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Recipes for Cookies: How Institutions Shape Communication Technologies

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Abstract

The ability of communication technologies to favor certain societal concerns, such as privacy, is widely recognized. This paper argues a central factor in how a technology favors a societal concern stems from its institutional origin. A case study of the cookies technology, which allows web sites to maintain surveillance on their visitors, shows the differing influences of universities, firms, and consortia. Each of these institutions acted according to their own norms and processes and differentially shaped the cookies technology. The result suggests societal institutions act in a systematic and predictable fashion in shaping how communication technologies affect fundamental societal concerns.

Keywords: Institutions, Communication Technologies, Law & Policy, Privacy

Recipes for Cookies: How Institutions Shape Communication Technologies

Our lives are increasingly affected by communication technologies. In three recent high profile incidents concerning online privacy, it was the design of the communication technology that played a crucial role. The controversy over the Pentium III chip concerned an embedded serial number, which could theoretically be used by online marketers and governments to universally identify people using the Internet. Similar concerns exist over cookies, which allow companies such as DoubleClick to build "online profiles" of Internet users. And recently, there are concerns that Digital Rights Management technologies will require users to identify themselves to access protected media, such as electronic books or music.

This has led legal scholars, most notably Lessig, to argue that code is a crucial regulatory force (1999). The term code refers to communication technologies, which includes the hardware and software components. The design of code can regulate or influence fundamental societal concerns by embedding values, assumptions, and biases that favor certain groups and interests. This idea is becoming influential in communicational law and policy (Braman, 2003). Scholars are proposing using code to regulate behavior as an alternative to law for issues as diverse as crime, competition, free speech, privacy, protection of intellectual property, and the revitalization of democratic discourse.

This article argues that the values inscribed into technologies are substantially influenced by their institutional origins. By recognizing and analyzing these institutional norms and processes, it is possible to predict the varying emphases on various social and technical attributes inscribed into a technology. The effects of the institutional shaping are significant in modern communication technologies, such as web browsers, operating systems, and routers. These technologies are typically not malleable by users, and instead users are forced to reckon with

entrenched values and biases. While there are cases when users are capable of modifying and changing technologies (Boczkowski, 1999), in the typical case, users are incapable of altering the embedded values contained within the complex software and hardware components that characterize modern communication technologies.

The approach here is a historical case study of the cookies technology. The cookies technology allows web sites to maintain information on their users. This technology fundamentally affects privacy, because cookies allow web sites to track and store information about their visitors. The cookies case study provides a unique perspective, because it was substantially influenced by three different institutions. The original developers worked within a university and later switched to developing cookies within a firm. A consortium then developed a precise technical standard on cookies, which led to changes in how cookies were implemented in web browsers. The resulting comparison highlights how the developmental motivations, norms, and processes of a firm, university, or consortium differentially affected the cookies technology. The institutional influences are evident in both technical attributes of cookies as well as social attributes that affect online privacy.

The article begins by reviewing the literature on value-ladeness of technology and how these values are incorporated into technology. The review shows how scholars, especially within communications law and policy, have overlooked how values are embedded in technologies. This issue is of heightened importance with the enhanced malleability of code and the exploitation of this malleability by firms to incorporate their values into code. This section also points out the limitations of the past scholarship on the development of communication technologies. The existing literature has not yet fully addressed new communication technologies and the new institutional forms developing these technologies. The second part of

the paper outlines the research methodology. The third part contains the case study on cookies. The final part discusses the implications for this institutional approach upon our understanding of how communication technologies develop.

Background

This part reviews the literature in two areas. First, the idea that values are embedded in technologies. These embedded values influence or regulate the users of the technology. The second part discusses scholarship that has considered how these values are embedded during the development of code. This section highlights contributions from the technology studies and the political economy of communication.

Values In Technology

Philosophers of technology have long emphasized how technologies are value-laden, and hence they can favor certain groups and interests (Feenberg, 1991; Winner, 1980). This has led researchers to argue that values or biases are found in code (Flanagan, Farinola, & Metzger, 2000; Foner, 2002; Friedman & Nissenbaum, 1996), such Internet search engines (Introna & Nissenbaum, 2000). For example, scholars in cultural studies have shown how the design of code can affect issues such as race or sexuality in online environments (Nakamura, 2000). Kolko discusses how the malleability of cyberspace allows creators to decide whether to mandate categories of race and gender to everyone, make them optional, or remove them entirely from cyberspace (2000). While this work has revealed the presence of values embedded in code, this research has not addressed how societal concerns, such as privacy, are embedded into code.

Communication law and policy scholars have generally overlooked the value-ladeness of communication technologies. Debates around technologies as varied as caller-id (Mukherjee &

Samarajiva, 1996), and the v-chip (Samoriski, Huffman, & Trauth, 1997) typically focus on public policy issues, while the design and values incorporated into code are placed in the background. More recently, scholars, such as Braman, are challenging scholars to examine how rules are embedded into code (2003). However, there is still little known about how societal concerns are embedded into the code.

Two recent developments suggest that communication law and policy must consider how code affects societal concerns. First, new communication technologies are malleable. It is no longer just the physical properties that can be modified, but also the software. The software contains the instructions of the actions the hardware must follow. Frequently, developers can shape the software into many variations, each of which may favor particular values. For example, Microsoft has been gradually shaping its operating systems to protect intellectual property, through Digital Rights Management technology. Second, the laws of cyberspace are increasingly being reshaped by corporate concerns (Lessig, 1999; McChesney, 1996; Schiller, 1999). In intellectual property, software and hardware technologies are increasingly used in the place of intellectual property law. These new Digital Rights Management technologies can constrain actions that are legally permitted, such as making copies for educational purposes. Thus, the malleability of the code, is allowing content producers to move from a system of copyright as a bargain between the public and authors to a new model based on technology and contracts (Litman, 2001). This then leads to the question of how exactly the code is shaped.

How the Code Is Shaped by Societal Institutions

The idea that society influences the development of the code is well accepted. This rejection of technological determinism is found in a variety of fields from philosophy to science and technology studies, and even histories of communication technologies. In fact, virtually any

examination of the development of technology imparts some role to society. However, the dominant theories vary in how much influence society has over the development of a technology. The social construction of technology theory places a very strong emphasis on society in not only shaping, but also actually constructing technologies (Pinch & Bijker, 1987). At the other end of the spectrum is soft technological determinism, in which society's influence still operates but is attenuated. For instance, De Sola Pool argues that the development of communication technologies is constrained by established institutions within society (1983). A middle approach is the social shaping of technology, which recognizes that the design and implementation of technologies are influenced by non-technical facts such as culture, economics, and politics (Williams & Edge, 1996). A common factor in all three of these theories is the role of institutions.

An institution is composed of individuals suspended within a web of values, norms, procedures, laws, beliefs, and taken-for-granted assumptions (Barley & Tolbert, 1997). This view of institutions stems from work within new institutionalism theory (Powell & DiMaggio, 1991). Simply put, although the developers are individuals, they work within institutions. They are subject to the rules and norms of these institutions, thus attenuating individual preferences or desires. Therefore an institutional perspective is a useful approach for analyzing and predicting how technologies may develop. This emphasis on an institutional unit of analysis has been recognized by a variety of scholars studying the development of communication technologies (Agre, 1999; Fountain, 2001; Hawkins, 1996; Schmidt & Werle, 1998). A prominent example of this is social informatics, which considers the institutional context during the development and use of information technology (Kling, 1999).

From an institutional perspective, most scholars have focused on either the government or firms in shaping the code. For example, Savage describes how governments have been instrumental in shaping the standards governing television (1989). Other scholars have examined how the military has influenced the development of communication technologies. For example, Abbate argues the military influenced the development of the ARPANET, the predecessor to the Internet by favoring military values of survivability, flexibility, and high performance over commercial goals such as low cost, simplicity, and consumer appeal (1999).

The political economy of communications has examined how firms shape the code. Mansell shows how telecommunications networks were shaped by institutional concerns of large telecommunication firms (1993). These characteristics affected public participation as well as innovation within these telecommunication networks. Similarly, Meehan's history of the interactive television system QUBE described how characteristics of the code, affecting societal concerns such as privacy, were shaped by corporate concerns (1988). Both scholars emphasized the role of profit making and control as key factors, while noting that firms ignored other societal interests.

This past scholarship on government and firms is increasingly less relevant for three reasons. First, there is an increased reliance on private law, which is accomplished with contracts and licenses, as well as industry self-regulation. Schiller discusses how and why this trend has developed since the mid 1950s (1999). This is culminating in the ideological manta that government must keep its hands off the Internet. This very thought is expressed by the U.S. Department of Commerce, General Counsel, Andrew Pincus, when he states "the needs and dynamics of the marketplace, and not governments, must guide standard development and implementation activities. Governments should refrain from issuing technical regulations and

instead should rely, to the maximum extent possible, on the private sector to self-regulate" (Pincus, 1999). The result is that private development of communication technologies is generally unimpeded by government regulation, which is a shift from previous communication technologies such as television and radio.

A second development concerns the nature of new communication technologies. With the rise of the computer and the Internet, communication technologies have proliferated. They not only impact how we receive information, but also how we communicate, conduct business, and interact with other communication technologies. It is no longer just the newspaper, radio, and television, but technologies such as, web browsers, instant messaging, email, filtering software, and screen readers. The sheer quantity and how woven these technologies are into everyday life is a monumental shift from past communication technologies.

A third significant development is the rise of other institutions, besides firms, in shaping the development of communication technologies. Some of the significant institutions include universities, consortia, and the open source movement. Universities are an important source of innovative research and development and account for over half of all fundamental research within the United States (Brooks, 1993). Many significant communication technologies have emerged from universities including the Internet, computer graphics, search engines, and digital libraries. A second institution is the consortium. A consortium arises from the cooperative efforts between firms or individuals. The majority of standards for communication technologies are created within consortia (Weiss & Cargill, 1992). Two prominent consortia for the Internet are the World Wide Web Consortium and the Internet Engineering Task Force. A third institution that has arisen recently is the open source movement. The open source movement strives to keep the source code, or the human readable instructions for code, freely available to the public (Feller

& Fitzgerald, 2002). By keeping this code freely available, the open source movement utilizes the cooperative efforts of its members to create and continually improve code. This has allowed them to create products that rival or surpass those created by firms, such as the Apache web server and the Linux operating system.

These changes led us to reexamine the role of institutions in shaping the development of the code. The goal was to identify and delineate how institutional motivations, norms, and processes result in a differing emphases on social and technical attributes of code. Fundamentally, we were concerned with whether these new institutions shape the code in a meaningfully different manner than firms. After all, there is little need to differentiate these institutions if they shape the code similarly. A second goal was to examine how these institutions influenced the social and technical values embedded in code.

The Cookies Case Study

To examine the development of the code, we choose historical case studies. Case studies are the preferred methodology when studying a how or why question over which researchers have little control (Yin, 1994). Case studies provide a holistic manner to study a phenomenon through which propositions and variables can then be developed and further tested using other methods. This approach is appropriate, because the literature provides little theoretical guidance in assessing how the code develops outside of firms.

This approach is widely used in both science and technology studies and the political economy of communication. For example, a political economy approach is sensitive to how political, economic, and social forces shape the development of the communication technologies (Mosco, 1996). According to Smythe and Dinh, this involves a “reality-based analysis of

institutional processes" (1983, 120). Mansell follows this approach in examining how economic and political interests were embedded into the design of telecommunications network (1993).

The cookies case study is one of several case studies conducted to examine the development of the code. The case studies were selected based on their interaction with a public policy issue and an institution of interest. The cookies case study was chosen because it implicated privacy and was developed by a firm. This article focuses on the cookies case study, because it not only shows how firms influenced cookies, but also how universities and consortia influenced the same technology. Thus, this case study is well qualified to highlight the differences between institutions during the development process. Other scholars have also discussed cookies, but in different contexts, such as the legal issues related to cookies (Mayer-Schönberger, 1997) or user's control of cookie settings (Elmer, 2002).

The data collection relied primarily on archives of discussions concerning the technical development of the cookies technology, documentary evidence, including press accounts and information contained in web browsers. Because the cookies technology was the foremost privacy concern for the internet for several years, there are a large number of press accounts. This led to corroborating the data with several qualitative semi-structured interviews including the developer of the cookies technology, authors on both of the Internet Engineering Task Force's (IETF) standards associated with cookies, experts participating in the IETF's standards process, and the author of the authoritative text on the cookies technology. The citations within this article point the reader to documentary evidence has become recently available.

The authors acknowledge that a single case study of cookies is not enough to generalize about how all institutions differently emphasize certain social and technical attributes during the development process. This is why we conducted a variety of case studies involving other

societal values and code developed within other institutions. This article is limited to the cookies case study and therefore focuses on how universities, firms, and consortia differ in shaping code. While cookies was developed within these institutions, there were a variety of actors influencing this development process, including the Federal Trade Commission, state Attorney Generals, legislators, private citizen class action suits, public interest organizations, open source movement, and privacy activists.

Development of Web Browsers

The story of cookies begins with the origin of the World Wide Web (web) and the creation of web browsers within university style institutions. The web was developed by Berners-Lee at the European particle physics laboratory, CERN (Gillies & Cailliau, 2000). He developed the first web browser and web server. At this point, neither were cookies developed, nor was their concern by users over privacy. As our story unfolds, it becomes clear that the initial developers were not concerned with gathering data about users, but instead about providing the users with a novel, but useful experience. As a result, no one was concerned with protecting privacy, because there was no palpable threat of privacy exploitation.

The first widely used web browser was developed at the National Center for Supercomputing Applications (NCSA) at the University of Illinois at Urbana-Champaign. In the fall of 1992, Marc Andreessen was asked to write graphical interface for file downloads. He later saw a demonstration of the web and began investigating the web through the www-talk newsgroup hosted by CERN. He found that existing web browsers were limited and not easy to use. This led him and fellow NCSA staff member Eric Bina to write a better web browser. They started writing code in December 1992 and by January 1993 they came up with a workable beta version called NCSA Mosaic.

The most significant advances in NCSA Mosaic were its ease of use and its inclusion of graphic images in web pages. NCSA Mosaic was designed to be an easy to use navigational tool for browsing the web by using similar commands and interfaces that existed for ordinary applications such as word processing (Quittner & Slatalla, 1998). The addition of images moved the web browser towards a multimedia experience and away from Berners-Lee's text based browser. The focus on the inclusion of images also led to a neglect in the lack of publishing features in NCSA Mosaic. The original web browser designed by Berners-Lee allowed people to write, edit, and publish web pages. Instead of a browser, it was a browser/editor. In this browser/editor, it was as easy to compose pages, as it was to read pages. According to Berners-Lee, "my vision was a system in which sharing what you knew or thought should be as easy as learning what someone else knew" (Berners-Lee, 1999, 33). In fact, Berners-Lee was uncomfortable with NCSA Mosaic, because of its emphasis on presentation, and the absence of functionality to allow people to easily write pages.

The tension between NCSA Mosaic and Berners-Lee highlights how both developers were similarly motivated in their creation of innovative web browsers, not by potential economic gain, but for peer recognition. While both Andreessen and Berners-Lee developed innovative web browsers, they were concerned with different peers. The student developers thought it would be cool to add images to the web, while many within the Internet community, including Berners-Lee, disagreed. Berners-Lee thought of the web as a tool for serious communication between scientific researchers and not about what looks cool.

Creation of Cookies by Netscape

The next step was the development of cookies by Netscape. Netscape's roots were firmly embedded in NCSA Mosaic. Andreessen and Jim Clark persuaded almost all the core developers

of NCSA Mosaic to leave NCSA and to join them at Mosaic Communications Corp., which eventually become Netscape Communications (Clark, 1999). As a result, the same individuals that developed NCSA Mosaic also had a significant role in the development of Netscape's web browser.

Netscape understood they needed to make money. They decided to emphasize the sale of web servers. According to Jim Clark, the profit margin on web browsers was slim, but significant on 50,000 secure server applications (Clark, 1999). These secure web servers would be in demand by corporations seeking to make money over the Internet. This business decision led to an emphasis on commerce, security, and performance in both web servers and browsers. This was manifested in new technologies, such as cookies, continuous document streaming, and Secure Sockets Layer, for both web servers and web browsers.

Economic pressures led Netscape to focus on a rapid development process. Netscape was trying to gain the first-mover advantage (Shapiro & Varian, 1999). According to Andreessen, the Netscape team,

> Cranked out the first clients and servers in the first two months or so. We tried to just blow this out the door. . . If you took two years to get it out, the product would be far more technically advanced. But it's more important to get it out there fast so people begin using it and begin to integrate the technology as rapidly as possible. (Allison, 1995)

This emphasis on speed would eventually lead to defects in cookies.

Cookies were developed to foster commerce and became one of the most innovative features for the web and one that would forever alter the web. Simply put, cookies gave the web a memory. Cookies allow web sites to store information on their visitors. The implications for privacy were awesome. The web changed overnight from an anonymous private space to one

where every action could be recorded and analyzed. This change was in stark contrast to previous web browsers created within universities, which were not concerned with recording information on their users.

The name cookies was borrowed from an old programming term that referred to a small data object passed between cooperating programs (St. Laurent, 1998). Similarly, Netscape's cookies pass information between a user's computer and the web site they were visiting. A web site could now keep information about the user on the user's computer. The term within computer science for this process is state, which refers to maintaining past information. A stateless web is analogous to a vending machine. It has little regard for who you were, what product you are asking for, or how many purchases you have made. You could not buy more than one product at a time and there would be no automatic one-click automated shopping feature that remembers your personal information. With cookies, web sites could identify their users or maintain information about them, such as a zip code for the local weather forecast.

Cookies are now widely recognized as providing a benefit, while also affecting a user's privacy. Just as technologies can constrain and enable, discipline users and liberate users, cookies are a technology that could conduct surveillance while also serving as a helpful friend for users by remembering certain information. The most effective privacy arguments were framed as follows. The "end-user would not expect their own PC (browser) to automatically help sites at the other end to track or label them" (Koen Holtman, personal communication, August 24, 1999). This argument was considered strong, because it tapped into a libertarian ethos of Netscape's developers that users should be in control of the technology. The countervailing argument was that cookies acted similarly to the watchful proprietor of a brick and mortar store.

The proprietor was not interested in violating privacy, but instead watching what products consumers were interested in and helping consumers in selecting the best product for their needs.

Cookies were designed as generalizable and therefore useful for a number of problems. However, two key uses were foremost. First, cookies gave the web a memory and now people could have virtual shopping carts with multiple goods. Second, cookies allowed web sites track users through their web sites by combining the memory of cookies with referrer information. Referrer information, consisting of the previous URL visited by the person, was already provided to web sites. The combination of cookies and referrer information allows web sites to easily track a person's movement through their web sites. In fact, the first use of cookies was by Netscape to determine if visitors to Netscape's web site were repeat visitors or first time users. Web sites can then acquire considerable information about the long-term habits of their visitors. This ability to monitor and remember a user's movement is a central concern of privacy advocates.

Netscape recognized the privacy risks with cookies and built in some protections. According to Montulli, the developer of cookies at Netscape, "we didn't want cookies to be used as a general tracking mechanism" (Schwartz, 2001). To this end, the cookies technology did not create a unique identification number accessible by all web sites. Montulli understood that such an approach, while convenient, could result in a privacy nightmare, because it would allow for the tracking and profiling of web users. There were real concerns that such an approach could lead to a backlash against cookies as well as Netscape.

Cookies were deliberately designed to maintain information separately for each web site for the purpose of protecting privacy (Netscape Communications Inc., 1994). Cookies use domain matching to ensure that web sites can only examine or modify their own cookies. Montulli also designed the cookies technology to consider some other privacy issues. First, "the

amount of information was carefully limited in the specification so that you couldn't do denial of service attacks and other problematic things like that" (Montulli, personal communication, August 2, 1999). Second, the maximum number of cookies was limited to 20 per web site. Finally, web sites could set an expiration date for cookies. If no expiration date was specified then the cookies would expire when the user's web browser quit.

Despite the protections for privacy, Netscape introduced the cookies technology into the web browser surreptitiously, which meant users were unaware of the technology and unable to control or manage the technology. This is evident in four decisions by Netscape. First, Netscape turned the feature on by default without notifying or asking the consent of users. Second, there was no notification mechanism to alert people when cookies were being placed on their computer. Users did not know that information about them was being saved. Third, the cookies technology was not transparent. Examining a cookies file provides no information about what is stored in the cookie file. Fourth, there was no documentation available that explained what cookies were and their privacy implications. As a result, although Netscape incorporated cookies into its web browsers in 1994, it was not until early 1996 that the public became aware of cookies. The Financial Times broke the story on February 12, 1996 with an article on cookies and privacy (Jackson, 1996). The article immediately drew attention to cookies and resulted in a great deal of uproar about the use of cookies. Over the next few years, cookies became one of the Internet's top privacy issues.

The Internet Engineering Task Force's Standard for Cookies

The next significant development in the cookies technology was the entry of consortium, the Internet Engineering Task Force (IETF). The IETF is an open standards body that is the de facto Internet standards body. Because it is open, it allows anyone to participate in the standards

process. In 1995, the IETF sought to ensure there was a complete technical specification on state management. Over the next few years, they proceeded to shape the cookies technology by identifying problems with Netscape's technology and proposing an improved technical standard that accounted for the security and privacy flaws.

When the IETF began developing a standard for state management in mid 1995, many participants were unaware of Netscape's cookies. This is not surprising given Netscape's surreptitious handling of cookies. The original basis of the IETF's effort was Kristol's State-Info proposal. Kristol's proposal limited the state information to a browser session (D. M. Kristol, 2001). In contrast, Netscape's cookies can persist for many years across multiple sessions. For example, the Google search engine (www.google.com) routinely sets an expiration date in the year 2038 for cookies it creates, thus effectively making the cookies last forever. In sum, while Kristol's proposal protected users' privacy, Netscape's was more useful to web sites that sought to maintain long-term information on their visitors.

The IETF eventually abandoned Kristol's proposal and switched to Netscape's cookies specification (Kristol, personal communication, July 29, 1999). This was largely because the Netscape version was a ubiquitous working model that was a de facto standard. The IETF's new goal was to develop a more precise standard for cookies than Netscape's one page draft standard. This led them to conduct a peer review of Netscape's technical specification for cookies. This process found problems. The IETF determined that Netscape's specification was fraught with privacy and security problems (D. M. Kristol, 2001).

The most serious problem was third party cookies. The intent of Netscape's cookies specification was to only allow cookies to be written and read by the web site a person was visiting. For example, if the New York Times placed a cookie on a computer, Yahoo could not

read or modify the New York Times cookie. This provided security and privacy by only allowing web sites access to information they authored. However, Netscape's cookies specification allowed third party components of a web page to place their own cookies. This created a loophole by which third parties could read and write cookies. This loophole has led to a new breed of businesses, the online advertising management companies.

The online advertising management companies, such as DoubleClick, use third party cookies to track users at affiliated web sites. Though the loophole of third party cookies, DoubleClick can read and write to a cookie when a user visits any of their affiliated web sites. This allows them to aggregate information about a person's web surfing from its client web sites. The result is a detailed profile of a person's surfing habits across multiple web sites. This was widely recognized by privacy advocates as a serious risk to online privacy and was exactly what Montulli was trying to prevent.

The IETF quickly identified this flaw. Within a short time, Holtman warned others about third party cookies. He wrote to other IETF members in December 1995 that, “someone is bound to try this trick and it will, when discovered, generate a lot of bad publicity for the whole Web” (Schwartz, 2001). Holtman’s discovery was not accidental. Security is a shared value that the IETF explicitly mandates its work. Every IETF standard has a section discussing security considerations (Postel & Reynolds, 1997)

The rapid identification of this flaw shows that it was not totally unforeseeable. Moreover, this episode highlights the results of Netscape’s rapid development process. Netscape simply didn’t have the time or willingness to ensure its technology was fully secure. In other contexts, such as medical or avionics technology, firms are regulated to ensure their technologies are fully documented, reviewed, and tested. Not surprisingly, cookies have been characterized as

a technological kludge put together overnight. In fact, Montulli deeply regrets his oversight and acknowledges he never would have allowed such a serious flaw.

The IETF then sought to fix this flaw. The resulting cookies standard was critical of third party cookies allowed by Netscape's cookies specification (D. Kristol & Montulli, 1997). The IETF standard states that third party cookies must not be allowed. It does allow an exception if the program wants to give the user different options. However, the baseline default must be set to off. The standard also focuses on informing users and ensuring they can manage cookies. Specifically, the standard requires that a user be able to disable cookies, determine when cookies are being placed, and manage cookies by web site. This last one is especially significant, because it allows users to control what web sites can and can't place cookies. In sum, the IETF's standard called for cookie management tools and a default set to turn off third party cookies.

It took the IETF almost five more years to develop a standard for cookies. The lengthy process was largely because of privacy problems with third party cookies. While some members of the IETF sought to ease the standard, members of the Internet Engineering Steering Group (IESG), which monitors and administers the IETF's activities, felt that third party cookies were a security and privacy issue. They insisted the standard address these issues. Their opposition was led by new web advertising networks that relied upon third party cookies, such as DoubleClick. According to Kristol, who was a co-author on the standard, "feeling I was being bullied made me more determined to persist, and I didn't like to see an attempt to bully the IETF" (Schwartz, 2001). Interestingly, the other prominent standards group for the Internet, the World Wide Web Consortium (W3C) avoided working on cookies. According to Roger Clarke, this was simply because the W3C did not want to upset its corporate sponsors. Nevertheless, the IETF maintained its support for disabling third party cookies by default. The final standard was

published in October 2000 (D. M. Kristol & Montulli, 2000). Additionally, the IESG insisted on developing strong guidelines for the use of cookies before a new cookies specification would be approved (Moore, 2000).

There are two reasons why the IETF insisted on privacy protections in its standards. The first reason stems from the IETF's membership policy. IETF allows anyone to participate in their discussion and decision for adopting a standard. In the case of IETF's standard, Koen Holtman, had a distinctively different attitude towards privacy than most Americans because he was European. He recognized that Europe had strict rules for privacy, which were reflected in the attitude of many Europeans. His different perspective led him to point out the privacy problems with cookies that others had disregarded. Consequently, the IETF's standard on cookies was more responsive to privacy concerns. The second is the IETF's insistence that all standards consider security. This focus on security is a shared value among IETF's membership. The result is a standard that supports cookie management tool for users as well as disabling third party cookies by default.

Discussion

Three dominant institutions in shaping the cookies technology were universities, firms, and consortia. This section begins by discussing each of these actors and highlights their tendencies in shaping code. After all, each of these actors had their own recipe for cookies, which follow from their own institutional tendencies. This section ends by noting the implications of this research both for scholars and policymakers.

The history of cookies highlights the usefulness of analyzing the development process from an institutional perceptive. Consider the tendencies of each actor in their norms and

processes. At CERN and NCSA, the developers were motivated by peer recognition to create innovative web browsers. They also were not concerned with exploiting privacy and did not include technical means to track users. This finding is consistent with the theoretical view that developers within universities are motivated by peer recognition and not economic gain.

In contrast, economic pressures dramatically influenced the development of Netscape's cookies. After all, the developers were largely from universities, but focused on developing features that supported commerce. This led to Netscape's recognition of the potential profitability for collecting and using user information. Netscape then rapidly developed their web browser to gain a first mover advantage and in the process Netscape didn't inform users about cookies or provide them with any tools to manage the cookies technology. This highlights the well-established theoretical insight on the role of economic pressures for firms. The implication is society cannot expect firms to adequately protect societal concerns that are unprofitable.

It was the IETF through their peer review process that quickly identified the privacy problems associated with cookies. The IETF's emphasis on security as a shared value and their open membership policy lead them to identify and correct the security and privacy flaws with cookies. Their suggestions for modifying cookies involved informing users and providing them the ability to manage cookies. This behavior follows the institutional models of consortia that recognize that their actions are driven by their membership.

The implications of this study are threefold. First, this research supports examining the development of code from an institutional perspective. This perspective suggests that we should neither just treat technology as a block box, nor should be lured in by the lifestyles and words of the programmers. Instead, the focus should be how institutional motivations, norms, and

processes can influence the development of code. The cookies case study shows how the same programmers developed two radically differ browsers, with enormous consequences for privacy, as a result of a different institutional environment.

Second, this study shows how institutions can favor or emphasize certain social and technical attributes in communication technologies. The cookies case study shows how Netscape and the IETF differed in incorporating the value of privacy into cookies. Netscape designed in some privacy protections into cookies, while the IETF sought further protections as well as ensuring users had the tools to manage cookies. Future work will develop this by studying each institution separately along comparative lines for technical and social characteristics. This research could address what institution is more likely to incorporate open standards, have higher quality code, or offer technical support. The result would be a mapping out how different institutions systematically affect specific social and technical attributes of code.

Finally, this work begins to show how institutional motivations, norms, and processes, could be used proactively to foster development of socially valuable technologies. For example, this research found that Netscape sought to reshape the web for economic gain. In contrast, the work within the NCSA and IETF was not focused on economic gain and exploiting privacy. The work by the IETF led to improved cookie management tools. This suggests policymakers should look to incentivize institutional actors, outside of firms, to address privacy concerns for technologies analogous to cookies. After all, these motivations are not unique to cookies and are likely to repeat themselves systematically.

Conclusion

This article analyzed the development of code from an institutional perspective. Specifically, the analysis focused on how privacy was differentially embedded into cookies by universities, firms, and consortia. The analysis found that each of these institutions has their own motivations, norms, and processes. As a result, they emphasize different social and technical attributes in the code they develop. For example, the work within a university did not seek to exploit privacy, while a firm developed the cookies technology for profits. Finally, a consortium evaluated the cookies technology, identified privacy and security flaws, and developed a standard to address the problems. This example illustrates how the values inscribed into technologies are substantially influenced by their institutional origins.

This analysis differs from past scholarship, which typically focuses on the development of code by firms. The story neither begins with Netscape, nor does it end with Netscape. In the case of cookies, various societal institutions, outside of firms, continued to work on and refine the cookies technology. They each had their own recipe for cookies. This finding suggests further research needs to consider these newer institutional forms, such as consortia and the open source movement.

This research also suggests that with further research on institutional tendencies, it may be possible to map out how different institutions systematically affect specific social and technical attributes of code. This mapping could have a considerable impact upon public policy issues if policymakers could predict how code may develop. This could allow policymakers to act proactively by seeking to influence institutions that are likely to promote certain attributes in code. This is a valuable finding for those engaged in ensuring these new technologies comport with our societal values.

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