Open access • Journal Article • DOI:10.1109/MTAS.2003.1216240

Incorporating societal concerns into communication technologies — Source link

Rajiv C. Shah, Jay P. Kesan

Institutions: University of Illinois at Urbana–Champaign

Published on: 28 Jul 2003 - IEEE Technology and Society Magazine (IEEE)

Topics: Intellectual property

Incorporating Societal Concerns into Communication Technologies

Rajiv C. Shah and Jay P. Kesan

Communication technologies are no longer seen as just impinging upon societal concerns such as privacy. Instead, computer scientists, social scientists, and policymakers are designing and advocating the use of technologies to proactively protect or serve societal values. These include protecting minors from indecent content, protecting privacy, and protecting intellectual property rights [1]-[3].

The design of communication technologies is not autonomous; rather it is shaped by conflicting social groups [4]. As a result, communication technologies may have different properties depending upon their designers [5]. Consider the stark differences in privacy features between a university web browser funded by government grants [6], and a web browser developed by a firm dependent upon marketing revenue [7]. We focus here on how the consideration of societal concerns is affected by the institutional origins of the technology.

We focus on four important institutions for the development of communication technologies. We use the term "code" to refer to the hardware and software of communications technologies. The four institutions include universities, firms, consortia, and the open source movement. To study these institutions we chose four historical case studies. They are: NCSA Mosaic web browser developed at the University of Illinois; cookies developed by Netscape; the Platform for Internet Content Selection (PICS) developed by the World Wide Web Consortium (W3C); and the Apache web server developed by the open source movement. Based on these case studies, we have found institutional values translated into the properties of the code.

This article is part of a larger

This material is based upon work supported by the National Science Foundation under Grant No. ITR-0081426. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation.

Rajiv C. Shah is with the Institute of Communications Research, University of Illinois at Urbana-Champaign, IL. Email: r-shah4 @uiuc.edu. Jay P. Kesan is Associate Professor at the University of Illinois at Urbana-Champaign, Champaign, IL, and he is appointed at the College of Law, Dept. of Electrical & Computer Engineering, and the Institute of Government and Public Affairs. Email: kesan@ uiuc.edu.

0278-0079/03/$17.00©2003IEEE

effort to systematically analyze the production of code in societal institutions. This larger project begins by considering the different roles, motivations, end users, and structures of institutions. As a result, the institutions are differentially affected by social, political, economic, and legal influences. This is then reflected in the attributes of the final code. These attributes include technical features, such as the use of open standards, as well as features that affect societal concerns, such as privacy. This article focuses on the features that affect societal concerns.

The consideration of societal values in code is important for policymakers seeking code-based solutions to societal concerns. Policymakers can use this analysis to selectively support the development of code in an institution.

Universities

A university provides its developers considerable autonomy [8]. As a result, the academic developers largely determine the values in the code. This allows social, economic, or political influences to affect code, reflecting the values of the individual developers. Hence, there is a wide variation in considering societal concerns, even in similar projects by different developers. This difference in similar projects is evident in the development of web browsers by Berners-Lee and Andreessen. Berners-Lee developed the first web browser, while Andreessen developed the first mainstream web browser, NCSA Mosaic.

Berners-Lee developed a web browser that made it very easy for people to read and write pages. He envisioned the web as a place where it would be easy for people to find new information and contribute new information. He considered it important to develop tools to make it simple to publish material. Instead of browsers, he thought of the programs as browser/editors. This value of publishing was incorporated in Berners-Lee's code [9], [10]. In contrast, Andreessen focused on making a "cool" web browser. To this end, he added multimedia features, such as the inclusion of online images. He was not concerned with developing a web browser that allowed people to create content. Instead, his code valued the presentation of content [9]. In sum, these variations in development are allowed and encouraged within universities.

Firms

The goal of commercial firms is to develop profitable code. To this

end, they include attributes that are profitable. For example, firms profit from code that allows visually impaired people to use computers. In this case, firms are producing code that supports societal values. However, firms may not produce code that supports unprofitable but socially beneficial values. This is because firms seek to meet the needs of consumers and not society in general, which may then result in a phenomenon known as market failure [11]-[13]. This is not surprising and is a consequence of the structure and motivation of a firm.

There are four types of market failure from the perspective of economic efficiency. First, market failure occurs as a result of externalities. This transpires when the market price of a product does not reflect the costs that its use and production impose upon society. The classic example is how industrial pollution is usually not accounted for in the calculation of manufacturing costs of a product. Similarly, security is an externality, which is a cost not accounted for in the production of code. The costs of security have reached trillions of dollars, and a single virus incident that affects Microsoft's Windows based computers can cost over a billion dollars [14], [15]. Commentators have argued that Microsoft ignores security as a deliberate business decision [16], [17]. It believes that ease of use is more important than security [18]-[20]. However, the lack of security in Microsoft's products affects everyone by propagating viruses, reducing bandwidth across the Internet due to spurious traffic, and creating insecure machines that are then used to attack other machines across the Internet. Since Microsoft doesn't pay for this cost, this naturally leads to Microsoft's code overlooking the social value of security, thereby imposing this negative externality on others.

Second, market failure arises in the production of public goods. Public goods are non-excludable and non-rivalrous in consumption. The classic examples of public goods are property rights, national defense, and infrastructure, such as highways. Similarly, there are code-based goods that have some characteristics of a public good, such as interface standards, open source code, and code that addresses issues such as education and energy conservation. These are examples of goods that will be underprovided or not provided for by firms.

Third, market failure occurs when markets are monopolistic or oligopolistic, instead of being competitive. With information technologies, there are two phenomena that can lead to uncompetitive markets. First, network effects may lead some markets towards monopoly [21]. For example, communication networks become more valuable as they become larger, which can result in a monopolistic market. Secondly, lock-in and switching costs can lead to uncompetitive markets [21]. An example of lock-in is AOL's Instant Messenger. Lock-in occurs because only AOL subscribers can use this service. There are substantial switching costs for customers, since you cannot access AOL's Instant Messenger once you terminate your AOL service.

Fourth, market failure can occur because of incomplete information or an asymmetrical allocation of information. The classic example is the used car market, where the seller of used cars possesses much better information about the cars, and as a result, the lemons will crowd out the good used cars. The history of cookies illustrates how consumers have less information than firms. Cookies are a technology that allows web sites to maintain information on their visitors. This technology facilitates repeated interactions that are often required for electronic commerce. Netscape incorporated the cookies technology into its browsers. However, Netscape never incorporated tools that would allow users to manage cookies in their browsers [22]. Moreover, Netscape didn't notify users about the cookies technology. As a result, information was maintained on consumers by web sites without their knowledge. Netscape probably understood that if consumers knew about this feature, this could have led to a privacy backlash against cookies and lowered the adoption of the Netscape browser. This is an example of a firm exploiting the informational asymmetry between firms and consumers.

The second justification for market failures is not based on economic efficiency, but on ethical considerations. There are three types of market failures that can arise even when markets are efficient. First, market failure occurs when redistribution of goods does not result in social standards of equity. This is why there are programs such as universal service, which ensure that all citizens have access to telecommunications. A second market failure occurs when people do not act in their own self-interest. This calls for paternalism. An example of paternalism affecting code was the restriction on the transmission of indecent content to minors. A third market failure occurs when the market does not allow everyone equal opportunity. This leads to government intervention to ensure that everyone has an equal opportunity regardless of race, gender, ethnicity, or disability. For example, government intervention has required code capable of being accessed by disabled citizens.

CONSORTIA

A consortium's response to societal concerns is influenced by its structure. This section focuses on how the goals, membership, and the development process within a con-

sortia influence the incorporation of societal concerns. First, we note that consortia differ in their willingness to develop standards that address societal values. Second, we note the role of the development process in the inclusion of societal values. Finally, we note how the decision-making process can affect the societal values in code.

The PICS case study showed how a consortium setting allowed industry to cooperate in addressing a societal concern. PICS addressed the problem of minors accessing indecent content by specifying standards for labeling the content. This was a fitting purpose since firms individually would not support such an unprofitable societal value. This led James Miller, a co-developer of PICS to state, "[I]ndustry has never demonstrated, and it continues with the privacy stuff to demonstrate that unless a very serious external threat is imposed it will not get together and unify with any speed to address any serious vital issue."

The disadvantage of the consortium approach is that it may address a societal concern in a way that benefits the consortium's members over the general public. For example, PICS was designed by the W3C to address societal concerns about children's access to inappropriate material. However, PICS failed to make a significant difference in children's access to inappropriate material because the solution produced by the W3C was more about avoiding regulation than addressing the problem. This is evidenced by both the timetable for the development of PICS which sought to ensure it was completed in time for a constitutional challenge to the Communications Decency Act (CDA) as well as the lack of support for PICS after the CDA was found unconstitutional. Similar criticisms have been laid at the W3C's efforts in addressing privacy concerns with the Platform for Privacy Preferences (P3P) project [23], [24]. Jason Catlett of Junkbusters believes that the real motive behind the W3C's efforts is not user privacy, but to stave off potential legislation on privacy. So while a consortium may address societal concerns, it is biased by its reliance on its members' efforts and motivations. As a result, a consortium's product may be of marginal value to society.

The development process can affect the inclusion of societal values in code for a consortium. Specifically, social concerns may be manifested to different degrees during the development process depending upon the consortium's membership. For example, by including a diverse pool of contributors, the Internet Engineering Task Force (IETF) is more sensitive to societal concerns during the development process. The IETF's standard on cookies was more responsive to privacy due to the diversity of its participants. Koen Holtman, who participated in the discussion, had a distinctively different attitude towards privacy than most Americans because he was European. His different perspective led him to point out the privacy problems with cookies that others had disregarded.

The decision-making process at a consortium can also affect the inclusion of societal values. A consortium can be structured to allow for public review during the decision-making process. For example, the IETF's open membership and emphasis on rough consensus affected the development of the cookies standard. Rough consensus allowed members of the IETF to consider a wider array of values going beyond merely profitable ones. David Kristol, a co-author of the IETF's cookies standards, stated that he was under tremendous pressure to ignore the privacy and security problems of third party cookies [25]. But under the IETF's decision-making structure, he had enough freedom to resist these pressures. As a result, the IETF's standard for cookies addresses privacy and security concerns.

Open Source Movement

The open source movement consists of thousands of diverse developers. Some of these developers are employed by firms, while others are committed to creating free software for the benefit of society. As a result, the open source movement is subject to a variety of influences. This is often manifested in the wide-ranging values of open source code that sometimes includes the marginal values of society. Our first point is that the open source movement is less subject to the dominant economic and political influences. Second, we note that the open source movement is biased by the societal concerns of its members. Our third point notes how the open source movement can be influenced by

> Computer scientists, social scientists, and policymakers are designing and advocating the use of technologies to proactively protect or serve societal values.

bottom-up social influences. Finally, we discuss how the open source movement's support of modularity can allow for the development of code that supports a mosaic of social values.

Developers within the open source movement have a considerable amount of autonomy. The international group of volunteer developers decides the code's values. As a result, the open source movement is less subject to the dominant economic and political influences. The inclusion of politically, economically, or socially unpalatable features can be seen in open source code, such as the open source web browser Mozilla and file sharing programs. Mozilla includes the ability to block images from third party web sites as well as pop up advertising windows. File sharing programs, such as Gnutella, have facilitated widespread piracy.

The open source movement is biased by the societal concerns of its members, which are not representative of the public. Despite the diversity of open source developers, they often share similar beliefs about some issues. For example, the open source movement has not addressed the issue of children's access to inappropriate material on the Internet. This is not surprising given the anti-censorship inclination of the open source movement. These similar beliefs can shape the development of open source code because of the dependence on volunteer developers. This shows how the development of code within the open source movement is shaped by its members' proclivities.

The open source development process also allows for bottom-up social influences. By allowing the public to comment and participate in the design, there is room for bottom-up pressure. For example, Apache has had over 400 individuals contribute code, along with over 3000 people have contributed problem reports [27]. This bottom-up pressure is not necessarily from programmers, but could involve others who participate and support open source projects in other ways. One manifestation of bottom-up pressure is through the use of wish lists where the public can request new features. This is under-exploited, but it is useful to ensure that developers are cognizant of the needs of users.

The open source movement's use of modularity is capable of simultaneously supporting diverse social values. Through modularity, users can choose the modules that best support their values. For example, consider the modular open source browser Mozilla. Modularity of the browser code means that it will be possible to customize the browser. For example, a browser could be constructed to only visit children's sites as rated by PICS. Or a browser could be modified to not accept third-party cookies, or the browser's bookmarks could also be customized so as to contain a set of religious sites. The modularization of the open source code makes it possible to select values from a mosaic of code [26].

Privacy as an Illustration of Institutional Differences

Institutions can differently affect a societal value. The value under consideration here is informational privacy.

Universities provide their developers with considerable autonomy. This allows them to focus on developing code without having to incorporate features that may compromise privacy. There are researchers actively working to incorporate privacy technologies into code, for example, by designing a web browser that is sensitive to issues of privacy [6]. Moreover, other researchers argue that universities should lead by example by developing and using technologies in ways that are sensitive to privacy [28].

Firms are likely to support privacy to the extent that it is profitable. As a result, there are a number of firms selling code that people can use to protect their privacy. However, as a general matter, firms are not emphasizing privacy features in their code. As noted above, this is due to market failures. Lessig argues that this market failure can be addressed by treating personal information as property [29]. Providing a legal entitlement over personal information could lead to the development of code that allows people to control this property. Other commentators argue that additional forms of market failures, which arise from information asymmetries and other factors, means that a property-based approach is insufficient to induce the development of code that considers privacy [30]. Consequently, a firm "is eager to spy on us to create its marketing lists and profiles while, at the same time, seeking to keep this process opaque and refusing to grant basic fair information practices." These market failures have led to the under production of code that embodies the basic value of privacy.

Consortia may be structured to deal with societal issues such as privacy. For example, the W3C is working on a privacy project titled P3P, because it met the needs of its members. In contrast, the W3C chose not to work on cookies. According to Roger Clarke, he raised this matter with Berners-Lee. According to Clarke, the "W3C avoided the matter entirely, reflecting the increasing constraints on its freedom of action arising from its desire to avoid upsetting its corporate sponsors"[31]. Besides differences in deciding what projects to pursue, a consortium's membership and decision-making process can affect its consideration of societal concerns. For example, the IETF's

public review process was concerned about the privacy risks with cookies [32].

The open source movement is not as influenced by economic incentives to violate privacy. So we would expect the development of code to protect privacy. However, there is not a wide array or even a single good open source program to protect people's privacy. This is because there is no coordinated effort in the open source movement to develop tools to protect privacy. Moreover, there is little work on developing such code. For example, a search on the popular open source web site, SourceForge, finds only one working project that addresses problems with privacy and cookies. This program was originally created by a firm and then released to the open source movement. So while the open source movement has improved the code, it did not initiate its development.

There are two explanations for the lack of development of privacy tools for the general public. First, the open source community is technically sophisticated, and therefore, does not suffer from an informational asymmetry regarding privacy. That is, they understand the privacy risks with code as well as how to use code to limit privacy losses. A second more cynical explanation concerns the motivations of developers that seek peer recognition and prestige for career advancement [33]. These developers abstain from working on privacy features, because privacy features are not desired by the firms they are seeking to impress.

How Society Can Regulate Code

Most scholarly work on code has highlighted how code regulates society. This article has stressed how society can regulate code through societal institutions. Our analysis has shown how institutions differ in their incorporation of societal concerns into code. The results of our analysis should allow policymakers to shape the development of code by the choice of institution.

Policymakers can now begin by analyzing whether a firm is likely to incorporate a specific societal concern into code. If not, policymakers may seek the aid of other institutions such as universities, the open source movement, or consortia, if appropriate. To this end, we have highlighted how each of these institutions has its own approach and tendencies when incorporating societal concerns. For example, the open source movement is biased by the motivations, beliefs, and societal concerns of its members. It is our ultimate hope that this analysis will allow policymakers to anticipate and guide the development of code that contributes positively to society.

Acknowledgment

The helpful comments provided by Lorrie Cranor and Michael Loui have benefited this paper.

References

[1] L. Lessig and P. Resnick, "Zoning speech on the Internet: A legal and technical model," *Michigan Law Rev.*, vol. 98, pp. 395-431, 1999.

[2] S. Helms, "Translating privacy values with technology," *Boston Univ. J. Science and Technology Law*, vol. 7, pp. 288-326, 2001.

[3] A. Harmon, "Hearings on digital movies and privacy," *New York Times*, Mar. 2, 2002.

[4] R. Williams and D. Edge, "The social shaping of technology," *Research Policy*, vol. 25, pp. 865-899, 1996.

[5] B. Friedman, *Human Values and the Design of Computer Technology.* Cambridge, U.K.: Cambridge Univ. Press, 1997.

[6] B. Friedman, D. Howe, and E. Felten, "Informed consent in the Mozilla web browser: implementing value-sensitive design," in *Proc. Thirty-Fifth Annual Hawaii Int. Conf. on System Sciences,* 2002.

[7] J. Schwartz, "Giving the web a memory cost its users privacy," *New York Times*, Sep. 4, 2001.

[8] P. Dasgupta and P. David, "Toward a new economics of science," *Research Policy*, vol. 23, pp.487-521, 1994.

[9] J. Gillies and R. Cailliau, *How the Web Was Born.* Oxford, U.K.: Oxford Univ. Press, 2000.

[10] T. Berners-Lee, *Weaving the Web: The Original Design and Ultimate Destiny of the World Wide Web by its Inventor.* San Francisco, CA: Harper, 1999.

[11] S. Breyer, "Analyzing regulatory failure: Mismatches, less restrictive alternatives, and reform," *Harvard Law Review*, vol. 92, pp. 549-609, 1979.

[12] J. Wallis and B. Dollery, *Market Failure, Government Failure, Leadership and Public Policy.* New York, NY: St. Martin's, 1999.

[13] R. McChesney, "The Internet and U.S. communication policy-making in historical and critical perspective," *J. Communication*, vol. 46, pp. 98-124, 1996.

[14] L. Sherriff, "Network downtime costs planet $1.6 trillion," *Register*, Nov. 7, 2000.

[15] M. Zuckerman, "Feds warn of holiday hackings," *USA Today*, Dec. 14, 2000.

[16] E. Abreu, "Microsoft: Bad security, or bad press?," *IDG News Service*, Sep. 28, 1999.

[17] J. Menn, "Security flaws may be pitfall for Microsoft," *Los Angeles Times*, Jan. 14, 2002.

[18] R. Cringely, "The death of TCP/IP: Why the age of Internet innocence is over," Aug. 2, 2001.

[19] P. Thurrott, "A vulnerable future for Windows XP users," *Win2000 Mag.*, July 26, 2001.

[20] *Frontline: Hackers,* PBS television broadcast, Feb. 13, 2001.

[21] C. Shapiro and H. Varian, *Information Rules.* Cambridge, MA: Harvard Univ. Press, 1998.

[22] L. Millett *et al*., "Cookies and web browser design: Toward realizing informed consent online," in *CHI 2001 Proc.*, 2001, p. 46.

[23] C. Hunter, "Recoding the architecture of cyberspace privacy: Why self-regulation and technology are not enough," presented at Int. Communication Assoc. Conv., Acapulco, Mexico, June 2000.

[24] Electronic Privacy Information Center and Junkbusters, "Pretty poor privacy: An assessment of P3P and Internet privacy", June 2000.

[25] D. Kristol, "HTTP cookies: Standards, privacy, and politics," *ACM Trans. Internet Technology*, p. 10, Nov. 2001.

[26] L. Lessig, *Code and Other Laws of Cyberspace.* New York, NY: Basic, 1999.

[27] A. Mockus, R. Fielding, and J. Herbsleb, "A case study of open source software development: The Apache server," in *Proc. 22nd Int. Conf. Software Engineering*, Limerick, Ireland, 2000, pp. 263-272.

[28] D. Carnevale, "Logging in with Laura J. Gurak," *Chronicle of Higher Education*, Feb. 19, 2002.

[29] L. Lessig, "Law of the horse: What cyberlaw might teach," *Harvard Law Rev.,* vol. 113, pp. 501-549, 1999.

[30] P. Schwartz, "Internet privacy and the state," *Connecticut Law Rev.*, vol. 21, pp. 815-839, 2000.

[31] R. Clarke, "Cookies". http://www.anu.edu.au/people/Roger.Clarke/II/Cookies.html (Dec. 19, 2002).

[32] K. Moore and N. Freed, "Use of HTTP state management," Internet RFC 2964, Oct. 2000.

[33] J. Lerner and J. Tirole, "The simple economics of open source," *J. Industrial Economics*, to be published.