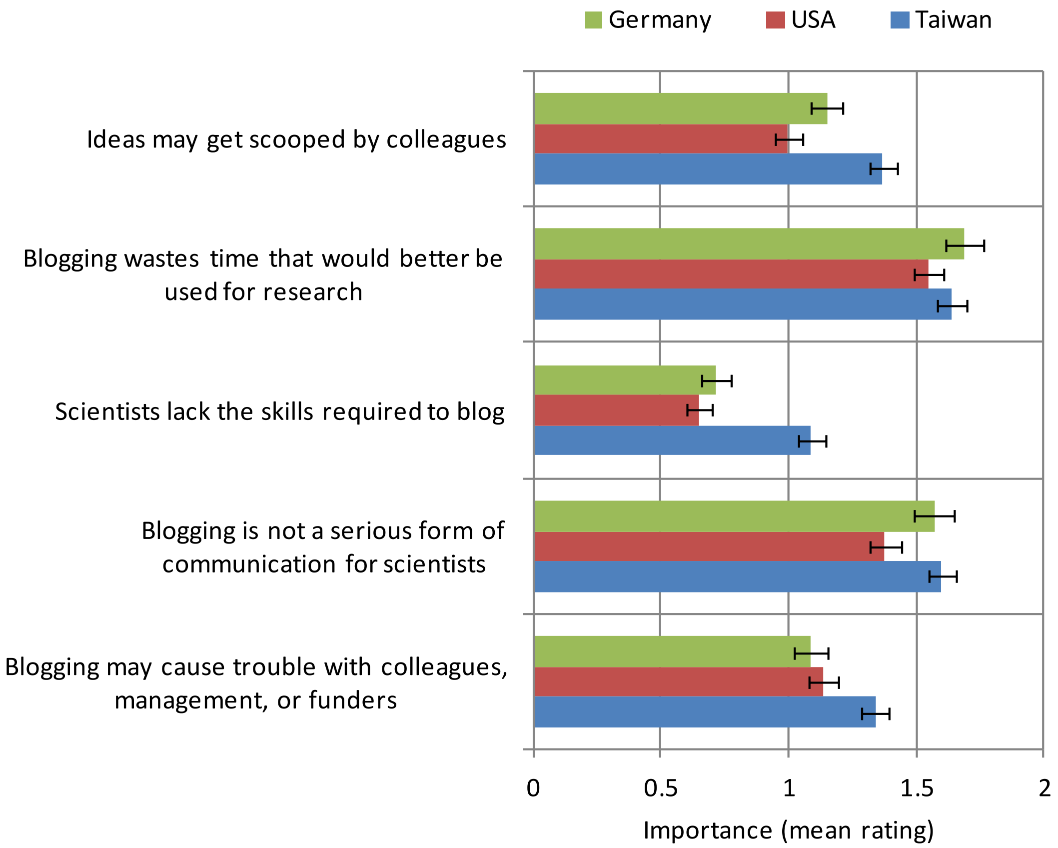


**Figure 9.2** Scientists' perception of the importance of various concerns about blogging by country. Responses to the question: "How important to you personally are the following concerns that increase scientists' reluctance to blog?" (Q13, appendix A). Bars represent mean values of a rating scale ranging from 0 (not important) to 3 (very important).

With regard to motivations to blog, scientists showed a broad spectrum of motivations (figure 9.3). For example, scientists in all three countries perceived similarly that "blogging gives scientists a voice in debates on science & technology" (F= 2.8, *df*=2, p>0.05) and that "blogging provides first-hand expertise to people seeking advice from science" (F= 2.71, *df*=2, p>0.05).

For US scientists, the item that "scientists must not leave the blogosphere to self-appointed experts and pseudo-scientists" was particularly important. Possible outcomes with regards to "public engagement" were perceived relatively more important among the US respondents. For example, they felt that blogging may help engage "the public to take a more active role in science & technology."

Compared with the responses of German and US scientists, for Taiwanese scientists positive outcomes of "online presence" were more important, although all scientists did not perceive it as "very important." For example, the Taiwanese participants' responses to the items that "blogging increases scientists' visibility within the scientific community" (F= 11.5, *df*=2, p<0.01), "blogging increases the scientific impact of scholarly publications" (F= 6.8, *df*=2, p<0.01) and "blogging increases scientists' visibility for sponsors and funding bodies" (F= 14.0, *df*=2, p<0.01) suggest that they were more aware of the potential advantages of blogging than German and US scientists. In the open-ended question (Q12.12, appendix A), a US respondent expressed his/her doubts whether sponsors read blogs, for example. He speculated that sponsors may attend a conference instead of reading blogs. The emphasis on prospects of "online presence" in Taiwan suggests an absence of a clear boundary between public communication and internal scientific communication, and it may indicate that reactions that are external to science may relatively easily have effects inside science.

Communication scholars expect that blogging may empower scientists, in contrast to journalistic media where scientists often feel that the quality of science stories is unpredictable. In the three countries, the perception that "blogging enables scientists to avoid journalists who often provide inaccurate and biased information about science or neglect scientific topics completely" was perceived as somehow important, and Taiwanese scientists considered this aspect more important than German and the US scientists (F=7.1, *df*=2, p<0.01), though the difference of perceived importance is rather small between the three countries. It may imply that Taiwanese scientists are less satisfied with science journalism. This finding is congruent with a previous study (Y.-Y. Lo & Peters, 2015).

Several scientists' answers to the open-ended question (Q12.12, appendix A), reflect expectations of facilitating communication and (social) participation by communicational technologies. For example, a respondent wrote that it is very convenient to communicate and share information with scientists immediately. Two other responses considered blogs as a forum for building consensus and to have an in-depth discussion.

## 9.2 Perceptions of relevant social environment

Besides motivations resulting from expected positive outcomes of blogging and concerns, motivating or demotivating influences from relevant social environments may affect scientists' decision to blog. In the following, we present results about how the respondents perceive the attitude of scientists towards colleagues who blog and the position of the management in their university or other research institution.

Scientists' perceptions of their colleagues' attitudes and the management's position toward blogging activities were operationalized by several questions. For example, one question asked scientists' perceptions of their colleagues' view about blogging colleagues (Q14, appendix A) and another question asked whether they know other scientists who regularly blog (Q15). Further questions asked about their management's position (Q18), whether there are regulations for scientists' blogging activities (Q19) and whether there are training courses for public communication (Q20-Q22).

The results show that large proportions of scientists (47% in Germany, 39% in the USA and 27% in Taiwan) do not know how their scientific peers feel about blogging. Another about 30% of the respondents in all three countries thought that most scientists in their research field do not care about colleagues who blog. Some scientists (28% in Germany, 18% in the United States and 24% in Taiwan) perceived an ambivalent attitude – partly positive, partly critical – towards blogging among their colleagues.

Only in Germany did respondents more often perceive a "mostly critical" than positive attitude towards colleagues who regularly blog (5% vs. 4%) (figure 9.4). In the United States and in Taiwan the perception of a "mostly positive" attitude (10% and 14%, respectively) towards blogging colleagues was more frequent than the perception of a "mostly negative" attitude (4% and 5%, respectively). The lack of a encouragement by colleagues may thus be one of the causes why blogging, and the use of new online media in general, is less practiced by German scientists compared to scientists in the United States and Taiwan (table 8.6).

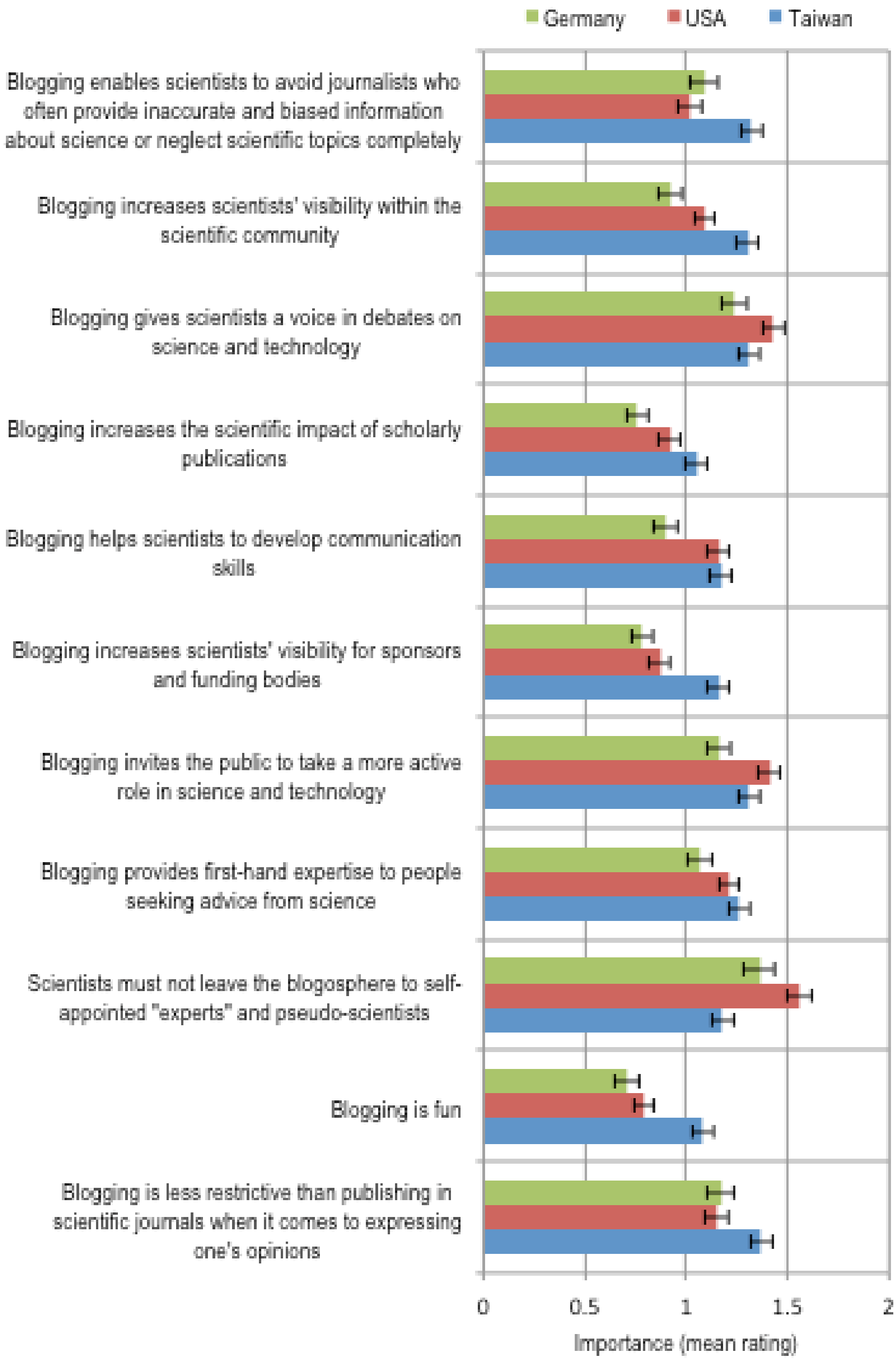


**Figure 9.3** Scientists' perception of the importance of possible positive outcomes of blogging by country. Responses to the question: "Regardless of whether you yourself blog or not, how important to you personally are the following possible outcomes that make scientists feel more positive about blogging?" (Q12, appendix A). Bars represent mean values of a rating scale ranging from 0 (not important) to 3 (very important).

Given the low proportion of blog-using scientists in Germany it is not surprising that when asked "How many colleagues in your research field do you know who regularly blog?" one third of the German scientists said they do not know any blogging colleague. In the United States and in Taiwan only 19% and 13%, respectively, said that. Blogging scientists in scientific communities are not unnoticed, though. A significant proportion of the survey participants said they know at least "some" blogging scientists in their scientific field. More than half of the American and Taiwanese respondents said that they know blogging colleagues. One respondent from Taiwan even claimed that almost all of his colleagues blog. Even in Germany nearly 40% of the scientists knew colleagues who blog.

Besides peers in the scientific community, the organizational context may be relevant for scientists' decision to blog. Compared to the peers' attitude toward blogging scientists, the management's position on blogging seems more decided – either encouraging or cautioning but at least "caring." The patterns are generally similar to the peers' attitudes, but in some ways the management seems to be more encouraging than the peers (figure 9.5). Again, the management of German universities or research institutions is clearly more reserved against blogging scientists than that in the United States and Taiwan. The proportions of German scientists perceiving the position of the management as mostly encouraging and of those perceiving it mostly cautioning were about equal (8%), while in the United States and in Taiwan the management was clearly more often perceived as encouraging blogging than cautioning against it. However, even in the USA and Taiwan respondents perceive the position of the management to be mostly ambivalent rather than clearly encouraging or cautioning – an indication that research organizations have also some concerns against scientists blogging on their own.


**Figure 9.4** Scientists' perception of how scientists in their research field feel about colleagues who regularly blog about their research or expertise (Q14, appendix A).

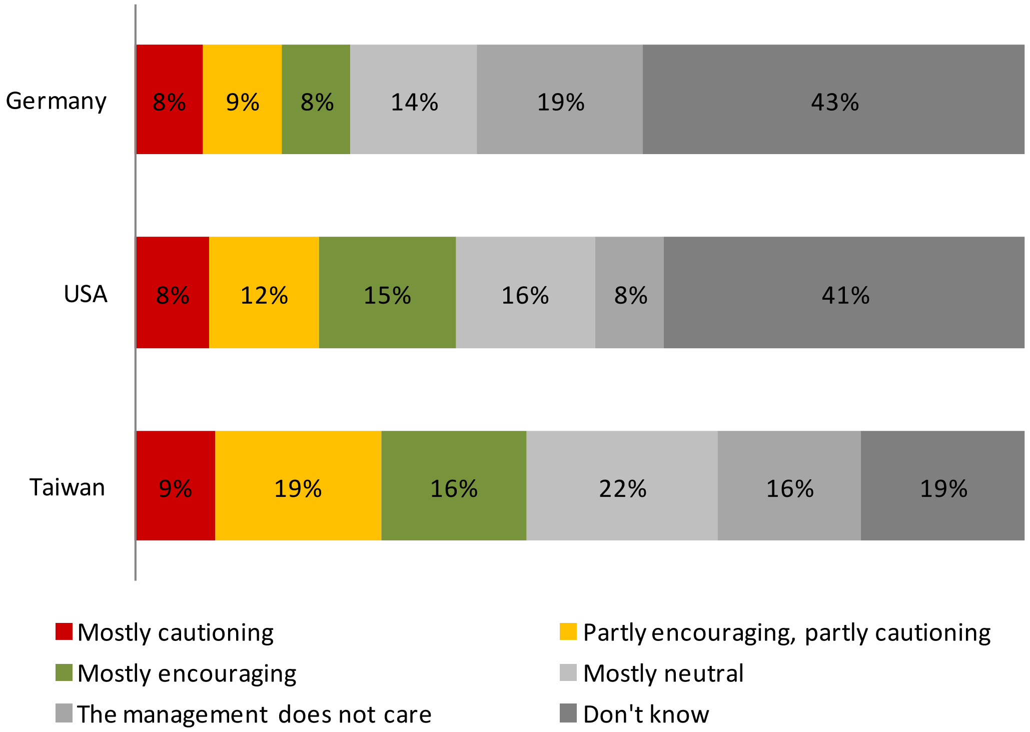


**Figure 9.5** Scientists' perception of the general position of the management towards scientists who blog about their research or expertise (Q18, appendix A).

Public visibility is considered important by the management of universities and research institutions because of expected effects on fundraising and access to other resources (Nelkin, 1995). Research organizations therefore have an interest to motivate scientists to contribute to the visibility of the organization on one hand, and to influence the scientists' public communication activities to make sure they do promote organizational interests on the other hand (Jung, 2012; Kohring et al., 2013; Peters, 2012). One way of exerting influence on scientists is by more or less obligatory regulations or guidelines that express the expectations of the management. Although the concern that "blogging may cause trouble with colleagues, management, or funders" was not the most important concern for scientists, in the Taiwanese cultural context it proved to be more significant than in other countries (figure 9.2). In extreme cases, scientists who blog against the interests of the organization as defined by its management might receive blows damaging their career. An American respondent reported a concrete example of such a case in his/her answer to an open question.

Many scientists do not know whether their institutions have regulations or guidelines for scientists who blog about their research (table 9.1). About 60% of the German and American scientists answered "don't know" when asked whether there are any regulations or guidelines on blogging in their institution. Interestingly, Taiwanese scientists were much less uncertain in their knowledge of regulations – only 28% said "don't know" when asked about organizational regulations or guidelines. Less than 10% of German confirmed the existence of an organizational policy including regulations or guidelines, while about 20% of American and Taiwanese scientists were aware that such regulations or guidelines exist. Almost 50% of the Taiwan scientists clearly acknowledged that there were no regulations or guidelines at their universities or research institutions, while about one third of German scientists and one in five American scientists confirmed this.

Another way to motivate scientists to blog and to provide advice to scientists who do, but also a way to create chances for the management to influence how scientists blog, is offering training courses about communication to scientists. Research organizations in Germany and the United States are more likely to provide such training for communication skills than those in Taiwan. About 30% of German and American scientists confirmed that they are aware of such an offer by their organization, but only about 20% of the Taiwanese respondents. Again, Taiwanese scientists seem better informed about the organizational policy as they were more often explicitly negating that such offers exist while German and American researchers more often said that they "don't know" (table 9.2).

| | | Germany | USA | Taiwan |
|---|---|---|---|---|
| Yes, there are binding regulations | | 5.6% | 12.0% | 6.1% |
| Yes, there are recommended guidelines | | 3.8% | 9.2% | 16.7% |
| No, there are neither regulations nor guidelines | | 30.7% | 19.4% | 49.7% |
| Don't know | | 60.0% | 59.3% | 27.5% |
| | Total | 100.0% (n=237) | 100.0% (n=302) | 100.0% (n=271) |

**Table 9.1** Organizational regulations or guidelines for blogging activities. Responses to the question: "Are there any regulations or guidelines for scientists blogging about their research or expertise?" (Q19, appendix A).

Scientists who answered that their university or research institution offered such training courses were further asked whether the offer included specific courses or modules about blogging. About 38% of 61 Taiwanese scientists confirmed this in contrast to only 3% of German (n=75) and 8% of American scientists (n=100). More than half of German scientists and American scientists who said their institution offered such courses did not know whether the training offer included courses or modules specifically about blogging.

Only a relatively small group of scientists participates in training courses for public communication. In Germany, about one fifth of scientists said that they took part in the training. The proportions of American and Taiwanese scientists who participated in communication training were 29% and 27%, respectively (table 9.2).

It is interesting to note that the proportions of Taiwanese scientists who reported "don't know" were again smaller than the proportions of German and US scientists (figures 9.4-9.5, tables 9.1-9.2). Taiwanese scientists seem to be more aware of their social environment, for example their colleagues' views and the management's positions about blogging activities than German and US scientists. One interpretation is that Taiwanese scientists feel less autonomy than their Western colleagues and are more strongly integrated in their scientific institutions.

| | | Germany | USA | Taiwan |
|---|---|---|---|---|
| Question: "Does your university or research institution offer scientists training courses for better communication with the public?" | | | | |
| | Yes | 30.6% | 32.5% | 23.5% |
| | No | 35.8% | 31.9% | 59.9% |
| | Don't know | 33.7% | 35.6% | 16.6% |
| | Total | 100.0% (n=240) | 100.0 (n=303) | 100.0 (n=272) |
| Question: "Have you yourself ever had any training in communicating with people outside science, regardless of whether this training focused on traditional media, new media, or face-to-face communication?" | | | | |
| | Yes | 21.0% | 28.7% | 26.8% |

**Table 9.2** Availability and participation in training for public communication (Q20 and Q22, appendix A).

## 9.3 Comparison of blogging and non-blogging scientists concerning their motivations for blogging and their perception of the relevant social environment

The theory of planned behavior (Ajzen, 1991) states that decisions about how to behave are influenced by perceptions and intentions toward the particular behavior. It is to be expected that blogging scientists perceive the importance of concerns and possible outcomes differently than scientists who do not blog. It is thus worthwhile to compare in detail the perceptions of blogging scientists[32] and those of non-blogging scientists.

In all three countries, the comparison between the perceptions of blogging scientists and those of non-blogging scientists shows that blogging scientists see "blogging is fun" as a significantly more important motivation to blog than their non-blogging scientists (table 9.3). Previous studies on science bloggers (Mahrt & Puschmann, 2014; Ranger & Bultitude, 2014a) also show that enjoying writing makes science bloggers launch a blog and keeps them writing blog posts.

Among the US scientists, those who blog consider increasing one’s online presence a more important motivation than those who do not blog do. For example, the US blogging scientists perceive increasing "scientists' visibility within the scientific community" (mean difference=0.58, p<0.01), "the scientific impact of scholarly

[32] For a detailed description of blogging scientists see chapter 10.

publications" (mean difference=0.42, $p<0.05$) and "scientists' visibility for sponsors and funding bodies" (mean difference=0.53, $p<0.01$) more important than their non-blogging counterparts.

With regards to concerns that increase scientists' reluctance to blog, US and Taiwanese scientists perceive a similar degree of importance of the concerns, regardless whether they blog or not (table 9.4). The perceptions of German blogging and non-blogging scientists differ regarding the concern that "blogging wastes time that would better be used for research" (mean difference=-0.99, $p<0.05$) and "blogging is not a serious form of communication for scientists" (mean difference=-0.89, $p<0.05$).

In all three countries, blogging scientists perceive a more positive attitude of colleagues towards blogging than non-blogging scientists. However, due to the small number of blogging respondents, this difference is only statistically significant in the US sample. A significant larger proportion of blogging US scientists (26%) than of non-blogging scientists (8%) perceive a positive image of blogging in their research field ($\chi^2$ =10.2, *df*=4, $p<0.05$) (figure 9.6). Similarly, blogging scientists perceive a more positive attitude management position towards blogging than non-blogging scientists in Germany and the US (difference not significant) (figure 9.7). However, in Taiwan blogging scientists perceive more positive but also more critical positions of the management towards blogging than their non-blogging colleagues (not significant).

### *Conclusion*

With regards to disadvantages of blogging, scientists in all three countries tend to feel that blogging may eat up their time for research and that blogging is not a proper form for internal scientific communication. Across all three countries, scientists who blog see the intrinsic motivation ("blogging is fun") significantly more important than scientists who do not blog. German blogging scientists reported less importance of the concerns regarding time-wasting and blogs being not serious enough than their non-blogging colleagues. US blogging scientists perceived the possible advantage of online presence to their career more important than their non-blogging scientists. Blogging scientists in the three countries were more likely to perceive positive and encouraging attitudes toward blogging in their social environment than non-blogging scientists.

| | Germany | | | USA | | | Taiwan | | |
|---|---|---|---|---|---|---|---|---|---|
| | Blogging scientists (n=9) | Non-blogging scientists (n=231) | Difference | Blogging scientists (n=23) | Non-blogging scientists (n=280) | Difference | Blogging scientists (n=12) | Non-blogging scientists (n=260) | Difference |
| Blogging enables scientists to avoid journalists who often provide inaccurate and biased information about science or neglect scientific topics completely | 1.40 | 1.08 | 0.32 | 1.34 | 0.99 | 0.35 | 1.50 | 1.31 | 0.19 |
| Blogging increases scientists' visibility within the scientific community | 1.59 | 0.90 | 0.69* | 1.63 | 1.05 | 0.58** | 1.57 | 1.29 | 0.28 |
| Blogging gives scientists a voice in debates on science and technology | 1.88 | 1.21 | 0.67* | 1.78 | 1.40 | 0.38 | 1.39 | 1.31 | 0.08 |
| Blogging increases the scientific impact of scholarly publications | 1.08 | 0.75 | 0.33 | 1.30 | 0.88 | 0.42* | 1.26 | 1.04 | 0.22 |
| Blogging helps scientists to develop communication skills | 1.80 | 0.86 | 0.94** | 1.51 | 1.13 | 0.38 | 1.48 | 1.16 | 0.33 |
| Blogging increases scientists' visibility for sponsors and funding bodies | 0.84 | 0.78 | 0.06 | 1.36 | 0.83 | 0.53** | 1.72 | 1.14 | 0.58* |
| Blogging invites the public to take a more active role in science and technology | 1.55 | 1.14 | 0.40 | 1.44 | 1.41 | 0.04 | 1.81 | 1.28 | 0.53* |
| Blogging provides first-hand expertise to people seeking advice from science | 1.42 | 1.06 | 0.36 | 1.78 | 1.16 | 0.62** | 1.67 | 1.24 | 0.43 |
| Scientists must not leave the blogosphere to self-appointed "experts" and pseudo-scientists | 1.26 | 1.36 | -0.11 | 1.94 | 1.52 | 0.42 | 1.72 | 1.16 | 0.56* |
| Blogging is fun | 2.09 | 0.65 | 1.44** | 1.26 | 0.75 | 0.51** | 1.78 | 1.05 | 0.73** |
| Blogging is less restrictive than publishing in scientific journals when it comes to expressing one's opinions | 2.10 | 1.13 | 0.96** | 1.51 | 1.12 | 0.39 | 1.59 | 1.36 | 0.23 |

Mean rating on a 4-step scale ranging from 0 (not important) to 3 (very important).
Statistical significance of difference of means (t-test): *p<0.05; **p<0.01.

**Table 9.3** Motivation for blogging: rating of importance of possible outcomes by blogging and non-blogging scientists (Q12, appendix A).

| | Germany | | | USA | | | Taiwan | | |
|---|---|---|---|---|---|---|---|---|---|
| | Blogging scientists (n=9) | Non-blogging scientists (n=231) | Difference | Blogging scientists (n=23) | Non-blogging scientists (n=280) | Difference | Blogging scientists (n=12) | Non-blogging scientists (n=260) | Difference |
| Ideas may get scooped by colleagues | 0.92 | 1.16 | -0.24 | 0.96 | 1.01 | -0.05 | 1.46 | 1.37 | 0.09 |
| Blogging wastes time that would better be used for research | 0.74 | 1.73 | -0.99* | 1.38 | 1.56 | -0.18 | 1.24 | 1.66 | -0.42 |
| Scientists lack the skills required to blog | 1.26 | 0.70 | 0.56 | 0.67 | 0.65 | 0.03 | 1.11 | 1.09 | 0.02 |
| Blogging is not a serious form of communication for scientists | 0.71 | 1.60 | -0.89* | 1.24 | 1.39 | -0.15 | 1.54 | 1.60 | -0.06 |
| Blogging may cause trouble with colleagues, management, or funders | 0.84 | 1.10 | -0.26 | 1.14 | 1.14 | 0.00 | 1.28 | 1.35 | -0.07 |

Mean rating on a 4-step scale ranging from 0 (not important) to 3 (very important).
Statistical significance of difference of means (t-test): *p<0.05; **p<0.01.

**Table 9.4** Motivation for blogging: rating of importance of concerns by blogging and non-blogging scientists (Q13, appendix A).

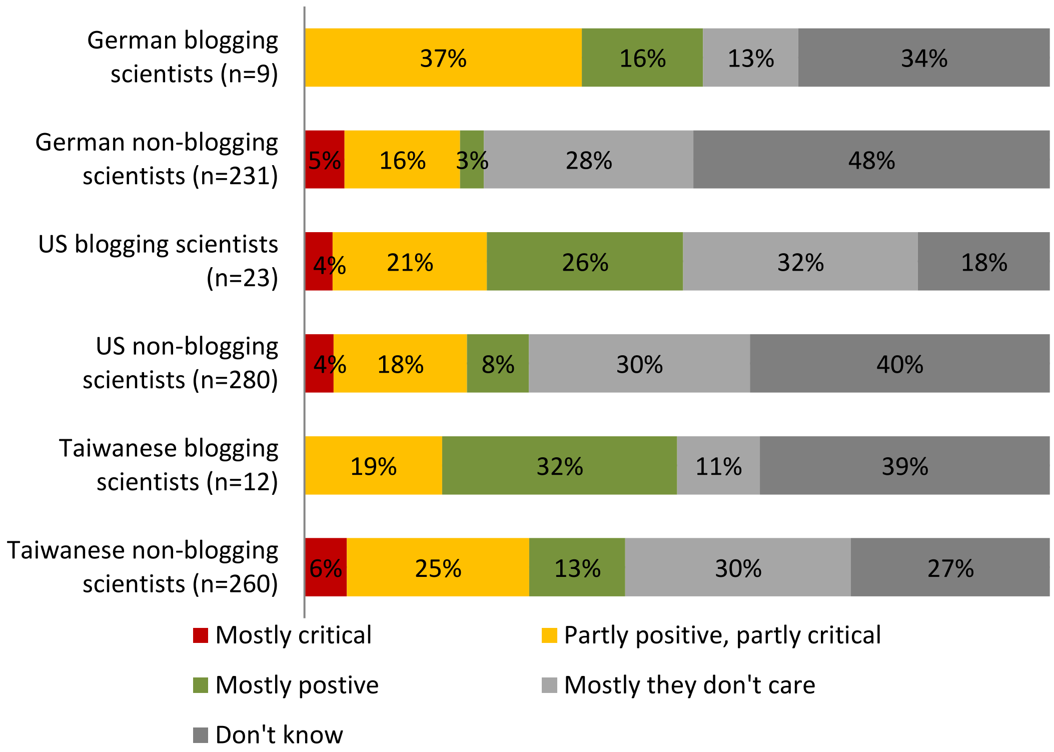


**Figure 9.6** Perception of how scientists in their research field feel about colleagues who regularly blog about their research or expertise by blogging and non-blogging scientists (Q14, appendix A).

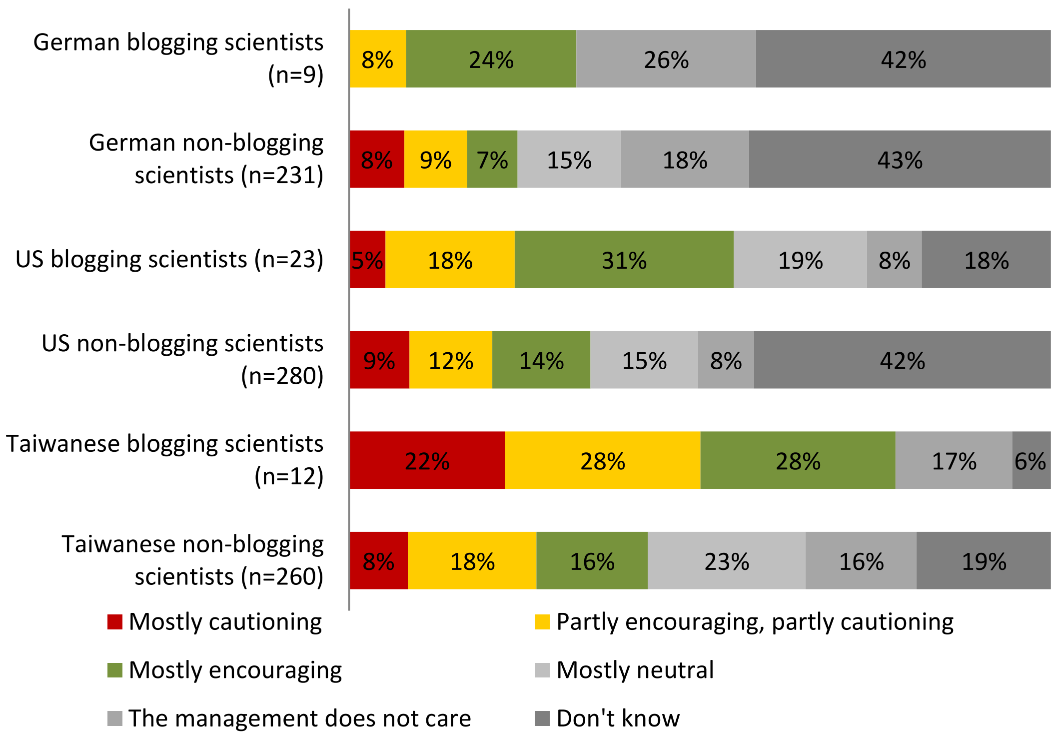


**Figure 9.7** Perception of the management's position toward scientists who blog about their research or expertise by blogging and non-blogging scientists (Q18, appendix).

# 10 Blogging scientists and their interactions with their audiences

In chapter 8.2 I have analyzed scientists' use of new media, in particular their use of blogs. This chapter deals with the relatively small group of scientists who actively blog to communicate with interested laypeople.

This chapter presents empirical findings from my survey about the practice of blogging scientists. This chapter tries to answer research questions: RQ 1.4, RQ 1.5, RQ 1.6, and RQ 1.7.

The definition of "blogging scientists" was based on survey respondents' answers to the questions of whether they had published blog posts related to science on their own blog, on a blog that they share with other people, or on a blog owned by others (B01, appendix A). Survey participants confirming that they have written blog posts in at least one of the three categories were considered "blogging scientists."

## 10.1 Characteristics of blogging scientists

In all three countries, the numbers of blogging scientists are rather small. About 5% (n=44) of the surveyed scientists confirmed that they blogged about science: 23 of the 303 US scientists (8%), 9 of the 240 German scientists (4%) and 12 of the 272 Taiwanese scientists (4%). The blogging scientists are usually male and 40-50 years old on average (table 10.1). They are from all career levels and most of them have a management role.

The type of research blogging scientists are engaged in differs across countries. While most of the German bloggers are doing basic research, those doing applied research dominate among the Taiwanese bloggers. Pure basic researchers are also a minority among American blogging scientists.

Blogging and non-blogging scientists are quite similar with respect to socio-demographic characteristics. For example, the difference between the average age of blogging scientists (46 years old) and those of non-blogging scientists (48 years old) is not statistically significant. The same is true for gender (Q34, appendix A), scientists' focus of research (Q32, appendix A), career level (Q28, appendix A) and management role (Q25, appendix A).

| | | Germany | USA | Taiwan | Total |
|---|---|---|---|---|---|
| Average age [years] | | 39 | 49 | 44 | 46 |
| Gender | Female | 3 | 3 | 1 | 7 |
| | Male | 6 | 20 | 11 | 37 |
| Focus of research (What is the main focus of your research?) | Basic research | 7 | 3 | 1 | 13 |
| | About equally basic and applied research | 1 | 10 | 2 | 13 |
| | Applied research | 1 | 8 | 9 | 18 |
| Career level | Junior | 4 | 7 | 2 | 13 |
| | Mid-career | 3 | 7 | 5 | 15 |
| | Senior | 2 | 9 | 5 | 16 |
| Management role ("Which term best describes your current management role in your unit?") | Dean, head of institute, director, head of department, CEO, chair | 1 | 6 | 1 | 8 |
| | Group leader, principal investigator | 4 | 11 | 7 | 22 |
| | Other management position | 0 | 2 | 0 | 2 |
| | No management position at this time | 4 | 4 | 4 | 12 |
| | n= | 9 | 23 | 12 | 44 |

**Table 10.1** Social demographic characteristics of blogging respondents. Because of the small number of active bloggers absolute values rather than percentages are shown.

## 10.2 Frequency of blogging and expenditure of time

This and the following subchapters analyze the practice of blogging by scientists in more detail and provide a more concrete description of scientists' blogging activities, dealing with research questions RQ 1.4-1.7 about, for example, frequency of blogging, typical topics, addressed audiences, feedback, and relationship to own research. The small numbers of blogging scientists limits the generalization of results and prevents a systematic comparison of countries, though.

About two thirds of the blogging scientists have their own blog. The other blogging scientists either post on a blog that they share with other people, or write blog posts on invitation only. Of the various blogging platforms such as *WordPress*, *Tumblr* or *Blogger*, scientists favored *Blogger* and *WordPress*: 14 blogging scientists setup their blogs on *WordPress* and 10 on *Blogger*.

Mostly scientists use blogs that do not belong to a blog network. 32 blogging scientists said that their blogs do not belong to a blog network, and 10 said that their blogs were part of a blog network. A blog network such as *ScienceBlogs*[33] consists of several blogs that share a common topic. It is believed (Batts et al., 2008) that individual blogs gain more visibility and weight if they are part of such a network. The respondents mentioned a great variety of blog networks. The providers of these networks are diverse and include, for example, journalistic media (e.g., NY Times), popular science magazines (e.g., National Geographic), scientific organizations (e.g., a university) and scientific societies (e.g., AAAS). Obviously, different types of organizations have noticed the potential of the new media for their own goals and the need to include blogs into their communication portfolio. However, as mentioned above already, the majority of blogging scientists in this survey ran their blog independently.

Most of the blogging scientists do not blog regularly (figure 10.1). Almost 80% of the forty-four blogging scientists publish new posts only every few weeks or less often. Only three blogging scientists said that they update their blogs daily – all three were from Taiwan. On average, blogging scientists spent four hours weekly on blogging. However, there is a large variance in the actual time spent. Two Taiwanese scientists said that they devoted more than 20 hours per week to their blogs. The vast majority of blogging scientists (84%) spent only up to two hours (per week) on blog posts. The low frequency of publishing posts and the limited time devoted to blogging activities indicate that blogging activities remain rather peripheral for most scientists.

Whether a blogger blogs under his/her real name or under a pseudonym is believed to be relevant for the credibility of a blog, even if an empirical study shows that the content of blogs has greater impact on readers' perception of credibility than transparency of authorship (Chesney & Su, 2010). Thirty-three blogging scientists reported that they posted under their real name; only two blogging scientists said they usually posted under a pseudonym, and eight reported they did both.

Results of this survey regarding the anonymity of blog authors and membership in blog networks are similar to the results of the study about science bloggers by Shema et al. (2012a). In their sample, less than 20% of the bloggers wrote their

[33] http://scienceblogs.com/ [last accessed 17 June 2015].

blog posts anonymously, and about 30% belonged to a blog networks. As in this study, the majority was blogging independently and under their real name.

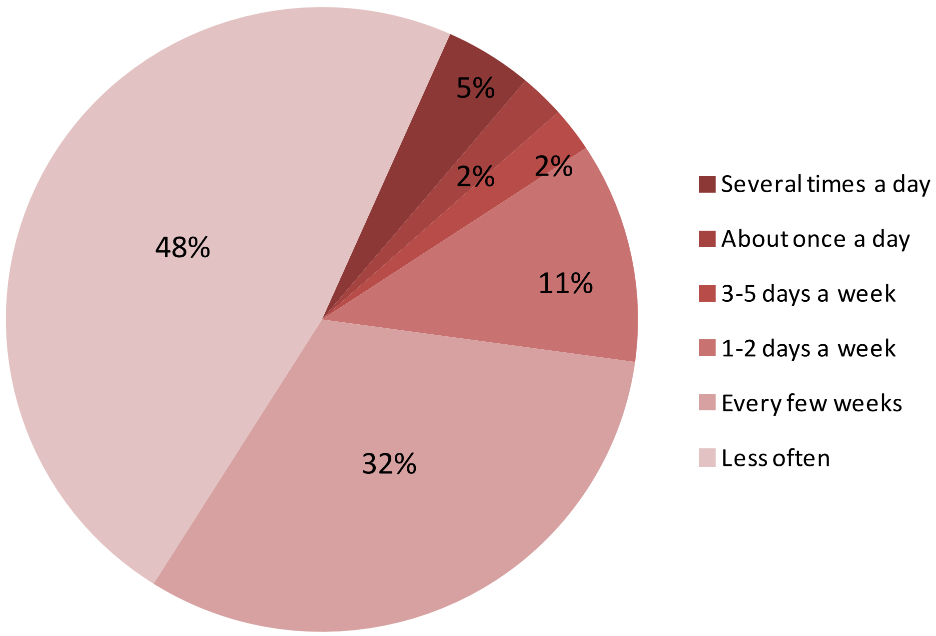


**Figure 10.1** Frequency of writing blog posts (B05, appendix A).

### 10.3 Topics of blog posts and target audiences

Bloggers answered a question about the contents of their blog (B07, appendix A). The purpose of that question was not to identify the thematic focus of the blog such as "medicine" or "environment" or "astronomy," for example, but to characterize the type of information provided in the blog. The answers to that question show that bloggers address a broad spectrum of topics (figure 10.2). The most important topic is "research," however. They focus on information related to research more frequently than on other types of information. Only few (14%) of the 44 blogging scientists reported that they never blogged about "research and outcomes," such as research results, discoveries, experiments, applications, and methods. But 59% said that they blogged about research and outcomes frequently (32%) or occasionally (27%).

Compared to the percentage of the scientists blogging about "research and outcomes" in general, the percentage of those blogging about own research is somewhat lower. 48% of the 44 blogging scientists said that they often or sometimes write about their own research in blog posts. More than one in five blogging scientists never cover their own research. The difference between the numbers of the scientists blogging about "research and outcomes" and of those about "own research" indicates that the scientists blogging about research do not necessarily focus only on their own research.

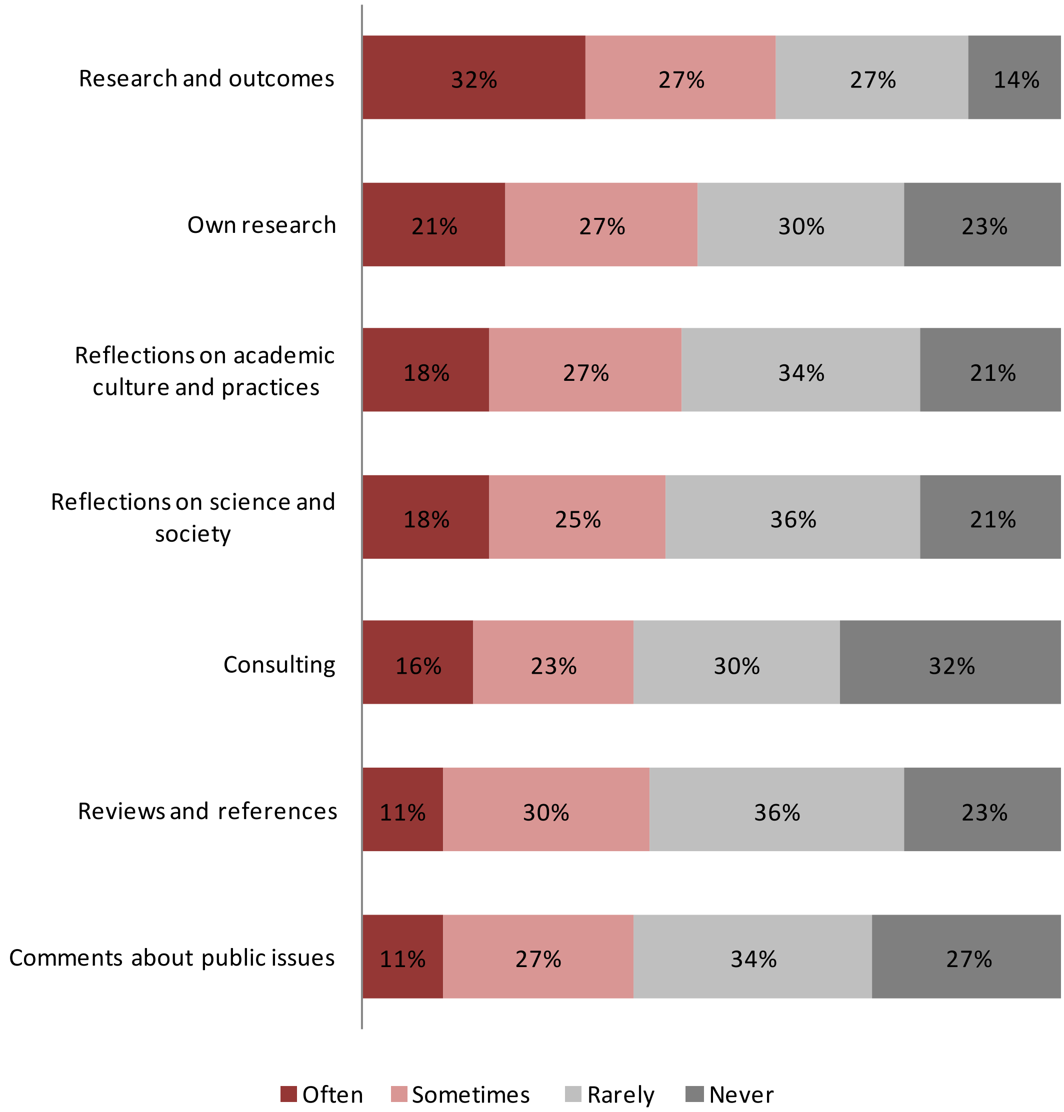


**Figure 10.2** Frequency of blogging about different topics (B07, appendix A, n=44).

However, blogging scientists do not only deal with research but also with science as a social system and its relationships with the broader society. "Reflection on academic culture and practice" and "reflections on science and society" are topics in survey participants' blogs that are about equally important as the respondents' own research. Only little less frequently science bloggers publish "comments about public issues" or provide information relevant for "consulting." About 40% of the 44 blogging scientists reported that their posts dealt with these two aspects of public issues occasionally or frequently. Similarly, about 40% of the 44 blogging scientists reported that they sometimes or often blog about "events or publications within and outside of science."

What scientists blog about may relate to the groups of audiences the blogging scientists would like to reach. Popular blogging scientists often write various topics to attract a broader audience (Bonetta, 2007). A survey of 60 German science bloggers of the blog platform *scilogs.de* showed that science bloggers privilege public communication (Puschmann & Mahrt, 2012). The majority of bloggers targeted members of the general public; colleagues and students were less important. Puschmann and Mahrt (2012) therefore concluded that science bloggers perceive themselves as communicator to a broader audience and see blogging as a public activity.

The blogger sample of Puschmann and Mahrt (2012) included scientists, journalists and public information officers. In contrast to them, this survey focuses only on individual scientists. The results show that blogging scientists value general audiences too, but that they assign higher priority to their colleagues and students as target groups than the respondents in the mixed sample of Puschmann and Mahrt (2012). The results of this survey suggest a hybrid pattern of addressing different audiences by blogging: colleagues, students and general public are the three most important audiences with roughly equal priority (figure 10.3). The vast majority of respondents considered members of the general public (81%), college/university students (83%) and their colleagues (72%) as target audiences of high or medium priority. There are other groups important to the blogging scientists – groups of people who are fond of science or have a professional relationship with science. More than 60% of the blogging scientists thought of "practitioners using scientific knowledge" and of "amateur scientists" as audiences of at least medium priority. "Scientists in other research fields" and "Teachers and pupils" were also audiences which two third of the blogging scientists considered as being of high or medium priority (figure 10.3).

A previous study has shown that science journalists increasingly seek their stories on the Internet (Brumfiel, 2009). Correspondingly, some prominent US blogging scientists reveal that their blog posts are somehow written for journalists, to alert them to a potential story (Bonetta, 2007). Blogging scientists may thus believe that the influence of their blog increases if it is read by opinion leaders and mediators such as journalists. However, this appears not to be a prevalent thought of the blogging scientists in this survey. Only 18 of the 44 blogging scientists assigned journalists high or medium priority as audience of their blog posts.

The relative low priority of the group "patients and their family members" may be due to the fact that only a part of the survey participants were involved in research relevant for health issues. Not surprisingly, life scientists were more likely to address patients and their relatives in their blogs than scientists from other fields.

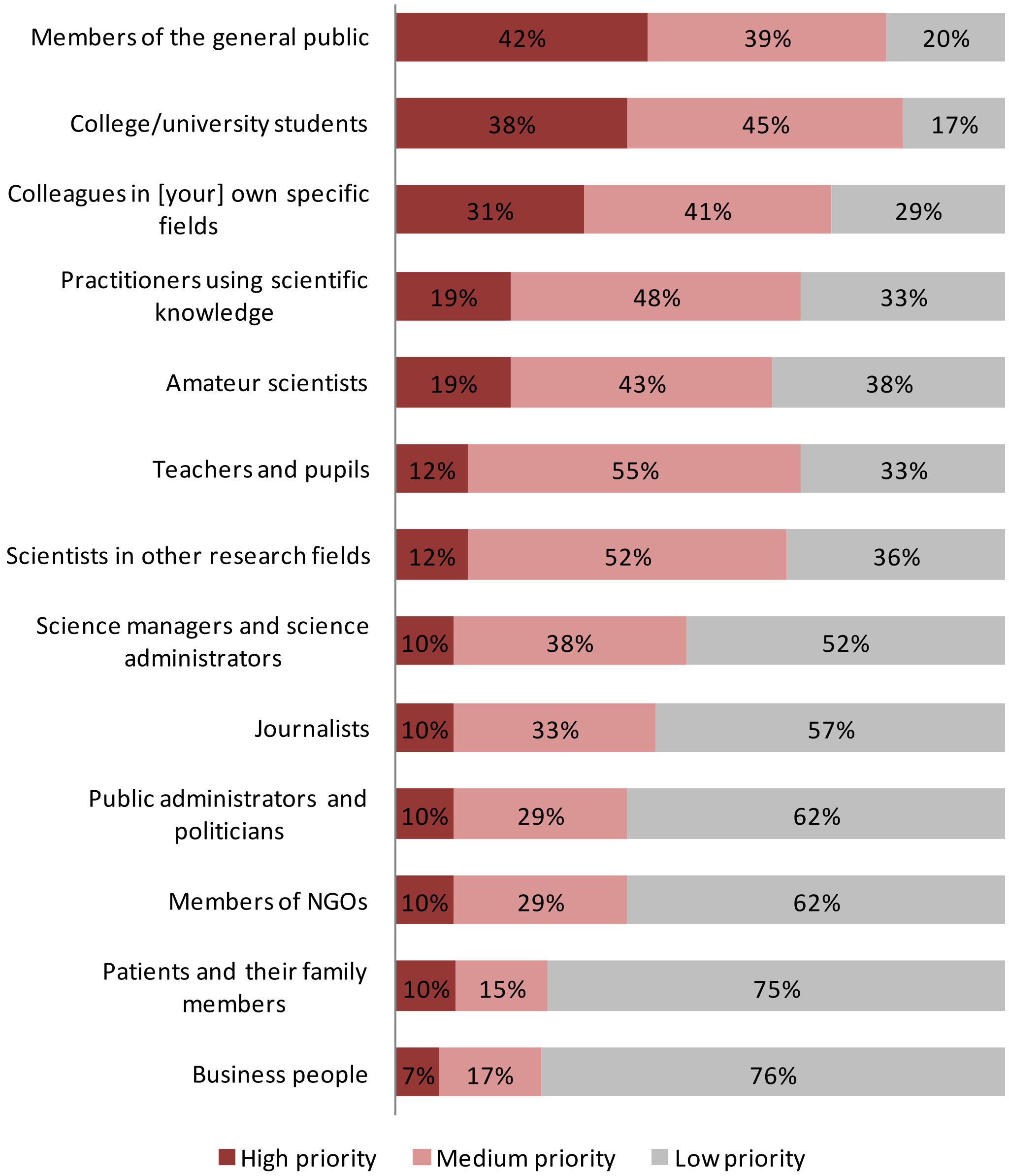


**Figure 10.3** Priority of different audience groups (B10, appendix A, n=44).

Target groups with direct or indirect involvement in decision-making, i.e., "science managers and science administrators," "business people," "public administrators and politicians" and "members of NGOs," are assigned less priority by blogging scientists.

Largely, the priority rank orders are similar across countries, with students, general public and scientific colleagues are at the top of the priority list and groups such as "business people" at the bottom. The high priority of groups like students and general public and the low priority of decision-making groups implies that most blogging scientists use their blogs as communication or teaching tools, and less as an instrument to increase their influence in the science management or policy field.

## 10.4 Feedback from audiences and reasons to comment on other peoples' posts

One of the features of science blogs compared to traditional channels such as websites or printed material is that they enable a dialogue between the blogger and their audience. Dialogical communication seems to occur only to a limited extend, however. While the vast majority of the 44 blogging scientists (86%) reported that they received at least one comment per blog post on average, about two third of them reported that they receive only 1-5 comments when they published a blog post, and only very few of them (7%) said that they receive more than 10 comments on average.

Even if they receive comments, blogging scientists do not always reply to them. Of the 44 blogging scientists about 54% said that they "sometimes" answered their readers' comments but 30% of them answered "rarely." Only 16% of the blogging scientists said that they "frequently" respond to their readers' comments. It is interesting to note that blogging scientists who reported frequent replies to comments received on average less than 10 comments per blog post and most of them only received 1-5 comments. Scientists reporting that they receive more than 10 comments per post replied only "rarely" or "sometimes" to their readers.

The blogging scientists indicating that they received at least one comment per blog post were asked from which groups of readers most comments come (B12, appendix A). According to their answers, readers who are close to science are the most frequent comment contributors (figure 10.4). Respondents most often mentioned "colleagues" in their own specific fields, "scientists in other research fields" and "college/university students" as comment contributors. About one of three blogging scientists mentioned members of the general public as sources of comments to their blog posts. "Amateur scientists" and "practitioners using scientific knowledge" were also mentioned as comment contributors, but less frequently.

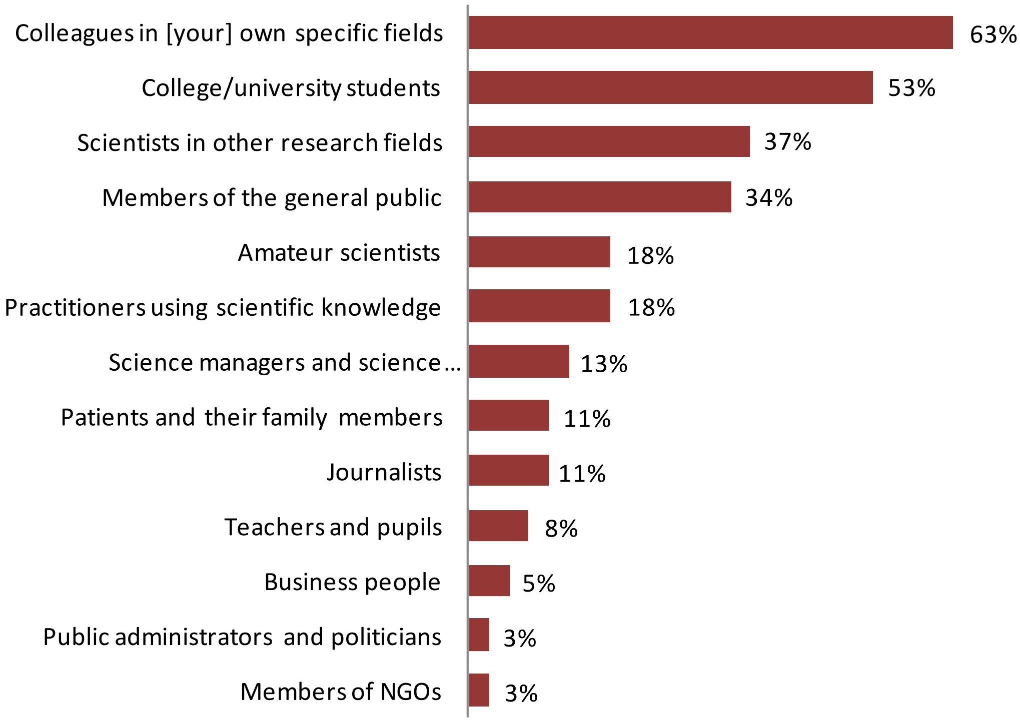


**Figure 10.4** Scientists' perception of groups of readers who left comments on their blog posts (B12, appendix A, n=44). Multiple answers possible: up to 5 groups could be selected.

Groups of readers who comment most are not always those to which scientists assign medium or high priority as audiences (table 10.2). For example, scientists targeting their blog posts at the general public do not primarily receive feedback from the general public, but from a spectrum of groups: colleagues in same specific fields, amateur scientists, science managers and science administrators, patients and their family members, and business people.

One may assume that blogs – as interactive media – are a good opportunity to improve the dialogue between science and society. The survey results presented here challenge this belief as they suggest that the extent of dialogical communication in the blogosphere is rather limited and blogging scientists mostly receive comments from their scientific peers and students. The online discourses are dominated by people inside science or at the periphery of science. Furthermore, even though "members of the general public" are an important target audience for the majority of blogging scientists (figure 10.4), it is unclear to which extent blog posts related to science and technology do actually reach the general public.

| | Phi | p-value |
|---|---|---|
| Colleagues in [your] own specific fields | 0.47 | 0.00** |
| Scientists in other research fields | 0.11 | 0.51 |
| Amateur scientists | 0.38 | 0.02* |
| College/university students | 0.11 | 0.50 |
| Science managers and science administrators | 0.41 | 0.01* |
| Members of the general public | 0.22 | 0.18 |
| Teachers and pupils | 0.22 | 0.18 |
| Patients and their family members | 0.37 | 0.03* |
| Journalists | 0.20 | 0.22 |
| Practitioners using scientific knowledge | 0.29 | 0.07 |
| Business people | 0.39 | 0.02* |
| Public administrators and politicians | 0.19 | 0.25 |
| Members of NGOs | -0.13 | 0.43 |

*p<0.05; **p<0.01

**Table 10.2** Correlation between priority by target groups (B10, appendix A) and source of readers' comments (B12).

There are country differences in terms of groups of comment contributors. Western blogging scientists more frequently than Taiwanese scientists received comments from colleagues in their own specific fields. In Taiwan the comments were mostly from college/university students. The different groups of readers who leave their comments may be affected by different characteristics of blog posts. American and German scientists focus on scientific knowledge in their blogs. As a consequence, their blogs tend to be read and commented by other scientists. In contrast, Taiwanese scientists frequently offer "consulting" in their blogs, and the sources of comments are distributed among a broader variety of groups; in particular they come from college/university students.

The tone of the readers' comments is mostly encouraging. Of the 44 blogging scientists, about 76% said that they received mostly positive comments, 11% received "mostly neutral" comments, 13% received "about equally positive and critical" comments and none of them said that the comments were mostly critical.

The general approving tone in the comments to scientists' blog posts raises concern about the quality of online communication – whether the blogosphere could serve a fair and appropriate platform for public communication of science. If the participants of online discourses are rather homogeneous – since the comments mostly come from other scientists or students, and readers' feedback mostly agrees with the arguments of the blog authors – discourses may quickly lead to a common perspective and fail to include enough opinion variance to cover all aspects of the issue in question.

The scientists themselves hardly comment on blog posts of other people. Only 18 US scientists, 8 German scientists and 9 Taiwanese scientists reported that they "commented on posts related to science that other people have published" (B15, appendix A). Furthermore, the frequency of their commenting is rather low. Of the 35 scientists who commented on others' posts, about 40% reported they did it "rarely," about 49% "sometimes" and 11% "frequently."

What motivates scientists to leave comments on others' posts? Most of them said that their comments aim at adding "relevant information or viewpoints" to the others' posts (figure 10.5). They use the comment function to make the discussion of the topic in the original posts more comprehensive. Some of them entered a debate with the blog authors by asking a question, providing an answer, offering advice or correcting errors or clarifying ambiguities. Few of them explicitly expressed their agreement or disagreement in their comments.

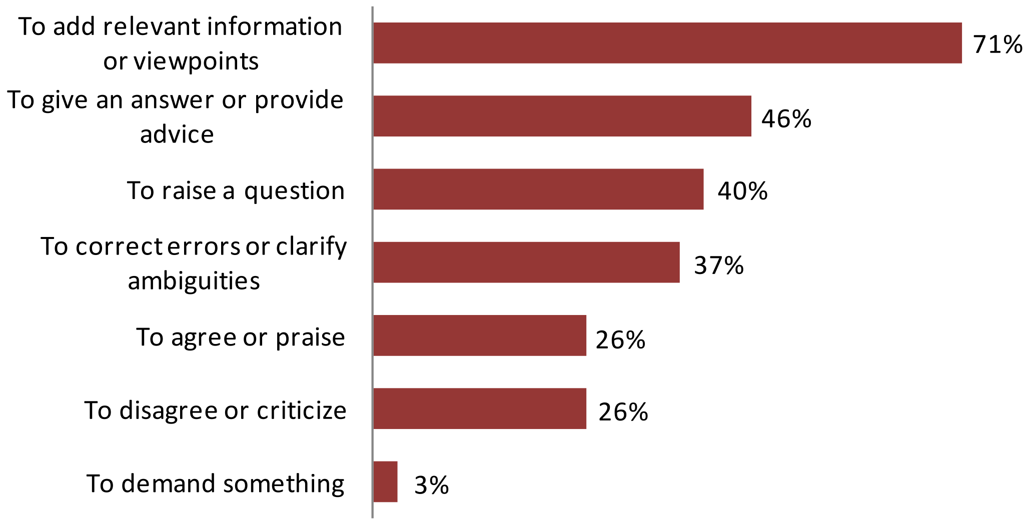


**Figure 10.5** Scientists' reasons to comment on others' blog posts (B17, appendix A, n=35). Multiple answers possible: up to 3 reasons could be selected.

## 10.5 Repercussions of blogging on scientific work

Because of the small sample (n=44) of blogging scientists, the possibility to analyze repercussions is limited. Half of the blogging scientists did not perceive an influence of their blogging activities on their work. One in four said the influence was only minor, and only one in four said that their blogging had some or strong influence on their scientific work. Scientists who perceived an influence of blogging on their scientific work tended to post information about their own research (Phi=0.43, p<0.01). Furthermore, there are some correlations between experiencing impact of blogging on research and the audience groups that scientists address (table 10.3). Scientists who assigned "colleagues," "amateur scientists," "practitioners using scientific knowledge," "public administrators and politicians" and "members of NGOs" medium or high priority, particularly often perceived a (positive) influence of blogging on their scientific work. The correlations between priority and perception of an influence are moderate, however.

| | Phi | p-value |
|---|---|---|
| Colleagues in [your] own specific fields | 0.32 | 0.04* |
| Scientists in other research fields | 0.25 | 0.11 |
| Amateur scientists | 0.39 | 0.01* |
| College/university students | -0.06 | 0.68 |
| Science managers and science administrators | 0.29 | 0.06 |
| Members of the general public | 0.14 | 0.39 |
| Teachers and pupils | 0.00 | 1.00 |
| Patients and their family members | 0.20 | 0.20 |
| Journalists | 0.29 | 0.06 |
| Practitioners using scientific knowledge | 0.30 | 0.05* |
| Business people | 0.22 | 0.15 |
| Public administrators and politicians | 0.49 | 0.00** |
| Members of NGOs | 0.39 | 0.01* |

*p<0.05; **p<0.01

**Table 10.3** Correlation between blogging scientists' priority of target groups (B10, appendix A) and their perception of repercussions on their research (B18).

Repercussions of blogging on research are mostly rated positively by the blogging scientists. Scientists who perceived an influence were asked to specify whether their scientific work had been affected positively or negatively. In total, almost three in four reported "mostly positive" influences, about one in four reported influences that were "partly positive and partly negative" and none of them mentioned "mostly negative" influences on their work.

In an additional open-ended question, scientists mentioning repercussions were asked to describe these in their own words. Only six scientists used the opportunity to describe the impacts in more detail. Mentioning a positive influence, one scientist said that he/she has been invited to be a co-author in more than one scientific article because of his/her blog posts. There were other examples of positive influences, such as the use of blogs as a tool for research (analysis of blogging data, or collecting thoughts) or as a self-marketing tool (to enlarge the scientific networks or to disseminate information).

# 11 Differences in the affinity to communication models and degree of medialization between groups of scientists preferring different ways of communicating with the public

This chapter compares scientists' affinity to communication models and indicators of their "medialization" between groups of researchers who prefer different ways of communication with the public (chapter 11.1) and who practice blogging or not.[34] Affinity to communication models is measured by a list of items that correspond to the "public understanding approach" or the more recent "public engagement approach" (Q17, appendix A; see also chapter 3). As indicators of medialization the anticipation of presumed expectations of the public (Q16, appendix A; see also chapter 3) and the acceptance of repercussions of anticipated media effects on decisions in the research and publication process (Q23, appendix A; see also chapter 3) are used.

The analysis is aimed to answer my research questions whether communication models differ between groups of scientists who prefer communication with the public via new media or mediated by journalism (RQ 2.2) and whether there is a difference in the degree of "medialization" between scientists belonging to these groups (RQ 2.3). It also checks the corresponding hypothesis H 2.3 stating that a preference for new online media or the practice of blogging is associated with a higher degree of medialization. In this chapter, I do not consider country differences but analyze data from the three countries together. Country differences with regard to affinity to communication models and degree of medialization are analyzed in chapter 12.

## 11.1 Scientists' preferences regarding ways of communicating with the public

Survey participants were asked about their communication preferences (Q04, appendix A). Answers to that question were used to define three groups of scientists who prefer communication with the public via journalism, self-produced online content or face-to-face interactions. Furthermore, a fourth group of scientists was defined who explicitly stated that they are not interested in communicating with the public. This group is largest among Taiwanese scientists (20%) and smallest

[34] The distinction between blogging and non-blogging scientists follows the approach already used in chapter 10.

among American scientists (6%); 15% of the German scientists indicated that they are not interested in communicating with the public (figure 11.1).[35]

In each country a relative majority of scientists prefer face-to-face interaction with members of the public compared to those preferring mediated communication (talking to journalists or writing for online media). 49% of the German, 46% of the American and 35% of the Taiwanese scientists expressed a preference for face-to-face communication. Furthermore, in each country significantly more scientists said that they prefer talking to journalists rather than writing themselves for online media. About 26% of American and Taiwanese scientists would like to talk "to a journalist from the media who report on science"; the proportion of German scientists who reported this preference was 21%. About 18% of American scientists and 17% of Taiwanese scientists prefer to write themselves "for websites, blogs, or social networks" or to produce their own podcasts and videos, while only about 11% of German scientists said they prefer this.

The preference of how to communicate with the public is associated with age, career level and management position. Respondents preferring to write for online media were significantly younger on average than respondents of the other preference groups ($F=3.7$, $df=3$, $p<0.05$).[36] They were more likely in earlier stages of their career ($\chi^2=18.9$, $df=6$, $p<0.01$) and without a management position ($\chi^2=30.3$, $df=9$, $p<0.01$). Correspondingly, scientists preferring to talk to journalists tended to be older, to be in an advanced phase of their career and to occupy a management position. About 50% of the scientists in the three countries whose preference was talking to a journalist were senior researchers and about 80% of them had a management position. There is no significant relationship between communication preference and gender ($\chi^2=2.4$, $df=3$, $p>0.05$).

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[35] Only a marginal proportion of scientists indicated a preference for "other ways" of communicating with the public, for example by helping setting up exhibitions. Because of the heterogeneous character of this residual group it is excluded from the comparisons in the next subchapters.

[36] The average age of scientists preferring to write for online media is 44 years, the average age of those preferring talking to journalists or face-to-face interactions is 48 years.

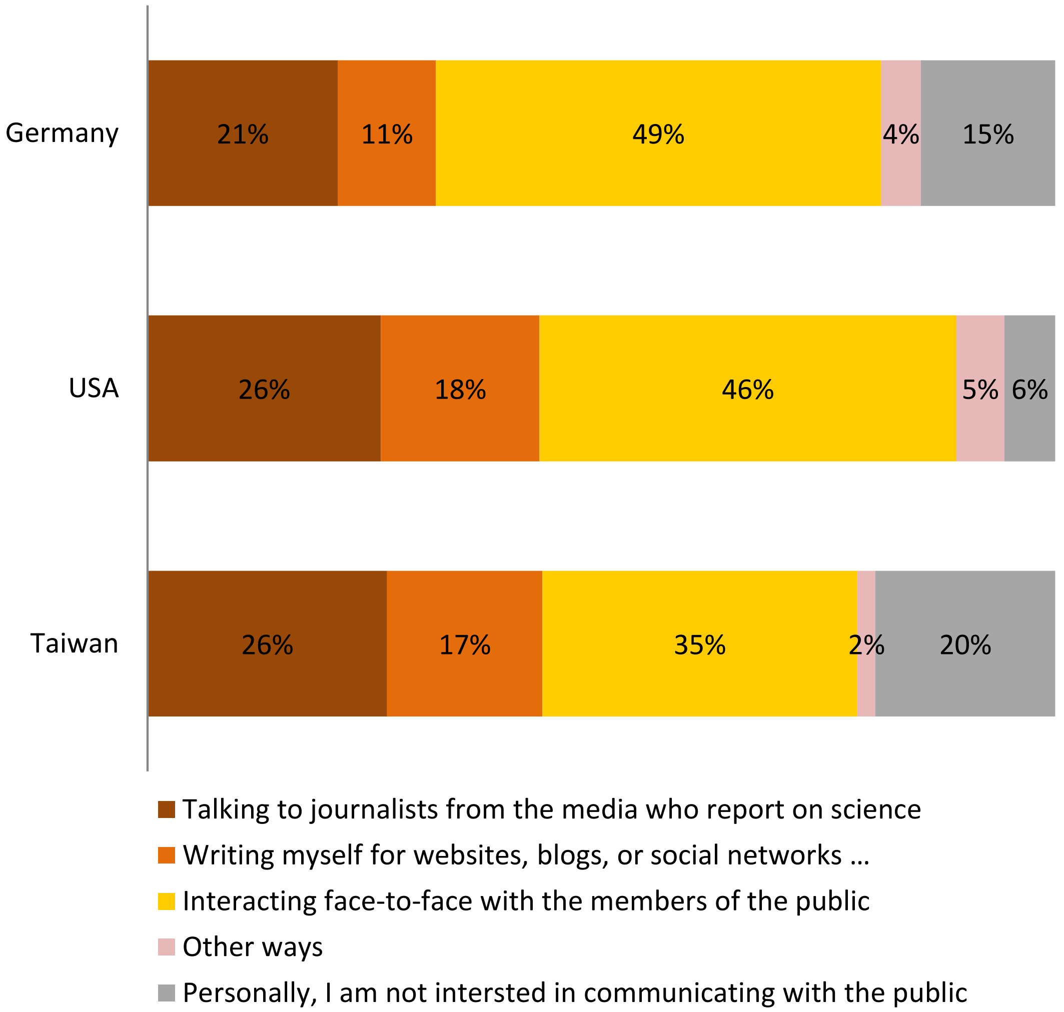


**Figure 11.1** Scientists' preferences of how to communicate with the public by country (Q04, appendix A).

## 11.2 Scientists' affinity to different communication models by communication preference

After a more comprehensive analysis of the relationship between scientists' communication preferences and their affinity to different communication models, this subchapter concludes answering research question RQ2.2: "How do communication models differ between groups of scientists who prefer communication with the public via new media or mediated by journalism" and checks the corresponding hypothesis H 2.3.

A question asked about scientists' beliefs about various aspects of public communication (Q17, appendix A). Some items of that question refer to beliefs consistent with the "public understanding/deficit model," other items refer to beliefs consistent with the "public engagement model."[37] Scientists with different communication preferences (i.e., preference for a certain channel or a preference for avoiding public communication altogether) did not differ significantly in their agreement or disagreement with several communication beliefs (figure 11.2). For example, they had similar views about two aspects related to public understanding/deficit model. They agreed mildly with the statement that "scientists should strategically frame their messages to guide the public's attitudes" ($F=1.6$, $df=3$, $p>0.05$) and disagreed mildly with the claim that "the public should be discouraged from interfering with the regulation of scientific activities and applications" ($F=0.97$, $df=3$, $p>0.05$). They also showed similar views about two aspects indicating a public engagement orientation. They agreed – without significant differences between the four groups – that "the public may lack scientific knowledge, but [...] possesses a lot of relevant common sense and good judgment" ($F=2.15$, $df=3$, $p>0.05$) and disagreed similarly that "editors of scientific journals should demand from authors that their articles are comprehensible to interested laypeople" ($F=1.99$, $df=3$, $p>0.05$).

In several aspects, scientists' communication beliefs are different between scientists with different communication preferences, however. Scientists who were not interested in communicating with the public were more inclined to agree to two statements related to the public understanding/deficit approach than those who were interested in public communication (figure 11.2). Those not interested in public communication disagreed less with the statement that "scientists and laypeople have different levels of knowledge, which make a true dialog between them impossible" ($F=8.0$, $df=3$, $p<0.01$) than the other scientists. Furthermore, they agreed more to the statement that "the public is not well educated enough to really understand scientific findings" ($F=3.3$, $df=3$, $p<0.05$).

[37] For a characterization of the "public understanding/deficit" and "public engagement" models, and for the mapping of items to these models see chapter 3 and table 7.3.

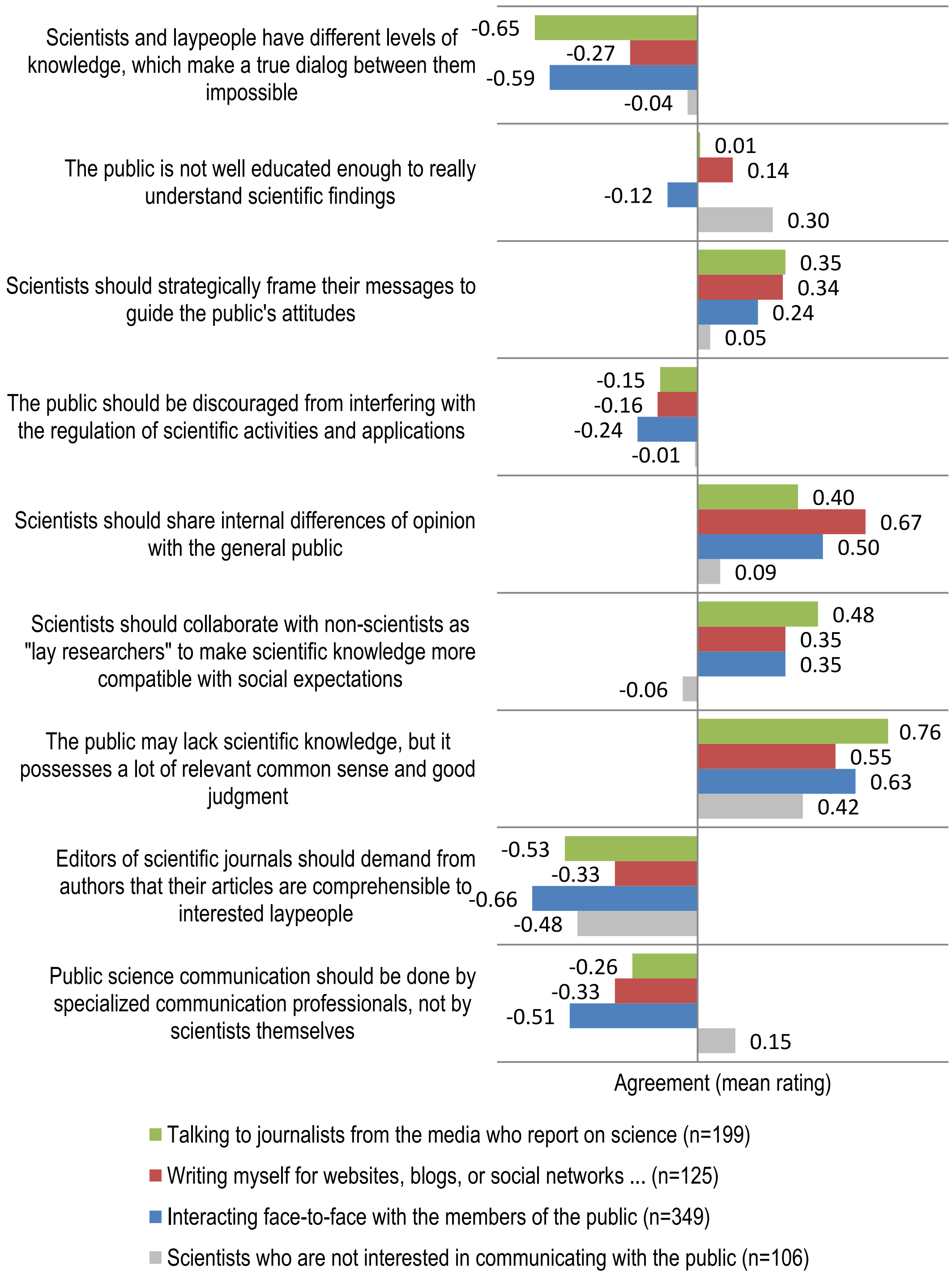


**Figure 11.2** Scientists' affinity to communication models (PUS/deficit vs. PEST approach) by communication preference (Q04 and Q17, appendix A). Bars represent mean values of a rating scale ranging from -2 (strongly disagree) to 2 (strongly agree).

It is not surprising that scientists who were not interested in public communication were also less in favor of the public engagement approach. These scientists reported less agreement than the other scientists with the statement that "scientists should share internal differences of opinion with the general public" ($F=5.8$, $df=3$, $p<0.01$). In contrast to the opinions of the other scientists, scientists not interested in public communication reported slight disagreement with the item that "scientists should collaborate with non-scientists as lay researchers to make scientific knowledge more compatible with social expectations" (F=4.7, *df*=3, p<0.01). Furthermore, scientists who were not interested in public communication tended to agree that "public science communication should be done by specialized communication professionals, not by scientists themselves" while the other scientists tended to reject the statement (F=8.4, *df*=3, p<0.01).

Consistent with their stronger rejection of the public engagement approach and their stronger approval of the public understanding/deficit approach as demonstrated in figure 11.2, for scientists not interested in public communication the item that "blogging invites the public to take a more active role in science & technology" (Q12.07, appendix A) was a less important motivator for blogging than for scientists preferring one of the three options of public communication (F=9.8, *df*=3, p<0.01).

It is not surprising that scientists not interested in public communication hold communication beliefs different from those of scientists who were interested in public communication. To answer research question RQ 2.2 and test hypothesis H 2.3, claiming a difference between scientists preferring different media channels for public communication, I compared only the two subgroups of scientists preferring to talk "to journalists from the media who report on science" and preferring to write themselves "for websites, blogs, or social networks," respectively. For each item shown in figure 11.2, a t-test between the mean values of the two subgroups was performed.

With the exception of two items, the differences are not statistically significant. Scientists who preferred talking to journalists rejected the statement claiming the impossibility of "a true dialog" between scientists and laypeople more strongly than those who preferred the new online media as means of communication (p<0.01). This difference would suggest that journalism-affine scientists are more inclined towards the public engagement approach than new online media-affine scientists. However, journalism-affine scientists were less prepared to make scientific knowledge transparent to laypeople ("Scientists should share internal differences of opinions with the general public") than new online media-affine scientists (p<0.05), indicating less inclination toward public engagement. With respect to the two items showing a statistically significant difference between the two subgroups, the results are ambivalent. The findings, thus, do not confirm hypothesis H 2.3 claiming that scientists who prefer new online media more often hold beliefs consistent with the engagement model (dialog, participation) than scientists who prefer journalistic mass media or who do not want to communicate with the public at all.

### 11.3 Scientists' degree of medialization by communication preference

The findings presented in this subchapter serve to answer research question RQ 2.3 "Is there a difference in medialization between scientists preferring or being active in the new media and those preferring or interacting with the journalistic mass media?" Weingart (2012) distinguishes three levels of medialization of science: the interactional, the organizational and the program level (chapter 3). In this survey, indicators of medialization of science referring to the interactional and the program level were used. Medialization at the interactional level is operationalized as anticipation of media criteria in scientists' interactions with the public (Q16, appendix A); medialization at the program level is operationalized as acceptance that anticipated public response is used by scientists as criterion in decisions about research and scientific publishing (Q23, appendix A).

*Communication with the public*

The results show that scientists' opinions about how to communicate with the public by and large do not differ grossly between groups of scientists with different communication preferences (figure 11.3). In five of the nine items, the mean values of agreement/disagreement of the four subgroups do not differ significantly ($p>0.05$, F-test). All groups similarly tended to reject the item "simplify even at the expense of scientific accuracy." They were inclined to agree that scientists should "use their expertise to criticize decisions affecting society or make practical suggestions for action." They strongly agreed with the item that scientists should "put an emphasis on the practical uses of research rather than on the research itself" when communicating with the public. Their opinions differed somewhat, but not significantly, regarding the statement whether scientists should "use catchy phrases that attract public attention." And finally, they agreed similarly to the statement that scientists should "be prepared to focus on their own role as researchers and to provide personal views."

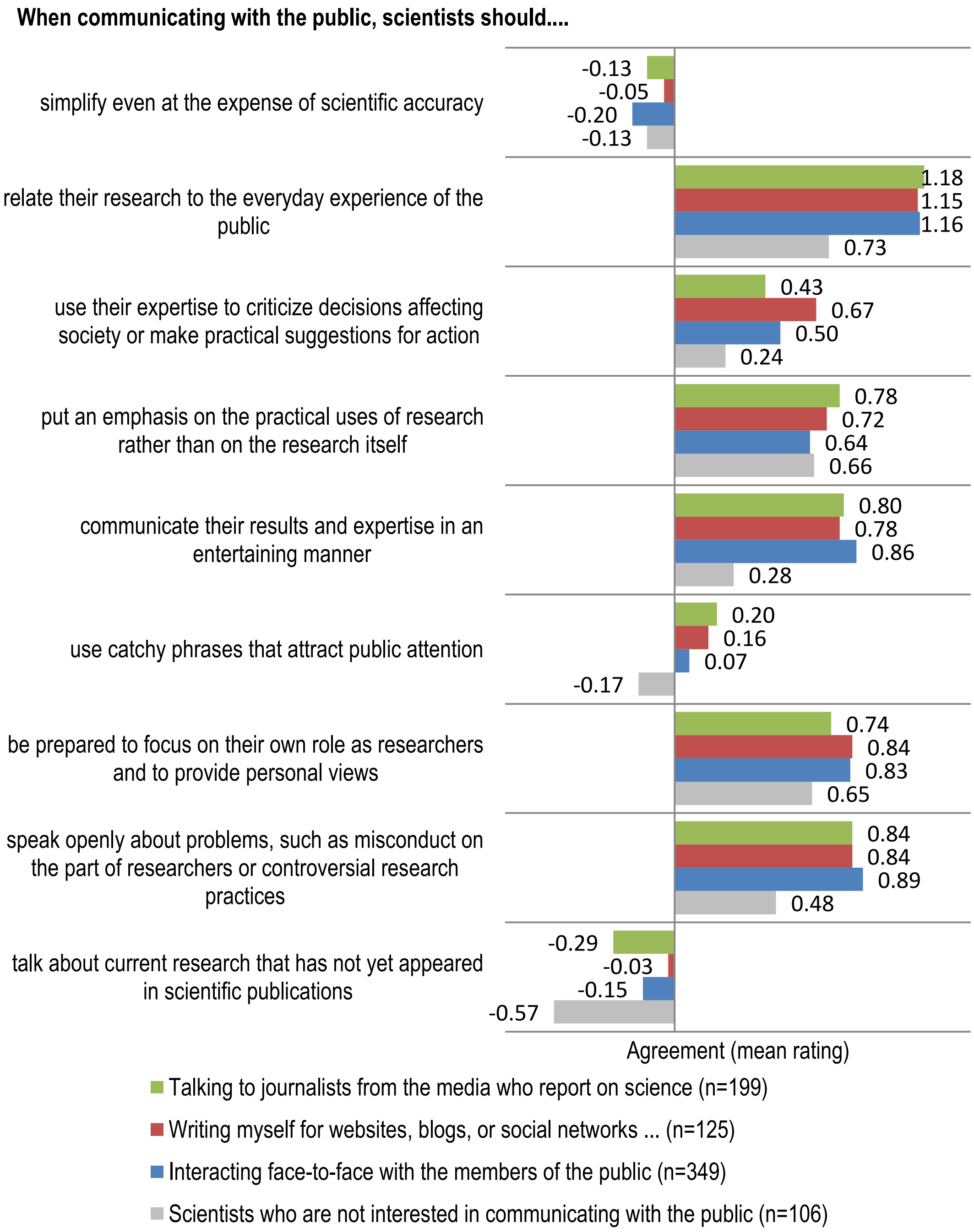


**Figure 11.3** Medialization of science measured by scientists' disposition to use media criteria when communicating with the public by communication preference (Q16 and Q04, appendix A). Bars represent mean values of a rating scale ranging from -2 (strongly disagree) to 2 (strongly agree).

Yet, in their responses to the four items with significant differences between the subgroups, scientists who were not interested in communicating with the public consistently showed lower medialization than scientists preferring to talk to journalists, write and produce online material themselves or interact face-to-face with the public (figure 11.3). Scientists who were not interested in public communication, agreed less with the statements that scientists should "relate their research to the everyday experience of the public" (F=6.0, *df*=3, $p<0.01$), that they should "communicate their results and expertise in an entertaining manner" (F=7.7, *df*=3, $p<0.01$), and that they should "speak openly about problems such as misconduct on the part of researchers or controversial research practices" (F=3.5, *df*=3, $p<0.05$). Furthermore, scientists not interest in public communication clearly rejected the item that scientists should "talk about current research that has not yet appeared in scientific publications" while the other scientist only slightly rejected it (F=4.4, *df*=3, $p<0.01$).

After excluding the subgroup of scientists who were not interested in public communication, the analysis of mean differences between scientists of different preferences of how to communicate with the public by means of F-tests showed no significant differences between the three subgroups. Regardless their preference of different channels of public communication – via journalism, publishing online or face-to-face interactions – the degree of medialization is similar.

*Repercussions on research*

The question operationalizing medialization of science at the program level asked participants of this survey to respond to the question whether it is justified "for scientists to take the public response into account" in eight different decisions on research and scientific publication (Q23, appendix A).

With one exception, scientists with different communication differences did not statistically significant differ in their opinions on whether it is justified that scientists take the public response into account in decisions regarding research and publication. The exception is the item about considering public response in choosing or avoiding certain collaborators ($\chi^2$ =12.8, *df*=6, $p<0.05$). Journalism-affine scientists seemed to have more polarized opinions than the other scientists. While most of the other scientists responded with the answer "justified in some situations," journalism-affine scientists tended to answer either "never justified" or "always justified." But this does not constitute a clear different in the degree of medialization. Overall, on the program level no significant differences in medialization between scientists of different preferences regarding communication channels are found.

## 11.4 Differences in the affinity to communication models and degree of medialization between blogging scientists and non-blogging scientists

Whether a scientist blog or not has no implications for their affinity with the public understanding/deficit or public engagement model. Responses of blogging and non-blogging scientists to the question regarding communication models (Q17, appendix A) are rather similar; the differences as shown in figure 11.4 are not statistically significant. Blogging scientists[38] hold similar beliefs regarding communication models than non-blogging scientists. No difference between both groups is significant, not even the difference in the item shown in figure 11.4 regarding the statement that "the public is not well educated enough to really understand scientific findings."

Neither is there a difference in the degree of medialization of blogging and non-blogging scientists. For both indicators of medialization – anticipation of media criteria in public communication (Q16, appendix A) and acceptance of repercussions on research and scientific publishing (Q23) – none of the mean differences reaches the level of statistical significance.

[38] The definition of blogging scientists was described in chapter 10.

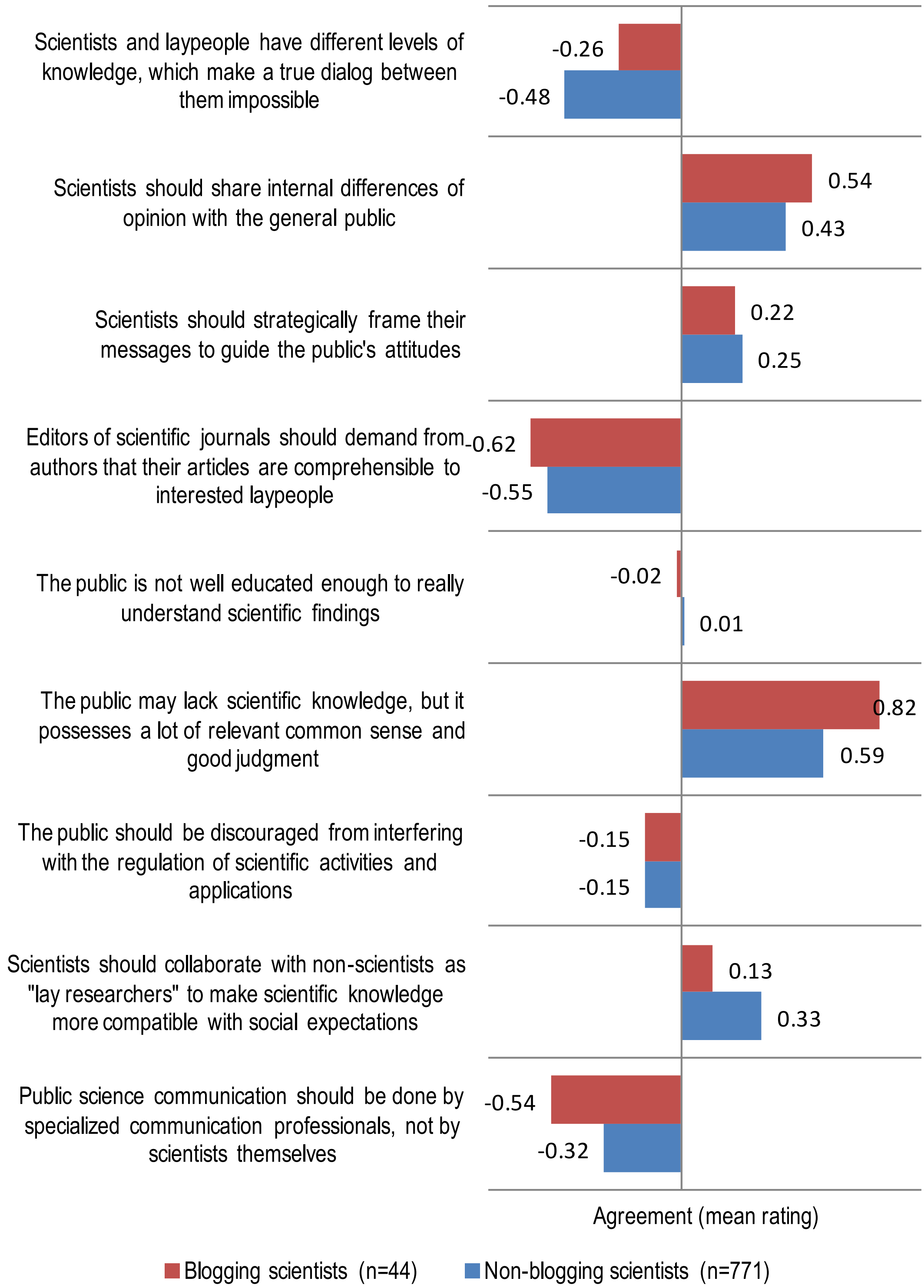


**Figure 11.4** Comparison of affinity to communication models of blogging and non-blogging scientists (Q17, appendix A). Bars represent mean values of a rating scale ranging from -2 (strongly disagree) to 2 (strongly agree).

# 12 Cultural variations

In chapter 6 possible reasons to expect cross-country differences in the survey results were discussed. Already in the presentation of survey results in chapters 8-11 differences between countries became apparent and were cursory discussed, e.g., differences regarding scientists' perceptions of blogging. This chapter focuses on survey findings about how the use of new online media and beliefs about public communication vary between scientists in countries with different science-society and media contexts (RQ 3.1, RQ 3.2 and RQ 3.3), and checks the corresponding hypothesis H 3.1.

## 12.1 Significance and practice of blogging[39]

Research question RQ 3.1 asked about the proportions of blogging scientists in the three countries. Results show that American scientists are most often active in the new online media and German scientists least often. Taiwanese scientists take a middle position (table 8.6). While 80% of the American and 77% of the Taiwanese respondents said they were members of a social online network, this was confirmed by only 70% of the German respondents. With regard to blog use, about one third of American and Taiwanese respondents but only about one fifth of the German respondents reported they read blog posts. About 61% of German respondents said they never put information related to their research or professional expertise "on a website, blog, or social network site aimed at the general public" in the past year (figure 8.1), while the proportions in the United States and in Taiwan were only 42% and 45% respectively. In all countries only a small proportion of scientists write blog posts, and the United States has the largest proportion of blogging scientists (8%). Furthermore, German scientists were least likely to indicate "online communication" as the preferring way of communicating with the public (figure 11.1).

The small number of blogging scientists in our sample makes a detailed comparison of the practice of science blogging across countries difficult (RQ 3.2). In all three countries blogging remains a peripheral activity for most blogging scientists, measured by the frequency of posting. With regards to topics of blog posts, there

[39] Selected results reported in this chapter were presented at the IHPST 2014 conference, 4-7 December 2014, in Taipei, Taiwan.

is some indication of country differences. Blogging scientists from the US and Germany more frequently mention "research and outcomes" as their first priority than Taiwanese blogging scientists: 33% of the German and 39% of the American but only 17% of the Taiwanese blogging scientists mentioned that topic. The first priority of Taiwanese blogging scientists was "consulting." One may speculate that the different topic selection of Western and Taiwanese blogging scientists reflects the cultural dimension of low- and high- context communication of Hall (1976). The high priority of covering "research and outcomes" reported by German and American blogging scientists might be recognized as low-context communication rooted in science rather in the life world of the audience; "consulting" by Taiwanese researchers in contrast might be considered a more context-sensitive form of communication.

RQ 3.3 asks whether "state of science journalism" and "diffusion of new media" explain the relative significance of blogging in the Germany, Taiwan and the United States. Hypothesis H 3.1 was stated, expecting that "scientists in Taiwan with less developed science journalism and high diffusion of new media tend to use blogs most frequently than scientists in Germany with developed science journalism and low diffusion of new media, whereas scientists in the USA are in a middle position." The rank order of the three countries with respect to the proportion of blogging scientists does not fully confirm the hypotheses. The results of t-tests show that the proportion of blogging scientists in the US is larger than that in Germany ($p<0.05$); the differences between Germany and Taiwan, and between the USA and Taiwan were not significant ($p>0.05$), however. While the expectation is confirmed that US scientists are more likely to blog than their German colleagues, probably because of the higher diffusion of new media in the US, the lower proportion of blogging scientists in Taiwan than in the US was not anticipated. The state of science journalism in Taiwan is clearly lagging behind that in Germany or the United States (chapter 6). It seems that, contrary to the expectation, blogging as compensation for weak science journalism is not an important factor. A possible explanation is that other factors not anticipated in this hypothesis - such as perceived relevance of public communication – may be also involved into scientists' decisions on the use of new media for science communication; and this perceived relevance is higher in Western countries than in Taiwan, as is shown by the higher proportion of Taiwanese scientists who are not interested in public science communication at all (figure 11.1), for example.

## 12.2 Country differences in the "medialization" of science

As shown in chapter 11, results of this survey hardly confirmed any difference in degrees of the media orientation and medialization of science between scientists with different communication preferences, nor between blogging and non-blogging scientists. However, a previous study comparing beliefs and preferences of German and Taiwanese scientists found country differences with respect to their media orientation (Y.-Y. Lo & Peters, 2015). This subchapter focuses on differences between scientists of the three countries in their orientation toward media and the medialization of science – first in the anticipation of media criteria in public communication, second in the acceptance of repercussions of public responses on research.

One of the questions (Q16, appendix A) asked scientists in the three countries about "their expectations of how scientists should communicate with the general public." It included nine items referring to anticipation of media criteria such as a comprehensibility, attention-arousal, entertainment, personalization and relevance to the public. Respondents were asked to indicate agreement or disagreement with these items on 5-step rating scales. Higher values indicate more compliance with presumed media expectations (figure 12.1).

Across countries, respondents agreed that scientists should "use their expertise to criticize decisions affecting society" and that they should "speak openly about problems" such as scientific misconduct. In both cases, country differences are statistically not significant (F-test, $p>0.05$). With the exception of these two items, scientists of the three countries differ significantly in their acceptance of presumed media criteria, however.

While scientists generally favored that they "should relate their research to the everyday experience of the public," US scientists showed somewhat stronger approval than German and Taiwanese scientists ($F=8.6$, $df=2$, $p<0.01$). Western scientists were also more inclined to "communicate their results and expertise in an entertaining manner" than Taiwanese scientists ($F=16.1$, $df=2$, $p<0.01$). However, Western scientists showed an ambivalent attitude toward using "catchy phrases that attract public attention," while Taiwanese scientists mildly agreed ($F=4.8$, $df=2$, $p<0.01$). The responses may reflect different communication priorities. A possible explanation is that to Western scientists it is more important to make science "digestible" for the public than to raise public attention. They may see an entertaining manner as a means to reach this goal. To Taiwanese scientists, it may be more important to get public attention and they may expect the public to respect the seriousness of their research. Taiwanese scientists might be worried that making their research entertaining will put their credibility at risk.

Journalists and general public audiences may prefer personalized stories and scientists may not always be happy to conform to this expectation. Scientists' opinions about this aspect differ across countries (F=11.3, *df*=2, p<0.01). Taiwanese scientists showed the largest approval of the statement that "when communicating with the public, scientists should be prepared to focus on their own role as researchers and to provide personal views."

The largest differences between the three countries concern the item that "when communicating with the public, scientists should simplify even at the expense of scientific accuracy" (F =37.1, *df*=2, p<0.01). While Taiwanese scientists tended to agree, German scientists on average slightly rejected this statement and American scientists moderately rejected it. Y.-Y. Lo and Peters (2015) who found a similar difference between German and Taiwanese scientists in a previous survey assume that it is the consequence of scientists' image of the public. They argue that Taiwanese scientists are more skeptical about the public's ability to understand science than German scientists. Results of this study confirm their argument that Taiwanese scientists are more skeptical about the public than Western scientists. While Taiwanese scientists in a separate question (Q17.05, appendix A) moderately agreed with the statement that "the public is not well educated enough to really understand scientific findings" (mean=0.35), German (mean=-0.20) and American (mean=-0.13) scientists were inclined to reject it.

For scientists, publication of results in a scientific journal after peer review is generally considered the first step of making new knowledge available, a step that should precede public communication. Accordingly, scientists of all three countries rejected the statement that "when communicating with the public, scientists should talk about current research that has not yet appeared in scientific publications." The degree of disapproval differed significantly across countries, however (F=4.5, *df*=2, p<0.05). While Taiwanese scientists were ambivalent towards this statement, responses of the Western scientists indicated moderate disapproval. This shows that scientists do clearly distinguish internal scientific communication from public communication of science. The boundary between the two kinds of communication seems stricter in the West than in Taiwan.

Interesting differences exist in the responses to the statement that "when communicating with the public, scientists should put an emphasis on the practical uses of research rather than on the research itself" (F=15.4, *df*=2, p<0.01). While scientists of all three countries agreed to this item, Taiwanese scientists on average agreed strongest. These differences find a plausible explanation in the different character of scientific research in the three countries. In a country in which a larger part of scientists focus on applied research, it is to be expected that scientists are more likely to emphasize the practical uses of their research when talking about it to the public. And in Taiwan the focus on applied research is clearly stronger than in the two Western countries. Scientists were asked about the main focus of their research (Q32, appendix A). Only 20% of the Taiwanese scientists said that they focus on basic research; more than 80% said that their research is at least partly "applied." In contrast, nearly 40% of US scientists and 45% of the German scientists indicated that they are mainly involved in basic research.

Support of the explanation that the research focus of scientists influences their preference of communicating practical uses of research comes from the comparison of research fields. In all three countries, researchers from the technology/engineering research field were most often dealing with applied rather than pure basic research, researchers in the in the natural sciences least. Researchers in the life sciences took a middle position but were closer to those in technology/engineering than to those in the natural sciences (see red line in figure 12.2). In all three countries, the differences in focus on basic vs. applied research of the three research fields correspond to similar patterns regarding the preference for communicating practical uses of research (see bar chart in figure 12.2). To summarize, the natural sciences are clearly less applied than life sciences and technology/engineering in all three countries; and in each research field Taiwanese research is more applied than research in the two Western countries. Both patterns are reflected in scientists' preferences of communicating practical uses of research rather than the research itself.

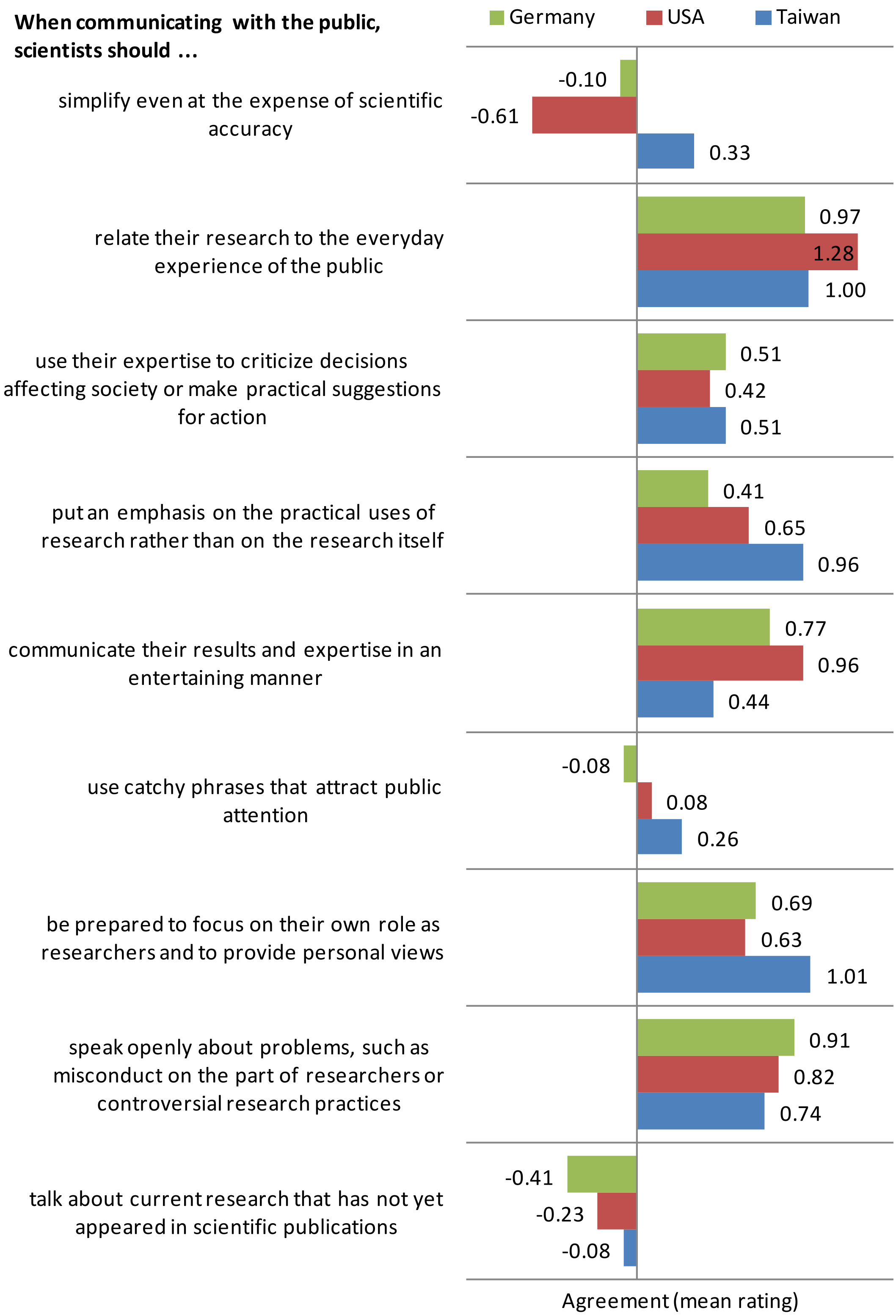


**Figure 12.1** Medialization of science measured by scientists' disposition to use media criteria when communicating with the public (Q16, appendix A) by country. Bars represent mean values of a rating scale ranging from -2 (strongly disagree) to 2 (strongly agree).

The focus on applied research in Taiwan (as in other Asian countries) may be a consequence of the Confucian culture. Marginson (2010) argues that the autonomy of research systems in countries with a Confucian culture is weak and that governments have strong influence on research policy and orientation. Governments though may prefer commercially relevant applied research over basic research. The weak autonomy of the Taiwanese research system may also weaken the border between scientific communities and their societal environment. This will become obvious in the following analysis of scientists' acceptance of external influence on scientific decisions and a less strict separation of scientific and public discourses.

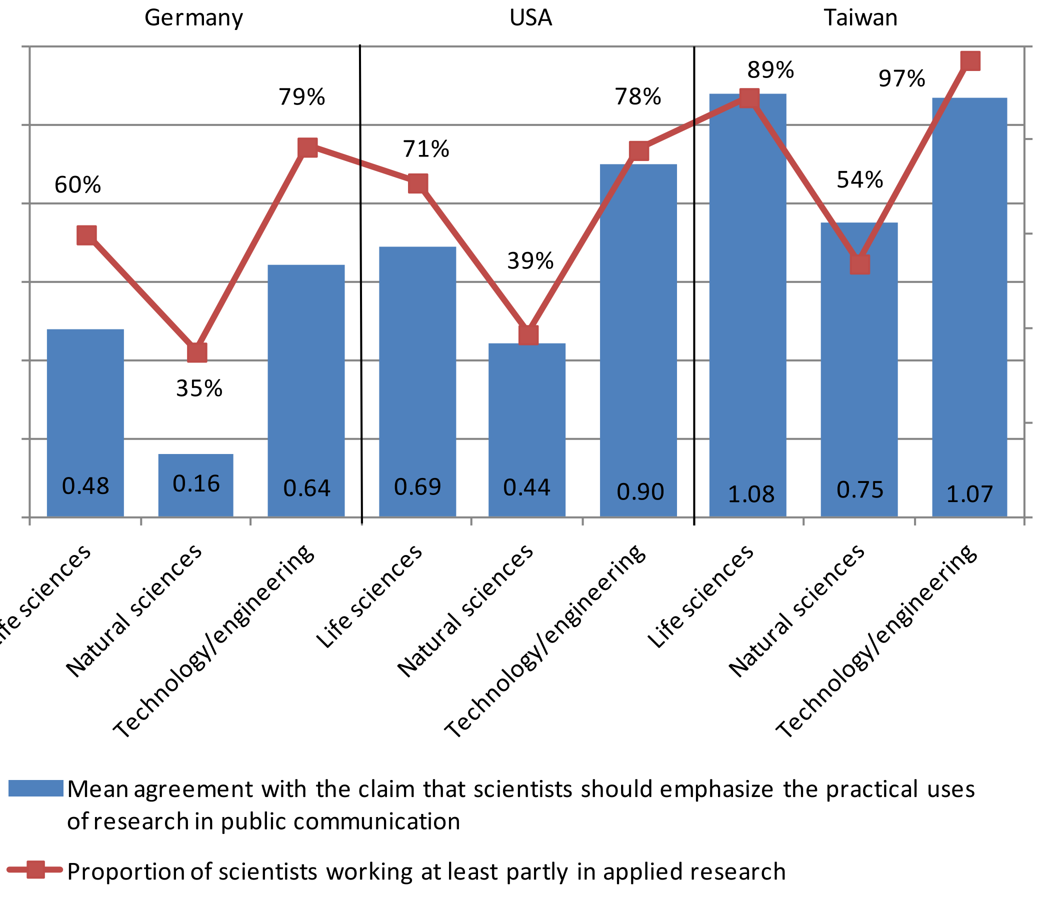


**Figure 12.2** Scientists' agreement to emphasizing the practical uses of research in public communication (Q16.4, appendix A) compared with research focus (Q32) by country and research area. (Results are based on unweighted data.)

According to the medialization hypothesis, scientists' anticipation of journalistic criteria is one of the consequences of the increasing proximity of science and the mass media. Other possible consequences are repercussions of scientists' interest in media visibility and in a positive public image on decisions in the research process. Weingart (2012) argues that such repercussions may harm the autonomy of science in the long run.

Empirical results showing repercussions on the "program level" (Weingart, 2012), i.e., indications of substantial effects of anticipated media visibility on decision-making within science, are rather indirect. While there is some evidence of cross-disciplinary differences in medialization (Peters et al., 2012), little is known about cross-country differences. Using a list of 8 items mentioning possible repercussions of anticipated publicity on decisions in the research and publication process, Peters et al. (2013) have compared medialization effects among neuroscientists in Germany and in the United States. They did hardly find significant differences between the two countries.

This survey used the same items as Peters et al. (2013). But rather than asking about perceived repercussions as Peters et al. (2009), the question in this study asked respondents to indicate whether they find it justified to consider possible public responses in making these decisions (Q23, appendix A). The results show general similarity between Germany and the United States but a different pattern for Taiwan. German and Americans scientists were in general more reluctant to accept criteria of public responses in making decisions on research issues than Taiwanese scientists (figure 12.3). Compared to Western scientists, Taiwanese scientists have thus greater tolerance for public influences on research. In each of the 8 items more than 75% of Taiwanese scientists found it "always" or "in some situations" justified to consider possible public responses in making decisions on research and scientific publication. The difference of Taiwanese to German and US scientists is particularly pronounced when comparing the proportion of respondents who found is "always justified" to consider public responses in decision-making.

The responses of Western scientists differed somewhat between items related to the design of research (choosing research questions and methods, selecting funding sources or collaborators) and the publication of results (timing of publication, avoiding publication, emphasizing interpretations, avoiding certain phrases). Using possible public responses as decision-criterion was rated more often acceptable in the research design phase than in the publication phase. The responses of Taiwanese researchers did not show such a difference; the justification of using such criteria was rated about equally high in the research design and in the publication phase.

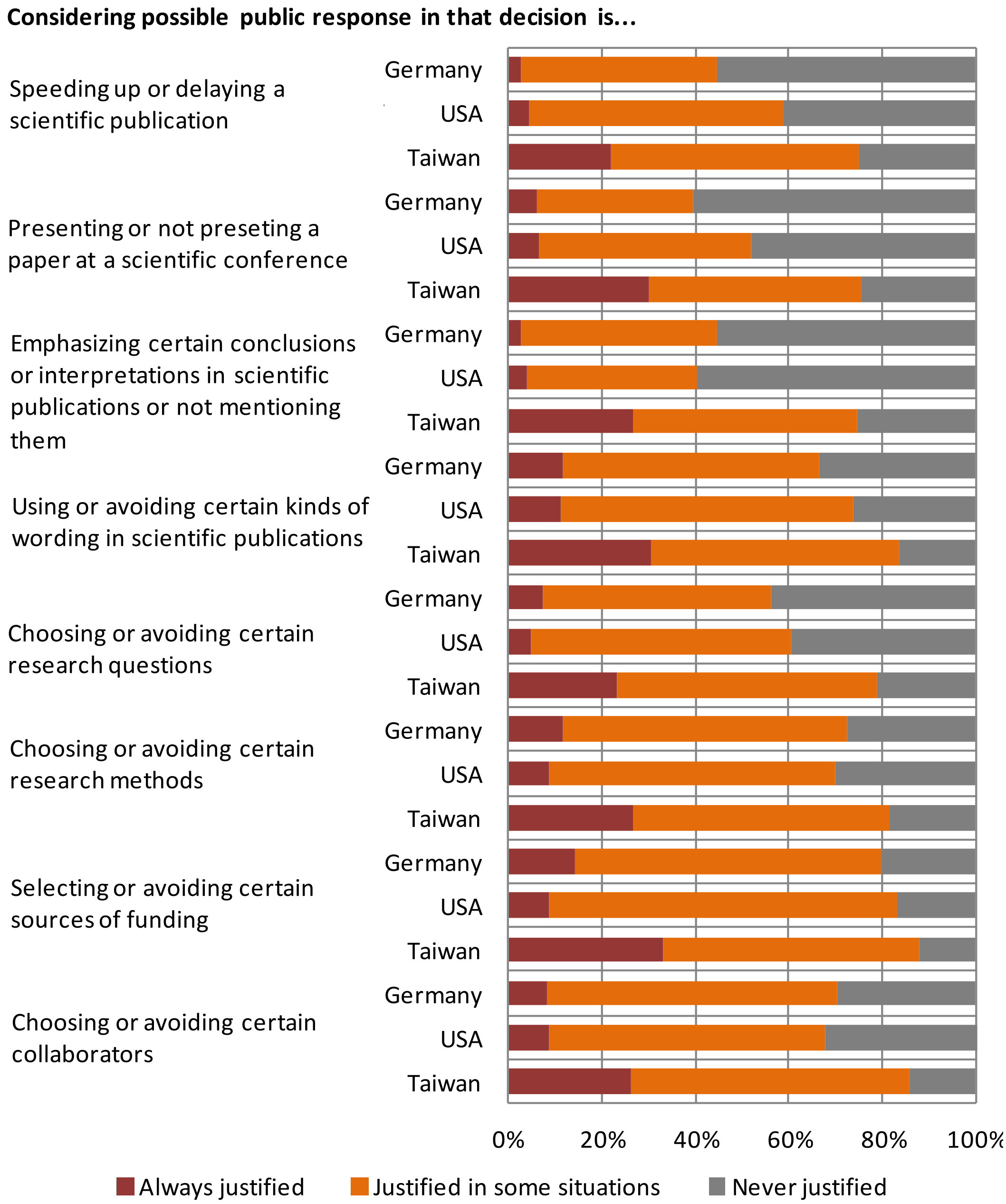


**Figure 12.3** Scientists' acceptance of medialization at the program level by country (Q23, appendix A).

## 12.3 Country differences in scientists' beliefs in communication models

As shown in chapter 11, neither scientists with different communication preferences in communicating with the public (i.e., journalism, writing themselves for online media, face-to-face interactions) nor blogging and non-blogging scientists differ clearly in their beliefs about public communication. However, the following analysis will show such differences between scientists from different countries (figure 12.4).

In all items but one ("The public may lack scientific knowledge, but it possesses a lot of relevant common sense and good judgment") statistically significant country differences between the mean ratings exist (as measured by F-tests).

The Western scientists' view of the public is slightly more positive than the Taiwanese scientists' view. Taiwanese scientists agreed more to some items compatible with the PUS/deficit model (table 7.3) than their Western colleagues. For example, scientists in Germany (mean=-0.20) and in the United States (mean=-0.13) mildly rejected the statement that "the public is not well educated enough to really understand scientific findings" while the Taiwanese scientists moderately agreed to this statement (mean=0.35). However, Taiwanese researchers are not consistently more inclined to agree to items compatible with the PUS/deficit model. For example, they showed the most open attitude toward sharing internal differences with the public (mean=0.70) while German scientists were ambivalent about the statement that "scientists should share internal differences of opinion with the general public" (mean=0.07) and American scientists were moderately in favor of it (mean=0.48).

Scientists in the West were ambivalent regarding the statement that "scientists should strategically frame their messages to guide the public's attitude." Contrary to Western scientists' attitudes, Taiwanese scientists clearly agreed with this statement (mean=0.81). This is again compatible with the PUS/deficit model. Because of Taiwanese scientists' stronger belief in the knowledge deficit of the public, it is especially important to them to "guide" public opinion. Perhaps also following from their conviction that it is their task to guide the public, Taiwanese scientists agreed most strongly with the statement that "when communicating with the public, scientists should be prepared to focus on their own role as researchers and to provide personal views" (mean=1.01 as compared with 0.63 and 0.69 in the US and Germany, respectively).

The idea of "framing" relates to a communication model advocated by Nisbet and Mooney (2007) who argue that it is necessary to strategically phrase scientific messages in order to reduce public misunderstandings of science. Their argument is based on the assumption of the PUS/deficit model that the public is easily misled. There is indeed a weak but statistically significant correlation ($r=0.16$, $p<0.01$)

between the "framing" item and the item stating a cognitive deficit of the public ("The public is not well educated enough to really understand scientific findings"). Furthermore, scientists who agreed with the necessity of framing scientific messages were also likely to oppose public participation in the regulation of science ("The public should be discouraged from interfering with the regulation of scientific activities and applications") ($r=0.12$, $p<0.01$). However, apparently contradictory to the perceived need to guide the public, there is a positive correlation between support of "framing" and the idea to collaborate with the interested public in research ("Scientists should collaborate with non-scientists as 'lay researchers' to make scientific knowledge more compatible with social expectations") ($r=0.31$, $p<0.01$). At the first glance this correlation is surprising. The item was intended to claim that scientific knowledge will change through involvement of lay researchers; respondents obviously understood it as expressing the belief that "social expectations" will change as a result of laypeople's involvement in research, however.

The public engagement model assigns the public a more active role in science communication than the PUS/deficit model. It conceptualizes knowledge differences between scientists and the public less as a deficit or a gap, but rather as a difference in the kind of knowledge held. The public engagement model assumes good common sense and ability to make a good judgment on the public's side, despite the lack of specific scientific knowledge. A previous survey of biomedical researchers showed that scientists in five countries did not clearly ascribe to the assumption that "the public may lack scientific knowledge, but it possesses a lot of relevant common sense and good judgment" (Peters, 2013a).

When confronted with the same statement in this survey, respondents of all three countries were moderately in favor of it (mean=0.60 in all three countries). The difference to the previous survey may indicate a change of the public's image among Western scientists between 2005 and 2013 or be due to the different samples of the two studies. However, another item in which a low knowledge level of the public is implicitly mentioned as a possible obstacle to a "true dialog" also shows a positive image of the public only among German and American scientists, but not among Taiwanese scientists. American and German scientists moderately disagreed with the statement that "scientists and laypeople have different levels of knowledge, which make a true dialog between them impossible" while Taiwanese scientists were ambivalent (mean=0.01).

German and American respondents in this survey showed a somehow different attitude towards public participation in the regulation of science than Taiwanese researchers. When confronted with the statement that "the public should discourage from interfering with the regulation of scientific activities and applications," Western respondents tended to decline it (mean=-0.32 for German respondents; mean=-0.20 for US respondents), while Taiwanese respondents were indecisive or ambivalent towards this statement (mean=0.08).

In the West, the belief in the public's ability to make good judgments is consistent with scientists' attitude towards the public's interference in regulation of science. German scientists and American scientists have a more positive image of the public than Taiwanese researchers and this may reduce their rejection of public participation in science regulation. However, even Western scientists are ambivalent regarding the statement that "scientists should collaborate with non-scientists as 'lay researchers' to make scientific knowledge more compatible with social expectations" (mean=0.06 and 0.12 in Germany and the United States, respectively). In contrast to the attitudes of Western researchers, Taiwanese scientists have less problems accepting collaboration with laypeople in research (mean=0.74) than accepting their involvement in science regulation.

Scientists do not respond consistently to all aspects of the public engagement approach (table 7.3). For example, answers to the two items regarding participation of laypeople in research and public participation in science regulation correlated only very weakly. In Germany ($r=-0.14$, $p>0.05$) and the United States ($r=-0.26$, $p<0.01$) the correlations are in the expected direction, though. I.e., scientists accepting one form of lay participation were also likely to accept the other form of participation. However, in Taiwan the correlation was not only weak but even in the reverse direction ($r=0.14$, $p<0.05$): scientists accepting collaboration with laypeople in research were less likely to accept public participation in science regulation.

One of the interesting questions is whether scientists make a clear distinction between communication within science and public communication or not. While the classical popularization model assumes a rather strict distinction between the two communication arenas (Peters, 2013a), one of the arguments in the debate about open access publishing is that interested laypeople should have access to scientific publications too (Rinaldi, 2014). If one accepts that argument, the question of comprehensibility of scientific publications for laypeople is raised. Western respondents clearly disagreed with the statement that "editors of scientific journals should demand from authors that their articles are comprehensible to interested laypeople" (mean=-0.99 in Germany and -0.90 in the United States, respectively). Taiwanese researchers seem to perceive less need to restrict scientific communication to peers. They were mildly in favor of making scientific publications comprehensible to laypeople (mean=0.20).

The responses of this item differ not only significantly between countries ($F=78.9$, $df=2$, $p<0.01$), but also between research fields ($F=4.6$, $df=2$, $p<0.05$).[40] Again the research focus – basic science, applied science or both basic science and applied science equally – has consequences for scientists' responses to this statement. In each country, natural scientists (with the highest proportion of scientists involved in basic science) rejected the demand of comprehensible publications most strongly, researchers in engineering/technology least strongly (figure 12.5).

Who should communicate with the public about science – scientists themselves or professional science communicators? A public opinion survey shows that the public regards scientists the best candidates for public science communication due to their credibility and accuracy (Eurobarometer, 2007). In a British survey of scientists the majority of scientists agreed that they have a responsibility to communicate the implications of scientific findings to laypeople. Many of them argued that science communicators are better equipped for public communication in terms of their professional expertise, however (MORI, 2000, p. 26).

In this survey, Western scientists indicated a preference of communicating themselves with the public rather than delegating it to professional science communicators. They rejected the statement that "public science communication should be done by specialized communication professionals, not by scientists themselves" – American respondents (mean=-0.73) more strongly rejecting it than German respondents (mean=-0.48). Taiwanese respondents mildly agreed with this statement, however (mean=0.23).

[40] Results are based on un-weighted data because this part does not focus on country differences, but rather on disciplinary differences within a single country.

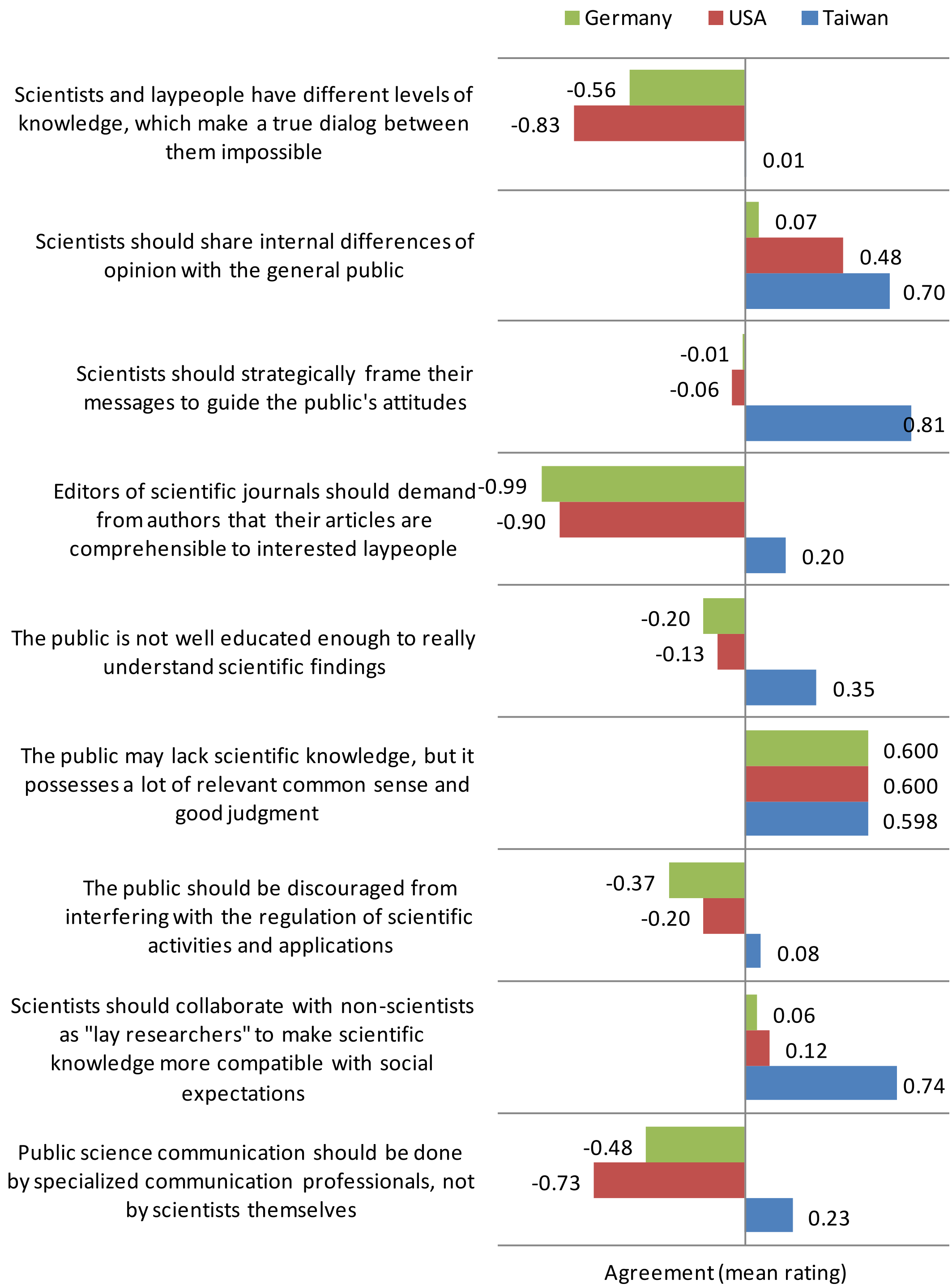


**Figure 12.4** Scientists' affinity to communication models (PUS/deficit vs. PEST approach) by country (Q17, appendix A). Bars represent mean values of a rating scale ranging from -2 (strongly disagree) to 2 (strongly agree).

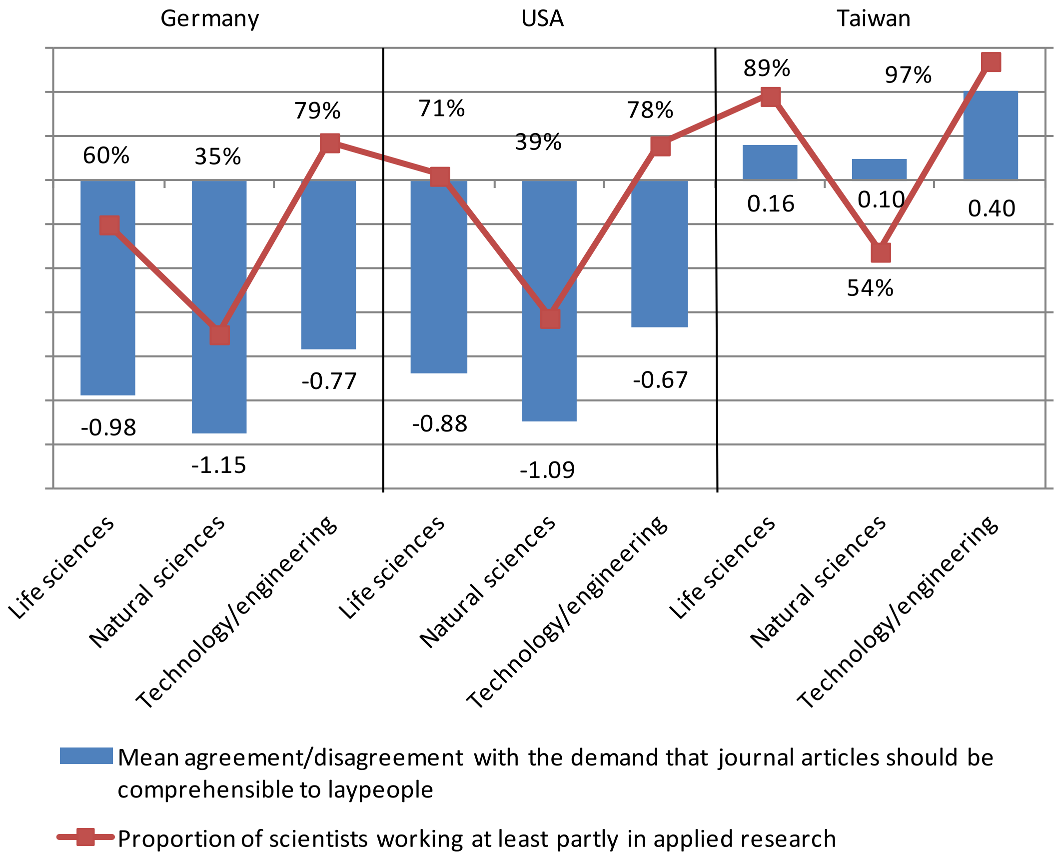


**Figure 12.5** Scientists' acceptance of the demand of comprehensibility of scientific publications (Q17.04, appendix A) compared with research focus (Q32) by country and research area.

# 13 Discussion

## 13.1 Methodological limitations and issues

The present study is based on an online survey of scientists from Germany, the United States and Taiwan. However, it is important to consider methodological limitations of the study. As it uses individual scientists' answers to survey questions as empirical approach to analyze the role of new online media in science communication, evidence on some important aspects addressed in the thesis – such as the role of science organizations, the assessment of impacts of new online media on research or the content of blogs – relies on the perceptions of individual scientists.

The samples for this survey consisted of scientists and a "scientist" was defined as a person doing research and publishing it in scientific peer-reviewed journals. With this definition in mind the samples were compiled from authors of articles published in scientific journals listed by the Science Citation Index (SCI). Furthermore, in the very beginning of the questionnaire the question was asked "Are you a scientist?" and the answers were used to select only those respondents who referred to themselves as scientists. The semantics of the term "scientist" seems to differ somewhat by country, however.

Awareness of differences in the concept of a scientist was raised by inquiring e-mails sent by respondents. An e-mail of a Taiwanese professor said that he understood his career as that of an engineer, not as that of a scientist. In several e-mails from the United States respondents expressed their doubt whether they are appropriate persons to answer the questionnaire because they were still students enrolled in a Ph.D. program. The social role of a Ph.D. student differs across education systems. In Germany, a Ph.D. student is expected to work as a junior scientist, whereas in the United States and in Taiwan, with an education system strongly influenced by the American one, the "student" role is more emphasized. Correspondingly, compared with the American and Taiwanese samples, the German sample included a higher proportion of respondents without a Ph.D. title and the average age in the German sample is lower than that in the US and Taiwanese sample. About 12% of German scientists do not have a doctoral degree, compared to only 6.5% of the American scientists and 4.5% of the Taiwanese scientists. The average age of respondents in the German sample was 44 years compared to 50 years in the US sample and 48 years in the Taiwanese sample.

As this study is based on a survey it provides an overview of scientists' uses of the new media for public science communication, and their perceptions of blogging. Lacking an accordant content analysis, it is difficult to see how serious a blogging scientist uses his or her blog to actually communicate with the public, or to understand which proportion of blog contents posted by scientists is related to science. Content analyses of scientists' blogs often show that they cover various topics, even topics extending beyond science.

## 13.2 Summary of empirical findings

This study explores the role of blogs as a specific example of new online media in public science communication from the scientists' point of view. Apart from a handful of studies such as Puschmann and Mahrt (2012), Mewburn and Thomson (2013) and Ranger and Bultitude (2014a), studies on scientists' perception and use of blogs for public science communication are rare, and even fewer include a cross-country comparison such as the study by Allgaier et al. (2013a). In the following paragraphs, results of my study are summarized along the research questions and hypotheses stated in chapter 7.1.

*Patterns of new media involvement*

Research questions related to patterns of new media involvement concern scientists' use of online media for public communication and the actual practice of blogging. An overview of scientists' participation in activities of public science communication via different types of online media shows that many scientists in each of the three countries – Germany, United States and Taiwan – are involved in a broad spectrum of public communication activities (RQ 1.1). More than 85% of the respondents reported at least one activity of public communication (chapter 8.2). Yet only a minority of scientists reads online blogs, and only very few of them write blog posts themselves (chapter 8.3).

Scientists' concerns and expectations regarding blogging and their perceptions of how their social environment appraises blogging activities may play a role in their decisions of joining or not joining the blogosphere (RQ 1.2 and RQ 1.3). Scientists view blogs as informal information sources. They perceive blogging as time consuming and not serious enough to communicate with scientific peers and colleagues (chapter 9.1). A large proportion of scientists do not know how their scientific peers feel about blogging. Compared to the peers' attitudes toward blogging, the management's position on blogging seems more decided – either encouraging or cautioning but at least "caring" (chapter 9.2). Scientists' concerns about the time-requirement and the scientific "seriousness" of blogging may de-motivate them to blog. Crucial for their decision to engage in blogging activities may be their intrinsic motivation for communication. In all three countries, agreement to the item "blogging is fun" distinguishes most clearly between blogging and non-blogging scientists (chapter 9.3).

Blogging is a marginal activity for most scientists who blog (RQ 1.4). A majority of blogging scientists publishes blog posts only every few weeks or less frequently, and blogging scientists typically spend two hours weekly on blogging (chapter 10.2). Scientists blog about a broad spectrum of topics but they provide information related to research more frequently than any other type of information (chapter 10.3) (RQ 1.5).

Blogging scientists address several types of audiences by blogging: colleagues, students and the general public are the three most important audiences (chapter 10.3). Dialogical communication seems to take place only to a limited degree. While the vast majority of the blogging scientists reported that they receive at least one comment per blog post on average, only very few of them said that they receive more than 10 comments on average. Furthermore, dialogs occurring in the blogosphere are mostly confined to special groups. According to the experience of blogging scientists most comments are from readers close to science – e.g., colleagues, scientific peers and students (chapter 10.4) (RQ 1.6).

Because of the small sample of blogging scientists, the possibility to analyze possible repercussions of blogging on research is limited (RQ 1.7). Half of the blogging scientists did not perceive any influence of their blogging activities on their work. About three in four of the blogging scientists who perceived an influence reported that the influences were mostly positive. Those who perceived an influence of blogging on their scientific work tended to post information about their own research (chapter 10.5).

*Characteristics of new media users among scientists*

Do scientists differ who interact with journalists or are online active, in terms of their leadership position and age (RQ 2.1)? Congruent with previous studies (e.g., Dunwoody & Ryan, 1985; Jensen et al., 2008; Peters, Brossard, et al., 2008) results of this survey show a positive association between scientific productivity and frequency of contacts with a journalist and between leadership position and frequency. However, as expected (H 2.1), scientific productivity and leadership position are less predictive for scientists' online activities than for their contacts with journalists (chapter 8.2). In all three countries, there is no association between age and frequency of online activities, such as "contributed to a Wikipedia article," "uploaded a video" to YouTube and "put information" in the new online media. With regard to the relation between scientists' age and frequency of their online activities in general, hypothesis H 2.2 that younger scientists are more often active online than older scientists is thus not confirmed. Scientists in all three countries blogging actively are not younger than those who do not. However, in all countries scientists using blogs passively are generally younger than those who do not (chapter 8.3).

There are no consistent differences in the preferences for communication models between groups of scientists preferring communication with the public via new media or mediated by journalism (RQ 2.2). On the one hand, journalism-affine scientists are more inclined towards the public engagement approach than new online media-affine scientists, because they believe more in the possibility of a true dialog between scientists and laypeople. On the other hand, journalism-affine scientists were less prepared to make scientific knowledge transparent to laypeople than new online media-affine scientists, indicating less inclination toward public engagement. The findings, thus, do not confirm hypothesis H 2.3 claiming that scientists who prefer new online media more often hold beliefs consistent with the engagement model (dialog, participation) than scientists who prefer journalistic mass media or do not want to communicate with the public at all (chapter 11.2).

The degree of "medialization," i.e., acceptance of using media visibility as criterion in decisions on research and scientific publication, does not differ between groups of scientists preferring journalistic mediation or direct online publishing as channels of public communication (chapter 11.3) (RQ 2.3). Rather than preference for a communication channel, culture is a predictor of medialization (chapter 12.2).

### *Cross-cultural variations*

The analysis of cross-cultural variations focused on variations of the proportion of blogging scientists in the three countries (RQ 3.1) and their practice of blogging (RQ 3.2). In all countries only a small proportion of scientists write blog posts. In the United States the proportion of blogging scientists is largest (8%), followed by Taiwan (5%) and Germany (4%) (chapter 10.1). The small number of blogging scientists in our sample made a detailed comparison of the practice of science blogging across countries difficult. However, in all three countries blogging remains a peripheral activity for most blogging scientists, measured by the frequency of posting.

The three countries differ in terms of "state of science journalism" and "diffusion of new media." RQ 3.3 asked whether these factors can explain the country differences in scientists' blogging? Of the three countries, the state of science journalism in Taiwan is clearly weakest compared to Germany and the United States (chapter 6) and the diffusion of new media in Taiwan seems to be higher than in Germany (chapter 2.1). Against the expectation (H 3.1), the proportion of blogging scientists is highest in the United States (8%), not in Taiwan where it is only little higher than in Germany (5% vs. 4% which is not a significant difference) (chapter 10.1).

Obviously, reasons other than the state of science journalism and the level of diffusion of new media also influence scientists' participation in online communication. A plausible explanation for the unexpectedly low level of activities among Taiwanese scientists is that they assign less priority to public communication than German and US scientists. The item "Public science communication should be done by specialized communication professional, not by scientists themselves" found agreement among Taiwanese respondents while German and US respondents tended to disagree (Q17.10, appendix B). Furthermore, the proportions of Taiwanese scientists indicating that they are "not interested in communicating with the public" (Q04, appendix B) and considering public communication "neither a moral duty nor a good thing to do" (Q24, appendix B) was higher than among German and US scientists. Compared with German and US scientists, Taiwanese scientists thus consider communicating with the public clearly less important.

The difference in the prevalence of blogging among scientists in Germany and USA is well explained by different levels of diffusion of online media. Although the German trend of increasing use of online communication tools is quite obvious (Hasebrink & Hölig, 2013), the diffusion of online media among the general media audience as well as among scientists is higher in the United States than in Germany (Allgaier et al., 2013a; Newman & Levy, 2013). German scientists' lower readiness of using new online media for science communication may also reflect that journalistic sources remain dominant in Germany. According to Newman and Levy (2013), Germans show a particular brand-loyalty in news consumption. Furthermore, a survey shows that young Germans are likely to read online news provided by well-known traditional media organizations (van Eimeren, 2015). Corresponding to the lower relevance of online news sources in Germany, the proportion of blogging scientists is lower in Germany than in the US. Furthermore, German scientists perceive more critical attitudes towards blogging from their colleagues than US scientists. And finally, German scientists assess the impact of new media on public opinion and political decision-making on science weaker than American scientists, as Allgaier et al. (2013a) substantiate.

## 13.3 Conclusions

*Blogging is currently a marginal activity of scientists*

Communication scholars emphasize the growing importance of the new online media for public science communication and argue for increased use of these media by scientists (e.g., Brossard, 2013a; Buckler, 2012). However, results of this study suggest that online communication activities with the general public as audience in mind play only a marginal role for most scientists. The majority of scientists participate in communication via new online media, but engagement with the public is only rarely a priority for scientists communicating via new online media. While about 70% of the respondents were members of a social online network, less than 10% said that they frequently use it to communicate with interested laypeople (figure 8.2).

With regard to the number of the group of scientists who blog, only 5% of all respondents write blog posts. Furthermore, those who blog write only occasionally and typically only spend two hours weekly on blogging.

At first glance, the finding of only a small proportion of bloggers among scientists seems to be at odds with other surveys which claim higher figures of blogging scientists. The most recent survey of the members of the American Association for the Advancement of Science (AAAS) on scientists' public communication activities by the Pew Research Center (2015, p. 14) claims that "some 24% of the AAAS scientists blog about science and research," while only 8% of the US respondents in this study reported active blogging.

Looking more closely at the AAAS survey one finds that the results of this survey match the AAAS results quite well, in fact. First, the figure of 24% blogging respondents of the AAAS survey is based on a combination of responses to two questions (Pew Research Center, 2015, Q50a and Q50b, Appendix B). Secondly, the sampling of the AAAS survey is different from that of this study. The sample for the PEW study consisted of the AAAS members in a variety of scientific areas, including social sciences and students (Pew Research Center, 2015, Appendix A). According to the results of the AAAS survey, social scientists are more likely to blog than scientists from biomedicine, chemistry, physics and engineering (p. 19). The sample of this study consists of "scientists" in life sciences, natural sciences and engineering only.

However, these two factors have only a marginal effect on the results. The main factor is related to a different definition of blogging scientists. The PEW figure includes respondents who often, occasionally and rarely blog about science or about their research and specialty areas (Pew Research Center, 2015, p. 32). The question in the AAAS survey was: "[H]ow often, if ever, do you write for a blog about science?" (Pew Research Center, 2015, Q50a, Appendix B). Only 8% of the AAAS members said they often or occasionally blogged about science; further 12% said "rarely." Similarly, 8% of the AAAS members said they often or occasionally "write a blog post that describes [their] research and specialty areas" (PEW 2015, Q50f, appendix B). The group of scientists who regularly blog is thus smaller than the verbal description of the survey findings by PEW suggests. In this survey, respondents were first asked whether they "occasionally or frequently write blog posts or comment on blog posts by other people?" (Q09, appendix A). If they confirmed this, they were further asked to indicate whether they post in a blog (rather than just comment) (B01, appendix A). The finding in this survey of about 8% of the US respondents who occasionally or frequently blog is thus consistent with the AAAS survey results. The AAAS survey (Pew Research Center, 2015, p. 14) and this survey (chapter 8) both show that the proportion of scientists having contacts with journalists remains much higher than the proportion of blogging scientists.

The small proportion of scientists who blog may reflect the fact that many scientists do not see blogs as an appropriate way for public science communication. Referring to media richness theory, a study published before the rise of the Internet substantiates that a match between task demands and communication tools is essential for effective communication (Daft et al., 1987). Previous studies show that scientists implicitly match their online communication tools to the respective communication purposes (Dzeyk, 2013; Moran et al., 2011; Pscheida et al., 2013). Answers to the questions of this study show that scientists assign online communication tools to different purposes. For example, in all three countries scientists use personal websites mainly for communicating with other scientists, less so for public communication. On the other hand, scientists in all three countries perceived that blogging is not serious enough for internal science communication.

The rise of the new online media provides additional communication options for scientists' outreach activities. It is noticeable that scientists still seem to prefer conventional science communication ways over the new ways, however. Compared to the proportion of scientists preferring face-to-face interactions with members of the public or talking to journalists, the proportion of scientists who prefer to write for websites, blogs or social networks etc. to reach the public is rather small (figure 11.1). The preference for journalism compared to the new media might partly be due to the perceived public impact of each medium. Empirical studies have evidenced that traditional media remain the most important mediators for external contacts, for example contacts with policy-maker and members of the public (Wilkinson & Weitkamp, 2013). According to Allgaier et al. (2013a), scientists perceive that the journalistic media – offline or online – have a greater impact on public opinion and policy decisions than social networks and blogs. When communicating with the public, scientists may thus see journalistic media more effective in terms of "impact" than posting their opinions in social networks or blogs.

The frequency of contacts of scientists with journalists found in this study is by and large similar to those found in previous studies. About half of the respondents of this survey claim to have had journalistic contacts in the past year. Scientists who have frequent journalistic contacts also tend to have a high research productivity, similar to findings of Jensen et al. (2008) that scientists who produce more scientific publications are also more active in outreach activities than scientists with fewer scientific publications. Dunwoody and Scott (1982) and Peters, Brossard, et al. (2008) show that scientists with a management role in an institute have more media contacts than those without such a role. This is also found in this study.

With regards to the frequency of scientists' outreach activities through websites, blogging or social online networking, the effects of their research productivity and of whether they have a management role are less pronounced. Only in Taiwan is the frequency with which scientists put information on their website, blog and share information in social online networks related to their leadership position – but only weakly. In the three countries, leadership position and scientific productivity have a stronger impact on the frequencies of scientists' journalistic contacts than on the frequencies of their online activities through websites, blogging or social online networking (table 8.2 and table 8.3).

*Bloggers and non-bloggers share basic beliefs about public communication*

The implementation of the new online media in public science communication is expected to facilitate the interaction between science and the public. The function of comments, for example, enables dialogic communication and complies with the approach of public engagement model which emphasizes two-way communication and an active role of laypeople (e.g., Ashlin & Ladle, 2006; Regenberg, 2010). The hypothesis H 2.3 thus assumed that scientists who prefer new online media more often hold beliefs consistent with the engagement model (dialog, participation) than scientists who prefer journalistic mass media or who do not want to communicate with the public at all. However, it is not clear whether scientists who are active in online communication are also more prepared to accept the public engagement approach than those who are not active online. For example, Besley (2014) did not confirm the relation between scientists' online engagement and their communication beliefs in the PUS/deficit or the PEST approach and Bubela et al. (2009) criticized that blogs written by scientists reinforce the public understanding/deficit approach.

The analysis shows no consistent differences in beliefs characterizing the two communication models between scientists who prefer new online media and scientists who prefer journalistic mass media. Scientists who prefer new online media and scientist who prefer journalistic mass media have similar beliefs regarding communication models (chapter 11.2). A difference only exists between scientists interested in public communication at all and those who are not. Scientists who are not interested in public communication at all are more inclined to prefer the public understanding/deficit approach. For example, they are less likely to believe in the possibility of "a true dialog" between scientists and laypeople than other scientists.

Similarly, and contrary to the expectation that scientists who are online active are more inclined to the public engagement approach, whether a scientist blogs or not has no implications for their affinity with the public understanding/deficit or public engagement model. Blogging scientists and non-blogging scientists share similar beliefs regarding communication models (chapter 11.4).

The mentioned results indicate that how scientists think about the public is unrelated to their preference for online communication or blogging activities. That implies that scientists who blog are motivated by other reasons than just wanting to apply the public engagement model in the communication with laypeople. Other possible reasons might be their dissatisfaction with the quality of (mass) media coverage of science, their goal of building an online presence or their intrinsic motivation.

Interviews with science bloggers often reveal a critical view toward (journalistic) media coverage of science (e.g., Colson, 2011; Puschmann & Mahrt, 2012). Their critical view on science journalism might partly explain their decision to launch a blog as this enables scientists to bypass journalism as mediator. Results of this study do not support this hypothesis as respondents of this study did not consider the belief that "blogging enables scientists to avoid journalists who often provide inaccurate and biased information about science or neglect scientific topics" as an important reason to launch a blog. Furthermore, science bloggers interviewed by Colson (2011) differentiate between the function of blogging and the function of science journalism. For example, the blogging scientists interviewed by her did not intend to influence public opinion which in their view was the job of science journalism. In an interview with Spiegel Online, the German science blogger and former scientist Florian Freistetter distinguishes bloggers from journalists in that the former introduce science to the public and the latter provide a critique of science (Bojanowski, 2014).

Another important motivation for scientists to blog might be improving the public representation of science from the perspective of science. Indeed, respondents rated the argument that the blogosphere should not be left to "self-appointed experts and pseudo-scientists" quite important as a possible motivator (chapter 9.1). Furthermore, this study shows several differences between blogging and non-blogging scientists regarding the motivations of increasing "scientists' visibility within the scientific community," "the scientific impact of scholarly publications" and "scientists' visibility for sponsors and funding bodies" (table 9.4).

However, the most important motivator for scientists to blog seems to be the intrinsic reward gained by blogging. Even before the rise of the Internet, scientists' intrinsic motivations played an important role in their decisions on talking with journalists and the public (Dunwoody & Ryan, 1985). Congruent with other studies pointing to the significance of intrinsic motivation (Mahrt & Puschmann, 2014; Masters, 2013; Ranger & Bultitude, 2014a), this study finds clear and highly significant differences between scientists who blog and those who do not blog in the expected or experienced "fun" of blogging (table 9.4).

*No indications of strong "medialization" effects by blogging*

Weingart (1998) has developed his medialization thesis with the traditional journalistic media in mind. By analogy, this study attempts to apply the concept to the new online media, where audience response rather than journalistic selectivity is the basis of medialization effects. It is thus crucial to look at audience response to scientists' communication activities in the new online media.

Science communication scholars such as Brossard (2013) and Wilcox (2012) expect that the new online media will greatly facilitate dialogic communication between scientists and laypersons. According to this survey, scientists in all three countries to a certain degree share the expectation that blogging might improve public engagement with science. For example, the statement that "[b]logging invites the public to take a more active role in science and technology" is among the items rated as most important as possible outcomes of blogging (figure 9.1).

Several findings of this study suggest that dialogs between scientists and laypeople initiated by blogging scientists are still limited, however. First, the percentage of blogging scientists is rather small and their blogging activities are mostly occasional. Second, the survey findings suggest a low frequency of interaction between blogging scientists and their audiences. The majority of blogging scientists received less than 10 comments per post on average, and most respond only "rarely" or "sometimes" to the comments. Furthermore, it is not common for scientists to comment on posts of others. Third, readers who comment on blog posts are mostly people working in closely related fields or in science in general such as the bloggers' peers or university students. Kenix (2009), who analyzed political blogs and their comments, came to similar conclusions. Her findings also raised doubts about the significance of two-way communication in blogs.

However, there may be interdependencies between public visibility of research in the online environment and scientific processes. In the last decade, many guides and introductions to the new online media for scientists were published pointing to advantages for scientists using these media (e.g., Bik & Goldstein, 2013; Tachibana, 2014). Several articles do suggest a relation between scientists' online visibility and the scientific impact (in terms of efficiency of crowdfunding) of their research (Byrnes et al., 2014). Brookes (2014) demonstrates that scientific papers questioned publicly are more likely to be retracted or revised afterwards. In some cases public discourses among scientists in the online environment influenced internal scientific communication, such as participating in scientific publications or correcting results already published (Wolinsky, 2011).

However, this study hardly confirms a strong relationship between online visibility in blogs and scientific impact. Although part of the respondents saw increased "scientists' visibility within the scientific communities," "scientific impact of scholarly publications" or "visibility for sponsors and funding bodies," as possible advantages of blogging, most respondents did not consider these possible effects "moderately" or "very" important. Furthermore, the great majority of the 44 blogging scientists in the sample perceived no or only minor influence on their scientific work.

The study used two indicators of medialization of science: anticipation of media criteria in public communication (Q16, appendix A) and acceptance of using anticipated public response as a criterion in decisions on research and scientific publishing (Q23). Comparing scientists' orientation toward journalistic criteria in their public communication activities, this study did not find significant differences between blogging scientists and non-blogging scientists (figure 11.5). Neither is there a difference in the acceptance of considering public response in scientific decisions between blogging and non-blogging scientists (chapter 11.4). In both indicators of medialization none of the items showed statistically significant differences between the groups of blogging and non-blogging scientists.

*East versus West: Science communication in a Confucian context*

This study identified several patterns in which Taiwan – as a culture still strongly influenced by the East Asian Confucian tradition – differs from the Western countries Germany and the USA. Compared with Germany and the USA, the focus of Taiwanese science is more strongly on applied research which is also reflected in the topics of public communication. Furthermore, scientists in Taiwan are more sensitive to social relations between them and their social environment than on the rational goal of information transmission. Finally, and perhaps most important, the boundary between science and its social context in Taiwan is less strict than in Western countries such as Germany and the United States.

The Confucian tradition provides possible explanations for the mentioned differences between Taiwan on one hand and Germany and the US on the other hand. According to Marginson (2010), a characteristic of science systems in Confucian countries is that the governments have more influence on science than in Western countries. Correspondingly, the Taiwanese research system is particularly susceptible for policy influences and – reflecting policy expectations – shows a strong application approach. Furthermore, the research system is less decentralized and has a rather strict organizational hierarchy. In Confucian cultures with their emphasis on hierarchical structures (Inglehart & Carballo, 1997), central governments thus have rather direct influence on the research agenda by their funding decisions. Policy strongly favors applied research over basic research because the later is usually "academically controlled" and the impact of government policy is limited (Marginson, 2010, p. 601).

Findings of this study match the analysis of Marginson (2010) about the strong application approach and the importance of organizational hierarchy. Of all surveyed scientists, Taiwanese scientists showed the highest agreement with the item that when communicating with the public, scientists should "put an emphasis on the practical uses of research rather than on the research itself" (figure 12.1). Moreover, the emphasis on utility and applications of science is reflected in the surveyed scientists' research orientation. About 48% of Taiwanese scientists reported that they focused mainly on applied research compared to only 31% and 32% of the respondents in Germany and in the United States, respectively.

Furthermore, the distinction between materialistic and postmaterialistic societies also provides an explanation for the different science communication priorities in Taiwan and Germany/USA. According to Inglehart and Welzel (2005), materialistic goals in a society emphasize economic development and physical security, and postmaterialistic goals emphasize self-expression and value the quality of life. Y.-Y. Lo and Peters (2015) speculate that in a materialistic culture "science may be mainly seen from the utilitarian perspective as a tool for technological and economic progress," while in a postmaterialistic society "science may be perceived more strongly as a source of ‘enlightenment' – a conceptualization requiring in-depth knowledge to be widely shared" (p.13). The sixth World Value Survey (2010-2014) shows that Taiwan is the most materialistic of the three countries included in this study while postmaterialism is strongest among the German population (table 6.2).

The government-driven research system further implies a less strict boundary between science and society in Taiwan, i.e., less professional autonomy. This is observed in several items regarding communication preferences (table 12.4). Taiwanese scientists agree with the item that "[e]ditors of scientific journals should demand from authors that their articles are comprehensible to interested laypeople" while German and US scientists strongly reject this demand. Furthermore, Taiwanese scientists were more strongly in favor of sharing "internal differences of opinion with the general public" than German and US scientists.

The lower demand for scientific autonomy is also evident from Taiwanese scientists' attitude towards considering public response in scientific decisions. Taiwanese scientists were clearly more prepared than Western scientists to accept the anticipation of public responses in decision-making inside the sphere of science (table 12.3). Taiwanese scientists are thus more likely to adjust their decisions in science to conform to public expectations. In Weingart's term, Taiwanese scientists are more strongly "medialized" at the program level than Western scientists.

Hall (1976) observed that the communication style differs across cultures and distinguishes the direct and explicit Western communication style and the indirect and implicit communication style in Eastern Asia. Siau et al. (2010) demonstrate that in the Western world online communication is orientated towards objectivity and in East Asian towards relation building. This difference is reflected in the content of scientists' blogs (B07-B08, appendix B). Western scientists in this survey more often reported that they covered aspects about scientific research than Taiwanese scientists. Taiwanese scientists tended to focus more than Western scientists on the "peripheral" aspects of science, such as on the working culture in science and on support for colleagues or students. Furthermore, Taiwanese scientists seem to be more aware of their social role as scientists when they communicate with the public. For example, they agreed more to the statement that in public communication "scientists should be prepared to focus on their own role as researchers and to provide personal views" than their Western colleagues (Q16.7, appendix B). Probably in order not to endanger their relationship with the public, Taiwanese scientists are less prepared to speak openly about problems that are caused "on the part of researchers or controversial research practices" than American and German scientists (figure 12.1). This finding is congruent with findings of a previous survey of life scientists by Y.-Y. Lo and Peters (2015) who concluded that German scientists have rational goals in their interaction with media while Taiwanese scientists have relational goals.

### 13.4 Final remarks – the place of blogs in science communication

Science blogs seem to serve as a space in which blogging scientists enjoy their blogging activities and networking with other scientific peers is possible. The most pronounced difference between non-blogging and blogging scientists is that the latter consider blogging to be "fun." A particularly strong belief in dialogic communication does not drive a scientist to launch a blog. Blogging scientists do not embrace the public engagement approach more strongly than their non-blogging colleagues. Despite a critical view on the journalistic coverage of science, blogging scientists distinguish their role as a blogger from that of a journalist.

In terms of public science communication, blog posts are more likely to reach small and specialized target groups than to attract a broad public audience. Although blogging scientists intend to address members of the general public, they receive feedback mostly from other scientists or students. This indicates that the participants in online debates taking place in science blogs are very likely constrained to people who are in one way or another related to science. The shared science background among the audiences suggests that blogs serve as communication within an extended peer community.

The possibility of networking with scientific peers via blogs reveals ambivalence between scientists' perception of blogging and their experience with it. On the one hand, respondents of this survey perceived that blogging is not a serious form of internal scientific communication. On the other hand, blogging scientists reported that they received comments from scientists (understood in a broad sense) in their research field.

Hilgartner (1990) argues that communication of scientific knowledge has various arenas, which depend on which group of audience the communication is addressed to. Blogging scientists might contribute to communication in a specific arena in which science-related people who are not direct involved into scientific research can virtually interact with scientists. The group of science-related people includes students, practitioners, patients and others who use and might profit from access to scientific knowledge.

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## Appendix A: Questionnaire

[Page 1]

**Research Project on New Online Media in Science Communication**
This survey of scientists aims at a better understanding of the role of new online media – such as blogs or social networks – in the public communication of science in the United States, Germany, and Taiwan.

It is part of my Ph.D. thesis conducted in the context of research done at the Research Center Jülich and the Free University of Berlin, Germany, supervised by professor Dr. Hans Peter Peters.

For the survey, we have randomly selected researchers from several research fields who have recently published articles in international journals.

We kindly ask that you take about 15-20 minutes of your time to complete this questionnaire. The results will be published and will be used for scientific purposes only.

If you have any questions concerning the study, please contact me (y.lo@fz-juelich.de) or my supervisor Dr. Peters (h.p.peters@fz-juelich.de).

Thank you,
Yin-Yueh Lo, Ph.D. student

*Note:* If you need to interrupt your work on the survey, your responses up to that point will be saved. To return to where you have stopped, click on the survey link in the email you received.

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[Page 3]

**[Q01] Are you a scientist?**

O Yes, I am a scientist

O No, I am not currently (or no longer) working in science

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[Page 4]

**[Q02] In which country are you employed or doing research?**

O In the [United States / Germany / Taiwan]

O In another country

O In the [United States / Germany / Taiwan] and in another country

[Page 5]

**[Q03.x] Communicating as a scientist with the general public can take various forms. Approximately how often have you been involved in the following activities in the past 12 months?**

| | In the past 12 months… | | | |
|---|---|---|---|---|
| | Never | 1-5 times | 6-10 times | More than 10 times |
| [.1] Talked to a journalist from a newspaper, magazine, online news provider, radio or TV channel, or participated as an expert in a radio or TV program | O | O | O | O |
| [.2] Wrote an article about my field of expertise for a newspaper, magazine, or online news provider as an invited guest author | O | O | O | O |
| [.3] Cooperated with a public information officer from my university or another institution to prepare a press release or participate in a press conference | O | O | O | O |
| [.4] Wrote, edited, or translated a book or brochure about a scientific topic for the general public | O | O | O | O |
| [.5] Contributed to a Wikipedia article or another online encyclopedia for the general public | O | O | O | O |
| [.6] Uploaded a video, picture, or audio file related to my work to YouTube or another video-, picture-, or podcast-sharing website for public use | O | O | O | O |
| [.7] Put information related to my research or professional expertise on a website, blog, or social network site aimed at the general public | O | O | O | O |
| [.8] Participated actively in an event for the general public such as a talk, panel discussion, science exhibition, science festival, or science café | O | O | O | O |

[Page 6]

**[Q04] There are several ways in which scientists can communicate with the public. Which of the following do you personally prefer?**

O Talking to journalists from the media who report on science

O Writing myself for websites, blogs, or social networks or producing my own podcasts and videos

O Interacting face-to-face with the members of the public

O Other ways (please specify): ______________________________

O Personally, I am not interested in communicating with the public

[Page 7]

**[Q05] Are you a member of a social online network such as Facebook, Google+, Twitter, ResearchGate, or LinkedIn?**

O Yes

O No

[Page 8]

**[Q06.x] How often do you use social networks for the following purposes?**

| I use social networks . . . | Never | Occasionally | Frequently |
|---|---|---|---|
| [.1] for private purposes, to stay in contact with my friends and relatives | O | O | O |
| [.2] to keep myself informed about general political, cultural, and other public issues | O | O | O |
| [.3] to keep myself informed about public issues related to science or my area of expertise | O | O | O |
| [.4] to communicate professionally with other scientists | O | O | O |
| [.5] to communicate professionally with college/university students | O | O | O |
| [.6] to communicate about my research or area of expertise with interested laypeople | O | O | O |

[Page 9]

**[Q07] Do you have a personal website (other than blog) where you provide information about your research or your area of expertise?**

O Yes

O No

[Page 10]

**[Q08] Which groups of users are targeted by the information on your website?**

O Mainly scientists or college/university students

O Mainly people who are not scientists or college/university students

O Both scientists or students and people who are not scientists or students

[Page 11]

**[Q09] Active blogging: Do you occasionally or frequently <u>write</u> blog posts or comment on blog posts by other people?**

O Yes

O No

**[Q10] Passive blog use: Do you regularly <u>read</u> online blogs?**

O Yes

O No

[Page 12]

**[Q11.x] How often do you use blogs for the following purposes?**

| I use blogs . . . | Never | Occasionally | Frequently |
|---|---|---|---|
| [.1] for private purposes, to stay in contact with my friends and relatives | O | O | O |
| [.2] to keep myself informed about general political, cultural, and other public issues | O | O | O |
| [.3] to keep myself informed about public issues related to science or my area of expertise | O | O | O |
| [.4] to communicate professionally with other scientists | O | O | O |
| [.5] to communicate professionally with college/university students | O | O | O |
| [.6] to communicate about my research or area of expertise with interested laypeople | O | O | O |

[Page 13]

**[Q12] The following questions specifically concern blogging by scientists on topics related to science in a broader sense – including research, scientific knowledge and its applications, the culture of science, the relationship of science with politics, industry, or the public, and the funding and regulation of science.**

**Regardless of whether you yourself blog or not, how important to you personally are the following possible outcomes that make scientists feel more positive about blogging.**

| | To me, this outcome is . . . | | | |
|---|---|---|---|---|
| | Not important | Slightly important | Moderately important | Very important |
| [.01] Blogging enables scientists to avoid journalists who often provide inaccurate and biased information about science or neglect scientific topics completely. | O | O | O | O |
| [.02] Blogging increases scientists' visibility within the scientific community. | O | O | O | O |
| [.03] Blogging gives scientists a voice in debates on science & technology. | O | O | O | O |
| [.04] Blogging increases the scientific impact of scholarly publications. | O | O | O | O |
| [.05] Blogging helps scientists to develop communication skills. | O | O | O | O |
| [.06] Blogging increases scientists' visibility for sponsors and funding bodies. | O | O | O | O |
| [.07] Blogging invites the public to take a more active role in science & technology. | O | O | O | O |
| [.08] Blogging provides first-hand expertise to people seeking advice from science. | O | O | O | O |
| [.09] Scientists must not leave the blogosphere to self-appointed "experts" and pseudo-scientists. | O | O | O | O |
| [.10] Blogging is fun. | O | O | O | O |
| [.11] Blogging is less restrictive than publishing in scientific journals when it comes to expressing one's opinions. | O | O | O | O |

[.12] Other ____________________________

[Page 14]

**[Q13] How important to you personally are the following concerns that increase scientists' reluctance to blog.**

| | To me, this concern is . . . | | | |
|---|---|---|---|---|
| | Not important | Slightly important | Moderately important | Very important |
| [.1] Ideas may get scooped by colleagues. | O | O | O | O |
| [.2] Blogging wastes time that would better be used for research. | O | O | O | O |
| [.3] Scientists lack the skills required to blog. | O | O | O | O |
| [.4] Blogging is not a serious form of communication for scientists. | O | O | O | O |
| [.5] Blogging may cause trouble with colleagues, management, or funders. | O | O | O | O |

[.6] Other ______________________________

[Page 15]

**[B01.x] In the following, we ask you to share some information about how you use blogs on topics that are related to science in some way or another.**

**A few words to clarify the terminology used in this questionnaire:**

**When using the term "blog", we do NOT mean to include so-called microblogs (e.g. Twitter), social networks (e.g. Facebook), or personal websites.**

**A blog is usually composed of a number of threads, each one consisting of an initiating "post" followed by "comments" in response to the post or to other comments.**

**With "blogging" we mean publishing blog posts and comments.**

**Where do you usually publish your blog posts related to science? Please indicate for each option whether this applies to your blogging or not.**

| | No | Yes |
|---|---|---|
| [.1] I post on my own blog | O | O |
| [.2] I post on a blog that I share with other people | O | O |
| [.3] On invitation, I post on a blog owned by others | O | O |

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[Page 16]

**Please enter the URL(s) of your blogs owned by yourself and the URL(s) of the blogs where you sometimes post but which are owned by other people or institutions.**
**In order to secure the anonymity of your responses, the URL(s) you provide here will be stored independently from the answers to the previous questions.**

______________________________________________

______________________________________________

______________________________________________

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[Page 17]

**[B02] Do you usually post under your real name or under a pseudonym?**

O Usually, I post under my real name

O Usually, I post under a pseudonym

O It depends: I do both

**[B03] What blogging platform do you use (e.g. WordPress, Tumblr, or Blogger)?**

__________________________________

**[B04] Does the blog that you mostly use belong to a blog network (e.g. SciLogs, ScienceBlog, PanSci.tw, AAAS, NYTimes, National Geographic)?**

O No

O Yes; please specify which network: _________________________________

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[Page 18]

**[B05] How often do you typically post new material related to science on blogs?**

O Several times a day

O About once a day

O 3-5 days a week

O 1-2 days a week

O Every few weeks

O Less often

**[B06] How much time do you spend blogging in a typical week (please estimate)?**

About ___ hours per week

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[Page 19]

**[B07.x] Blogs can deal with different aspects of science. Please indicate how often your blog posts deal with topics in each of the following content areas.**

| | Never | Rarely | Sometimes | Often |
|---|---|---|---|---|
| **[.1] Research and outcomes:** Research results, discoveries, experiments, applications, and methods | O | O | O | O |
| **[.2] Reflections on academic culture and practices:** Issues in science regarding the publication system, careers, or research ethics, for example | O | O | O | O |
| **[.3] Reflections on science and society:** Issues such as science policy, funding, public acceptance, public communication, or pseudoscience | O | O | O | O |
| **[.4] Comments about public issues:** Scientific viewpoints on health, environment, risks, and other public issues | O | O | O | O |
| **[.5] Consulting:** Advice and tips for colleagues, students, policy-makers, patients, or the public | O | O | O | O |
| **[.6] Reviews and references:** Information on and discussion of events or publications within and outside of science | O | O | O | O |

[Page 20]

**[B08] Do you blog about your own research?**

O Yes, often

O Yes, sometimes

O Yes, rarely

O Never

**[B09] Please list the most important themes or titles of your blog posts in the last 12 months (keywords):**

[.1] 1st theme: ________________________

[.2] 2nd theme: ________________________

[.3] 3rd theme: ________________________

[.4] 4th theme: ________________________

[.5] 5th theme: ________________________

[Page 21]

**[B10.x] Blog posts can be written with different groups of readers in mind. Which priority do you assign the following groups as possible audiences of your blog posts?**

| | Low priority | Medium priority | High priority |
|---|---|---|---|
| [.01] Colleagues in your own specific field | O | O | O |
| [.02] Scientists in other research fields | O | O | O |
| [.03] Amateur scientists | O | O | O |
| [.04] College/university students | O | O | O |
| [.05] Science managers and science administrators | O | O | O |
| [.06] Members of the general public | O | O | O |
| [.07] Teachers and pupils | O | O | O |
| [.08] Patients and their family members | O | O | O |
| [.09] Journalists | O | O | O |
| [.10] Practitioners using scientific knowledge | O | O | O |
| [.11] Business people | O | O | O |
| [.12] Public administrators and politicians | O | O | O |
| [.13] Members of NGOs (e.g. environmentalists) | O | O | O |

[.14] Other groups (please specify): ________________________

[Page 22]

**[B11] On average, how many comments do you get when you publish a blog post?**

O None
O 1-5
O 6-10
O 11-25
O More than 25

[Page 23]

**[B12.x] As far as you can infer from the content of the comments – from which groups of readers do most comments come (select up to 5)?**

[.01]☐ Colleagues in <u>your own specific field</u>

[.02]☐ Scientists in <u>other research fields</u>

[.03]☐ Amateur scientists

[.04]☐ College/university students

[.05]☐ Science managers and science administrators

[.06]☐ Members of the general public

[.07]☐ Teachers and pupils

[.08]☐ Patients and their family members

[.09]☐ Journalists

[.10]☐ Practitioners using scientific knowledge

[.11]☐ Business people

[.12]☐ Public administrators and politicians

[.13]☐ Members of NGOs (e.g. environmentalists)

[.14]☐ Other group (please specify): ________________________

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[Page 24]

**[B13] Are the comments you receive mostly positive or critical towards your posts?**

O Mostly positive

O Mostly critical

O About equally positive and critical

O Mostly neutral

**[B14] How often do you respond to readers' comments on your own blog posts related to science?**

O Rarely

O Sometimes

O Frequently

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[Page 25]

**[B15] Do you comment on posts related to science that other people have published?**

O Yes

O No

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[Page 26]

**[B16] How often do you comment on posts related to science that other people have?**

O Rarely

O Sometimes

O Frequently

**[B17.x] What are the reasons for you to comment on other peoples' posts related to science?**

**Please tick the reasons most important to you (select up to 3):**

[.1]☐ To correct errors or clarify ambiguities

[.2]☐ To add relevant information or viewpoints

[.3]☐ To agree or praise

[.4]☐ To disagree or criticize

[.5]☐ To demand something

[.6]☐ To raise a question

[.7]☐ To give an answer or provide advice

[.8]☐ Other reason (please specify): ______________________

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[Page 27]

**[B18] Has your blogging had an influence on your scientific work – e.g. regarding publications, resources, contacts, criticism and ideas? If yes, how strong was that influence?**

O No, my blogging has had <u>no influence</u> on my scientific work so far

O Yes, my blogging has had <u>a minor influence</u>

O Yes, my blogging has had <u>some influence</u>

O Yes, my blogging has had <u>a strong influence</u>

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[Page 28]

**[B19] Has your blogging affected your scientific work in a positive or negative way?**

O Mostly positive

O Mostly negative

O Partly positive, partly negative

**[B20] Please describe in your own words how your blogging has influenced your scientific work:**

____________________________________________________

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[Page 29]

**[Q14] How do scientists in your research field feel about colleagues who regularly blog about their research or expertise? Are scientists mostly positive or critical towards blogging colleagues, or do they not care?**

O Mostly positive

O Mostly critical

O Partly positive, partly critical

O Mostly they don’t care

O Don't know

**[Q15] How many colleagues in your research field do you know who regularly blog?**

O None

O Some colleagues do so

O Many colleagues do so

O Almost all colleagues do so

O Don't know

[Page 30]

**[Q16.x] People differ in their expectations of how scientists should communicate with the general public. Please indicate your agreement or disagreement with the following statements.**

| When communicating with the public, scientists should . . . | Strongly disagree -2 | -1 | 0 | +1 | Strongly agree +2 | Don't know |
|---|---|---|---|---|---|---|
| [.1] simplify even at the expense of scientific accuracy | O | O | O | O | O | O |
| [.2] relate their research to the everyday experience of the public | O | O | O | O | O | O |
| [.3] use their expertise to criticize political, economic, and other decisions affecting society or make practical suggestions for action | O | O | O | O | O | O |
| [.4] put an emphasis on the practical uses of research rather than on the research itself | O | O | O | O | O | O |
| [.5] communicate their results and expertise in an entertaining manner | O | O | O | O | O | O |
| [.6] use catchy phrases that attract public attention | O | O | O | O | O | O |
| [.7] be prepared to focus on their own role as researchers and to provide personal views | O | O | O | O | O | O |
| [.8] speak openly about problems, such as misconduct on the part of researchers or controversial research practices | O | O | O | O | O | O |
| [.9] talk about current research that has not yet appeared in scientific publications | O | O | O | O | O | O |

[Page 31]

**[Q17.x] The following statements contain various positions that may have consequences on communication between science and the public. What is your opinion of each statement?**

| | Strongly disagree -2 | -1 | 0 | +1 | Strongly agree +2 | Don't know |
|---|---|---|---|---|---|---|
| [.01] Scientists and laypeople have different levels of knowledge, which makes a true dialog between them impossible. | O | O | O | O | O | O |
| [.02] Scientists should share internal differences of opinion with the general public. | O | O | O | O | O | O |
| [.03] Scientists should strategically frame their messages to guide the public's attitudes. | O | O | O | O | O | O |
| [.04] Editors of scientific journals should demand from authors that their articles are comprehensible to interested laypeople. | O | O | O | O | O | O |
| [.05] The public is not well educated enough to really understand scientific findings. | O | O | O | O | O | O |
| [.06] The public may lack scientific knowledge, but it possesses a lot of relevant common sense and good judgment. | O | O | O | O | O | O |
| [.07] The public is strongly interested in science. | O | O | O | O | O | O |
| [.08] The public should be discouraged from interfering with the regulation of scientific activities and applications. | O | O | O | O | O | O |
| [.09] Scientists should collaborate with non-scientists as “lay researchers” to make scientific knowledge more compatible with social expectations. | O | O | O | O | O | O |
| [.10] Public science communication should be done by specialized communication professionals, not by scientists themselves. | O | O | O | O | O | O |

[Page 32]

**[Q18] How would you describe the general position of the management of your university or research institution towards scientists blogging about their research or expertise?**

O Mostly encouraging

O Mostly cautioning

O Partly encouraging, partly cautioning

O Mostly neutral

O The management does not care

O Don't know

**[Q19] What about the policy of your university or research institution? Are there any regulations or guidelines for scientists blogging about their research or expertise?**

O Yes, there are binding regulations

O Yes, there are recommended guidelines

O No, there are neither regulations nor guidelines

O Don't know

[Page 33]

**[Q20] Does your university or research institution offer scientists training courses for better communication with the public?**

O Yes

O No

O Don't know

[Page 34]

**[Q21] Do these offers include specific courses for blogging or specific modules for blogging as part of more general communication training?**

O Yes, specific courses or modules for blogging

O No, no specific courses or modules for blogging

O Don't know

[Page 35]

**[Q22] Have you yourself ever had any training in communicating with people outside science, regardless of whether this training focused on traditional media, new media, or face-to-face communication?**

O Yes

O No

[Page 36]

**[Q23.x] Decisions about research and scientific publishing are sometimes influenced by factors outside science, such as the availability of funding, the institution's research agenda, or the applicability of results.**

**Other factors could be the intention to raise the interest of the public for one's research or to avoid negative publicity.**

**To what extent do you find it justified or not justified for scientists to take the public response into account when making the following decisions?**

| | Considering possible public response in that decision is... | | | |
|---|---|---|---|---|
| | Never justified | Justified in some situations | Always justified | Don't know |
| [.1] Speeding up or delaying a scientific publication | O | O | O | O |
| [.2] Presenting or not presenting a paper at a scientific conference | O | O | O | O |
| [.3] Emphasizing certain conclusions or interpretations in scientific publications or not mentioning them | O | O | O | O |
| [.4] Using or avoiding certain kinds of wording in scientific publications | O | O | O | O |
| [.5] Choosing or avoiding certain research questions | O | O | O | O |
| [.6] Choosing or avoiding certain research methods | O | O | O | O |
| [.7] Selecting or avoiding certain sources of funding | O | O | O | O |
| [.8] Choosing or avoiding certain collaborators | O | O | O | O |

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**[Q24] Some consider it a moral duty for scientists to communicate with the public; others prefer scientists to stay away from the public.**

**How do you feel about this? Which of the following statements comes closest to your personal opinion?**

- O Public communication is a moral duty for scientists
- O It is not a moral duty, but nevertheless a good thing for scientists to do
- O It is neither a moral duty nor a good thing to do

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[Page 38]

**[Q25] Which term best describes your current management role in your unit?**

- O Dean, head of institute, director, head of department, CEO, chair
- O Group leader, principal investigator
- O Other management position
- O No management position at this time

**[Q26] Do you hold a Ph.D. or doctoral degree?**

- O Yes
- O No

**[Q27] Are you a full professor or associate professor?**

- O Yes
- O No

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[Page 39]

**[Q28] Which term best describes your current career level?**

- O Junior
- O Mid-career
- O Senior

**[Q29] So far in your career, how many articles have you published in peer-reviewed scientific journals as author or coauthor?**

- O Fewer than 5 articles
- O 5–9 articles
- O 10-25 articles
- O 26-50 articles
- O 51-100 articles
- O More than 100 articles

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**[Q30] At which institution are you currently employed?**

**(If you have more than one contract or combined contracts, please name the institution providing the majority of your income. If you are retired, please name the institution where you most recently worked.)**

O University, college, or university hospital
O Hospital (other than university hospital)
O Public non-university research institution
O Private non-university research institution (other than private company)
O Private company or industry
O Government branch or agency
O Science academy
O Museum
O Other institution
O Self-employed
O No employment

[Page 41]

**[Q31] In which branch of science & technology are you working?**

O Life sciences
O Natural sciences (other than life sciences)
O Technology & engineering
O Others, please specify ___________________________________

**[Q32] What is the main focus of your research?**

O Basic research
O Applied research
O About equally basic and applied research
O Currently, I am not involved in research

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[Page 42]

**[Q33] In what year were you born?**

19 __

**[Q34] Are you...**

O Male

O Female

**[Q35] Are you a citizen of [Germany / the United States / Taiwan]?**

O Yes

O No

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**[Q36] Please use the space below to write any other comments you may have about the topics of the questionnaire.**

____________________________________________________________

____________________________________________________________

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[Page 43]

Thank you for taking the time to complete our questionnaire.

If you have any questions or comments or if you are interested in the results of the survey, please send a short email to:

sci-survey@fz-juelich.de

Thank you very much for your cooperation

Yin-Yueh Lo

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Thank you for your willingness to answer this questionnaire.

Your answers to the first question(s) show that you are not part of the target group of this survey. Therefore, you do not need to complete the questionnaire. We sincerely appreciate your cooperation, though.

If you have any questions or comments or if you are interested in the results of the survey, please send a short email to:

sci-survey@fz-juelich.de

Thank you for your cooperation

Yin-Yueh Lo

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**End of questionnaire**

Your answers have been saved. You may now close your browser window.

## Appendix B: Tables

## Q03 Use of different media

**Q03.1 Talked to a journalist from a newspaper, magazine, online news provider, radio or TV channel, or participated as an expert in a radio or TV program**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Never | 55.5 | 47.1 | 49.3 | 57.3 | 47.0 | 49.3 | 44.8 | 43.9 | 37.9 | 66.4 | 56.0 | 58.7 | 57.6 | 39.7 | 54.7 |
| 1-5 times | 38.3 | 41.9 | 38.2 | 36.8 | 41.7 | 37.9 | 47.1 | 41.7 | 43.7 | 29.4 | 38.0 | 34.9 | 36.4 | 47.6 | 34.0 |
| 6-10 times | 3.8 | 7.5 | 3.8 | 3.3 | 7.6 | 3.7 | 3.4 | 9.4 | 4.9 | 2.5 | 4.0 | 3.2 | 6.1 | 9.5 | 2.8 |
| More than 10 times | 2.4 | 3.5 | 8.7 | 2.5 | 3.6 | 9.2 | 4.6 | 5.0 | 13.6 | 1.7 | 2.0 | 3.2 | 0.0 | 3.2 | 8.5 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 239 | 302 | 272 | 239 | 302 | 272 | 87 | 139 | 103 | 119 | 100 | 63 | 33 | 63 | 106 |
| | Chi-2=19.9; df=6; p=0.003 | | | Chi-2=23.4; df=6; p=0.001 | | | Chi-2=11.6; df=6; p=0.071 | | | Chi-2=3.1; df=6; p=0.800 | | | Chi-2=11.6; df=6; p=0.072 | | |

**Q03.2 Wrote an article about my field of expertise for a newspaper, magazine or online news provider as an invited guest author**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Never | 59.0 | 67.5 | 49.8 | 60.7 | 68.0 | 48.9 | 58.6 | 67.9 | 48.0 | 64.7 | 79.0 | 54.0 | 51.5 | 50.8 | 46.7 |
| 1-5 times | 37.3 | 29.9 | 43.2 | 36.0 | 29.3 | 43.7 | 37.9 | 27.7 | 44.0 | 32.8 | 21.0 | 41.3 | 42.4 | 46.0 | 44.8 |
| 6-10 times | 2.6 | 1.0 | 3.9 | 2.1 | 1.0 | 4.1 | 1.1 | 1.5 | 2.0 | 1.7 | 0.0 | 4.8 | 6.1 | 1.6 | 5.7 |
| More than 10 times | 1.2 | 1.6 | 3.1 | 1.3 | 1.7 | 3.4 | 2.3 | 2.9 | 6.0 | 0.8 | 0.0 | 0.0 | 0.0 | 1.6 | 2.9 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 239 | 300 | 268 | 239 | 300 | 268 | 87 | 137 | 100 | 119 | 100 | 63 | 33 | 63 | 105 |
| | Chi-2=22.2; df=6; p=0.001 | | | Chi-2=25.8; df=6; p=0.000 | | | Chi-2=10.7; df=6; p=0.098 | | | Chi-2=15.7; df=6; p=0.016 | | | Chi-2=3.1; df=6; p=0.798 | | |

**Q03.3 Cooperated with a public information officer from my university or another institution to prepare a press release or participate in a press conference**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Never | 49.8 | 47.1 | 52.5 | 51.3 | 46.6 | 51.9 | 46.0 | 41.6 | 46.1 | 56.3 | 52.0 | 59.7 | 46.9 | 49.2 | 52.9 |
| 1-5 times | 45.3 | 46.2 | 39.3 | 43.7 | 46.6 | 39.9 | 48.3 | 51.8 | 43.1 | 38.7 | 39.8 | 33.9 | 50.0 | 46.0 | 40.4 |
| 6-10 times | 3.9 | 4.1 | 3.7 | 4.2 | 4.0 | 3.4 | 3.4 | 3.6 | 3.9 | 5.0 | 4.1 | 4.8 | 3.1 | 4.8 | 1.9 |
| More than 10 times | 0.9 | 2.6 | 4.5 | 0.8 | 2.7 | 4.9 | 2.3 | 2.9 | 6.9 | 0.0 | 4.1 | 1.6 | 0.0 | 0.0 | 4.8 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 238 | 298 | 268 | 238 | 298 | 268 | 87 | 137 | 102 | 119 | 98 | 62 | 32 | 63 | 104 |
| | Chi-2=8.6; df=6; p=0.194 | | | Chi-2=9.8; df=6; p=0.133 | | | Chi-2=4.4; df=6; p=0.619 | | | Chi-2=5.9; df=6; p=0.433 | | | Chi-2=6.5; df=6; p=0.373 | | |

**Q03.4 Wrote, edited, or translated a book or brochure about a scientific topic for the general public**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Never | 75.1 | 73.5 | 55.5 | 75.7 | 73.6 | 54.9 | 74.7 | 71.7 | 46.0 | 77.3 | 80.8 | 65.1 | 72.7 | 66.1 | 57.1 |
| 1-5 times | 23.2 | 24.5 | 40.1 | 22.6 | 24.4 | 40.7 | 21.8 | 26.1 | 48.0 | 21.8 | 18.2 | 31.7 | 27.3 | 30.6 | 39.0 |
| 6-10 times | 0.3 | 1.1 | 2.5 | 0.4 | 1.0 | 2.6 | 0.0 | 0.7 | 3.0 | 0.8 | 0.0 | 1.6 | 0.0 | 3.2 | 2.9 |
| More than 10 times | 1.4 | 0.9 | 2.0 | 1.3 | 1.0 | 1.9 | 3.4 | 1.4 | 3.0 | 0.0 | 1.0 | 1.6 | 0.0 | 0.0 | 1.0 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 239 | 299 | 268 | 239 | 299 | 268 | 87 | 138 | 100 | 119 | 99 | 63 | 33 | 62 | 105 |
| | Chi-2=31.2; df=6; p=0.000 | | | Chi-2=33.9; df=6; p=0.000 | | | Chi-2=25.2; df=6; p=0.000 | | | Chi-2=7.6; df=6; p=0.272 | | | Chi-2=4.5; df=6; p=0.613 | | |

**Q03.5 Contributed to a Wikipedia article or another online encyclopedia for the general public**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Never | 90.4 | 90.1 | 91.5 | 89.5 | 90.3 | 91.3 | 94.3 | 92.7 | 92.0 | 85.7 | 87.0 | 91.8 | 90.9 | 90.3 | 90.3 |
| 1-5 times | 9.3 | 9.2 | 5.7 | 10.0 | 9.0 | 6.1 | 5.7 | 6.6 | 5.0 | 13.4 | 12.0 | 4.9 | 9.1 | 9.7 | 7.8 |
| 6-10 times | 0.3 | 0.3 | 1.9 | 0.4 | 0.3 | 1.9 | 0.0 | 0.7 | 2.0 | 0.8 | 0.0 | 1.6 | 0.0 | 0.0 | 1.9 |
| More than 10 times | 0.0 | 0.4 | 1.1 | 0.0 | 0.3 | 0.8 | 0.0 | 0.0 | 1.0 | 0.0 | 1.0 | 1.6 | 0.0 | 0.0 | 0.0 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 239 | 299 | 264 | 239 | 299 | 264 | 87 | 137 | 100 | 119 | 100 | 61 | 33 | 62 | 103 |
| | Chi-2=11.0; df=6; p=0.090 | | | Chi-2=9.3; df=6; p=0.155 | | | Chi-2=4.6; df=6; p=0.593 | | | Chi-2=6.1; df=6; p=0.411 | | | Chi-2=2.0; df=4; p=0.732 | | |

**Q03.6 Uploaded a video, picture, or audio file related to my work to YouTube or another video-, picutre, or podcast-sharing website for public use**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Never | 86.6 | 77.0 | 76.3 | 87.0 | 77.3 | 74.9 | 89.7 | 79.0 | 70.6 | 86.6 | 78.8 | 85.5 | 81.8 | 71.4 | 72.8 |
| 1-5 times | 11.9 | 20.6 | 16.9 | 11.3 | 20.3 | 18.0 | 8.0 | 18.8 | 21.6 | 11.8 | 18.2 | 9.7 | 18.2 | 27.0 | 19.4 |
| 6-10 times | 1.5 | 0.6 | 2.5 | 1.7 | 0.7 | 2.6 | 2.3 | 0.7 | 2.9 | 1.7 | 1.0 | 1.6 | 0.0 | 0.0 | 2.9 |
| More than 10 times | 0.0 | 1.7 | 4.3 | 0.0 | 1.7 | 4.5 | 0.0 | 1.4 | 4.9 | 0.0 | 2.0 | 3.2 | 0.0 | 1.6 | 4.9 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 239 | 300 | 267 | 239 | 300 | 267 | 87 | 138 | 102 | 119 | 99 | 62 | 33 | 63 | 103 |
| | Chi-2=23.0; df=6; p=0.001 | | | Chi-2=25.2; df=6; p=0.000 | | | Chi-2=15.4; df=6; p=0.018 | | | Chi-2=6.5; df=6; p=0.371 | | | Chi-2=7.0; df=6; p=0.323 | | |

**Q03.7 Put information related to my research or professional expertise on a website, blog, or social network site aimed at the general public**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Never | 61.1 | 42.3 | 45.0 | 60.3 | 42.9 | 43.7 | 57.0 | 48.5 | 46.1 | 60.5 | 39.2 | 48.4 | 68.8 | 36.5 | 38.5 |
| 1-5 times | 32.8 | 41.9 | 38.6 | 33.3 | 41.9 | 40.7 | 34.9 | 41.2 | 42.2 | 33.6 | 43.3 | 29.0 | 28.1 | 41.3 | 46.2 |
| 6-10 times | 3.1 | 7.1 | 7.3 | 3.0 | 6.8 | 7.5 | 3.5 | 3.7 | 3.9 | 2.5 | 8.2 | 9.7 | 3.1 | 11.1 | 9.6 |
| More than 10 times | 3.1 | 8.7 | 9.1 | 3.4 | 8.4 | 8.2 | 4.7 | 6.6 | 7.8 | 3.4 | 9.3 | 12.9 | 0.0 | 11.1 | 5.8 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 237 | 296 | 268 | 237 | 296 | 268 | 86 | 136 | 102 | 119 | 97 | 62 | 32 | 63 | 104 |
| | Chi-2=26.3; df=6; p=0.000 | | | Chi-2=23.8; df=6; p=0.001 | | | Chi-2=2.7; df=6; p=0.845 | | | Chi-2=17.4; df=6; p=0.008 | | | Chi-2=13.8; df=6; p=0.032 | | |

## Q03 Use of different media (continued)

**Q03.8 Participated actively in an event for the general public such as a talk, panel discussion, science exhibition, science festival, or science café**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Never | 49.5 | 38.9 | 26.1 | 48.3 | 39.2 | 25.1 | 46.6 | 41.3 | 17.5 | 47.1 | 40.4 | 36.5 | 57.6 | 32.8 | 25.7 |
| 1-5 times | 41.3 | 47.4 | 55.7 | 42.9 | 47.2 | 57.6 | 42.0 | 44.9 | 60.2 | 46.2 | 49.5 | 46.0 | 33.3 | 48.4 | 61.9 |
| 6-10 times | 6.5 | 9.4 | 11.9 | 5.8 | 9.3 | 11.4 | 6.8 | 10.1 | 12.6 | 4.2 | 5.1 | 12.7 | 9.1 | 14.1 | 9.5 |
| More than 10 times | 2.7 | 4.4 | 6.3 | 2.9 | 4.3 | 5.9 | 4.5 | 3.6 | 9.7 | 2.5 | 5.1 | 4.8 | 0.0 | 4.7 | 2.9 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 240 | 301 | 271 | 240 | 301 | 271 | 88 | 138 | 103 | 119 | 99 | 63 | 33 | 64 | 105 |
| | Chi-2=31.8; df=6; p=0.000 | | | Chi-2=32.1; df=6; p=0.000 | | | Chi-2=23.5; df=6; p=0.001 | | | Chi-2=7.5; df=6; p=0.278 | | | Chi-2=14.4; df=6; p=0.025 | | |

## Q04 Communication preference

**Q04 Preference of communication ways**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Talking to journalists | 21.0 | 25.7 | 26.4 | 20.6 | 26.5 | 27.3 | 28.7 | 34.5 | 35.0 | 16.1 | 19.2 | 16.1 | 15.2 | 20.3 | 26.4 |
| Writing myself online | 10.8 | 17.5 | 17.1 | 12.2 | 16.9 | 17.3 | 12.6 | 11.5 | 11.7 | 14.4 | 19.2 | 21.0 | 3.0 | 25.0 | 20.8 |
| Face-to-face interaction | 49.1 | 45.9 | 34.7 | 48.3 | 45.7 | 32.8 | 43.7 | 42.4 | 35.0 | 49.2 | 51.5 | 40.3 | 57.6 | 43.8 | 26.4 |
| Other ways | 4.4 | 5.3 | 2.0 | 4.2 | 5.3 | 2.2 | 3.4 | 5.8 | 0.0 | 4.2 | 4.0 | 3.2 | 6.1 | 6.2 | 3.8 |
| No interest in communication | 14.8 | 5.6 | 19.8 | 14.7 | 5.6 | 20.3 | 11.5 | 5.8 | 18.4 | 16.1 | 6.1 | 19.4 | 18.2 | 4.7 | 22.6 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 238 | 302 | 271 | 238 | 302 | 271 | 87 | 139 | 103 | 118 | 99 | 62 | 33 | 64 | 106 |
| | Chi-2=40.2; df=8; p=0.000 | | | Chi-2=41.3; df=8; p=0.000 | | | Chi-2=16.2; df=8; p=0.039 | | | Chi-2=9.1; df=8; p=0.337 | | | Chi-2=23.8; df=8; p=0.003 | | |

## Q05 Membership of a social online network

**Q05 Membership of a social online network**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Yes | 70.1 | 80.1 | 76.9 | 68.8 | 79.5 | 77.9 | 70.5 | 77.0 | 77.7 | 65.5 | 75.0 | 73.0 | 75.8 | 92.2 | 81.1 |
| No | 29.9 | 19.9 | 23.1 | 31.2 | 20.5 | 22.1 | 29.5 | 23.0 | 22.3 | 34.5 | 25.0 | 27.0 | 24.2 | 7.8 | 18.9 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 240 | 303 | 272 | 240 | 303 | 272 | 88 | 139 | 103 | 119 | 100 | 63 | 33 | 64 | 106 |
| | Chi-2=7.5; df=2; p=0.023 | | | Chi-2=9.5; df=2; p=0.009 | | | Chi-2=1.6; df=2; p=0.442 | | | Chi-2=2.6; df=2; p=0.276 | | | Chi-2=5.4; df=2; p=0.066 | | |

## Q06 Purposes of using social online network

**Q06.1 Purposes of using social online network: for private purposes, to stay in contact with my friends and relatives**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Never | 29.9 | 16.7 | 5.6 | 30.3 | 17.2 | 5.2 | 38.7 | 21.7 | 3.8 | 26.9 | 14.7 | 8.7 | 20.0 | 12.3 | 4.7 |
| Occasionally | 42.1 | 50.1 | 46.9 | 38.2 | 50.0 | 47.2 | 40.3 | 50.0 | 50.0 | 29.5 | 48.0 | 43.5 | 60.0 | 52.6 | 46.5 |
| Frequently | 28.0 | 33.2 | 47.4 | 31.5 | 32.8 | 47.6 | 21.0 | 28.3 | 46.2 | 43.6 | 37.3 | 47.8 | 20.0 | 35.1 | 48.8 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 165 | 238 | 212 | 165 | 238 | 212 | 62 | 106 | 80 | 78 | 75 | 46 | 25 | 57 | 86 |
| | Chi-2=45.3; df=4; p=0.000 | | | Chi-2=47.3; df=4; p=0.000 | | | Chi-2=30.1; df=4; p=0.000 | | | Chi-2=10.4; df=4; p=0.034 | | | Chi-2=10.8; df=4; p=0.029 | | |

**Q06.2 Purposes of using social online network: to keep infomed about general political, cultural, and other public issues**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Never | 57.1 | 40.7 | 24.7 | 55.2 | 40.9 | 23.8 | 58.3 | 42.5 | 26.2 | 50.0 | 40.5 | 26.7 | 64.0 | 38.6 | 20.0 |
| Occasionally | 27.3 | 40.0 | 48.6 | 28.8 | 39.7 | 51.0 | 28.3 | 36.8 | 48.8 | 32.1 | 41.9 | 40.0 | 20.0 | 42.1 | 58.8 |
| Frequently | 15.6 | 19.3 | 26.7 | 16.0 | 19.4 | 25.2 | 13.3 | 20.8 | 25.0 | 17.9 | 17.6 | 33.3 | 16.0 | 19.3 | 21.2 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 163 | 237 | 210 | 163 | 237 | 210 | 60 | 106 | 80 | 78 | 74 | 45 | 25 | 57 | 85 |
| | Chi-2=40.9; df=4; p=0.000 | | | Chi-2=38.9; df=4; p=0.000 | | | Chi-2=14.9; df=4; p=0.005 | | | Chi-2=8.8; df=4; p=0.066 | | | Chi-2=19.1; df=4; p=0.001 | | |

**Q06.3 Purposes of using social online network: to keep informed about public issues related to science or own area of expertise**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Never | 38.9 | 36.6 | 17.8 | 39.8 | 36.6 | 17.6 | 37.9 | 34.6 | 13.8 | 42.3 | 41.9 | 21.7 | 36.0 | 33.3 | 19.0 |
| Occasionally | 48.0 | 47.1 | 57.3 | 47.2 | 47.5 | 58.1 | 51.7 | 52.3 | 60.0 | 43.6 | 40.5 | 52.2 | 48.0 | 47.4 | 59.5 |
| Frequently | 13.2 | 16.3 | 25.0 | 13.0 | 16.0 | 24.3 | 10.3 | 13.1 | 26.2 | 14.1 | 17.6 | 26.1 | 16.0 | 19.3 | 21.4 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 161 | 238 | 210 | 161 | 238 | 210 | 58 | 107 | 80 | 78 | 74 | 46 | 25 | 57 | 84 |
| | Chi-2=28.0; df=4; p=0.000 | | | Chi-2=29.0; df=4; p=0.000 | | | Chi-2=16.5; df=4; p=0.002 | | | Chi-2=7.1; df=4; p=0.130 | | | Chi-2=5.0; df=4; p=0.285 | | |

## Q06 Purposes of using social online network (continued)

**Q06.4 Purposes of using social online network: to communicate professionally with other scientists**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Never | 39.2 | 43.4 | 26.4 | 39.9 | 43.4 | 26.4 | 24.6 | 39.6 | 23.1 | 48.7 | 54.8 | 28.9 | 50.0 | 35.7 | 28.2 |
| Occasionally | 48.8 | 42.5 | 62.8 | 48.5 | 43.0 | 63.0 | 62.3 | 49.1 | 65.4 | 41.0 | 35.6 | 60.0 | 37.5 | 41.1 | 62.4 |
| Frequently | 12.0 | 14.1 | 10.8 | 11.7 | 13.6 | 10.6 | 13.1 | 11.3 | 11.5 | 10.3 | 9.6 | 11.1 | 12.5 | 23.2 | 9.4 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 163 | 235 | 208 | 163 | 235 | 208 | 61 | 106 | 78 | 78 | 73 | 45 | 24 | 56 | 85 |
| | Chi-2=19.3; df=4; p=0.001 | | | Chi-2=19.1; df=4; p=0.001 | | | Chi-2=7.5; df=4; p=0.112 | | | Chi-2=8.2; df=4; p=0.084 | | | Chi-2=11.2; df=4; p=0.024 | | |

**Q06.5 Purposes of using social online network: to communicate professionally with college/university students**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Never | 57.8 | 54.3 | 30.8 | 58.6 | 55.3 | 28.9 | 51.7 | 59.4 | 28.7 | 63.6 | 66.2 | 39.1 | 60.0 | 34.5 | 23.5 |
| Occasionally | 33.7 | 37.4 | 46.2 | 34.0 | 36.6 | 47.9 | 43.3 | 32.1 | 42.5 | 29.9 | 31.0 | 43.5 | 24.0 | 51.7 | 55.3 |
| Frequently | 8.5 | 8.2 | 23.0 | 7.4 | 8.1 | 23.2 | 5.0 | 8.5 | 28.7 | 6.5 | 2.8 | 17.4 | 16.0 | 13.8 | 21.2 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 162 | 235 | 211 | 162 | 235 | 211 | 60 | 106 | 80 | 77 | 71 | 46 | 25 | 58 | 85 |
| | Chi-2=44.6; df=4; p=0.000 | | | Chi-2=53.2; df=4; p=0.000 | | | Chi-2=29.0; df=4; p=0.000 | | | Chi-2=13.7; df=4; p=0.008 | | | Chi-2=13.0; df=4; p=0.011 | | |

**Q06.6 Purposes of using social online network: to communicate with interested laypeople**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Never | 63.9 | 52.7 | 43.7 | 64.2 | 53.2 | 43.1 | 66.7 | 54.7 | 46.2 | 63.6 | 59.7 | 43.5 | 60.0 | 42.1 | 40.0 |
| Occasionally | 33.5 | 40.5 | 47.2 | 32.7 | 40.4 | 47.9 | 30.0 | 40.6 | 41.2 | 32.5 | 38.9 | 50.0 | 40.0 | 42.1 | 52.9 |
| Frequently | 2.6 | 6.8 | 9.1 | 3.1 | 6.4 | 9.0 | 3.3 | 4.7 | 12.5 | 3.9 | 1.4 | 6.5 | 0.0 | 15.8 | 7.1 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 162 | 235 | 211 | 162 | 235 | 211 | 60 | 106 | 80 | 77 | 72 | 46 | 25 | 57 | 85 |
| | Chi-2=17.4; df=4; p=0.002 | | | Chi-2=17.9; df=4; p=0.001 | | | Chi-2=9.5; df=4; p=0.050 | | | Chi-2=6.5; df=4; p=0.164 | | | Chi-2=8.5; df=4; p=0.074 | | |

## Q07-Q08 Personal website

**Q07 Ownership of a personal website**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Yes | 38.9 | 56.9 | 47.7 | 40.8 | 55.4 | 47.1 | 29.5 | 41.7 | 33.0 | 49.6 | 64.0 | 61.9 | 39.4 | 71.9 | 51.9 |
| No | 61.1 | 43.1 | 52.3 | 59.2 | 44.6 | 52.9 | 70.5 | 58.3 | 67.0 | 50.4 | 38.0 | 38.1 | 60.6 | 28.1 | 48.1 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 240 | 303 | 272 | 240 | 303 | 272 | 88 | 139 | 103 | 119 | 100 | 63 | 33 | 64 | 106 |
| | Chi-2=17.5; df=2; p=0.003 | | | Chi-2=11.7; df=2; p=0.003 | | | Chi-2=4.0; df=2; p=0.137 | | | Chi-2=5.3; df=2; p=0.071 | | | Chi-2=11.0; df=2; p=0.004 | | |

**Q08 Target groups of personal websites**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Mainly scientists or students | 72.2 | 71.0 | 73.1 | 73.5 | 70.2 | 72.2 | 57.7 | 58.6 | 64.7 | 79.7 | 78.1 | 78.9 | 76.9 | 73.9 | 72.2 |
| Mainly the public | 0.0 | 3.3 | 4.5 | 0.0 | 3.6 | 4.0 | 0.0 | 6.9 | 5.9 | 0.0 | 1.6 | 5.3 | 0.0 | 2.2 | 1.9 |
| Both scientists and the public | 27.8 | 25.6 | 22.4 | 26.5 | 26.2 | 23.8 | 42.3 | 34.6 | 29.4 | 20.3 | 20.3 | 15.8 | 23.1 | 23.9 | 25.9 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 98 | 168 | 127 | 98 | 168 | 126 | 26 | 58 | 34 | 59 | 64 | 38 | 13 | 46 | 54 |
| | Chi-2=4.6; df=4; p=0.327 | | | Chi-2=4.0; df=4; p=0.404 | | | Chi-2=2.6; df=4; p=0.625 | | | Chi-2=3.8; df=4; p=0.433 | | | Chi-2=0.4; df=4; p=0.985 | | |

## Q09-Q10 Active and passive blogging

**Q09 Active blogging**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Yes | 6.3 | 10.0 | 7.3 | 7.1 | 9.6 | 7.0 | 5.7 | 7.2 | 9.7 | 9.2 | 8.0 | 6.3 | 3.0 | 17.2 | 4.7 |
| No | 93.7 | 90.0 | 92.7 | 92.9 | 90.4 | 93.0 | 94.3 | 92.8 | 90.3 | 90.8 | 92.0 | 93.7 | 97.0 | 82.8 | 95.3 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 240 | 303 | 272 | 240 | 303 | 272 | 88 | 139 | 103 | 119 | 100 | 63 | 33 | 64 | 106 |
| | Chi-2=2.8; df=2; p=0.251 | | | Chi-2=1.7; df=2; p=0.433 | | | Chi-2=1.1; df=2; p=0.563 | | | Chi-2=0.5; df=2; p=0.792 | | | Chi-2=9.6; df=2; p=0.008 | | |

**Q10 Passive blogging**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Yes | 21.3 | 33.0 | 31.7 | 23.3 | 32.3 | 34.6 | 14.8 | 27.3 | 34.0 | 31.1 | 34.0 | 20.6 | 18.2 | 40.6 | 43.4 |
| No | 78.7 | 67.0 | 68.3 | 76.7 | 67.7 | 65.4 | 85.2 | 72.7 | 66.0 | 68.9 | 66.0 | 79.4 | 81.8 | 59.4 | 56.6 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 240 | 303 | 272 | 240 | 303 | 272 | 88 | 139 | 133 | 119 | 100 | 63 | 33 | 64 | 106 |
| | Chi-2=10.2; df=2; p=0.006 | | | Chi-2=8.4; df=2; p=0.015 | | | Chi-2=9.3; df=2; p=0.010 | | | Chi-2=3.5; df=2; p=0.177 | | | Chi-2=7.0; df=2; p=0.031 | | |

## Q11 Purposes of blogging

**Q11.1 Purpose of blogging: for private purposes, to stay in contact with my friends and relatives**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Never | 64.2 | 58.5 | 31.4 | 59.3 | 59.4 | 33.7 | 57.1 | 65.9 | 29.7 | 53.8 | 63.9 | 21.4 | 100.0 | 44.8 | 40.4 |
| Occasionally | 27.0 | 35.6 | 51.4 | 32.2 | 34.9 | 49.0 | 21.4 | 29.3 | 51.4 | 41.0 | 33.3 | 64.3 | 0 | 44.8 | 42.6 |
| Frequently | 8.8 | 5.9 | 17.2 | 8.5 | 5.7 | 17.3 | 21.4 | 4.9 | 18.9 | 5.1 | 2.8 | 14.3 | 0 | 10.3 | 17.0 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 59 | 106 | 98 | 59 | 106 | 98 | 14 | 41 | 37 | 39 | 36 | 14 | 6 | 29 | 47 |
| | Chi-2=22.0; df=4; p=0.000 | | | Chi-2=18.6; df=4; p=0.001 | | | Chi-2=12.7; df=4; p=0.013 | | | Chi-2=8.2; df=4; p=0.085 | | | Chi-2=8.2; df=4; p=0.085 | | |

**Q11.2 Purpose of blogging: to keep informed about general political, cultural and other public issues**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Never | 21.4 | 9.9 | 26.4 | 23.7 | 10.3 | 25.8 | 30.8 | 12.2 | 27.0 | 25.0 | 13.5 | 28.6 | 0.0 | 3.4 | 23.9 |
| Occasionally | 51.1 | 56.1 | 59.6 | 49.2 | 56.1 | 58.8 | 46.2 | 58.5 | 59.5 | 47.5 | 48.6 | 64.3 | 66.7 | 62.1 | 56.5 |
| Frequently | 27.5 | 33.9 | 14.0 | 27.1 | 33.6 | 15.5 | 23.1 | 29.3 | 13.5 | 27.5 | 37.8 | 7.1 | 33.3 | 34.5 | 19.6 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 59 | 107 | 97 | 59 | 107 | 97 | 13 | 41 | 37 | 40 | 37 | 14 | 6 | 10 | 46 |
| | Chi-2=15.9; df=4; p=0.003 | | | Chi-2=14.6; df=4; p=0.006 | | | Chi-2=5.3; df=4; p=0.259 | | | Chi-2=5.7; df=4; p=0.224 | | | Chi-2=7.8; df=4; p=0.099 | | |

**Q11.3 Purpose of blogging: to keep informed about public issues related to science or own area of expertise**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Never | 27.1 | 16.6 | 21.3 | 29.8 | 17.0 | 21.9 | 18.2 | 20.0 | 24.3 | 35.0 | 18.9 | 14.3 | 16.7 | 10.3 | 22.2 |
| Occasionally | 46.4 | 55.0 | 63.2 | 43.9 | 54.7 | 62.5 | 63.6 | 52.5 | 59.5 | 37.5 | 54.1 | 71.4 | 50.0 | 58.6 | 62.2 |
| Frequently | 26.5 | 28.4 | 15.6 | 26.3 | 28.3 | 15.6 | 18.2 | 27.5 | 16.2 | 27.5 | 27.0 | 14.3 | 33.3 | 31.0 | 15.6 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 57 | 106 | 96 | 57 | 106 | 96 | 11 | 40 | 37 | 40 | 37 | 14 | 6 | 29 | 45 |
| | Chi-2=7.3; df=4; p=0.119 | | | Chi-2=8.9; df=4; p=0.064 | | | Chi-2=1.7; df=4; p=0.790 | | | Chi-2=6.2; df=4; p=0.183 | | | Chi-2=3.8; df=4; p=0.436 | | |

**Q11.4 Purpose of blogging: to communicate professionally with other scientists**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Never | 57.6 | 61.9 | 42.7 | 62.1 | 62.3 | 41.8 | 53.8 | 58.5 | 45.9 | 69.2 | 80.6 | 42.9 | 33.3 | 44.8 | 38.3 |
| Occasionally | 39.0 | 28.9 | 53.5 | 34.5 | 28.3 | 54.1 | 38.5 | 26.8 | 48.6 | 28.2 | 19.4 | 57.1 | 66.7 | 41.4 | 57.4 |
| Frequently | 3.4 | 9.3 | 3.8 | 3.4 | 9.4 | 4.1 | 7.7 | 14.6 | 5.4 | 2.6 | 0.0 | 0.0 | 0.0 | 13.8 | 4.3 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 58 | 106 | 98 | 58 | 106 | 98 | 13 | 41 | 37 | 39 | 36 | 14 | 6 | 29 | 47 |
| | Chi-2=14.2; df=4; p=0.007 | | | Chi-2=17.0; df=4; p=0.002 | | | Chi-2=4.8; df=4; p=0.306 | | | Chi-2=8.3; df=4; p=0.082 | | | Chi-2=4.1; df=4; p=0.392 | | |

**Q11.5 Purpose of blogging: to communicate professionally with college/university students**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Never | 75.7 | 72.8 | 41.1 | 78.0 | 73.6 | 39.6 | 69.2 | 75.6 | 40.0 | 82.5 | 86.1 | 50.0 | 66.7 | 55.2 | 36.2 |
| Occasionally | 21.7 | 19.8 | 52.4 | 18.6 | 18.9 | 53.1 | 30.8 | 12.2 | 51.4 | 12.5 | 13.9 | 50.0 | 33.3 | 34.5 | 55.3 |
| Frequently | 2.6 | 7.4 | 6.5 | 3.4 | 7.5 | 7.3 | 0.0 | 12.2 | 8.6 | 5.0 | 0.0 | 0.0 | 0.0 | 10.3 | 8.5 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 59 | 106 | 96 | 59 | 106 | 96 | 13 | 41 | 35 | 40 | 36 | 14 | 6 | 29 | 47 |
| | Chi-2=29.6; df=4; p=0.000 | | | Chi-2=36.4; df=4; p=0.000 | | | Chi-2=15.4; df=4; p=0.004 | | | Chi-2=12.8; df=4; p=0.012 | | | Chi-2=4.6; df=4; p=0.326 | | |

**Q11.6 Purpose of blogging: to communicate about own research or area of expertise with interested laypeople**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Never | 65.0 | 61.8 | 41.7 | 69.0 | 62.9 | 41.8 | 53.8 | 68.3 | 40.5 | 76.9 | 74.3 | 42.9 | 50.0 | 41.4 | 42.6 |
| Occasionally | 30.8 | 30.0 | 48.1 | 27.6 | 28.6 | 49.0 | 30.8 | 17.1 | 43.2 | 23.1 | 25.7 | 50.0 | 50.0 | 48.3 | 53.2 |
| Frequently | 4.2 | 8.2 | 10.2 | 3.4 | 8.6 | 9.2 | 15.4 | 14.6 | 16.2 | 0.0 | 0.0 | 7.1 | 0.0 | 10.3 | 4.3 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 58 | 105 | 98 | 58 | 105 | 98 | 13 | 41 | 37 | 39 | 35 | 14 | 6 | 29 | 47 |
| | Chi-2=11.2; df=4; p=0.024 | | | Chi-2=15.2; df=4; p=0.004 | | | Chi-2=7.3; df=4; p=0.123 | | | Chi-2=9.9; df=4; p=0.042 | | | Chi-2=1.7; df=4; p=0.798 | | |

## Q12 Possible outcomes of blogging

**Q12.01 Possible outcome: Blogging enalbes scientists to avoid journalists who often provide inaccurate and biased information about science or neglect scientific topics completely**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Not important | 35.4 | 37.2 | 21.6 | 32.6 | 37.2 | 22.3 | 36.5 | 35.8 | 23.3 | 25.9 | 43.0 | 17.7 | 46.9 | 31.1 | 24.0 |
| Slightly important | 32.6 | 30.8 | 35.1 | 34.3 | 31.2 | 34.6 | 38.8 | 35.8 | 33.0 | 35.3 | 26.0 | 38.7 | 18.8 | 29.5 | 33.7 |
| Moderately important | 19.5 | 24.5 | 33.2 | 19.3 | 24.2 | 32.7 | 11.8 | 21.2 | 34.0 | 22.4 | 25.0 | 33.9 | 28.1 | 29.5 | 30.8 |
| Very important | 12.5 | 7.5 | 10.1 | 13.7 | 7.4 | 10.4 | 12.9 | 7.3 | 9.7 | 16.4 | 6.0 | 9.7 | 6.2 | 9.8 | 11.5 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 233 | 298 | 269 | 233 | 298 | 269 | 85 | 137 | 103 | 116 | 100 | 62 | 32 | 61 | 104 |
| | Chi-2=26.1; df=6; p=0.000 | | | Chi-2=25.4; df=6; p=0.000 | | | Chi-2=16.1; df=6; p=0.013 | | | Chi-2=19.1; df=6; p=0.004 | | | Chi-2=6.9; df=6; p=0.333 | | |

**Q12.02 Possible outcome: Blogging increases scientists' visibility within the scientific community**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Not important | 38.7 | 29.8 | 20.8 | 38.1 | 30.1 | 20.7 | 37.2 | 32.1 | 21.4 | 37.6 | 30.3 | 21.0 | 42.4 | 25.0 | 19.8 |
| Slightly important | 35.8 | 38.2 | 35.1 | 37.3 | 38.5 | 34.3 | 41.9 | 42.3 | 41.7 | 37.6 | 34.3 | 32.3 | 24.2 | 36.7 | 28.3 |
| Moderately important | 19.6 | 25.3 | 36.8 | 18.6 | 25.0 | 37.6 | 16.3 | 21.9 | 29.1 | 17.9 | 28.3 | 40.3 | 27.3 | 26.7 | 44.3 |
| Very important | 5.8 | 6.8 | 7.3 | 5.9 | 6.4 | 7.4 | 4.7 | 3.6 | 7.8 | 6.8 | 7.1 | 6.5 | 6.1 | 11.7 | 7.5 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 235 | 299 | 270 | 236 | 296 | 271 | 86 | 137 | 103 | 117 | 99 | 62 | 33 | 60 | 106 |
| | Chi-2=28.8; df=6; p=0.000 | | | Chi-2=32.0; df=6; p=0.000 | | | Chi-2=9.7; df=6; p=0.137 | | | Chi-2=11.8; df=6; p=0.067 | | | Chi-2=11.7; df=6; p=0.069 | | |

**Q12.03 Possible outcome: Blogging gives scientists a voice in debates on science and technology**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Not important | 24.6 | 19.5 | 22.2 | 23.8 | 19.7 | 22.6 | 27.9 | 20.9 | 22.8 | 20.5 | 21.2 | 20.6 | 25.0 | 14.8 | 23.6 |
| Slightly important | 36.5 | 31.6 | 33.5 | 34.9 | 32.1 | 33.7 | 33.7 | 38.1 | 34.7 | 32.5 | 24.2 | 31.7 | 46.9 | 31.1 | 34.0 |
| Moderately important | 29.5 | 35.7 | 35.0 | 31.1 | 35.1 | 35.6 | 26.7 | 28.8 | 36.6 | 35.9 | 42.4 | 31.7 | 25.0 | 37.7 | 36.8 |
| Very important | 9.3 | 13.2 | 9.3 | 10.2 | 13.0 | 8.1 | 11.6 | 12.2 | 5.9 | 11.1 | 12.1 | 15.9 | 3.1 | 16.4 | 5.7 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 235 | 299 | 270 | 235 | 299 | 270 | 86 | 139 | 101 | 117 | 99 | 63 | 32 | 61 | 106 |
| | Chi-2=6.8; df=6; p=0.338 | | | Chi-2=5.6; df=6; p=0.474 | | | Chi-2=5.8; df=6; p=0.445 | | | Chi-2=3.4; df=6; p=0.751 | | | Chi-2=10.9; df=6; p=0.090 | | |

**Q12.04 Possible outcome: Blogging increases the scientific impact of scholarly publications**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Not important | 45.6 | 41.5 | 29.2 | 44.2 | 41.8 | 29.6 | 47.7 | 43.9 | 34.0 | 40.0 | 40.8 | 24.2 | 50.0 | 38.3 | 28.6 |
| Slightly important | 35.1 | 32.8 | 41.0 | 36.1 | 33.0 | 41.2 | 31.4 | 34.5 | 37.0 | 40.0 | 32.7 | 43.5 | 34.4 | 30.0 | 43.8 |
| Moderately important | 17.1 | 18.4 | 25.5 | 17.2 | 18.2 | 25.1 | 18.6 | 16.5 | 23.0 | 16.5 | 19.4 | 29.0 | 15.6 | 20.0 | 24.8 |
| Very important | 2.1 | 7.4 | 4.2 | 2.6 | 7.1 | 4.1 | 2.3 | 5.0 | 6.0 | 3.5 | 7.1 | 3.2 | 0.0 | 11.7 | 2.9 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 233 | 297 | 267 | 233 | 297 | 267 | 86 | 139 | 100 | 115 | 98 | 62 | 32 | 60 | 105 |
| | Chi-2=25.3; df=6; p=0.000 | | | Chi-2=21.6; df=6; p=0.001 | | | Chi-2=5.5; df=6; p=0.487 | | | Chi-2=9.8; df=6; p=0.132 | | | Chi-2=14.4; df=6; p=0.026 | | |

**Q12.05 Possible outcome: Blogging helps scientists to develop communication skills**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Not important | 40.4 | 28.7 | 24.4 | 39.1 | 29.2 | 25.1 | 44.2 | 32.8 | 26.5 | 34.5 | 27.6 | 20.6 | 42.4 | 23.3 | 26.4 |
| Slightly important | 32.8 | 34.7 | 41.0 | 33.6 | 34.2 | 39.9 | 31.4 | 31.4 | 35.3 | 36.2 | 33.7 | 49.2 | 30.3 | 41.7 | 38.7 |
| Moderately important | 23.5 | 28.2 | 27.8 | 23.0 | 28.1 | 28.4 | 22.1 | 26.3 | 30.4 | 22.4 | 32.7 | 23.8 | 27.3 | 25.0 | 29.2 |
| Very important | 3.3 | 8.4 | 6.8 | 4.3 | 8.5 | 6.6 | 2.3 | 9.5 | 7.8 | 6.9 | 6.1 | 6.3 | 0.0 | 10.0 | 5.7 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 235 | 295 | 271 | 235 | 295 | 271 | 86 | 137 | 102 | 116 | 98 | 63 | 33 | 60 | 106 |
| | Chi-2=20.5; df=6; p=0.002 | | | Chi-2=15.5; df=6; p=0.017 | | | Chi-2=9.9; df=6; p=0.129 | | | Chi-2=7.8; df=6; p=0.252 | | | Chi-2=7.6; df=6; p=0.272 | | |

**Q12.06 Possible outcome: Blogging increases scientists' visibility for sponsors and funding bodies**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Not important | 45.9 | 41.0 | 25.6 | 44.7 | 41.1 | 25.1 | 44.2 | 41.7 | 22.3 | 42.7 | 43.0 | 30.2 | 53.1 | 36.7 | 24.8 |
| Slightly important | 33.3 | 34.9 | 39.9 | 35.7 | 35.1 | 39.5 | 33.7 | 36.7 | 39.8 | 41.0 | 35.0 | 41.3 | 21.9 | 31.7 | 38.1 |
| Moderately important | 17.6 | 20.6 | 26.8 | 16.2 | 20.1 | 28.4 | 19.8 | 16.5 | 30.1 | 12.0 | 20.0 | 19.0 | 21.9 | 28.3 | 32.4 |
| Very important | 3.2 | 3.6 | 7.6 | 3.4 | 3.7 | 7.0 | 2.3 | 5.0 | 7.8 | 4.3 | 2.0 | 9.5 | 3.1 | 3.3 | 4.8 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 235 | 299 | 271 | 235 | 299 | 271 | 86 | 139 | 103 | 117 | 100 | 63 | 32 | 60 | 105 |
| | Chi-2=29.3; df=6; p=0.000 | | | Chi-2=30.3; df=6; p=0.000 | | | Chi-2=16.5; df=6; p=0.011 | | | Chi-2=9.8; df=6; p=0.133 | | | Chi-2=9.6; df=6; p=0.144 | | |

**Q12.07 Possible outcome: Blogging invites the public to take a more active role in science and technology**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Not important | 26.2 | 20.5 | 19.3 | 25.6 | 20.2 | 20.5 | 26.7 | 17.5 | 18.6 | 24.1 | 22.2 | 16.1 | 28.1 | 23.0 | 25.0 |
| Slightly important | 38.8 | 31.1 | 38.5 | 36.8 | 31.3 | 39.2 | 37.2 | 32.8 | 41.2 | 32.8 | 30.3 | 33.9 | 50.0 | 29.5 | 40.4 |
| Moderately important | 28.3 | 35.2 | 34.6 | 30.8 | 35.4 | 33.6 | 32.6 | 36.5 | 31.4 | 34.5 | 36.4 | 40.3 | 12.5 | 31.1 | 31.7 |
| Very important | 6.7 | 13.2 | 7.6 | 6.8 | 13.1 | 6.7 | 3.5 | 13.1 | 8.8 | 8.6 | 11.1 | 9.7 | 9.4 | 16.4 | 2.9 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 234 | 297 | 268 | 234 | 297 | 268 | 86 | 137 | 102 | 116 | 99 | 62 | 32 | 61 | 104 |
| | Chi-2=15.4; df=6; p=0.017 | | | Chi-2=13.8; df=6; p=0.032 | | | Chi-2=9.4; df=6; p=0.152 | | | Chi-2=2.1; df=6; p=0.909 | | | Chi-2=14.8; df=6; p=0.022 | | |

## Q12 Possible outcomes of blogging (continued)

**Q12.08 Possible outcome: Blogging provides first-hand expertise to people seeking advice from science**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Not important | 31.7 | 23.9 | 23.1 | 30.5 | 24.4 | 23.0 | 32.2 | 29.0 | 24.5 | 27.6 | 21.2 | 22.2 | 36.4 | 19.4 | 21.9 |
| Slightly important | 36.6 | 38.7 | 37.1 | 36.4 | 38.8 | 37.0 | 43.7 | 38.4 | 36.3 | 32.8 | 41.4 | 38.1 | 30.3 | 35.5 | 37.1 |
| Moderately important | 24.5 | 29.8 | 31.0 | 25.4 | 29.1 | 32.2 | 20.7 | 23.2 | 29.4 | 29.3 | 32.3 | 28.6 | 24.2 | 37.1 | 37.1 |
| Very important | 7.2 | 7.6 | 8.8 | 7.6 | 7.7 | 7.8 | 3.4 | 9.4 | 9.8 | 10.3 | 5.1 | 11.1 | 9.1 | 8.1 | 3.8 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 236 | 299 | 270 | 236 | 299 | 270 | 87 | 138 | 102 | 116 | 99 | 63 | 33 | 62 | 105 |
| | Chi-2=7.0; df=6; p=0.319 | | | Chi-2=5.3; df=6; p=0.503 | | | Chi-2=6.3; df=6; p=0.386 | | | Chi-2=4.7; df=6; p=0.587 | | | Chi-2=6.3; df=6; p=0.387 | | |

**Q12.09 Possible outcome: Scientists must not leave the blogosphere to self-appointed "experts" and pseudo-scientists**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Not important | 32.9 | 21.4 | 26.8 | 30.2 | 21.1 | 26.4 | 31.4 | 18.7 | 24.3 | 24.8 | 21.0 | 30.2 | 46.9 | 26.7 | 26.2 |
| Slightly important | 19.3 | 23.5 | 39.5 | 20.0 | 23.4 | 40.1 | 23.3 | 23.7 | 42.7 | 19.7 | 21.0 | 34.9 | 12.5 | 26.7 | 40.8 |
| Moderately important | 26.6 | 33.1 | 22.4 | 27.7 | 33.1 | 22.7 | 26.7 | 32.4 | 19.4 | 29.9 | 36.0 | 23.8 | 21.9 | 30.0 | 25.2 |
| Very important | 21.1 | 22.0 | 11.3 | 22.1 | 22.4 | 10.8 | 18.6 | 25.2 | 13.6 | 25.6 | 22.0 | 11.1 | 18.8 | 16.7 | 7.8 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 235 | 299 | 269 | 235 | 299 | 269 | 86 | 139 | 103 | 117 | 100 | 63 | 32 | 60 | 103 |
| | Chi-2=44.6; df=6; p=0.000 | | | Chi-2=44.6; df=6; p=0.000 | | | Chi-2=20.2; df=6; p=0.003 | | | Chi-2=11.9; df=6; p=0.065 | | | Chi-2=15.0; df=6; p=0.021 | | |

**Q12.10 Possible outcome: Blogging is fun**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Not important | 57.0 | 48.1 | 30.1 | 55.4 | 48.5 | 29.9 | 65.1 | 50.0 | 28.3 | 47.8 | 51.0 | 32.3 | 56.2 | 40.7 | 30.1 |
| Slightly important | 21.3 | 29.9 | 38.6 | 22.7 | 30.2 | 37.9 | 17.4 | 33.1 | 37.4 | 27.8 | 28.1 | 41.9 | 18.8 | 27.1 | 35.9 |
| Moderately important | 15.6 | 16.5 | 24.6 | 15.9 | 16.2 | 25.4 | 8.1 | 14.0 | 26.3 | 20.0 | 14.6 | 21.0 | 21.9 | 23.7 | 27.2 |
| Very important | 6.1 | 5.4 | 6.6 | 6.0 | 5.2 | 6.8 | 9.3 | 2.9 | 8.1 | 4.3 | 6.2 | 4.8 | 3.1 | 8.5 | 6.8 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 233 | 291 | 264 | 233 | 291 | 264 | 86 | 136 | 99 | 115 | 96 | 62 | 32 | 59 | 103 |
| | Chi-2=40.5; df=6; p=0.000 | | | Chi-2=37.8; df=6; p=0.000 | | | Chi-2=34.5; df=6; p=0.000 | | | Chi-2=7.7; df=6; p=0.260 | | | Chi-2=8.6; df=6; p=0.200 | | |

**Q12.11 Possible outcome: Blogging is less restrictive than publishing in scientific journals when it comes to expressing one's opinions**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Not important | 32.2 | 33.4 | 21.0 | 30.9 | 33.6 | 21.2 | 29.9 | 36.7 | 22.5 | 29.1 | 26.5 | 19.4 | 40.6 | 37.7 | 21.0 |
| Slightly important | 30.8 | 28.1 | 32.9 | 29.2 | 28.2 | 32.7 | 37.9 | 27.3 | 30.4 | 22.2 | 33.7 | 35.5 | 31.2 | 21.3 | 33.3 |
| Moderately important | 24.8 | 28.2 | 33.9 | 28.0 | 28.2 | 33.8 | 25.3 | 28.1 | 36.3 | 35.0 | 27.6 | 32.3 | 9.4 | 29.5 | 32.4 |
| Very important | 12.2 | 10.3 | 12.2 | 11.9 | 10.1 | 12.3 | 6.9 | 7.9 | 10.8 | 13.7 | 12.2 | 12.9 | 18.8 | 11.5 | 13.3 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 236 | 298 | 269 | 236 | 298 | 269 | 87 | 139 | 102 | 117 | 98 | 62 | 32 | 61 | 105 |
| | Chi-2=14.2; df=6; p=0.028 | | | Chi-2=11.8; df=6; p=0.065 | | | Chi-2=8.9; df=6; p=0.177 | | | Chi-2=6.0; df=6; p=0.426 | | | Chi-2=12.9; df=6; p=0.044 | | |

## Q13 Concerns of blogging

**Q13.1 Concern: Ideas may get scooped by colleagues**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Not important | 33.0 | 37.8 | 17.0 | 31.5 | 37.7 | 16.2 | 24.7 | 35.6 | 7.8 | 31.9 | 41.4 | 27.0 | 48.4 | 36.5 | 17.9 |
| Slightly important | 27.9 | 33.0 | 38.8 | 28.4 | 33.0 | 39.1 | 34.1 | 31.9 | 44.1 | 26.7 | 36.4 | 33.3 | 19.4 | 30.2 | 37.7 |
| Moderately important | 30.4 | 20.2 | 34.0 | 31.0 | 20.2 | 34.3 | 31.8 | 21.5 | 33.3 | 31.9 | 16.2 | 33.3 | 25.8 | 23.8 | 35.8 |
| Very important | 8.7 | 9.0 | 10.2 | 9.1 | 9.1 | 10.3 | 9.4 | 11.1 | 14.7 | 9.5 | 6.1 | 6.3 | 6.5 | 9.5 | 8.5 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 232 | 297 | 271 | 232 | 297 | 271 | 85 | 135 | 102 | 116 | 99 | 63 | 31 | 63 | 106 |
| | Chi-2=37.6; df=6; p=0.000 | | | Chi-2=39.4; df=6; p=0.000 | | | Chi-2=26.0; df=6; p=0.000 | | | Chi-2=11.6; df=6; p=0.0071 | | | Chi-2=14.9; df=6; p=0.021 | | |

**Q13.2 Concern: Blogging wastes time that would better be used for research**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Not important | 20.8 | 20.6 | 11.7 | 18.3 | 20.6 | 12.9 | 18.6 | 21.0 | 11.8 | 13.7 | 19.0 | 7.9 | 34.4 | 22.2 | 17.0 |
| Slightly important | 19.6 | 25.0 | 32.1 | 19.6 | 25.2 | 32.1 | 14.0 | 28.3 | 32.4 | 22.2 | 21.0 | 31.7 | 25.0 | 25.4 | 32.1 |
| Moderately important | 29.0 | 33.1 | 36.4 | 30.6 | 32.9 | 36.2 | 38.4 | 31.9 | 39.2 | 29.9 | 32.0 | 34.9 | 12.5 | 36.5 | 34.0 |
| Very important | 30.6 | 21.3 | 19.8 | 31.5 | 21.3 | 18.8 | 29.1 | 18.8 | 16.7 | 34.2 | 28.0 | 25.4 | 28.1 | 15.9 | 17.0 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 235 | 301 | 271 | 235 | 301 | 271 | 86 | 138 | 102 | 117 | 100 | 63 | 32 | 63 | 106 |
| | Chi-2=25.2; df=6; p=0.000 | | | Chi-2=23.5; df=6; p=0.001 | | | Chi-2=14.6; df=6; p=0.023 | | | Chi-2=7.1; df=6; p=0.315 | | | Chi-2=10.7; df=6; p=0.099 | | |

**Q13.3 Concern: Scientists lack the skills required to blog**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Not important | 49.6 | 55.7 | 28.0 | 47.8 | 55.7 | 28.9 | 44.6 | 56.6 | 25.5 | 46.1 | 54.1 | 27.0 | 62.5 | 56.2 | 33.3 |
| Slightly important | 33.5 | 26.8 | 40.2 | 34.8 | 26.5 | 40.4 | 36.1 | 22.8 | 38.2 | 36.5 | 30.6 | 41.3 | 25.0 | 28.1 | 41.9 |
| Moderately important | 11.8 | 14.4 | 26.9 | 13.5 | 14.8 | 26.3 | 13.3 | 17.6 | 29.4 | 16.5 | 13.3 | 27.0 | 3.1 | 10.9 | 22.9 |
| Very important | 5.1 | 3.1 | 4.9 | 3.9 | 3.0 | 4.4 | 6.0 | 2.9 | 6.9 | 0.9 | 2.0 | 4.8 | 9.4 | 4.7 | 1.9 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 230 | 298 | 270 | 230 | 298 | 270 | 83 | 136 | 102 | 115 | 98 | 63 | 32 | 64 | 105 |
| | Chi-2=54.5; df=6; p=0.000 | | | Chi-2=47.3; df=6; p=0.000 | | | Chi-2=27.1; df=6; p=0.000 | | | Chi-2=14.8; df=6; p=0.022 | | | Chi-2=21.4; df=6; p=0.002 | | |

**Q13.4 Concern: Blogging is not a serious form of communication for scientists**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Not important | 24.9 | 24.2 | 10.7 | 23.6 | 24.2 | 11.5 | 21.8 | 20.6 | 6.8 | 22.2 | 34.7 | 11.3 | 33.3 | 15.6 | 16.2 |
| Slightly important | 22.2 | 32.0 | 35.8 | 21.1 | 32.6 | 35.2 | 21.8 | 39.7 | 35.0 | 18.8 | 22.4 | 38.7 | 27.3 | 32.8 | 33.3 |
| Moderately important | 24.1 | 25.5 | 36.5 | 25.7 | 25.2 | 37.4 | 32.2 | 22.8 | 41.7 | 25.6 | 25.5 | 29.0 | 9.1 | 29.7 | 38.1 |
| Very important | 28.9 | 18.3 | 17.0 | 29.5 | 18.1 | 15.9 | 24.1 | 16.9 | 16.5 | 33.3 | 17.3 | 21.0 | 30.3 | 21.9 | 12.4 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 237 | 298 | 270 | 237 | 298 | 270 | 87 | 136 | 103 | 117 | 98 | 62 | 33 | 64 | 105 |
| | Chi-2=44.0; df=6; p=0.000 | | | Chi-2=45.0; df=6; p=0.000 | | | Chi-2=22.5; df=6; p=0.001 | | | Chi-2=21.9; df=6; p=0.001 | | | Chi-2=16.7; df=6; p=0.010 | | |

**Q13.5 Concern: Blogging may cause trouble with colleagues, management, or funders**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Not important | 35.7 | 32.1 | 17.5 | 34.2 | 32.4 | 17.0 | 27.9 | 34.6 | 13.6 | 34.5 | 33.0 | 22.2 | 50.0 | 27.0 | 17.1 |
| Slightly important | 29.4 | 32.2 | 40.6 | 30.8 | 32.1 | 39.9 | 37.2 | 32.4 | 38.8 | 30.2 | 29.0 | 44.4 | 15.6 | 36.5 | 38.1 |
| Moderately important | 25.1 | 25.5 | 32.1 | 24.8 | 25.4 | 32.5 | 23.3 | 24.3 | 35.0 | 25.0 | 27.0 | 28.6 | 28.1 | 25.4 | 32.4 |
| Very important | 9.9 | 10.2 | 9.8 | 10.3 | 10.0 | 10.7 | 11.6 | 8.8 | 12.6 | 10.3 | 11.0 | 4.8 | 6.2 | 11.1 | 12.4 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 234 | 299 | 271 | 234 | 299 | 271 | 86 | 136 | 103 | 116 | 100 | 63 | 32 | 63 | 105 |
| | Chi-2=25.5; df=6; p=0.000 | | | Chi-2=24.5; df=6; p=0.000 | | | Chi-2=14.8; df=6; p=0.022 | | | Chi-2=7.5; df=6; p=0.281 | | | Chi-2=15.8; df=6; p=0.015 | | |

## Q14-Q15 Colleagues' attitude toward blogging

**Q14 Are scientists mostly positive or critical towards blogging colleagues, or do they not care?**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Mostly positive | 3.7 | 9.7 | 13.7 | 4.2 | 9.6 | 12.5 | 2.3 | 8.7 | 7.8 | 5.9 | 10.0 | 22.2 | 3.0 | 10.9 | 11.3 |
| Mostly critical | 5.2 | 3.9 | 5.4 | 5.8 | 4.3 | 6.2 | 4.5 | 8.0 | 6.8 | 7.6 | 2.0 | 1.6 | 3.0 | 0.0 | 8.5 |
| Partly positive, partly critical | 16.3 | 18.1 | 24.3 | 14.6 | 18.2 | 26.1 | 15.9 | 18.8 | 27.2 | 10.9 | 18.0 | 15.9 | 24.2 | 17.2 | 31.1 |
| Mostly they don't care | 27.5 | 29.8 | 29.4 | 30.0 | 29.8 | 29.0 | 19.3 | 29.0 | 37.9 | 39.5 | 33.0 | 23.8 | 24.2 | 26.6 | 23.6 |
| Don't know | 47.3 | 38.5 | 27.2 | 45.4 | 38.1 | 26.1 | 58.0 | 35.5 | 20.4 | 36.1 | 37.0 | 36.5 | 45.5 | 45.3 | 25.5 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 240 | 302 | 272 | 240 | 302 | 272 | 88 | 138 | 103 | 119 | 100 | 63 | 33 | 64 | 106 |
| | Chi-2=33.4; df=8; p=0.000 | | | Chi-2=34.0; df=8; p=0.000 | | | Chi-2=31.7; df=8; p=0.000 | | | Chi-2=20.5; df=8; p=0.009 | | | Chi-2=16.9; df=8; p=0.031 | | |

**Q15 How many colleagues in your research field do you know who regularly blog?**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| None | 33.4 | 18.5 | 13.3 | 32.5 | 18.2 | 13.2 | 37.5 | 15.1 | 14.6 | 28.6 | 21.2 | 12.7 | 33.3 | 20.3 | 12.3 |
| Some colleagues do so | 37.5 | 49.4 | 53.5 | 39.2 | 50.0 | 54.4 | 30.7 | 54.0 | 59.2 | 46.2 | 50.5 | 46.0 | 36.4 | 40.6 | 54.7 |
| Many colleagues do so | 0.3 | 2.8 | 5.3 | 0.4 | 2.6 | 5.9 | 0.0 | 1.4 | 7.8 | 0.8 | 2.0 | 1.6 | 0.0 | 6.2 | 6.6 |
| Almost all colleagues do so | 0.0 | 0.0 | 0.4 | 0.0 | 0.0 | 0.4 | 0.0 | 0.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Don't know | 28.9 | 29.2 | 27.4 | 27.9 | 29.1 | 26.1 | 31.8 | 29.5 | 17.5 | 24.4 | 26.3 | 39.7 | 30.3 | 32.8 | 26.4 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 240 | 302 | 272 | 240 | 302 | 272 | 88 | 139 | 103 | 119 | 99 | 63 | 33 | 64 | 106 |
| | Chi-2=46.6; df=8; p=0.000 | | | Chi-2=45.9; df=8; p=0.000 | | | Chi-2=42.9; df=8; p=0.000 | | | Chi-2=9.2; df=6; p=0.164 | | | Chi-2=11.8; df=6; p=0.068 | | |

## Q16 How should scientists communicate with the public

**Q16.1 When communicating with the public, scientists should simplify even at the expense of scientific accuracy**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Average (Scale: -2….+2) | -0.1 | -0.61 | 0.33 | -0.07 | -0.63 | 0.34 | -0.14 | -0.86 | 0.27 | 0.01 | -0.36 | 0.32 | -0.19 | -0.58 | 0.44 |
| n | 233 | 300 | 264 | 233 | 300 | 264 | 85 | 136 | 101 | 116 | 100 | 62 | 32 | 64 | 101 |
| | F=37.1; df=2; p=0.000 | | | F=40.2; df=2; p=0.000 | | | F=2.3; df=2; p=0.096* | | | | | | | | |

**Q16.2 When communicating with the public, scientists should relate their research to the everyday experience of the public**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Average (Scale: -2….+2) | 0.97 | 1.28 | 1.00 | 0.96 | 1.28 | 1.00 | 1.12 | 1.25 | 0.87 | 0.88 | 1.27 | 1.11 | 0.84 | 1.35 | 1.05 |
| n | 228 | 295 | 265 | 228 | 295 | 265 | 82 | 132 | 100 | 115 | 100 | 62 | 31 | 63 | 103 |
| | F=8.6; df=2; p=0.000 | | | F=8.8; df=2; p=0.000 | | | F=0.0; df=2; p=0.996* | | | | | | | | |

**Q16.3 When communicating with the public, scientists should use their expertise to criticize decisions affecting society or make practical suggestions for action**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Average (Scale: -2….+2) | 0.51 | 0.42 | 0.51 | 0.56 | 0.41 | 0.51 | 0.62 | 0.28 | 0.55 | 0.63 | 0.56 | 0.45 | 0.18 | 0.45 | 0.51 |
| n | 227 | 295 | 260 | 227 | 295 | 260 | 82 | 137 | 98 | 112 | 96 | 60 | 33 | 62 | 102 |
| | F=0.5; df=2; p=0.618 | | | F=1.1; df=2; p=0.335 | | | F=0.9; df=2; p=0.413* | | | | | | | | |

**Q16.4 When communicating with the public, scientists should put an emphasis on the practical uses of research rather than on the research itself**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Average (Scale: -2….+2) | 0.41 | 0.65 | 0.96 | 0.35 | 0.65 | 1.00 | 0.48 | 0.69 | 1.08 | 0.16 | 0.44 | 0.75 | 0.64 | 0.90 | 1.07 |
| n | 236 | 297 | 265 | 236 | 297 | 265 | 87 | 137 | 101 | 116 | 100 | 60 | 33 | 60 | 104 |
| | F=15.4; df=2; p=0.000 | | | F=15.8; df=2; p=0.000 | | | F=8.5; df=2; p=0.000* | | | | | | | | |

**Q16.5 When communicating with the public, scientists should communicate their results and expertise in an entertaining manner**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Average (Scale: -2….+2) | 0.77 | 0.96 | 0.44 | 0.80 | 0.96 | 0.45 | 0.70 | 0.88 | 0.35 | 0.91 | 1.15 | 0.49 | 0.70 | 0.84 | 0.53 |
| n | 235 | 299 | 265 | 235 | 299 | 265 | 86 | 137 | 102 | 116 | 100 | 61 | 33 | 62 | 102 |
| | F=16.1; df=2; p=0.000 | | | F=4.7; df=2; p=0.010 | | | F=2.7; df=2; p=0.068* | | | | | | | | |

**Q16.6 When communicating with the public, scientists should use catchy phrases that attract public attention**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Average (Scale: -2….+2) | -0.08 | 0.08 | 0.26 | -0.06 | 0.07 | 0.27 | -0.24 | -0.11 | 0.25 | 0.08 | 0.26 | 0.22 | -0.06 | 0.14 | 0.34 |
| n | 235 | 297 | 266 | 235 | 297 | 266 | 85 | 135 | 102 | 117 | 99 | 60 | 33 | 63 | 104 |
| | F=4.8; df=2; p=0.009 | | | F=4.7; df=2; p=0.010 | | | F=2.5; df=2; p=0.085* | | | | | | | | |

**Q16.7 When communicating with the public, scientists should be prepared to focus on their own role as researchers and to provide personal views**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Average (Scale: -2….+2) | 0.69 | 0.63 | 1.01 | 0.72 | 0.62 | 1.03 | 0.58 | 0.60 | 1.04 | 0.83 | 0.65 | 0.90 | 0.69 | 0.63 | 1.10 |
| n | 225 | 296 | 268 | 225 | 296 | 268 | 85 | 134 | 101 | 111 | 99 | 62 | 29 | 63 | 105 |
| | F=11.3; df=2; p=0.000 | | | F=12.5; df=2; p=0.000 | | | F=3.1; df=2; p=0.730* | | | | | | | | |

**Q16.8 When communicating with the public, scientists should speak openly about problems, such as misconduct on the part of researchers or controversial research practices**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Average (Scale: -2….+2) | 0.91 | 0.82 | 0.74 | 0.94 | 0.84 | 0.75 | 0.92 | 0.94 | 0.75 | 1.01 | 0.95 | 0.68 | 0.75 | 0.43 | 0.80 |
| n | 232 | 294 | 269 | 232 | 294 | 269 | 85 | 135 | 102 | 115 | 98 | 62 | 32 | 61 | 105 |
| | F=1.3; df=2; p=0.263 | | | F=1.7; df=2; p=0.191 | | | F=2.2; df=2; p=0.106* | | | | | | | | |

**Q16.9 When communicating with the public, scientists should talk about current research that has not yet appeared in scientific publications**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Average (Scale: -2….+2) | -0.41 | -0.23 | -0.08 | -0.38 | -0.23 | -0.02 | -0.42 | -0.28 | -0.17 | -0.31 | -0.10 | -0.21 | -0.53 | -0.33 | 0.24 |
| n | 229 | 299 | 269 | 229 | 299 | 269 | 84 | 138 | 103 | 113 | 98 | 62 | 32 | 63 | 104 |
| | F=4.5; df=2; p=0.011 | | | F=5.6; df=2; p=0.004 | | | F=0.4; df=2; p=0.665* | | | | | | | | |

* The main effect for discipline was tested in the saturated model. The main effect variables are country and dicipline.

## Q17 Position of communication

**Q17.01 Scientists and laypeople have different levels of knowledge, which make a true dialog between them impossible**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Average (Scale: -2….+2) | -0.56 | -0.83 | 0.01 | -0.52 | -0.84 | 0.03 | -0.59 | -0.9 | 0.07 | -0.43 | -0.91 | -0.10 | -0.67 | -0.60 | 0.08 |
| n | 235 | 297 | 267 | 235 | 297 | 267 | 86 | 136 | 101 | 116 | 98 | 63 | 33 | 63 | 103 |
| | F=36.4; df=2; p=0.000 | | | F=38.6; df=2; p=0.000 | | | F=0.3; df=2; p=0.760* | | | | | | | | |

**Q17.02 Scientists should share internal differences of opinion with the general public**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Average (Scale: -2….+2) | 0.07 | 0.48 | 0.70 | 0.15 | 0.49 | 0.73 | -0.07 | 0.57 | 0.62 | 0.40 | 0.62 | 0.70 | -0.13 | 0.14 | 0.85 |
| n | 221 | 297 | 265 | 221 | 297 | 265 | 82 | 136 | 102 | 108 | 98 | 60 | 31 | 63 | 103 |
| | F=22.1; df=2; p=0.000 | | | F=18.3; df=2; p=0.000 | | | F=4.3; df=2; p=0.014* | | | | | | | | |

**Q17.03 Scientists should strategically frame their messages to guide the public's attitudes**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Average (Scale: -2….+2) | -0.01 | -0.06 | 0.81 | 0.01 | -0.06 | 0.81 | 0.11 | 0.02 | 0.79 | 0.02 | -0.15 | 0.81 | -0.24 | -0.07 | 0.83 |
| n | 226 | 287 | 267 | 226 | 287 | 267 | 80 | 133 | 100 | 113 | 94 | 63 | 33 | 60 | 104 |
| | F=52.2; df=2; p=0.000 | | | F=51.2; df=2; p=0.000 | | | F=0.8; df=2; p=0.430* | | | | | | | | |

**Q17.04 Editors of scientific journals should demand from authors that their articles are comprehensible to interested laypeople**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Average (Scale: -2….+2) | -0.99 | -0.90 | 0.20 | -1.04 | -0.90 | 0.24 | -0.98 | -0.88 | 0.16 | -1.15 | -1.09 | 0.10 | -0.77 | -0.67 | 0.40 |
| n | 227 | 298 | 261 | 227 | 298 | 261 | 80 | 137 | 99 | 117 | 97 | 60 | 30 | 64 | 102 |
| | F=78.9; df=2; p=0.000 | | | F=89.1; df=2; p=0.000 | | | F=4.6; df=2; p=0.011* | | | | | | | | |

**Q17.05 The public is not well educated enough to really understand scientific findings**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Average (Scale: -2….+2) | -0.20 | -0.13 | 0.35 | -0.14 | -0.14 | 0.33 | -0.23 | -0.28 | 0.39 | -0.01 | 0.05 | 0.37 | -0.39 | -0.16 | 0.27 |
| n | 236 | 297 | 266 | 236 | 297 | 266 | 87 | 136 | 101 | 116 | 98 | 60 | 33 | 63 | 105 |
| | F=14.8; df=2; p=0.000 | | | F=12.8; df=2; p=0.000 | | | F=2.1; df=2; p=0.123* | | | | | | | | |

**Q17.06 The public may lack scientific knowledge, but it possesses a lot of relevant common sense and good judgment**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Average (Scale: -2….+2) | 0.60 | 0.60 | 0.60 | 0.61 | 0.60 | 0.64 | 0.67 | 0.58 | 0.63 | 0.60 | 0.57 | 0.44 | 0.48 | 0.67 | 0.77 |
| n | 236 | 295 | 263 | 236 | 295 | 263 | 86 | 134 | 99 | 117 | 98 | 61 | 33 | 63 | 103 |
| | F=0.0; df=2; p=1.000 | | | F=0.1; df=2; p=0.907 | | | F=0.6; df=2; p=0.565* | | | | | | | | |

**Q17.07 The public is strongly interested in science**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Average (Scale: -2….+2) | 0.13 | 0.20 | 0.17 | 0.16 | 0.21 | 0.13 | 0.19 | 0.29 | 0.13 | 0.20 | 0.08 | 0.32 | -0.06 | 0.23 | 0.02 |
| n | 231 | 293 | 259 | 231 | 293 | 259 | 84 | 135 | 101 | 114 | 96 | 59 | 33 | 62 | 99 |
| | F=0.3; df=2; p=0.762 | | | F=0.3; df=2; p=0.722 | | | F=1.0; df=2; p=0.386* | | | | | | | | |

**Q17.08 The public should be discouraged from interfering with the regulation of scientific activities and applications**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Average (Scale: -2….+2) | -0.37 | -0.20 | 0.08 | -0.33 | -0.20 | 0.12 | -0.30 | -0.27 | 0.22 | -0.28 | -0.02 | -0.13 | -0.61 | -0.33 | 0.16 |
| n | 206 | 292 | 259 | 206 | 292 | 259 | 77 | 135 | 99 | 101 | 96 | 61 | 28 | 61 | 99 |
| | F=9.0; df=2; p=0.000 | | | F=9.2; df=2; p=0.000 | | | F=0.7; df=2; p=0.474* | | | | | | | | |

**Q17.09 Scientists should collaborate with non-scientists as "lay researchers" to make scientific knowledge more compatible with social expectations**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Average (Scale: -2….+2) | 0.06 | 0.12 | 0.74 | 0.05 | 0.12 | 0.78 | 0.23 | 0.19 | 0.78 | -0.04 | -0.12 | 0.60 | -0.07 | 0.32 | 0.90 |
| n | 220 | 283 | 260 | 220 | 283 | 260 | 79 | 134 | 100 | 111 | 89 | 63 | 30 | 60 | 97 |
| | F=27.5; df=2; p=0.000 | | | F=30.4; df=2; p=0.000 | | | F=3.7; df=2; p=0.026* | | | | | | | | |

**Q17.10 Public science communication should be done by specialized communication professionals, not by scientists themselves**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Average (Scale: -2….+2) | -0.48 | -0.73 | 0.23 | -0.47 | -0.73 | 0.28 | -0.37 | -0.72 | 0.36 | -0.50 | -0.73 | -0.02 | -0.61 | -0.74 | 0.37 |
| n | 232 | 296 | 263 | 232 | 296 | 263 | 86 | 135 | 100 | 113 | 99 | 61 | 33 | 62 | 102 |
| | F=52.8; df=2; p=0.000 | | | F=57.8; df=2; p=0.000 | | | F=1.6; df=2; p=0.197* | | | | | | | | |

* The main effect for discipline was tested in the saturated model. The main effect variables are country and dicipline.

## Q18-Q19 Position of the management toward blogging and regulations

**Q18 The general position of the management towards scientists blogging about their research or expertise**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Mostly encouraging | 7.8 | 15.3 | 16.3 | 7.5 | 14.9 | 15.6 | 4.6 | 11.6 | 11.8 | 8.4 | 16.0 | 22.2 | 12.1 | 20.3 | 15.2 |
| Mostly cautioning | 7.6 | 8.4 | 9.0 | 7.1 | 8.3 | 8.9 | 11.5 | 8.0 | 6.9 | 4.2 | 7.0 | 11.1 | 6.1 | 10.9 | 9.5 |
| Partly encouraging, partly cautioning | 8.9 | 12.3 | 18.7 | 8.8 | 12.6 | 18.9 | 9.2 | 15.2 | 25.5 | 8.4 | 11.0 | 12.7 | 9.1 | 9.4 | 16.2 |
| Mostly neutral | 14.2 | 15.6 | 21.6 | 13.0 | 15.6 | 22.6 | 12.6 | 13.8 | 24.5 | 10.9 | 20.0 | 15.9 | 21.2 | 12.5 | 24.8 |
| The management does not care | 18.6 | 7.9 | 15.9 | 20.1 | 7.9 | 16.7 | 14.9 | 8.0 | 14.7 | 25.2 | 8.0 | 14.3 | 15.2 | 7.8 | 20.0 |
| Don't know | 42.9 | 40.5 | 18.6 | 43.5 | 40.7 | 17.4 | 47.1 | 43.5 | 16.7 | 42.9 | 38.0 | 23.8 | 36.4 | 39.1 | 14.3 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 239 | 302 | 270 | 239 | 302 | 270 | 87 | 138 | 102 | 119 | 100 | 63 | 33 | 64 | 105 |
| | Chi-2=63.3; df=10; p=0.000 | | | Chi-2=73.1; df=10; p=0.000 | | | Chi-2=36.4; df=10; p=0.000 | | | Chi-2=26.7; df=10; p=0.003 | | | Chi-2=21.5; df=10; p=0.018 | | |

**Q19 Are there any regulations or guidelines for scientists blogging about their research or expertise?**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Yes, there are binding regulations | 5.6 | 12.0 | 6.1 | 5.1 | 11.9 | 5.9 | 1.1 | 11.6 | 10.7 | 5.9 | 10.0 | 3.2 | 12.5 | 15.6 | 2.9 |
| Yes, there are recommended guidelines | 3.8 | 9.2 | 16.7 | 4.2 | 9.3 | 17.0 | 2.3 | 8.7 | 16.5 | 5.9 | 12.0 | 15.9 | 3.1 | 6.2 | 18.1 |
| No, neither regulations nor guidelines | 30.7 | 19.4 | 49.7 | 29.5 | 19.2 | 51.7 | 32.2 | 18.1 | 50.5 | 26.3 | 17.0 | 42.9 | 34.4 | 25.0 | 58.1 |
| Don't know | 60.0 | 59.3 | 27.5 | 61.2 | 59.6 | 25.5 | 64.4 | 61.6 | 22.3 | 61.9 | 61.0 | 38.1 | 50.0 | 53.1 | 21.0 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 237 | 302 | 271 | 237 | 302 | 271 | 87 | 138 | 103 | 118 | 100 | 63 | 32 | 64 | 105 |
| | Chi-2=108.5; df=6; p=0.000 | | | Chi-2=122.2; df=6; p=0.000 | | | Chi-2=60.2; df=6; p=0.000 | | | Chi-2=21.7; df=6; p=0.001 | | | Chi-2=39.9; df=6; p=0.000 | | |

## Q20-Q22 Training for public communication

**Q20 Does your university or research institution offer scientists traning courses for better communication with the public?**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Yes | 30.6 | 32.5 | 23.5 | 31.2 | 32.7 | 23.2 | 30.7 | 33.8 | 26.2 | 32.8 | 33.0 | 22.2 | 27.3 | 29.7 | 20.8 |
| No | 35.8 | 31.9 | 59.9 | 34.6 | 31.7 | 59.9 | 37.5 | 29.5 | 59.2 | 31.1 | 33.0 | 60.3 | 39.4 | 34.4 | 60.4 |
| Don't know | 33.7 | 35.6 | 16.6 | 34.2 | 35.6 | 16.9 | 31.8 | 36.7 | 14.6 | 36.1 | 34.0 | 17.5 | 33.3 | 35.9 | 18.9 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 240 | 303 | 272 | 240 | 303 | 272 | 88 | 139 | 103 | 119 | 100 | 63 | 33 | 64 | 106 |
| | Chi-2=55.2; df=4; p=0.000 | | | Chi-2=57.2; df=4; p=0.000 | | | Chi-2=24.9; df=4; p=0.000 | | | Chi-2=17.1; df=4; p=0.002 | | | Chi-2=12.7; df=4; p=0.013 | | |

**Q21 Does these offers include specific courses for blogging or specific modules for blogging as part of more general communication training**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Yes | 2.5 | 7.6 | 37.5 | 2.7 | 7.0 | 37.7 | 3.7 | 4.2 | 33.3 | 2.6 | 3.0 | 41.7 | 0.0 | 21.1 | 40.9 |
| No | 44.0 | 37.3 | 48.1 | 45.3 | 38.0 | 47.5 | 37.0 | 45.8 | 48.1 | 51.3 | 27.3 | 50.0 | 44.4 | 36.8 | 45.5 |
| Don't know | 53.6 | 55.1 | 14.4 | 52.0 | 55.0 | 14.8 | 59.3 | 50.0 | 18.5 | 46.2 | 69.7 | 8.3 | 55.6 | 42.1 | 13.6 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 75 | 100 | 61 | 75 | 100 | 61 | 27 | 48 | 27 | 39 | 33 | 12 | 9 | 19 | 22 |
| | Chi-2=52.1; df=4; p=0.000 | | | Chi-2=52.8; df=4; p=0.000 | | | Chi-2=20.8; df=4; p=0.000 | | | Chi-2=28.2; df=4; p=0.000 | | | Chi-2=9.1; df=4; p=0.059 | | |

**Q22 Have you yourself ever had any training in communication?**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Yes | 21.0 | 28.7 | 26.8 | 20.1 | 29.0 | 27.6 | 28.4 | 32.1 | 30.4 | 14.4 | 27.3 | 21.0 | 18.2 | 25.0 | 28.8 |
| No | 79.0 | 71.3 | 73.2 | 79.9 | 71.0 | 72.4 | 71.6 | 67.9 | 69.6 | 85.6 | 72.7 | 79.0 | 81.8 | 75.0 | 71.2 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 239 | 300 | 268 | 239 | 300 | 268 | 88 | 137 | 102 | 118 | 99 | 62 | 33 | 64 | 104 |
| | Chi-2=4.2; df=2; p=0.120 | | | Chi-2=6.1; df=2; p=0.047 | | | Chi-2=0.3; df=2; p=0.840 | | | Chi-2=5.5; df=2; p=0.064 | | | Chi-2=1.5; df=2; p=0.467 | | |

## Q23 Index of medialization

**Q23.1 Considering public response: Speeding up or delaying a scientific publication**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Never justified | 55.3 | 41.4 | 24.9 | 56.6 | 41.7 | 23.3 | 49.4 | 44.6 | 17.2 | 62.2 | 37.5 | 36.2 | 54.8 | 41.4 | 21.3 |
| Justified in some situations | 41.9 | 54.2 | 53.0 | 41.1 | 54.0 | 53.5 | 49.4 | 52.3 | 57.0 | 36.0 | 54.5 | 48.3 | 38.7 | 56.9 | 53.2 |
| Always justified | 2.8 | 4.4 | 22.1 | 2.3 | 4.3 | 23.3 | 1.3 | 3.1 | 25.8 | 1.8 | 8.0 | 15.5 | 6.5 | 1.7 | 25.5 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 219 | 276 | 245 | 219 | 276 | 245 | 77 | 130 | 93 | 111 | 88 | 58 | 31 | 58 | 94 |
| | Chi-2=88.5; df=4; p=0.000 | | | Chi-2=102.4; df=4; p=0.000 | | | Chi-2=51.9; df=4; p=0.000 | | | Chi-2=22.7; df=4; p=0.000 | | | Chi-2=26.4; df=4; p=0.000 | | |

**Q23.2 Considering public response: Presenting or not presenting a paper at a scientific conference**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Never justified | 60.5 | 47.9 | 24.6 | 60.4 | 48.4 | 23.1 | 60.3 | 50.0 | 20.2 | 60.2 | 53.9 | 32.8 | 61.3 | 36.2 | 20.0 |
| Justified in some situations | 33.2 | 45.7 | 45.1 | 32.9 | 45.2 | 46.3 | 32.1 | 44.0 | 43.6 | 32.7 | 38.2 | 42.6 | 35.5 | 58.6 | 51.0 |
| Always justified | 6.3 | 6.4 | 30.2 | 6.8 | 6.4 | 30.6 | 7.7 | 6.0 | 36.2 | 7.1 | 7.9 | 24.6 | 3.2 | 5.2 | 29.0 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 222 | 281 | 255 | 222 | 281 | 255 | 78 | 134 | 94 | 113 | 89 | 61 | 31 | 58 | 100 |
| | Chi-2=109.0; df=4; p=0.000 | | | Chi-2=113.4; df=4; p=0.000 | | | Chi-2=56.4; df=4; p=0.000 | | | Chi-2=19.1; df=4; p=0.001 | | | Chi-2=31.6; df=4; p=0.000 | | |

**Q23.3 Considering public response: Emphasizing certain conclusions or interpretations in scientific publication or not mentioning them**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Never justified | 55.4 | 59.6 | 25.3 | 56.1 | 59.7 | 23.5 | 56.1 | 60.3 | 20.4 | 57.1 | 60.9 | 34.4 | 51.7 | 56.7 | 19.6 |
| Justified in some situations | 42.0 | 36.3 | 47.9 | 40.8 | 36.3 | 48.2 | 41.5 | 37.4 | 49.5 | 38.4 | 33.3 | 45.9 | 48.3 | 38.3 | 48.5 |
| Always justified | 2.6 | 4.1 | 26.8 | 3.1 | 4.0 | 28.3 | 2.4 | 2.3 | 30.1 | 4.5 | 5.7 | 19.7 | 0.0 | 5.0 | 32.0 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 223 | 278 | 251 | 223 | 278 | 251 | 82 | 131 | 93 | 112 | 87 | 61 | 29 | 60 | 97 |
| | Chi-2=123.8; df=4; p=0.000 | | | Chi-2=134.1; df=4; p=0.000 | | | Chi-2=68.5; df=4; p=0.000 | | | Chi-2=18.8; df=4; p=0.001 | | | Chi-2=38.0; df=4; p=0.000 | | |

**Q23.4 Considering public response: Using or avoiding certain kinds of wording in scientific publications**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Never justified | 33.7 | 26.4 | 16.4 | 35.0 | 26.2 | 16.3 | 24.4 | 24.2 | 14.9 | 42.2 | 29.7 | 17.9 | 36.7 | 25.4 | 16.8 |
| Justified in some situations | 54.6 | 62.3 | 53.0 | 53.9 | 63.1 | 53.0 | 62.8 | 71.2 | 52.1 | 48.6 | 56.0 | 53.6 | 50.0 | 55.9 | 53.5 |
| Always justified | 11.7 | 11.3 | 30.6 | 11.1 | 10.6 | 30.7 | 12.8 | 4.5 | 33.0 | 9.2 | 14.3 | 28.6 | 13.3 | 18.6 | 29.7 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 217 | 282 | 251 | 217 | 282 | 251 | 78 | 132 | 94 | 109 | 91 | 56 | 30 | 59 | 101 |
| | Chi-2=50.5; df=4; p=0.000 | | | Chi-2=56.7; df=4; p=0.000 | | | Chi-2=35.0; df=4; p=0.000 | | | Chi-2=16.9; df=4; p=0.002 | | | Chi-2=8.0; df=4; p=0.092 | | |

**Q23.5 Considering public response: Choosing or avoiding certain research questions**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Never justified | 43.8 | 39.4 | 21.1 | 46.0 | 39.4 | 20.7 | 38.6 | 39.5 | 19.4 | 53.6 | 38.2 | 23.7 | 38.7 | 40.7 | 20.2 |
| Justified in some situations | 48.7 | 55.8 | 55.5 | 47.3 | 56.0 | 55.0 | 51.8 | 57.4 | 50.5 | 42.9 | 55.1 | 61.0 | 51.6 | 54.2 | 55.6 |
| Always justified | 7.5 | 4.8 | 23.4 | 6.6 | 4.7 | 24.3 | 9.6 | 3.1 | 30.1 | 3.6 | 6.7 | 15.3 | 9.7 | 5.1 | 24.2 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 226 | 277 | 251 | 226 | 277 | 251 | 83 | 129 | 93 | 112 | 89 | 59 | 31 | 59 | 99 |
| | Chi-2=65.4; df=4; p=0.000 | | | Chi-2=76.1; df=4; p=0.000 | | | Chi-2=39.3; df=4; p=0.000 | | | Chi-2=18.8; df=4; p=0.001 | | | Chi-2=15.8; df=4; p=0.003 | | |

**Q23.6 Considering public response: Choosing or avoiding certain research methods**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Never justified | 27.4 | 29.9 | 18.7 | 27.0 | 30.0 | 18.5 | 21.0 | 31.2 | 16.5 | 29.1 | 30.3 | 21.1 | 35.5 | 26.8 | 18.8 |
| Justified in some situations | 60.7 | 61.5 | 54.5 | 61.3 | 61.9 | 54.2 | 64.2 | 65.6 | 53.8 | 60.9 | 58.4 | 56.1 | 54.8 | 58.9 | 53.5 |
| Always justified | 11.9 | 8.6 | 26.8 | 11.7 | 8.1 | 27.3 | 14.8 | 3.1 | 29.7 | 10.0 | 11.2 | 22.8 | 9.7 | 14.3 | 27.7 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 222 | 273 | 249 | 222 | 273 | 249 | 81 | 128 | 91 | 110 | 89 | 57 | 31 | 56 | 101 |
| | Chi-2=38.4; df=4; p=0.000 | | | Chi-2=42.8; df=4; p=0.000 | | | Chi-2=32.7; df=4; p=0.000 | | | Chi-2=6.4; df=4; p=0.169 | | | Chi-2=8.5; df=4; p=0.073 | | |

**Q23.7 Considering public response: Selecting or avoiding certain sources of funding**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Never justified | 20.1 | 16.7 | 12.1 | 21.1 | 17.5 | 12.1 | 22.9 | 22.8 | 14.1 | 22.0 | 16.9 | 10.3 | 12.9 | 6.8 | 11.3 |
| Justified in some situations | 65.6 | 74.7 | 54.7 | 64.1 | 74.2 | 54.7 | 60.2 | 70.1 | 56.5 | 63.3 | 74.2 | 53.4 | 77.4 | 83.1 | 53.6 |
| Always justified | 14.3 | 8.5 | 33.2 | 14.8 | 8.4 | 33.2 | 16.9 | 7.1 | 29.3 | 14.7 | 9.0 | 36.2 | 9.7 | 10.2 | 35.1 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 223 | 275 | 247 | 223 | 275 | 247 | 83 | 127 | 92 | 109 | 89 | 58 | 31 | 59 | 97 |
| | Chi-2=58.6; df=4; p=0.000 | | | Chi-2=59.1; df=4; p=0.000 | | | Chi-2=20.1; df=4; p=0.000 | | | Chi-2=21.1; df=4; p=0.000 | | | Chi-2=19.1; df=4; p=0.001 | | |

**Q23.8 Considering public response: Choosing or avoiding certain collaborators**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Never justified | 29.5 | 32.2 | 14.4 | 30.0 | 32.5 | 13.4 | 27.7 | 33.6 | 10.9 | 32.1 | 36.4 | 20.7 | 29.0 | 24.1 | 11.3 |
| Justified in some situations | 62.4 | 59.0 | 59.5 | 61.9 | 58.4 | 59.9 | 62.7 | 54.7 | 52.2 | 60.6 | 56.8 | 63.8 | 64.5 | 69.0 | 64.9 |
| Always justified | 8.1 | 8.9 | 26.1 | 8.1 | 9.1 | 26.7 | 9.6 | 11.7 | 37.0 | 7.3 | 6.8 | 15.5 | 6.5 | 6.9 | 23.7 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 223 | 274 | 247 | 223 | 274 | 247 | 83 | 128 | 92 | 109 | 88 | 58 | 31 | 58 | 97 |
| | Chi-2=54.1; df=4; p=0.000 | | | Chi-2=58.5; df=4; p=0.000 | | | Chi-2=35.5; df=4; p=0.000 | | | Chi-2=6.7; df=4; p=0.154 | | | Chi-2=14.3; df=4; p=0.006 | | |

## Q24 Public communication-a moral duty or a good thing?

**Q24 Is public communication a moral duty or a good thing?**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| A moral duty for scientists | 27.5 | 20.0 | 26.6 | 27.6 | 20.3 | 26.6 | 29.5 | 21.7 | 30.4 | 26.9 | 21.0 | 23.8 | 25.0 | 15.9 | 24.5 |
| A good thing for scientists | 71.1 | 78.6 | 65.8 | 70.7 | 78.4 | 66.1 | 69.3 | 76.8 | 59.8 | 70.6 | 78.0 | 69.8 | 75.0 | 82.5 | 69.8 |
| Neither a moral duty nor a good thing | 1.3 | 1.3 | 7.6 | 1.7 | 1.3 | 7.4 | 1.1 | 1.4 | 9.8 | 2.5 | 1.0 | 6.3 | 0.0 | 1.6 | 5.7 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 239 | 301 | 271 | 239 | 301 | 271 | 88 | 138 | 102 | 119 | 100 | 63 | 32 | 63 | 106 |
| | Chi-2=27.7; df=4; p=0.000 | | | Chi-2=24.9; df=4; p=0.000 | | | Chi-2=17.3; df=4; p=0.002 | | | Chi-2=5.3; df=4; p=0.260 | | | Chi-2=5.6; df=4; p=0.232 | | |

## B01 Where do the scientists post

**B01.1 I post on my own blog**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Yes | 48.1 | 42.1 | 54.9 | 41.2 | 41.4 | 57.9 | 60.0 | 40.0 | 70.0 | 27.3 | 25.0 | 25.0 | 100.0 | 54.5 | 60.0 |
| No | 51.9 | 57.9 | 45.1 | 58.8 | 58.6 | 42.1 | 40.0 | 60.0 | 30.0 | 72.7 | 75.0 | 75.0 | 0.0 | 45.5 | 40.0 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 17 | 29 | 19 | 17 | 29 | 19 | 5 | 10 | 10 | 11 | 8 | 4 | 1 | 11 | 5 |
| | n is too small for a significant test | | | | | | | | | | | | | | |

**B01.2 I post on a blog that I share with other people**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Yes | 18.6 | 46.9 | 32.3 | 23.5 | 48.3 | 31.6 | 0.0 | 70.0 | 60.0 | 36.4 | 25.0 | 0.0 | 0.0 | 45.5 | 0.0 |
| No | 81.4 | 53.1 | 67.7 | 76.5 | 51.7 | 68.4 | 100.0 | 30.0 | 40.0 | 63.6 | 75.0 | 100.0 | 100.0 | 54.5 | 100.0 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 17 | 29 | 19 | 17 | 29 | 19 | 5 | 10 | 10 | 11 | 8 | 4 | 1 | 11 | 5 |
| | n is too small for a significant test | | | | | | | | | | | | | | |

**B01.3 On invitation, I post on a blog owned by others**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Yes | 16.7 | 40.8 | 31.2 | 17.6 | 41.4 | 36.8 | 20.0 | 40.0 | 40.0 | 18.2 | 62.5 | 0.0 | 0.0 | 27.3 | 60.0 |
| No | 83.3 | 59.2 | 68.8 | 82.4 | 58.6 | 63.2 | 80.0 | 60.0 | 60.0 | 81.8 | 37.5 | 100.0 | 100.0 | 72.7 | 40.0 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 17 | 29 | 19 | 17 | 29 | 19 | 5 | 10 | 10 | 11 | 8 | 4 | 1 | 11 | 5 |
| | n is too small for a significant test | | | | | | | | | | | | | | |

## B02-B06 Blogging activity

**B02 Post under realname or under a pseudonym**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Post under real name | 43.9 | 83.1 | 84.3 | 55.6 | 83.3 | 81.8 | 66.7 | 90.0 | 85.7 | 60.0 | 66.7 | 100.0 | 0.0 | 87.5 | 66.7 |
| Post under a pseudonym | 0.0 | 4.3 | 5.9 | 0.0 | 4.2 | 9.1 | 0.0 | 0.0 | 0.0 | 0.0 | 16.7 | 0.0 | 0.0 | 0.0 | 33.3 |
| It depends | 50.1 | 12.7 | 9.8 | 44.4 | 12.5 | 9.1 | 33.3 | 10.0 | 14.3 | 40.0 | 16.7 | 0.0 | 100.0 | 12.5 | 0.0 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 9 | 24 | 11 | 9 | 24 | 11 | 3 | 10 | 7 | 5 | 6 | 1 | 1 | 8 | 3 |
| | n is too small for a significant test | | | | | | | | | | | | | | |

**B04 Blog network**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Yes | 20.9 | 21.8 | 24.1 | 22.2 | 23.8 | 25.0 | 33.3 | 44.4 | 28.6 | 20.0 | 0.0 | 0.0 | 0.0 | 12.5 | 25.0 |
| No | 79.1 | 78.2 | 75.9 | 77.8 | 76.2 | 75.0 | 66.7 | 55.6 | 71.4 | 80.0 | 100.0 | 100.0 | 100.0 | 87.5 | 75.0 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 9 | 21 | 12 | 9 | 21 | 12 | 3 | 9 | 7 | 5 | 4 | 1 | 1 | 8 | 4 |
| | n is too small for a significant test | | | | | | | | | | | | | | |

**B05 Frequency of blogging**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Several times a day | 0.0 | 0.0 | 18.5 | 0.0 | 0.0 | 16.7 | 0.0 | 0.0 | 28.6 | 0.0 | 0.0 | 100.0 | 0.0 | 0.0 | 0.0 |
| About once a day | 0.0 | 0.0 | 13.0 | 0.0 | 0.0 | 8.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 3-5 days a week | 8.1 | 0.0 | 0.0 | 11.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 20.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 1-2 days a week | 12.8 | 17.5 | 0.0 | 11.1 | 17.4 | 0.0 | 33.3 | 20.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 25.0 | 0.0 |
| Every few weeks | 20.9 | 43.9 | 18.5 | 22.2 | 43.5 | 16.7 | 33.3 | 50.0 | 28.6 | 20.0 | 0.0 | 0.0 | 0.0 | 62.5 | 0.0 |
| Less often | 58.2 | 38.6 | 50.0 | 55.6 | 39.1 | 58.3 | 33.3 | 30.0 | 42.9 | 60.0 | 100.0 | 0.0 | 100.0 | 12.5 | 100.0 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 9 | 23 | 12 | 9 | 23 | 12 | 3 | 10 | 7 | 5 | 5 | 1 | 1 | 8 | 4 |
| | n is too small for a significant test | | | | | | | | | | | | | | |

**B06 Time spending weekly on blogging**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| [ ] hours per week | 2.4 | 1.8 | 9.9 | 2.3 | 1.8 | 8.3 | 2.7 | 2.0 | 10.2 | 2.0 | 0.0 | 20 | 0 | 1.7 | 1.3 |
| n | 6 | 10 | 9 | 6 | 10 | 9 | 3 | 4 | 5 | 3 | 0 | 1 | 0 | 6 | 3 |
| | n is too small for a significant test | | | | | | | | | | | | | | |

## B07-B08 Content

**B07.1 Content areas: Research and outcomes**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Never | 8.1 | 13.2 | 11.1 | 11.1 | 13.0 | 16.7 | 0.0 | 10.0 | 0.0 | 20.0 | 20.0 | 0.0 | 0.0 | 12.5 | 50.0 |
| Rarely | 41.8 | 12.7 | 50.0 | 44.4 | 13.0 | 41.7 | 66.7 | 10.0 | 57.1 | 40.0 | 40.0 | 100.0 | 0.0 | 0.0 | 0.0 |
| Sometimes | 12.8 | 35.8 | 20.4 | 11.1 | 34.8 | 25.0 | 33.3 | 30.0 | 14.3 | 0.0 | 20.0 | 0.0 | 0.0 | 50.0 | 50.0 |
| Often | 37.2 | 38.3 | 18.5 | 33.3 | 39.1 | 16.7 | 0.0 | 50.0 | 28.6 | 40.0 | 20.0 | 0.0 | 100.0 | 37.5 | 0.0 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 9 | 23 | 12 | 9 | 23 | 12 | 3 | 10 | 7 | 5 | 5 | 1 | 1 | 8 | 4 |
| | n is too small for a significant test | | | | | | | | | | | | | | |

**B07.2 Content areas: Reflections on academic culture and practices**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Never | 20.9 | 29.5 | 0.0 | 22.2 | 30.4 | 0.0 | 33.3 | 40.0 | 0.0 | 20.0 | 20.0 | 0.0 | 0.0 | 25.0 | 0.0 |
| Rarely | 42.0 | 35.2 | 37.0 | 33.3 | 34.8 | 33.3 | 33.3 | 30.0 | 28.6 | 20.0 | 40.0 | 100.0 | 100.0 | 37.5 | 25.0 |
| Sometimes | 16.2 | 17.7 | 44.4 | 22.2 | 17.4 | 50.0 | 0.0 | 10.0 | 42.9 | 40.0 | 40.0 | 0.0 | 0.0 | 12.5 | 75.0 |
| Often | 20.9 | 17.5 | 18.5 | 22.2 | 17.4 | 16.7 | 33.3 | 20.0 | 28.6 | 20.0 | 0.0 | 0.0 | 0.0 | 25.0 | 0.0 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 9 | 23 | 12 | 9 | 23 | 12 | 3 | 10 | 7 | 5 | 5 | 1 | 1 | 8 | 4 |
| | n is too small for a significant test | | | | | | | | | | | | | | |

**B07.3 Content areas: Reflections on science and society**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Never | 33.7 | 20.7 | 5.5 | 33.3 | 21.7 | 8.3 | 66.7 | 30.0 | 0.0 | 20.0 | 20.0 | 0.0 | 0.0 | 12.5 | 25.0 |
| Rarely | 42.0 | 35.2 | 46.3 | 33.3 | 34.8 | 41.7 | 33.3 | 30.0 | 42.9 | 20.0 | 40.0 | 100.0 | 100.0 | 37.5 | 25.0 |
| Sometimes | 16.2 | 22.7 | 29.6 | 22.2 | 21.7 | 33.3 | 0.0 | 10.0 | 28.6 | 40.0 | 40.0 | 0.0 | 0.0 | 25.0 | 50.0 |
| Often | 8.1 | 21.3 | 18.5 | 11.1 | 21.7 | 16.7 | 0.0 | 30.0 | 28.6 | 20.0 | 0.0 | 0.0 | 0.0 | 25.0 | 0.0 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 9 | 23 | 12 | 9 | 23 | 12 | 3 | 10 | 7 | 5 | 5 | 1 | 1 | 8 | 4 |
| | n is too small for a significant test | | | | | | | | | | | | | | |

**B07.4 Content areas: Comments about public issues**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Never | 66.3 | 20.7 | 5.5 | 66.7 | 21.7 | 8.3 | 33.3 | 30.0 | 0.0 | 80.0 | 20.0 | 0.0 | 100.0 | 12.5 | 25.0 |
| Rarely | 12.8 | 41.5 | 46.3 | 11.1 | 39.1 | 41.7 | 33.3 | 20.0 | 42.9 | 0.0 | 40.0 | 100.0 | 0.0 | 62.5 | 25.0 |
| Sometimes | 20.9 | 25.8 | 33.3 | 22.2 | 26.1 | 33.3 | 33.3 | 30.0 | 42.9 | 20.0 | 20.0 | 0.0 | 0.0 | 25.0 | 25.0 |
| Often | 0.0 | 12.0 | 14.8 | 0.0 | 13.0 | 16.7 | 0.0 | 20.0 | 14.3 | 0.0 | 20.0 | 0.0 | 0.0 | 0.0 | 25.0 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 9 | 23 | 12 | 9 | 23 | 12 | 3 | 10 | 7 | 5 | 5 | 1 | 1 | 8 | 4 |
| | n is too small for a significant test | | | | | | | | | | | | | | |

**B07.5 Content areas: Consulting**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Never | 29.0 | 48.5 | 0.0 | 33.3 | 47.8 | 0.0 | 33.3 | 40.0 | 0.0 | 40.0 | 60.0 | 0.0 | 0.0 | 50.0 | 0.0 |
| Rarely | 42.0 | 22.7 | 42.6 | 33.3 | 21.7 | 41.7 | 33.3 | 10.0 | 28.6 | 20.0 | 40.0 | 100.0 | 100.0 | 25.0 | 50.0 |
| Sometimes | 12.8 | 20.0 | 33.3 | 11.1 | 21.7 | 33.3 | 33.3 | 40.0 | 42.9 | 0.0 | 0.0 | 0.0 | 0.0 | 12.5 | 25.0 |
| Often | 16.2 | 8.8 | 24.1 | 22.2 | 8.7 | 25.0 | 0.0 | 10.0 | 28.6 | 40.0 | 0.0 | 0.0 | 0.0 | 12.5 | 25.0 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 9 | 23 | 12 | 9 | 23 | 12 | 3 | 10 | 7 | 5 | 5 | 1 | 1 | 8 | 4 |
| | n is too small for a significant test | | | | | | | | | | | | | | |

**B07.6 Content areas: Reviews and references**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Never | 24.3 | 27.0 | 5.5 | 33.3 | 26.1 | 8.3 | 0.0 | 20.0 | 0.0 | 60.0 | 20.0 | 0.0 | 0.0 | 37.5 | 25.0 |
| Rarely | 29.0 | 35.2 | 42.6 | 33.3 | 34.8 | 41.7 | 33.3 | 30.0 | 28.6 | 40.0 | 40.0 | 100.0 | 0.0 | 37.5 | 50.0 |
| Sometimes | 25.6 | 26.5 | 42.6 | 22.2 | 26.1 | 41.7 | 66.7 | 20.0 | 57.1 | 0.0 | 40.0 | 0.0 | 0.0 | 25.0 | 25.0 |
| Often | 21.0 | 11.3 | 9.3 | 11.1 | 13.0 | 8.3 | 0.0 | 30.0 | 14.3 | 0.0 | 0.0 | 0.0 | 100.0 | 0.0 | 0.0 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 9 | 23 | 12 | 9 | 23 | 12 | 3 | 10 | 7 | 5 | 5 | 1 | 1 | 8 | 4 |
| | n is too small for a significant test | | | | | | | | | | | | | | |

**B08 Blogging about own research**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Yes, often | 16.2 | 25.1 | 9.3 | 22.2 | 26.1 | 8.3 | 0.0 | 40.0 | 14.3 | 40.0 | 0.0 | 0.0 | 0.0 | 25.0 | 0.0 |
| Yes, sometimes | 12.8 | 28.3 | 42.6 | 11.1 | 26.1 | 41.7 | 33.3 | 10.0 | 28.6 | 0.0 | 20.0 | 100.0 | 0.0 | 50.0 | 50.0 |
| Yes, rarely | 54.8 | 25.2 | 27.8 | 44.4 | 26.1 | 25.0 | 66.7 | 30.0 | 42.9 | 20.0 | 40.0 | 0.0 | 100.0 | 12.5 | 0.0 |
| Never | 16.2 | 21.5 | 20.4 | 22.2 | 21.7 | 25.0 | 0.0 | 20.0 | 14.3 | 40.0 | 40.0 | 0.0 | 0.0 | 12.5 | 50.0 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 9 | 23 | 12 | 9 | 23 | 12 | 3 | 10 | 7 | 5 | 5 | 1 | 1 | 8 | 4 |
| | n is too small for a significant test | | | | | | | | | | | | | | |

## B10 Audiences

**B10.01 Possible audiences: Colleagues in own specific field**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Low priority | 8.1 | 18.2 | 53.7 | 11.1 | 19.0 | 58.3 | 0.0 | 20.0 | 57.1 | 20.0 | 50.0 | 0.0 | 0.0 | 0.0 | 75.0 |
| Medium priority | 71.0 | 40.9 | 27.8 | 66.7 | 38.1 | 25.0 | 66.7 | 20.0 | 14.3 | 60.0 | 25.0 | 100.0 | 100.0 | 71.4 | 25.0 |
| High priority | 20.9 | 40.9 | 18.5 | 22.2 | 42.9 | 16.7 | 33.3 | 60.0 | 28.6 | 20.0 | 25.0 | 0.0 | 0.0 | 28.6 | 0.0 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 9 | 21 | 12 | 9 | 21 | 12 | 3 | 10 | 7 | 5 | 4 | 1 | 1 | 2 | 4 |
| | n is too small for a significant test | | | | | | | | | | | | | | |

**B10.02 Possible audiences: Scientists in other research fields**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Low priority | 29.0 | 27.8 | 44.4 | 33.3 | 28.6 | 50.0 | 33.3 | 30.0 | 42.9 | 40.0 | 50.0 | 0.0 | 0.0 | 14.3 | 75.0 |
| Medium priority | 58.2 | 58.3 | 46.3 | 55.6 | 57.1 | 41.7 | 33.3 | 50.0 | 42.9 | 60.0 | 50.0 | 100.0 | 100.0 | 71.4 | 25.0 |
| High priority | 12.8 | 13.8 | 9.3 | 11.1 | 14.3 | 8.3 | 33.3 | 20.0 | 14.3 | 0.0 | 0.0 | 0.0 | 0.0 | 14.3 | 0.0 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 9 | 21 | 12 | 9 | 21 | 12 | 3 | 10 | 7 | 5 | 4 | 1 | 1 | 7 | 4 |
| | n is too small for a significant test | | | | | | | | | | | | | | |

**B10.03 Possible audiences: Amateur scientists**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Low priority | 16.2 | 40.3 | 38.9 | 22.2 | 42.9 | 41.7 | 0.0 | 60.0 | 42.9 | 40.0 | 50.0 | 0.0 | 0.0 | 14.3 | 50.0 |
| Medium priority | 75.7 | 39.5 | 33.3 | 66.7 | 38.1 | 33.3 | 100.0 | 30.0 | 14.3 | 40.0 | 25.0 | 100.0 | 100.0 | 57.1 | 50.0 |
| High priority | 8.1 | 20.2 | 27.8 | 11.1 | 19.0 | 25.0 | 0.0 | 10.0 | 42.9 | 20.0 | 25.0 | 0.0 | 0.0 | 28.6 | 0.0 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 9 | 21 | 12 | 9 | 21 | 12 | 3 | 10 | 7 | 5 | 4 | 1 | 1 | 7 | 4 |
| | n is too small for a significant test | | | | | | | | | | | | | | |

**B10.04 Possible audiences: College/university students**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Low priority | 8.1 | 12.4 | 27.8 | 11.1 | 14.3 | 25.0 | 0.0 | 30.0 | 42.9 | 20.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Medium priority | 67.6 | 48.0 | 33.3 | 55.6 | 47.6 | 33.3 | 100.0 | 40.0 | 14.3 | 20.0 | 75.0 | 100.0 | 100.0 | 42.9 | 50.0 |
| High priority | 24.3 | 39.5 | 38.9 | 33.3 | 38.1 | 41.7 | 0.0 | 30.0 | 42.9 | 60.0 | 25.0 | 0.0 | 0.0 | 57.1 | 50.0 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 9 | 21 | 12 | 9 | 21 | 12 | 3 | 10 | 7 | 5 | 4 | 1 | 1 | 7 | 4 |
| | n is too small for a significant test | | | | | | | | | | | | | | |

**B10.05 Possible audiences: Science managers and science administrators**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Low priority | 62.9 | 46.0 | 53.7 | 55.6 | 47.6 | 58.3 | 66.7 | 50.0 | 57.1 | 40.0 | 100.0 | 0.0 | 100.0 | 14.3 | 75.0 |
| Medium priority | 37.1 | 45.7 | 27.8 | 44.4 | 42.9 | 25.0 | 33.3 | 30.0 | 14.3 | 60.0 | 0.0 | 100.0 | 0.0 | 85.7 | 25.0 |
| High priority | 0.0 | 8.3 | 18.5 | 0.0 | 9.5 | 16.7 | 0.0 | 20.0 | 28.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 9 | 21 | 12 | 9 | 21 | 12 | 3 | 10 | 7 | 5 | 4 | 1 | 1 | 7 | 4 |
| | n is too small for a significant test | | | | | | | | | | | | | | |

**B10.06 Possible audiences: Members of the general public**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Low priority | 8.1 | 32.2 | 0.0 | 11.1 | 35.0 | 0.0 | 0.0 | 50.0 | 0.0 | 20.0 | 66.7 | 0.0 | 0.0 | 0.0 | 0.0 |
| Medium priority | 50.1 | 32.0 | 51.8 | 44.4 | 30.0 | 50.0 | 33.3 | 20.0 | 42.9 | 40.0 | 0.0 | 100.0 | 100.0 | 57.1 | 50.0 |
| High priority | 41.8 | 35.8 | 48.2 | 44.4 | 35.0 | 50.0 | 66.7 | 30.0 | 57.1 | 40.0 | 33.3 | 0.0 | 0.0 | 42.9 | 50.0 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 9 | 20 | 12 | 9 | 20 | 12 | 3 | 10 | 7 | 5 | 3 | 1 | 1 | 7 | 4 |
| | n is too small for a significant test | | | | | | | | | | | | | | |

**B10.07 Possible audiences: Teachers and pupils**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Low priority | 33.9 | 30.6 | 35.2 | 22.2 | 33.3 | 41.7 | 33.3 | 50.0 | 28.6 | 0.0 | 50.0 | 0.0 | 100.0 | 0.0 | 75.0 |
| Medium priority | 58.0 | 59.7 | 46.3 | 66.7 | 57.1 | 41.7 | 66.7 | 40.0 | 42.9 | 80.0 | 50.0 | 100.0 | 0.0 | 85.7 | 25.0 |
| High priority | 8.1 | 9.7 | 18.5 | 11.1 | 9.5 | 16.7 | 0.0 | 10.0 | 28.6 | 20.0 | 0.0 | 0.0 | 0.0 | 14.3 | 0.0 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 9 | 21 | 12 | 9 | 21 | 12 | 3 | 10 | 7 | 5 | 4 | 1 | 1 | 7 | 4 |
| | n is too small for a significant test | | | | | | | | | | | | | | |

**B10.08 Possible audiences: Patients and their family members**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Low priority | 87.2 | 69.3 | 68.5 | 88.9 | 68.4 | 75.0 | 66.7 | 60.0 | 71.4 | 100.0 | 100.0 | 0.0 | 100.0 | 71.4 | 100.0 |
| Medium priority | 0.0 | 26.1 | 13.0 | 0.0 | 26.3 | 8.3 | 0.0 | 30.0 | 0.0 | 0.0 | 0.0 | 100.0 | 0.0 | 28.6 | 0.0 |
| High priority | 12.8 | 4.6 | 18.5 | 11.1 | 5.3 | 16.7 | 33.3 | 10.0 | 28.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 9 | 19 | 12 | 9 | 19 | 12 | 3 | 10 | 7 | 5 | 2 | 1 | 1 | 7 | 4 |
| | n is too small for a significant test | | | | | | | | | | | | | | |

## B10 Audiences (continued)

**B10.09 Possible audiences: Journalists**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Low priority | 62.8 | 46.6 | 59.2 | 66.7 | 47.6 | 66.7 | 100.0 | 50.0 | 57.1 | 60.0 | 75.0 | 0.0 | 0.0 | 28.6 | 100.0 |
| Medium priority | 37.2 | 39.5 | 31.5 | 33.3 | 38.1 | 25.0 | 0.0 | 30.0 | 28.6 | 40.0 | 25.0 | 100.0 | 100.0 | 57.1 | 0.0 |
| High priority | 0.0 | 13.8 | 9.3 | 0.0 | 14.3 | 8.3 | 0.0 | 20.0 | 14.3 | 0.0 | 0.0 | 0.0 | 0.0 | 14.3 | 0.0 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 9 | 21 | 12 | 9 | 21 | 12 | 3 | 10 | 7 | 5 | 4 | 1 | 1 | 7 | 4 |
| | n is too small for a significant test | | | | | | | | | | | | | | |

**B10.10 Possible audiences: Practitioners using scientific knowledge**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Low priority | 29.0 | 25.1 | 44.4 | 33.3 | 23.8 | 50.0 | 33.3 | 10.0 | 42.9 | 40.0 | 50.0 | 0.0 | 0.0 | 28.6 | 75.0 |
| Medium priority | 41.8 | 52.8 | 46.3 | 44.4 | 52.4 | 41.7 | 66.7 | 50.0 | 42.9 | 40.0 | 50.0 | 100.0 | 0.0 | 57.1 | 25.0 |
| High priority | 29.1 | 22.1 | 9.3 | 22.2 | 23.8 | 8.3 | 0.0 | 40.0 | 14.3 | 20.0 | 0.0 | 0.0 | 100.0 | 14.3 | 0.0 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 9 | 21 | 12 | 9 | 21 | 12 | 3 | 10 | 7 | 5 | 4 | 1 | 1 | 7 | 4 |
| | n is too small for a significant test | | | | | | | | | | | | | | |

**B10.11 Possible audiences: Business people**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Low priority | 79.0 | 76.5 | 59.2 | 88.9 | 76.2 | 66.7 | 100.0 | 70.0 | 57.1 | 100.0 | 100.0 | 0.0 | 0.0 | 71.4 | 100.0 |
| Medium priority | 21.0 | 11.1 | 40.8 | 11.1 | 9.5 | 33.3 | 0.0 | 0.0 | 42.9 | 0.0 | 0.0 | 100.0 | 100.0 | 28.6 | 0.0 |
| High priority | 0.0 | 12.4 | 0.0 | 0.0 | 14.3 | 0.0 | 0.0 | 30.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 9 | 21 | 12 | 9 | 21 | 12 | 3 | 10 | 7 | 5 | 4 | 1 | 1 | 7 | 4 |
| | n is too small for a significant test | | | | | | | | | | | | | | |

**B10.12 Possible audiences: Public administrators and politicians**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Low priority | 67.6 | 61.2 | 59.2 | 55.6 | 61.9 | 66.7 | 100.0 | 60.0 | 57.1 | 20.0 | 100.0 | 0.0 | 100.0 | 42.9 | 100.0 |
| Medium priority | 32.4 | 30.5 | 22.2 | 44.4 | 28.6 | 16.7 | 0.0 | 20.0 | 14.3 | 80.0 | 0.0 | 100.0 | 0.0 | 57.1 | 0.0 |
| High priority | 0.0 | 8.3 | 18.5 | 0.0 | 9.5 | 16.7 | 0.0 | 20.0 | 28.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 9 | 21 | 12 | 9 | 21 | 12 | 3 | 10 | 7 | 5 | 4 | 1 | 1 | 7 | 4 |
| | n is too small for a significant test | | | | | | | | | | | | | | |

**B10.13 Possible audiences: Members of NGOs**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Low priority | 50.1 | 66.8 | 59.2 | 44.4 | 66.7 | 66.7 | 33.3 | 60.0 | 57.1 | 40.0 | 100.0 | 0.0 | 100.0 | 57.1 | 100.0 |
| Medium priority | 37.1 | 24.9 | 31.5 | 44.4 | 23.8 | 25.0 | 33.3 | 20.0 | 28.6 | 60.0 | 0.0 | 100.0 | 0.0 | 42.9 | 0.0 |
| High priority | 12.8 | 8.3 | 9.3 | 11.1 | 9.5 | 8.3 | 33.3 | 20.0 | 14.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 9 | 21 | 12 | 9 | 21 | 12 | 3 | 10 | 7 | 5 | 4 | 1 | 1 | 7 | 4 |
| | n is too small for a significant test | | | | | | | | | | | | | | |

## B11-B12 Comments from audiences

**B11 Number of received comments per blog post**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| None | 20.9 | 13.8 | 9.3 | 22.2 | 13.0 | 8.3 | 33.3 | 10.0 | 14.3 | 20.0 | 0.0 | 0.0 | 0.0 | 25.0 | 0.0 |
| 1-5 | 66.3 | 64.9 | 68.5 | 66.7 | 65.2 | 75.0 | 33.3 | 60.0 | 71.4 | 80.0 | 100.0 | 0.0 | 100.0 | 50.0 | 100.0 |
| 6-10 | 12.8 | 8.8 | 22.2 | 11.1 | 8.7 | 16.7 | 33.3 | 10.0 | 14.3 | 0.0 | 0.0 | 100.0 | 0.0 | 12.5 | 0.0 |
| 11-25 | 0.0 | 5.0 | 0.0 | 0.0 | 4.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 12.5 | 0.0 |
| More than 25 | 0.0 | 7.5 | 0.0 | 0.0 | 8.7 | 0.0 | 0.0 | 20.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 9 | 23 | 12 | 9 | 23 | 12 | 3 | 10 | 7 | 5 | 5 | 1 | 1 | 8 | 4 |
| | n is too small for a significant test | | | | | | | | | | | | | | |

**B12.01 Comments from colleagues in own specific field**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Checked | 73.5 | 69.3 | 55.1 | 71.4 | 70.0 | 45.5 | 50.0 | 77.8 | 66.7 | 75.0 | 60.0 | 100.0 | 100.0 | 66.7 | 0.0 |
| n | 7 | 20 | 11 | 7 | 20 | 11 | 2 | 9 | 6 | 4 | 5 | 1 | 1 | 6 | 4 |
| | n is too small for a significant test | | | | | | | | | | | | | | |

**B12.02 Comments from scientists in other research fields**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Checked | 26.5 | 34.2 | 51.0 | 28.6 | 35.0 | 45.5 | 50.0 | 44.4 | 50.0 | 25.0 | 20.0 | 100.0 | 0.0 | 33.3 | 25.0 |
| n | 7 | 20 | 11 | 7 | 20 | 11 | 2 | 9 | 6 | 4 | 5 | 1 | 1 | 6 | 4 |
| | n is too small for a significant test | | | | | | | | | | | | | | |

## B12 Comments from audiences (continued)

**B12.03 Comments from amateur scientists**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Checked | 0.0 | 21.2 | 26.5 | 0.0 | 20.0 | 27.3 | 0.0 | 11.1 | 33.3 | 0.0 | 20.0 | 0.0 | 0.0 | 33.3 | 25.0 |
| n | 7 | 20 | 11 | 7 | 20 | 11 | 2 | 9 | 6 | 4 | 5 | 1 | 1 | 6 | 4 |
| | n is too small for a significant test | | | | | | | | | | | | | | |

**B12.04 Comments from college/university students**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Checked | 20.5 | 43.8 | 79.6 | 28.6 | 45.0 | 81.8 | 0.0 | 55.6 | 66.7 | 50.0 | 40.0 | 100.0 | 0.0 | 33.3 | 100.0 |
| n | 7 | 20 | 11 | 7 | 20 | 11 | 2 | 9 | 6 | 4 | 5 | 1 | 1 | 6 | 4 |
| | n is too small for a significant test | | | | | | | | | | | | | | |

**B12.05 Comments from science managers and science administrators**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Checked | 0.0 | 14.5 | 16.3 | 0.0 | 15.0 | 18.2 | 0.0 | 22.2 | 16.7 | 0.0 | 0.0 | 0.0 | 0.0 | 16.7 | 25.0 |
| n | 7 | 20 | 11 | 7 | 20 | 11 | 2 | 9 | 6 | 4 | 5 | 1 | 1 | 6 | 4 |
| | n is too small for a significant test | | | | | | | | | | | | | | |

**B12.06 Comments from members of the general public**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Checked | 26.5 | 35.1 | 28.5 | 28.6 | 35.0 | 36.4 | 50.0 | 33.3 | 16.7 | 25.0 | 40.0 | 0.0 | 0.0 | 33.3 | 75.0 |
| n | 7 | 20 | 11 | 7 | 20 | 11 | 2 | 9 | 6 | 4 | 5 | 1 | 1 | 6 | 4 |
| | n is too small for a significant test | | | | | | | | | | | | | | |

**B12.07 Comments from teachers and pupils**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Checked | 10.2 | 5.8 | 14.3 | 14.3 | 5.0 | 9.1 | 0.0 | 0.0 | 0.0 | 25.0 | 0.0 | 100.0 | 0.0 | 16.7 | 0.0 |
| n | 7 | 20 | 11 | 7 | 20 | 11 | 2 | 9 | 6 | 4 | 5 | 1 | 1 | 6 | 4 |
| | n is too small for a significant test | | | | | | | | | | | | | | |

**B12.08 Comments from patients and their family members**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Checked | 0.0 | 8.7 | 20.4 | 0.0 | 10.0 | 18.2 | 0.0 | 22.2 | 33.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| n | 7 | 20 | 11 | 7 | 20 | 11 | 2 | 9 | 6 | 4 | 5 | 1 | 1 | 6 | 4 |
| | n is too small for a significant test | | | | | | | | | | | | | | |

**B12.09 Comments from journalists**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Checked | 0.0 | 8.7 | 24.5 | 0.0 | 10.0 | 18.2 | 0.0 | 22.2 | 16.7 | 0.0 | 0.0 | 100.0 | 0.0 | 0.0 | 0.0 |
| n | 7 | 20 | 11 | 7 | 20 | 11 | 2 | 9 | 6 | 4 | 5 | 1 | 1 | 6 | 4 |
| | n is too small for a significant test | | | | | | | | | | | | | | |

**B12.10 Comments from practitioners using scientific knowledge**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Checked | 0.0 | 24.7 | 16.3 | 0.0 | 25.0 | 18.2 | 0.0 | 33.3 | 16.7 | 0.0 | 0.0 | 0.0 | 0.0 | 33.3 | 25.0 |
| n | 7 | 20 | 11 | 7 | 20 | 11 | 2 | 9 | 6 | 4 | 5 | 1 | 1 | 6 | 4 |
| | n is too small for a significant test | | | | | | | | | | | | | | |

**B12.11 Comments from business people**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Checked | 0.0 | 4.4 | 10.2 | 0.0 | 5.0 | 9.1 | 0.0 | 11.1 | 16.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| n | 7 | 20 | 11 | 7 | 20 | 11 | 2 | 9 | 6 | 4 | 5 | 1 | 1 | 6 | 4 |
| | n is too small for a significant test | | | | | | | | | | | | | | |

**B12.12 Comments from public administrators and politicians**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Checked | 0.0 | 4.4 | 0.0 | 0.0 | 5.0 | 0.0 | 0.0 | 11.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| n | 7 | 20 | 11 | 7 | 20 | 11 | 2 | 9 | 6 | 4 | 5 | 1 | 1 | 6 | 4 |
| | n is too small for a significant test | | | | | | | | | | | | | | |

**B12.13 Comments from members of NGOs**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Checked | 0.0 | 0.0 | 6.1 | 0.0 | 0.0 | 9.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 25.0 |
| n | 7 | 20 | 11 | 7 | 20 | 11 | 2 | 9 | 6 | 4 | 5 | 1 | 1 | 6 | 4 |
| | n is too small for a significant test | | | | | | | | | | | | | | |

## B13-B16 Comments

**B13 Tone of readers' comments**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Mostly postive | 73.5 | 78.2 | 73.5 | 71.4 | 78.9 | 72.7 | 50.0 | 88.9 | 66.7 | 75.0 | 60.0 | 100.0 | 100.0 | 80.0 | 75.0 |
| About equally postive and critical | 10.2 | 11.7 | 20.4 | 14.3 | 10.5 | 18.2 | 0.0 | 0.0 | 33.3 | 25.0 | 20.0 | 0.0 | 0.0 | 20.0 | 0.0 |
| Mostly neutral | 16.2 | 10.1 | 6.1 | 14.3 | 10.5 | 9.1 | 50.0 | 11.1 | 0.0 | 0.0 | 20.0 | 0.0 | 0.0 | 0.0 | 25.0 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 7 | 19 | 11 | 7 | 19 | 11 | 2 | 9 | 6 | 4 | 5 | 1 | 1 | 5 | 4 |
| | n is too small for a significant test | | | | | | | | | | | | | | |

**B14 Frequency of responding to readers' comments**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Rarely | 26.6 | 37.2 | 22.4 | 14.3 | 36.8 | 27.3 | 0.0 | 33.3 | 16.7 | 0.0 | 40.0 | 0.0 | 100.0 | 40.0 | 50.0 |
| Sometimes | 41.0 | 45.6 | 67.4 | 57.1 | 47.4 | 63.6 | 0.0 | 66.7 | 66.7 | 100.0 | 20.0 | 100.0 | 0.0 | 40.0 | 50.0 |
| Frequently | 32.4 | 17.2 | 10.2 | 28.6 | 15.8 | 9.1 | 100.0 | 0.0 | 16.7 | 0.0 | 40.0 | 0.0 | 0.0 | 20.0 | 0.0 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 7 | 19 | 11 | 7 | 19 | 11 | 2 | 9 | 6 | 4 | 5 | 1 | 1 | 5 | 4 |
| | n is too small for a significant test | | | | | | | | | | | | | | |

**B15 Comments on others' posts**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Yes | 42.6 | 61.4 | 50.6 | 47.1 | 62.1 | 47.4 | 40.0 | 60.0 | 60.0 | 54.5 | 87.5 | 50.0 | 0.0 | 45.5 | 20.0 |
| No | 57.4 | 38.6 | 49.4 | 52.9 | 37.9 | 52.6 | 60.0 | 40.0 | 40.0 | 45.5 | 12.5 | 50.0 | 100.0 | 54.5 | 80.0 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 17 | 29 | 19 | 17 | 29 | 19 | 5 | 10 | 10 | 11 | 8 | 4 | 1 | 11 | 5 |
| | n is too small for a significant test | | | | | | | | | | | | | | |

**B16 Frequency of commenting on others' posts**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Rarely | 35.2 | 49.5 | 36.2 | 33.3 | 50.0 | 33.3 | 50.0 | 66.7 | 33.3 | 28.6 | 28.6 | 50.0 | | 60.0 | 0.0 |
| Sometimes | 49.2 | 32.2 | 63.8 | 55.6 | 33.3 | 66.7 | 0.0 | 33.3 | 66.7 | 71.4 | 57.1 | 50.0 | | 0.0 | 100.0 |
| Frequently | 15.6 | 18.4 | 0.0 | 11.1 | 16.7 | 0.0 | 50.0 | 0.0 | 0.0 | 0.0 | 14.3 | 0.0 | | 40.0 | 0.0 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | | 100.0 | 100.0 |
| n | 9 | 18 | 9 | 9 | 18 | 9 | 2 | 6 | 6 | 7 | 7 | 2 | | 5 | 1 |
| | n is too small for a significant test | | | | | | | | | | | | | | |

## B17 Reasons to comment

**B17.1 Reasons to comment on other people's posts: to correct errors or clarify ambiguities**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Checked | 25.4 | 45.6 | 36.2 | 22.2 | 44.4 | 33.3 | 50.0 | 33.3 | 33.3 | 14.3 | 42.9 | 50.0 | | 60.0 | 0.0 |
| n | 9 | 18 | 9 | 9 | 18 | 9 | 2 | 6 | 6 | 7 | 7 | 2 | | 5 | 1 |
| | n is too small for a significant test | | | | | | | | | | | | | | |

**B17.2 Reasons to comment on other people's posts: to add relevant information or viewpoints**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Checked | 39.4 | 81.6 | 63.8 | 44.4 | 83.3 | 66.7 | 0.0 | 100.0 | 66.7 | 57.1 | 85.7 | 50.0 | | 60.0 | 100.0 |
| n | 9 | 18 | 9 | 9 | 18 | 9 | 2 | 6 | 6 | 7 | 7 | 2 | | 5 | 1 |
| | n is too small for a significant test | | | | | | | | | | | | | | |

**B17.3 Reasons to comment on other people's posts: to agree or praise**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Checked | 35.2 | 23.1 | 25.5 | 33.3 | 22.2 | 22.2 | 50.0 | 16.7 | 16.7 | 28.6 | 14.3 | 50.0 | | 40.0 | 0.0 |
| n | 9 | 18 | 9 | 9 | 18 | 9 | 2 | 6 | 6 | 7 | 7 | 2 | | 5 | 1 |
| | n is too small for a significant test | | | | | | | | | | | | | | |

**B17.4 Reasons to comment on other people's posts: to disagree or criticize**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Checked | 45.1 | 23.3 | 10.6 | 44.4 | 22.2 | 11.1 | 50.0 | 0.0 | 16.7 | 42.9 | 42.9 | 0.0 | | 20.0 | 0.0 |
| n | 9 | 18 | 9 | 9 | 18 | 9 | 2 | 6 | 6 | 7 | 7 | 2 | | 5 | 1 |
| | n is too small for a significant test | | | | | | | | | | | | | | |

**B17.5 Reasons to comment on other people's posts: to demand something**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Checked | 0.0 | 0.0 | 10.6 | 0.0 | 0.0 | 11.1 | 0.0 | 0.0 | 16.7 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 |
| n | 9 | 18 | 9 | 9 | 18 | 9 | 2 | 6 | 6 | 7 | 7 | 2 | | 5 | 1 |
| | n is too small for a significant test | | | | | | | | | | | | | | |

## B17 Reasons to comment (continued)

**B17.6 Reasons to comment on other people's posts: to raise a question**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Checked | 70.5 | 40.8 | 14.9 | 66.7 | 38.9 | 11.1 | 100.0 | 16.7 | 0.0 | 57.1 | 42.9 | 50.0 | | 60.0 | 0.0 |
| n | 9 | 18 | 9 | 9 | 18 | 9 | 2 | 6 | 6 | 7 | 7 | 2 | | 5 | 1 |
| | n is too small for a significant test | | | | | | | | | | | | | | |

**B17.7 Reasons to comment on other people's posts: to give an answer or provide advice**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Checked | 45.1 | 43.3 | 46.8 | 44.4 | 44.4 | 44.4 | 50.0 | 50.0 | 50.0 | 42.9 | 57.1 | 50.0 | | 20.0 | 0.0 |
| n | 9 | 18 | 9 | 9 | 18 | 9 | 2 | 6 | 6 | 7 | 7 | 2 | | 5 | 1 |
| | n is too small for a significant test | | | | | | | | | | | | | | |

## B18-Q19 Influence of blogging

**B18 Influence of blogging on scientific work**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| No influence | 39.9 | 56.5 | 71.0 | 47.1 | 55.2 | 73.7 | 20.0 | 30.0 | 80.0 | 63.6 | 87.5 | 50.0 | 0.0 | 54.5 | 80.0 |
| A minor influence | 26.7 | 24.0 | 12.9 | 23.5 | 24.1 | 10.5 | 60.0 | 30.0 | 10.0 | 9.1 | 12.5 | 25.0 | 0.0 | 27.3 | 0.0 |
| Some influence | 33.4 | 19.5 | 10.7 | 29.4 | 20.7 | 10.5 | 20.0 | 40.0 | 0.0 | 27.3 | 0.0 | 25.0 | 100.0 | 18.2 | 20.0 |
| A strong influence | 0.0 | 0.0 | 5.4 | 0.0 | 0.0 | 5.3 | 0.0 | 0.0 | 10.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 17 | 29 | 19 | 17 | 29 | 19 | 5 | 10 | 10 | 11 | 8 | 4 | 1 | 11 | 5 |
| | n is too small for a significant test | | | | | | | | | | | | | | |

**B19 Positive or negative influence of blogging on scientific work**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Mostly positive | 72.3 | 85.3 | 81.5 | 66.7 | 84.6 | 80.0 | 75.0 | 85.7 | 50.0 | 50.0 | 0.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Mostly negative | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Partly positive, partly negative | 27.7 | 14.7 | 18.5 | 33.3 | 15.4 | 20.0 | 25.0 | 14.3 | 50.0 | 50.0 | 100.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 9 | 13 | 5 | 9 | 13 | 5 | 4 | 7 | 2 | 4 | 1 | 2 | 1 | 5 | 1 |
| | n is too small for a significant test | | | | | | | | | | | | | | |

## Q25-Q35 Social demographics

**Q25 Current management role**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Dean, head of institute, CEO etc. | 14.6 | 17.1 | 17.7 | 13.0 | 17.3 | 17.4 | 14.9 | 19.4 | 19.4 | 9.3 | 14.0 | 17.5 | 21.2 | 17.7 | 15.4 |
| Group leader, principal investigator | 47.6 | 48.1 | 55.0 | 46.6 | 48.5 | 53.0 | 54.0 | 54.0 | 60.2 | 41.5 | 40.0 | 57.1 | 45.5 | 50.0 | 43.3 |
| Other management position | 12.0 | 4.4 | 7.4 | 10.5 | 4.7 | 8.1 | 12.6 | 5.8 | 7.8 | 6.8 | 6.0 | 4.8 | 18.2 | 0.0 | 10.6 |
| No management position at this time | 25.9 | 30.3 | 19.9 | 29.8 | 29.6 | 21.5 | 18.4 | 20.9 | 12.6 | 42.4 | 40.0 | 20.6 | 15.2 | 32.3 | 30.8 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 238 | 301 | 270 | 238 | 301 | 270 | 87 | 139 | 103 | 118 | 100 | 63 | 33 | 62 | 104 |
| | Chi-2=18.7; df=6; p=0.005 | | | Chi-2=13.8; df=6; p=0.032 | | | Chi-2=6.6; df=6; p=0.355 | | | Chi-2=11.3; df=6; p=0.080 | | | Chi-2=12.8; df=6; p=0.046 | | |

**Q26 Ph.D or doctoral degree**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Yes | 88.2 | 93.5 | 95.5 | 88.3 | 93.4 | 95.1 | 94.3 | 92.0 | 95.1 | 85.6 | 95.0 | 96.8 | 81.8 | 93.7 | 94.2 |
| No | 11.8 | 6.5 | 4.5 | 11.7 | 6.6 | 4.9 | 5.7 | 8.0 | 4.9 | 14.4 | 5.0 | 3.2 | 18.2 | 6.3 | 5.8 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 239 | 301 | 268 | 239 | 301 | 268 | 88 | 138 | 103 | 118 | 100 | 62 | 33 | 63 | 103 |
| | Chi-2=10.3; df=2; p=0.006 | | | Chi-2=9.1; df=2; p=0.011 | | | Chi-2=1.1; df=2; p=0.589 | | | Chi-2=9.0; df=2; p=0.011 | | | Chi-2=5.5; df=2; p=0.063 | | |

**Q27 Professorship**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Yes | 30.3 | 54.8 | 79.0 | 29.4 | 55.5 | 79.8 | 34.1 | 63.8 | 79.6 | 25.6 | 45.5 | 76.2 | 30.3 | 53.1 | 82.1 |
| No | 69.7 | 45.2 | 21.0 | 70.6 | 44.5 | 20.2 | 65.9 | 36.2 | 20.4 | 74.4 | 54.5 | 23.8 | 69.7 | 46.9 | 17.9 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 238 | 301 | 272 | 238 | 301 | 272 | 88 | 138 | 103 | 117 | 99 | 63 | 33 | 64 | 106 |
| | Chi-2=122.8; df=2; p=0.000 | | | Chi-2=130.7; df=2; p=0.000 | | | Chi-2=42.1; df=2; p=0.000 | | | Chi-2=42.6; df=2; p=0.000 | | | Chi-2=34.8; df=2; p=0.000 | | |

**Q28 Career level**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Junior | 19.0 | 24.5 | 15.8 | 20.1 | 24.2 | 14.4 | 14.9 | 20.1 | 12.7 | 24.4 | 30.3 | 22.6 | 18.2 | 23.4 | 11.3 |
| Mid-career | 43.8 | 30.9 | 37.8 | 41.0 | 30.1 | 38.1 | 46.0 | 24.5 | 39.2 | 33.6 | 31.3 | 35.5 | 54.5 | 40.6 | 38.7 |
| Senior | 37.1 | 44.7 | 46.4 | 38.9 | 45.7 | 47.4 | 39.1 | 55.4 | 48.0 | 42.0 | 38.4 | 41.9 | 27.3 | 35.9 | 50.0 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 239 | 302 | 270 | 239 | 302 | 270 | 87 | 139 | 102 | 119 | 99 | 62 | 33 | 64 | 106 |
| | Chi-2=14.5; df=4; p=0.006 | | | Chi-2=14.0; df=4; p=0.007 | | | Chi-2=13.0; df=4; p=0.011 | | | Chi-2=1.5; df=4; p=0.824 | | | Chi-2=9.1; df=4; p=0.058 | | |

## Q25-Q35 Social demographics (continued)

**Q29 Number of publications**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Fewer than 5 articles | 9.5 | 3.1 | 1.8 | 9.6 | 3.0 | 2.6 | 3.4 | 0.7 | 1.0 | 12.6 | 7.1 | 0.0 | 15.2 | 1.6 | 5.7 |
| 5-9 articles | 10.8 | 6.8 | 5.5 | 10.4 | 6.6 | 5.1 | 11.4 | 5.0 | 3.9 | 9.2 | 8.1 | 7.9 | 12.1 | 7.8 | 4.7 |
| 10-25 articles | 17.6 | 20.3 | 24.7 | 17.5 | 19.9 | 24.6 | 20.5 | 17.3 | 22.3 | 16.0 | 19.2 | 27.0 | 15.2 | 26.6 | 25.5 |
| 26-50 articles | 22.7 | 21.3 | 27.8 | 21.7 | 21.2 | 27.2 | 22.7 | 20.9 | 27.2 | 19.3 | 20.2 | 30.2 | 27.3 | 23.4 | 25.5 |
| 51-100 articles | 19.7 | 19.0 | 20.3 | 20.0 | 19.5 | 19.9 | 26.1 | 23.7 | 19.4 | 17.6 | 18.2 | 22.2 | 12.1 | 12.5 | 18.9 |
| More than 100 articles | 19.7 | 29.6 | 19.9 | 20.8 | 29.8 | 20.6 | 15.9 | 32.4 | 26.2 | 25.2 | 27.3 | 12.7 | 18.2 | 28.1 | 19.8 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 240 | 302 | 272 | 240 | 302 | 272 | 88 | 139 | 103 | 119 | 99 | 63 | 33 | 64 | 106 |
| | Chi-2=37.7; df=10; p=0.000 | | | Chi-2=34.0; df=10; p=0.000 | | | Chi-2=16.1; df=10; p=0.096 | | | Chi-2=18.0; df=10; p=0.055 | | | Chi-2=13.3; df=10; p=0.207 | | |

**Q30 Research Insitutions**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| University or university hospital | 59.6 | 71.7 | 83.5 | 61.5 | 71.5 | 84.4 | 71.6 | 71.9 | 83.2 | 60.2 | 65.7 | 81.0 | 39.4 | 79.7 | 87.7 |
| Hospital | 0.5 | 2.0 | 3.7 | 0.4 | 2.3 | 3.3 | 1.1 | 5.0 | 7.9 | 0.0 | 0.0 | 1.6 | 0.0 | 0.0 | 0.0 |
| Public research institution | 28.9 | 3.9 | 5.5 | 28.5 | 4.0 | 4.8 | 17.0 | 4.3 | 5.0 | 33.1 | 5.1 | 7.9 | 42.4 | 1.6 | 2.8 |
| Private research institution | 1.0 | 3.1 | 0.6 | 0.8 | 3.3 | 0.7 | 0.0 | 5.0 | 1.0 | 0.8 | 3.0 | 0.0 | 3.0 | 0.0 | 0.9 |
| Private company or industry | 5.5 | 6.6 | 0.7 | 4.2 | 6.3 | 1.1 | 4.5 | 5.0 | 0.0 | 1.7 | 4.0 | 0.0 | 12.1 | 12.5 | 2.8 |
| Government branch or agency | 2.0 | 10.4 | 2.8 | 1.7 | 10.3 | 3.0 | 2.3 | 6.5 | 2.0 | 0.8 | 19.2 | 3.2 | 3.0 | 4.7 | 3.8 |
| Science academy | 0.6 | 0.4 | 2.5 | 0.8 | 0.3 | 2.2 | 0.0 | 0.0 | 1.0 | 1.7 | 0.0 | 4.8 | 0.0 | 1.6 | 1.9 |
| Museum | 0.5 | 0.3 | 0.0 | 0.4 | 0.3 | 0.0 | 1.1 | 0.0 | 0.0 | 0.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Other institution | 0.8 | 0.6 | 0.0 | 0.8 | 0.7 | 0.0 | 1.1 | 0.7 | 0.0 | 0.8 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Self-employed | 0.0 | 0.3 | 0.6 | 0.0 | 0.3 | 0.4 | 0.0 | 0.0 | 0.0 | 0.0 | 1.0 | 1.6 | 0.0 | 0.0 | 0.0 |
| No employment | 0.8 | 0.6 | 0.0 | 0.8 | 0.7 | 0.0 | 1.1 | 1.4 | 0.0 | 0.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 239 | 302 | 270 | 239 | 302 | 270 | 88 | 139 | 101 | 118 | 99 | 63 | 33 | 64 | 106 |
| | Chi-2=154.6; df=20; p=0.000 | | | Chi-2=150.2; df=20; p=0.000 | | | Chi-2=41.3; df=18; p=0.001 | | | Chi-2=76.2; df=20; p=0.000 | | | Chi-2=66.8; df=10; p=0.000 | | |

**Q31 Branch of science and technology (unrecoded)**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Life sciences | 40.0 | 36.4 | 39.3 | 36.2 | 41.3 | 36.8 | 98.9 | 89.9 | 97.1 | | | | | | |
| Natural sciences | 33.3 | 31.8 | 33.1 | 47.9 | 30.4 | 22.1 | | | | 96.6 | 92.0 | 95.2 | | | |
| Technology / Engineering | 23.3 | 24.2 | 24.6 | 12.9 | 20.5 | 38.6 | | | | | | | 93.9 | 96.9 | 99.1 |
| Others | 3.3 | 7.6 | 2.9 | 2.9 | 7.9 | 2.6 | 1.1 | 10.1 | 2.9 | 3.4 | 8.0 | 4.8 | 6.1 | 3.1 | 0.9 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 240 | 303 | 272 | 240 | 303 | 272 | 88 | 139 | 103 | 119 | 100 | 63 | 33 | 64 | 106 |
| | Chi-2=8.8; df=6; p=0.187 | | | Chi-2=76.5; df=6; p=0.000 | | | Chi-2=10.2.2; df=2; p=0.006 | | | Chi-2=2.4; df=2; p=0.306 | | | Chi-2=2.9; df=2; p=0.233 | | |

**Q32 Focus of research**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Basic research | 43.8 | 38.2 | 21.0 | 49.6 | 38.0 | 15.8 | 39.8 | 28.8 | 10.7 | 64.7 | 61.0 | 46.0 | 21.2 | 21.9 | 2.8 |
| Applied research | 30.8 | 32.1 | 47.6 | 26.7 | 32.3 | 53.7 | 31.8 | 38.8 | 50.5 | 16.8 | 18.0 | 25.4 | 48.5 | 40.6 | 73.6 |
| Basic and applied research equally | 25.4 | 29.7 | 31.5 | 23.8 | 29.7 | 30.5 | 28.4 | 32.4 | 38.8 | 18.5 | 21.0 | 28.6 | 30.3 | 37.5 | 23.6 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 240 | 303 | 272 | 240 | 303 | 272 | 88 | 139 | 103 | 119 | 100 | 63 | 33 | 64 | 106 |
| | Chi-2=36.3; df=4; p=0.000 | | | Chi-2=75.9; df=4; p=0.000 | | | Chi-2=22.0; df=4; p=0.000 | | | Chi-2=6.2; df=4; p=0.187 | | | Chi-2=25.9; df=4; p=0.000 | | |

**Q33 Age**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Average (in years) | 44.3 | 49.9 | 48.3 | 44.4 | 50.1 | 48.3 | 46.0 | 52.7 | 49.2 | 43.8 | 48.0 | 47.5 | 42.3 | 47.8 | 47.7 |
| n | 226 | 275 | 258 | 227 | 275 | 257 | 83 | 128 | 100 | 114 | 90 | 59 | 30 | 57 | 98 |
| | F=15.3; df=2; p=0.000 | | | F=8.3; df=2; p=0.000 | | | F=6.3; df=2; p=0.002* | | | | | | | | |

**Q34 Gender**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TW | GER | USA | TW | GER | USA | TW | GER | USA | TW | GER | USA | TW |
| Male | 79.2 | 76.8 | 89.7 | 79.1 | 76.1 | 90.0 | 67.4 | 69.2 | 81.4 | 84.3 | 81.4 | 93.7 | 90.9 | 82.5 | 93.4 |
| Female | 20.8 | 23.2 | 10.3 | 20.9 | 23.9 | 10.0 | 32.6 | 30.8 | 16.0 | 15.7 | 18.6 | 6.3 | 9.1 | 17.5 | 6.6 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 234 | 293 | 269 | 234 | 293 | 269 | 86 | 133 | 100 | 115 | 97 | 63 | 33 | 63 | 106 |
| | Chi-2=17.4; df=2; p=0.000 | | | Chi-2=19.5; df=2; p=0.000 | | | Chi-2=8.5; df=2; p=0.014 | | | Chi-2=4.8; df=2; p=0.092 | | | Chi-2=5.1; df=2; p=0.079 | | |

**Q35 Citizen of Country**

| | Country (weighted) | | | Country | | | Life sciences | | | Natural sciences | | | Technology / Engineering | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN | GER | USA | TWN |
| Yes | 77.5 | 79.4 | 93.9 | 74.6 | 79.9 | 94.8 | 89.7 | 84.2 | 96.1 | 62.1 | 77.6 | 88.9 | 78.8 | 74.2 | 97.1 |
| No | 22.5 | 20.6 | 6.1 | 25.4 | 20.1 | 5.2 | 10.3 | 15.8 | 3.9 | 37.9 | 22.4 | 11.1 | 21.2 | 25.8 | 2.9 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| n | 236 | 293 | 271 | 236 | 293 | 271 | 87 | 133 | 103 | 116 | 98 | 63 | 33 | 62 | 105 |
| | Chi-2=31.3; df=2; p=0.000 | | | Chi-2=41.5; df=2; p=0.000 | | | Chi-2=8.7; df=2; p=0.013 | | | Chi-2=16.3; df=2; p=0.000 | | | Chi-2=20.5; df=2; p=0.000 | | |

* The main effect for discipline was tested in the saturated model. The main effect variables are country and dicipline.

## Abstract

Many communication researchers expect that the diffusion of the new media in modern societies creates new channels of communication that can be used as alternatives or supplements to traditional forms of science communication. Conclusive empirical evidence of scientists' appreciation and use of these new channels is rare, however. This study aims to contribute to the understanding of the role the new online media – in particular blogs – play for public science communication compared to traditional science communication in journalistic mass media. The focus of this study is on scientists' involvements in different old and new forms of science communication and on how this involvement differs across cultures.

The results presented in this dissertation are based on an international online survey of scientists in Taiwan, Germany and the United States. For each country, 1,500 scientists were selected from the database "Science Citation Index Expanded" on the basis of their authorship of publications in international scientific journals in the fields of natural sciences, medicine and engineering, using a stratified random sampling scheme. The response rates were 21.5% (Germany), 23.1% (USA) and 22.8% (Taiwan).

An overview of scientists' participation in activities of public science communication via different types of online media shows that many scientists in each of the three countries are involved in a broad spectrum of such activities. Yet only a minority of scientists reads online blogs, and only very few of them write blog posts themselves. Blogging was perceived as time consuming and not serious enough to communicate with scientific peers and colleagues. Crucial for scientists' decision to engage in blogging activities seems to be their intrinsic motivation, for example their enjoyment of blogging.

Blogging is a marginal activity for most scientists who blog. A majority of blogging scientists publishes blog posts only every few weeks or less frequently. Scientists blog about a broad spectrum of topics but they provide information related to research more frequently than any other type of information. Dialogical communication seems to take place only to a limited degree, obvious from the small number of readers' comments. Furthermore, dialogs occurring in the blogosphere are mostly confined to special groups; most comments are from readers close to science such as colleagues, scientific peers and students.

Blogging scientists perceive little influence of their blogging activities on their work.

Do scientists differ who interact with journalists or are online active, in terms of their leadership position and age? Results of this survey show a positive association between scientific productivity and frequency of contacts with journalists and between leadership position and frequency. However, scientific productivity and leadership position are less predictive for scientists' online activities than for their contacts with journalists. Incongruent with the intuition that younger scientists may be more online active in public science communication than older scientists, there is no significant association between age and frequency of online activities.

There are no consistent differences in the preferences for communication models (deficit vs. public engagement) between groups of scientists preferring communication with the public via new media or mediated by journalism. Furthermore, their acceptance of using media visibility as criterion in decisions on research and scientific publication does not differ between the two groups.

Of the three countries, the proportion of blogging scientists is highest in the United States (8%), followed by Taiwan (5%) and Germany (4%). The difference in the prevalence of blogging among scientists in Germany and USA is well explained by different levels of diffusion of online media. The lower prevalence of blogging among German scientists is consistent with the finding that German scientists more often perceive critical attitudes towards blogging from their colleagues than US scientists. A plausible explanation for the low level of activities among Taiwanese scientists is that they assign less priority to public communication than German and US scientists. The proportion of Taiwanese scientists indicating that they are not interested in communicating with the public and considering public communication neither a "moral duty" nor a "good thing to do" was higher than the respective proportions of German and US scientists.

The results of this study suggest that blogging currently plays only a limited role as part of public science communication activities. The number of blogging scientists is small and blogging is a peripheral activity for those who blog. The role of blogging for increasing public engagement with science seems to be limited.

## Zusammenfassung

Viele Kommunikationswissenschaftler erwarten, dass die Verbreitung der Neuen Medien in modernen Gesellschaften neue Kommunikationswege schafft, die alternativ oder ergänzend zu traditionellen Formen der Wissenschaftskommunikation dienen können. Schlüssige empirische Evidenz zur Einschätzung und Nutzung der Neuen Medien unter Wissenschaftlern liegt jedoch kaum vor. Ziel dieser Arbeit ist es, zum Verständnis der Rolle neuer Online-Medien – insbesondere von Blogs – in der öffentlichen Wissenschaftskommunikation im Vergleich zur traditionellen journalistischen Vermittlung beizutragen. Die Studie befasst sich vor allem mit der Beteiligung von Wissenschaftlern an verschiedenen alten und neuen Formen der Wissenschaftskommunikation – und damit, wie diese Beteiligung interkulturell variiert.

Die vorgestellten Befunde basieren auf einer internationalen Online-Befragung von Wissenschaftlern aus Taiwan, Deutschland und den USA. Für jedes Land wurden aus der Datenbank "Science Citation Index Expanded" mit einem geschichteten Zufallsstichprobenansatz 1.500 Wissenschaftler ausgewählt, die Autoren von Publikationen in internationalen wissenschaftlichen Zeitschriften der Bereiche Naturwissenschaften, Medizin und Ingenieurwissenschaft waren. Die Ausschöpfungsquoten betrugen 21,5% (Deutschland), 23,1% (USA) und 22,8% (Taiwan).

Ein Überblick über die Beteiligung von Wissenschaftlern an der öffentlichen Wissenschaftskommunikation in verschiedenen Online-Medien zeigt, dass in allen drei Ländern zahlreiche Wissenschaftler an einem breiten Spektrum solcher Aktivitäten beteiligt sind. Jedoch liest nur eine Minderheit der Wissenschaftler Blogs und sehr wenige verfassen selbst Blogbeiträge. Bloggen wurde als zeitaufwendig und nicht seriös genug für den Austausch mit wissenschaftlichen Fachkollegen wahrgenommen. Zentral für die Entscheidung zu bloggen scheint für Wissenschaftler ihre intrinsische Motivation zu sein, also beispielsweise ob ihnen Bloggen Spaß macht.

Für die meisten bloggenden Wissenschaftler ist Bloggen eine periphere Aktivität. Die Mehrzahl der bloggenden Wissenschaftler veröffentlicht Beiträge nur alle paar Wochen oder noch seltener. Sie bloggen über ein breites Spektrum an Themen, aber sie veröffentlichen Informationen über Forschung häufiger als andere Arten von Informationen. Wie aus der überschaubaren Zahl an Leserkom-

mentaren hervorgeht, findet dialogische Kommunikation nur in begrenztem Ausmaß statt. Außerdem sind solche Dialoge überwiegend auf spezielle Gruppen beschränkt; die meisten Kommentare stammen von Lesern mit engem Bezug zur Wissenschaft wie Arbeitskollegen, wissenschaftliche Fachkollegen und Studenten. Bloggende Wissenschaftler nehmen nur einen geringen Einfluss ihrer Blog-Aktivitäten auf ihre Arbeit wahr.

Unterscheiden sich Wissenschaftler, die mit Journalisten kommunizieren oder online aktiv sind von denen, die dies nicht tun, hinsichtlich Führungsposition und Alter? Die Befragungsergebnisse zeigen eine positive Assoziation zwischen wissenschaftlicher Produktivität und Häufigkeit von Journalist-Kontakten sowie zwischen Führungsposition und Kontakthäufigkeit. Jedoch sind Produktivität und Führungsposition weniger prädiktiv für die Nutzung der Online-Medien als für Journalisten-Kontakte von Wissenschaftlern. Entgegen der Annahme, dass jüngere Wissenschaftler in der öffentlichen Wissenschaftskommunikation stärker online aktiv sind als ältere, gibt es keine signifikante Assoziation zwischen Alter und Häufigkeit der Online-Aktivitäten.

In Bezug auf ihre Präferenz für Kommunikationsmodelle (Defizit vs. Public Engagement) gibt es keine konsistenten Unterschiede zwischen den Gruppen von Wissenschaftlern, die Kommunikation mit der Öffentlichkeit über Neue Medien bzw. durch journalistische Vermittlung bevorzugen. Außerdem unterscheiden sich die beiden Gruppen nicht in ihrer Akzeptanz von Mediensichtbarkeit als Kriterium in Entscheidungen über Forschung und wissenschaftliche Publikation.

Im Ländervergleich ist der Anteil bloggenden Wissenschaftler am höchsten in den USA (8%), gefolgt von Taiwan (5%) und Deutschland (4%). Der Unterschied in der Verbreitung des Bloggens bei deutschen und amerikanischen Wissenschaftlern lässt sich mit der unterschiedlichen Verbreitung der Online-Medien erklären. Die geringere Verbreitung der Blognutzung unter deutschen Wissenschaftlern korrespondiert zum Befund, dass deutsche Wissenschaftler häufiger eine kritische Einstellung zum Bloggen bei ihren Kollegen wahrnehmen als amerikanische Wissenschaftler. Eine plausible Erklärung für die geringe Verbreitung von Bloggen unter taiwanischen Wissenschaftler ist, dass sie öffentlicher Kommunikation einen geringeren Stellenwert zumessen als deutsche und amerikanische Wissenschaftler. Der Anteil taiwanischer Wissenschaftler, die sich nicht an öffentlicher Kommunikation interessiert zeigten und die öffentliche Kommunikation weder als "moralische Pflicht" noch als "eine gute Sache" betrachteten, war größer als die entsprechenden Anteile deutscher und amerikanischer Wissenschaftler.

Die Befunde der Studie deuten darauf hin, dass Bloggen derzeit nur eine begrenzte Rolle in der öffentlichen Wissenschaftskommunikation spielt. Die Zahl der bloggenden Wissenschaftler ist klein und für die meisten von ihnen ist Bloggen eine Randaktivität. Die Rolle von Bloggen für die Steigerung des "Public Engagement" mit Wissenschaft scheint begrenzt zu sein.