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Human–Computer Interaction and International Public Policymaking: A Framework for Understanding and Taking Future Actions[1]

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[1]The foundation for this monograph was a Workshop on Engaging the Human–Computer Interaction Community with Public Policymaking Internationally, held at the CHI 2013 Conference in Paris, France. The first 18 authors of this monograph were all participants of the workshop. The remaining 13 authors did not participate in the 2013 Workshop but provided substantial contributions to the monograph. The authors also appreciate feedback from members of the SIGCHI Executive Committee, including: Gerrit van der Veer, Elizabeth F. Churchill, Allison Druin, Gary Olson, Rob Jacob, John "Scooter" Morris, Tuomo Kujala, Fred Sampson, Kristina Höök, Jofish Kaye, Philippe Palanque, Zhengjie Liu, Jenny Preece, John Thomas, Loren Terveen, Dan Olsen, and Patrick Gage Kelley. Earlier versions of this monograph were released by SIGCHI as a SIGCHI-approved report, although this version of the monograph has not been reviewed by SIGCHI.

Contents

Abstract

This monograph lays out a discussion framework for understanding the role of human–computer interaction (HCI) in public policymaking. We take an international view, discussing potential areas for research and application, and their potential for impact. Little has been written about the intersection of HCI and public policy; existing reports typically focus on one specific policy issue or incident. To date, there has been no overarching view of the areas of existing impact and potential impact. We have begun that analysis and argue here that such a global view is needed. Our aims are to provide a solid foundation for discussion, cooperation and collaborative interaction, and to outline future programs of activity. The five sections of this report provide relevant background along with a preliminary version of what we expect to be an evolving framework. Sections 1 and 2 provides an introduction to HCI and public policy. Section 3 discusses how HCI already informs public policy, with representative examples. Section 4 discusses how public policy influences HCI and provides representative public policy areas relevant to HCI, where HCI could have even more impact in the future: (i) laws, regulations, and guidelines for HCI research, (ii) HCI research assessments, (iii) research funding, (iv) laws for interface design — accessibility and language, (v) data privacy laws and regulations, (vi) intellectual property, and (vii) laws and regulations in specific sectors. There is a striking difference between where the HCI community has had impact (Section 3) and the many areas of potential involvement (Section 4). Section 5 a framework for action by the HCI community in public policy internationally. This monograph summarizes the observations and recommendations from a daylong workshop at the CHI 2013 conference in Paris, France. The workshop invited the community's perspectives regarding the intersection of governmental policies, international and domestic standards, recent HCI research discoveries,

and emergent considerations and challenges. It also incorporates contributions made after the workshop by workshop participants and by individuals who were unable to participate in the workshop but whose work and interests were highly related and relevant.

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1

Introduction

Historically, the international community of researchers, practitioners, teachers, and students in the area of human–computer interaction (HCI) has not played a major role in the area of public policy. There could be many possible reasons for this: people with technical training are often not well-versed in public policy, those working in university or corporate settings may not get credit for working on policy-related issues, and there has been no clear path to involvement for those interested in both HCI and public policy.

The HCI community, when outwardly focused, has had some success in influencing actual hardware and software design by major technology companies. Companies with a large focus on usability, such as Apple, Google, IBM, Microsoft, and Samsung, have been greatly influenced by the work of the HCI community and have made major contributions to the HCI community.

With that being said, within the general public and public policy community (including national and local governments, human rights organizations, multinational organizations, and nongovernmental organizations), the HCI community is not well known and does not have a clear identity. In the public arena, people understand what software

engineers and security analysts do but may not be as familiar, say, with the work of people involved with human-centered design and usability. The mass media doesn't have any clear understanding about HCI, and there are no pop culture figures who work in HCI. The closest to a pop culture figure in HCI may have been Steve Jobs, who was well-known for being an opinionated designer with a keen vision of the "ideal" user experience, even if he was not a core part of the HCI community.

However, despite this limited awareness, individuals have played an active role in public policy, and some have had a significant impact. Two areas of measurable impact stand out: accessibility policy, and international technical standards (from groups such as International Organization for Standardization [ISO] and the World Wide Web Consortium).

Given that the public policy communities have not seen broad involvement by the HCI community and that the HCI community has not made great efforts to become involved with public policy, it is no surprise these communities are largely strangers to each other. Few people work at the intersection of public policy and HCI, and as a result, graduate programs in HCI seldom offer instruction in public policy. There is little awareness of the potential connection (and the potential impact from such a connection) between the two topics, and there has been too little promotion of existing work. Little has been written about the intersection of HCI and public policy, and what has been written often is about a specific policy issue or incident. Therefore, it is not surprising that policymakers rarely consult those in the HCI community, even when the topics (accessibility, privacy, universal usability, etc.) are key HCI topics.

In this monograph, we present a foundation for understanding the intersection of HCI and public policy. No global view that addresses all of the potential topical areas of HCI and public policy, and existing and potential impacts on policy, currently exists. Such a global view is needed and will provide a basis for discussion, cooperative and collaborative interaction, and future work. We believe this lack of a global view leads to misunderstandings. For instance, some have publicly stated that interface accessibility is the *only* topic at the

intersection of public policy and HCI. Although incorrect, the view is understandable because (1) the HCI community has been successful in having an impact on public policies regarding accessibility, (2) there has been sustained involvement, over decades, by the HCI community in accessibility policy, and (3) there are more active researchers and practitioners working in this space. We need to elevate other work at the intersection of public policy and HCI to this kind of broader consciousness and illustrate that the arena of HCI and public policy is a rich one for current and future attention and investment. We envision an expanded role for the HCI community in the world of public policy, through a number of different approaches. We envision more visibility of policy concerns at HCI-related conferences through related panels and sessions. We envision events at policymaking conferences specifically aimed at educating policymakers about the role that HCI can play. We envision that more computing conferences, specifically, HCI-related conferences, will hold events related to public policy and invite speakers to discuss policy-related issues. Finally, the authors of this monograph want to acknowledge that the monograph leans heavily towards North/South America and Europe. Despite many attempts to recruit co-authors who are from Asia and Africa, there were no successes in recruiting co-authors. Furthermore, the base of literature on HCI and public policy in those countries is virtually nonexistent (aside from a number of monographs criticizing the inaccessibility of government web sites in Asian countries). The authors of this monograph openly acknowledge that limitation of this monograph.

2

Background on HCI and Public Policy

Innovative applications of information and communication technologies (ICT) impact all aspects of our lives. A broad range of human–computer interaction (HCI) research shows how these technologies affect, and are intertwined with, social systems and how they have profound impacts to the quality of daily life. The quality of design is not a merely technical feature. It also needs to be understood in its interaction with the contextual social system.

Public policy is a core component of social systems. Understanding the relationships between public policy and HCI research and practice is important to societal development outcomes, evidence-based approaches to governance, and setting the priorities of policy goals.

The intersection of public policy and HCI can be understood along two dimensions. First, public policies can influence how HCI researchers and practitioners perform their work. Second, the HCI community can inform public policy by providing expertise, taking part in the development of policy, and researching the impact of various policies related to HCI. These two dimensions are not mutually exclusive and frequently interact.

2.1 What is human–computer interaction?

Human–computer interaction is a broad area of work. The people involved in that work might be described as being both interdisciplinary and multidisciplinary, both theoretical and applied. There are multiple definitions for the term HCI, and this monograph certainly will not settle once and for all what the appropriate definition is. We view HCI very broadly, as focusing on the **design**, **evaluation**, and **implementation** of interactive computing systems for human use, by reducing negative user experiences, increasing positive user experiences, and allowing people using technology to carry out their activities **productively**, **safely**, and **happily** [Preece et al., 2015]. We intend this definition to be as broad and inclusive as possible.

The origins of HCI lie in computer science, systems engineering, and psychology. However, over time, the community has grown to include the fields of sociology, anthropology, design, library science, management, communication, and others. The early roots of HCI, from the late 1970s and early 1980s, focused on improving task and time performance for office automation tasks taking place on desktop computers and dumb terminals. More than 30 years later, the field focuses much more on emotion, experience, computer-mediated communication, gaming, social media, and portable and ubiquitous devices. The overall goals of the field continue to focus on improving the user experience with technology. Within industry, services, education, and government, there has been tremendous growth in paying attention to HCI. Many senior leaders of the field have degrees in computer science, psychology, or engineering, but in the last decade, students have been awarded degrees in academic programs such as Human–Computer Interaction or Human-Centered Computing, Multimedia, and Industrial Design.

2.2 Understanding components of public policy related to human–computer interaction

Within science and technology communities, policy is sometimes described as having two facets: (1) policy influencing science and technology and (2) science and technology informing policy. Both aspects

are present in the current report, in which Section 3 focuses on HCI informing public policy and Section 4 focuses on public policies influencing HCI.

Human–computer interaction-related public policies cover a broad range of mandatory and voluntary rights, obligations, and activities and are implemented across a broad spectrum of institutions, legal and regulatory documents, and social, cultural, political, and economic environments at the local, regional, national, and international levels. HCI-related public policies also are shaped by information sharing and collaboration across public entities, businesses, nongovernmental organizations, nonprofits, and other civil society stakeholders. Within these contexts, HCI researchers and practitioners can find how policies are enacted, implemented, and interpreted. HCI-related public policies can be found in statutory laws (e.g., local, provincial, and national), regulations, executive orders, administrative decrees, ordinances, enforcement actions, lawsuits, and other administrative and judicial proceedings.

HCI-related public policies also may be reflected in bilateral, multinational, regional, and international agreements on topics ranging from trade (e.g., General Agreement on Tariffs and Trade [GATT], General Agreement on Trade in Services [GATS], and the Agreement on Trade-related Aspects of Intellectual Property Protection [TRIPs]) to human rights (e.g., United Nations Convention on the Rights of Persons with Disabilities [CRPD]). In addition, international technical standards adopted by standards organizations (e.g., the International Organization for Standardization [ISO] and the World Wide Web Consortium [W3C]) may be voluntarily adopted by industries or incorporated into various domestic, regional, and international legal requirements. International financial institutions (e.g., World Bank, International Finance Corporation, and African Development Bank) also play a significant role in driving and improving information and communications technologies and infrastructures around the world.

Furthermore, policymaking at all levels is inherently influenced by legal, political, social, cultural, political, and economic differences. In different locales, these influences may result in policy emphases on prescriptive requirements for ICT, performance-based requirements for

ICT, enhanced enforcement of accessibility standards or lack thereof, lawsuits to clarify interpretation of statutes, government funds for HCI research, or openness and transparency initiatives.

Examples

Participants of the 2013 workshop observed how countries varied in their policy approaches. Sweden was identified as favoring openness and transparency initiatives [Gulliksen et al., 2010], The accessible information technology regulation in Germany [BITV 2.0, 2011] was described as being prescriptively specific, whereas the UK Disability Discrimination Act of 1995 and Equality Act 2010 were both described as allowing flexibility in interpretation and implementation. The ISO Guide 71: Guide for Addressing Accessibility in Standards (http://www.iso.org/guide71) was published in December 2014 and contains two approaches to addressing accessibility in standards to fit with the different social policy models in different countries.

2.3 Public policy as an extension of human–computer interaction's history and focus

Human–computer interaction has long been concerned with enhancing human experience and social interaction, with an emphasis on examining how people interact with technology and real-world systems and designing interactions that enhance quality of life [Hochheiser and Lazar, 2007]. In the early years, the field concentrated on specific workplace concerns, such as ergonomics and efficiency. As computing and information technologies became integral to working life in North America and Europe, approaches for addressing the sociocultural implications of these tools emerged, including subfields, such as computer-supported cooperative work (CSCW) and participatory design. Given the uptake of digital technologies through all sectors of societies across the globe, HCI scholarship has moved beyond the conceptual boundaries of the Western workplace. With this broadened context, HCI has enlarged its focus to encompass computing interactions that are

ubiquitous in everyday life and mediating human values across diverse societies [Bidwell et al., 2013, Harrison et al., 2011].

Although there are many theoretical framings within HCI, an underlying commonality is an interactional perspective [Orlikowski, 2000, Friedman et al., 2008, Verbeek, 2006]. Winston Churchill captures the spirit of this interactional stance in his description of the British House of Commons: "We shape our buildings, and afterwards our buildings shape us" (May 10, 1941). What Churchill tells us about buildings becomes even more complicated when we consider the versatility and pervasiveness of contemporary computing and information technologies. As our interactions with ubiquitous computing shapes what we do even more than the buildings we are in, Churchill's statement might now be broadened to state: "We shape our technology and afterwards it shapes us." These tools are embedded in our clothing, our kitchens, and the toys our children take to bed. It is clear that design matters, as we shape our tools, technologies, and infrastructures. In turn, our tools, technologies, and infrastructures influence our experience of ourselves, human society, and the world. Yet how people appropriate any given technology in any given context, is beyond the control of the designer [Dix, 2007].

It is here that public policy enters the fore. Policy can be used to circumscribe the range of technical features deemed necessary or unacceptable by a group of people: for example, mandating that military drones must have override switches. Policy also can be used to circumscribe the actions that people can take with a given technical system. For example, although it is technically possible for young children to sign onto social media, policies may prohibit children younger than a certain age from opening an account. Both uses of policy regulate human action, albeit in different ways: the former through technical capability, the latter through law or social norms. Also relevant to the HCI community are issues in data, privacy, and analytics.

A range of approaches within HCI have engaged policy in significant ways. In the 1980s, the participatory design approach was developed by scholars involved in the implementation of Scandinavian codetermination policy, which gave workers a legal say in the design and adoption

of workplace technology [Floyd et al., 1989]. In the early 1990s, US policy requiring an Environmental Impact Statement for large construction projects inspired an analogous Social Impact Statement for information systems, with such statements being intended as a tool to support public discourse concerning the effects of proposed technologies on human stakeholders [Shneiderman and Rose, 1996]. In the European Union, employees may have rights to be informed and consulted about any technologies that could lead to substantial changes in their work.

Later in the 1990s and 2000s, value-sensitive design emerged as a structured approach to account for human values throughout the technology design process [Friedman et al., 2008]. Value-sensitive design has been applied to a range of technologies with policy implications, from web browser cookies [Millett et al., 2001] to urban simulation systems [Borning et al., 2005]. These approaches, among others, aim to support designers and researchers in understanding and accounting for the complex interplay between technology and human life. Although HCI research into values has increased in recent decades, so has HCI research that directly addresses issues of social relevance [Hayes, 2011]. So, for instance, recent research has examined how design can be improved to increase civic engagement [Harding et al., 2015], and crowdsourcing [Brady et al., 2015, Hara et al., 2015, among others]. A number of recent conference panels and other conference gatherings encourage HCI researchers and practitioners to focus on having a more activist agenda in their work [e.g., Busse et al., 2013].

Public policy does not proceed in a single format or arena. Rather, through their work HCI researchers and designers may encounter, interact with, have an impact on, and be affected by policy and policy makers at a multitude of organizational, national, and international levels [Nathan and Friedman, 2010]. At the domestic level, researchers and designers are bound by the principles, rules, regulations, and laws instituted by their own national, state/provincial, and perhaps municipal governing bodies. For example, HCI researchers and designers who work on electronic voting in democratically organized societies need to be aware of jurisdiction of control and policy that governs elections, including how voters are identified and verified, how votes may

be recorded, and how votes may be identified [Mercuri and Camp, 2004]. International policies, treaties, and pacts are critical considerations when HCI researchers and designers engage with systems that cross national boundaries. For instance, data collected from an experiment involving human participants may be stored in a data cloud, which crosses national boundaries. Laws from multiple countries may then apply to the research. Cloud computing poses fascinating policy challenges for the ownership and privacy of data stored, joined, analyzed, and interpreted in the cloud [Odom et al., 2012, Nanavati et al., 2014]. If human participants are involved in research spanning multiple countries, there may be a need for multiple Institutional Review Board (IRB) approvals. The recent debates about and ruling from the US Federal Communications Commission on net neutrality are another interesting area in which we see the ramifications of legal and policy issues on end user access and interactions with and through content.

HCI can help provide increased effective access to information by the public, as called for in open records laws, and enhanced mechanisms for trustworthy computing. Transparency and accountability initiatives to make information more accessible to the general public are improving access to government data, judicial information, corporate disclosures, research findings, and more through easy-to-use online websites and mobile apps. In both the public and private sectors, HCI can provide improved ways for users to conveniently find and understand ownership information, privacy policies, and terms of service. As the amount of digital information and big data continue to grow, HCI can help address long-term aspects of managing digital information and the computing infrastructure. In particular, the HCI community is addressing two aspects: (1) sustainability in the design of ICT and networks and (2) sustainability through design, which includes economic, social, and environmental impacts [Foth et al., 2009, DiSalvo et al., 2010].

2.4 Human–computer interaction as nonpartisan

Policy issues in the area of HCI policy do not fall within specific political party structures. This independence makes it easier for the HCI

community to form relationships with policymakers regardless of political affiliation. Unlike other topics at the intersection of policy and science (e.g., stem cell research, global warming), most policymakers have not taken sides on most HCI policy issues and do not have strong lobbying pressures bearing upon them (voting access may be one potential exception). This can be seen as a great opportunity for the HCI community to help inform policymaking without getting strongly partisan. It is even possible that in some situations, if there is not broad agreement within the HCI community about a certain topic, a range of informed views could be presented to policymakers, to help policymakers become informed about the existing research and how it relates to their policy decisions. Kriplean and colleagues describe using HCI to support reflective and engaged political discourse, even when there are diverse opinions [Kriplean et al., 2012a,b]. For members of the HCI community who are leery of partisan politics, topics related to HCI are generally nonpartisan, and there is not the existing infrastructure that brings negative connotations. The negative policy stereotype, of large lobbying firms, think tanks, and deep-pocket donors, does not exist for HCI-related topics. Although this means that HCI-related topics probably are not currently considered urgent topics by many policymakers, it also provides a great opportunity to create more informed policymaking, using data findings from research.

3

Human–Computer Interaction Informing Public Policy

3.1 General

HCI is by nature interdisciplinary, involving not only technology but also the social sciences and design. This makes the HCI community well placed to offer thoughtful feedback to policymakers, related to the development and adoption of laws and regulations that impose technology mandates or adopt technical standards.

However, research coming from the HCI community in the form of technical research articles might not directly be useful to policymakers. Some policy making comes over long periods of contemplation. At other times, policy makers face moments when they must implement decisions with limited time and technical information. The HCI community needs to take a long-term interest in developing relationships with policymakers. At a basic level, policymakers are more likely to find short overview summaries of research to be useful and to respond to persuasion in a face-to-face meeting, rather than through electronic communication [Lazar, 2014]. Furthermore, policymakers often are more interested in longitudinal data (looking at improvements on a yearly, five-year, or ten-year basis), something that the HCI community does not have a track record of performing. Not only must

information be presented in a usable format for policymakers, but the HCI community needs to be aware of which topics are relevant to policymakers. There are "windows of opportunity" when certain topics reach the awareness of policymakers and become hot topics and other times when a specific policy topic is "cold" and sees little activity [Birkland, 2010]. For instance, since approximately 2000, web accessibility has been a "hot" policy topic, with policy activities occurring at a national level, such as in Canada, France, Germany, Ireland, Italy, the United Kingdom, and the United States, and a regional level, such as in the European Union. Ergonomics of computer usage was a hot policy topic in the United States from 1999 to 2001, but there has been little activity in the United States since [Hedge, 2013]. Accessibility is the one area in which the HCI community has been successful, on a long-term basis, in informing policy.

3.2 Representative policy examples

3.2.1 Accessibility laws, regulations, and guidelines for information and communication technologies

Human–computer interaction experts have been involved in accessibility policies since the field came into being, driving the development of international standards, which have been adopted by governments around the world within domestic laws, regulations, and guidelines [Hochheiser and Lazar, 2007]. These international standards strive to make technology more accessible for people with disabilities and more usable by all users. The standard process allows researchers, interface and interaction designers, and practitioners to develop, review, and periodically update a harmonized set of accessibility requirements and evaluative criteria. The iterative human-centered design process utilized in the development of international standards, integrates well to the principles of the HCI community. There is the potential for the standards process to be an influence in a number of areas: (1) Better user interface design; (2) Reliable usability test data; (3) Making usability and user experience a part of systems engineering; (4) Good practice in user-centered design; (5) Helping organizations improve their processes; and (6) Documenting information about usability [Bevan, 2014].

The process for drafting standards has proven successful over many years, providing a credible, authoritative set of international standards with the flexibility to foster, rather than preclude, innovation and evolving designs and techniques that can provide better, and often more powerful, forms of communication. At the international level, the leading accessibility standards are adopted under the auspices of the World Wide Web Consortium (W3C), including the Web Content Accessibility Guidelines (WCAG), the Authoring Tool Accessibility Guidelines (ATAG), the User Agent Accessibility Guidelines (UAAG), and Accessible Rich Internet Applications (WAI-ARIA). The HCI community was involved, from the beginning, in the development of these standards. Because of the nature of the standards, it would be almost impossible to conceive of them, without involvement from members of the HCI community.

The W3C created the WCAG2ICT Task Force in 2013 "to develop documentation describing how to apply WCAG 2.0 and its principles, guidelines, and success criteria to non-Web Information and Communications Technologies (ICT)." Members of the Task Force included HCI and accessibility experts from W3C, industry, and national governments, such as representatives from the EU Mandate 376 team and the US Access Board Section 508 team. The Task Force has worked to get strong consensus on which elements of WCAG apply as written to nonweb ICT and which elements require interpretation and substitutions of terms. A growing body of knowledge from the HCI community provided guidance on how to implement these international standards and other accessibility requirements within specific contexts.[1]

The influence of HCI research can be seen in the two parallel accessibility regulation processes occurring at this very moment: the EU Mandate 376, and Section 508 of the Rehabilitation Act in the United States. Both regulatory processes, to define current standards, have been heavily influenced by the HCI community. The EU Mandate 376 is newer than Section 508 (which was originally implemented in 2001), but both require the accessibility of any technology developed or procured

[1]The final working group note is published at https://www.w3.org/TR/wcag2ict/

at a national governmental level. Section 508 of the Rehabilitation Act in the United States is currently undergoing a "refresh," to update the technical standards so they are relevant to newer technologies. In the regulation process, the original rule presented was an altered version of WCAG 2.0. Because of the outcry from the HCI and other technical communities, a later draft rule issued was consistent with the existing WCAG 2.0, rather than presenting an alternate version.

The HCI community also has been influential in the development and implementation of voluntary certification and labeling programs to assist consumers in identifying which websites, mobile apps, and devices are accessible for people with disabilities.

Examples

Countries increasingly are adopting the international accessibility standards, rather than creating national accessibility standards. There are many reasons why this is considered a good idea, for instance, (1) because international standards utilize an open development process that is open to all stakeholders, (2) the international standards are well-documented, and (3) using the same standards allows for knowledge and tools to transfer across borders. It is harder to manage multiple national standards (in terms of documentation, training, and tools) than one international standard [Brewer, 2017].

Canada guarantees technology accessibility for persons with disabilities under its Human Rights Act and requires all public and private websites to comply with WCAG 2.0, which is integrated into the Canadian Standard for Web Accessibility.

The US government is anticipated to propose adoption of WCAG 2.0 in 2016 as a final rule in its update of accessibility regulations under Section 508 of the Rehabilitation Act and Section 255 of the Telecommunications Act. A proposed rule was issued in February 2015. This is the third proposed draft rule (the previous two were preliminary) issued as a part of the regulatory process. In the recently released proposed rule, WCAG 2.0 was adopted as the standard. A dedicated website, http://www.disability.gov, provides information on the implementation of accessibility regulations and best practices.

Individual states also may have accessibility-related laws. Some have surprising enforcement mechanisms: for instance, Minnesota's regulations specify financial penalties for noncompliance by the state government.

All European Union websites created after January 2010 must comply with WCAG 2.0. In addition, the EU Council encourages state members to enact laws for accessibility of public websites at all levels of government. Many member states, such as France, Germany, Ireland, Italy, Netherlands, Spain, and the United Kingdom, among many others, have created laws for the accessibility of digital content that include or are based on WCAG. The European Union also ratified the United Nations Convention on the Rights of Persons with Disabilities (CRPD) in December 2010.

In the United Kingdom, the Interaction Specialist Group (part of BCS, The Chartered Institute for IT) encourages the adoption of British Standard 8878:2010 "Web Accessibility: Code of Practice" [British Standards Institution, 2010] which fills the operational gap left by guidelines such as WCAG 2.0. BS 8878 includes 16 process steps, providing specific guidance on creating and maintaining accessible websites. In the European Union, the Euracert quality label also certifies the accessibility of websites [Euracert, 2010].

In Brazil, the HCI community's criticism of electronic voting technologies as not being accessible to people with disabilities led to the evolution of a new generation of voting machines for use by voters with disabilities. Several studies pointed out usability and accessibility problems that would prevent users from casting their votes in a reasonable way [Cybis et al., 1997]. Despite the high number of countries with existing laws or regulations related to information and communications technology accessibility, enforcement of these laws is often inconsistent or totally absent.

An Appendix of laws and regulations can be found at:
http://www.w3.org/WAI/Policy/Overview.html or
http://blog.powermapper.com/blog/post/Government-Accessibility-Standards.aspx.

Finally, the Global Public Inclusive Infrastructure project (GPII.net; see also Lewis and Treviranus [2013]) is an example of a research initiative that may have a significant impact on accessibility policy. The project is developing a range of infrastructure enhancements to support automatic personalization of content and services so that material can be made automatically accessible to users with a wide range of individual needs. This technology will push beyond current legal requirements that access be made *possible* for people with disabilities, to making access *easy and convenient*, a significant upgrade. Will we see policy around the world evolve to embrace this upgrade?

A challenge here is that information and communication technologies have global scope, whereas most policy structures have a regional, national, or subnational scope. A partial exception to this generalization is the UN Convention on the Rights of Persons with Disabilities [United Nations, 2015], over 160 countries, whose signatories commit to "Promote access for persons with disabilities to new information and communications technologies and systems, including the Internet (Article 9.2.g)." However, the Convention articulates high-level aims, rather than specific policies.

The development of GPII has been supported by public funding in the United States (Department of Education: National Institute of Disability and Rehabilitation Research), Europe (European Commission), and Canada, illustrating the linkage discussed previously: public funding decisions influence HCI research. The linkage is reciprocal: research, such as that seen in the GPII project, lays the groundwork for policy innovation, including decisions about additional funding. For GPII to succeed, many people have to adopt it.

The Global Public Inclusive Infrastructure will be facilitated by technical standards, another aspect of public policy. A standard for user preference specifications, based on the existing Access For All standard [ISO/IEC 24751-3; ISO, 2008], will coordinate the development of tools for specifying preferences and implementing them.

Procurement policy is one way to promote the adoption of accessibility technology. Examples are Section 508 of the Rehabilitation Act in the United States, and a proposal to strengthen web accessibility

in the European Union, known as the 2012 directive [European Union, 2012a]. Another success factor will be the supply of content and services in accessible format. Today, restrictions in copyright law on modifying content can block access; these restrictions may be eased as the benefits of greater access are more widely understood.

3.2.2 Ergonomic standards for computer users

The ergonomic design of computer hardware and software is essential to the usability of the system. The fields of human factors and ergonomics are closely related to that of HCI. Design principles, based on research, have been incorporated into a series of international standards that have been developed over the past 20 years. These standards contain a wide range of information, including guidelines and recommendations for the design and use of computer systems and specific user interface and software design specifications.

The ISO standards, which now number more than 60, can be grouped into five categories:

- context of use and user test methods;
- software interface, interaction and software quality;
- hardware interfaces and display terminals;
- user-centered development process; and
- user-centered organizational issues.

Table 3.1 provides a list of ISO HCI standards.

The ISO standards can be adopted by any country and can form the basis of public policy for that country. For example, ISO standards for the basis of computer-use health and safety policy in the United Kingdom. However, some countries have created their own computer standards. For example, in the United States there is the ANSI/HFES 100-2007, Human Factors Engineering of Computer Workstations, which specifies hardware design requirements, and the ANSI/HFES 200-2008, Human Factors Engineering of Software User Interfaces. In addition, the AAMI HE-74:2001, Human Factors Design Process for

Table 3.1: ISO standards related to human–computer interaction.

1a. Context and test methods — Principles and recommendations

- ISO/IEC 9126-1: Software Engineering — Product quality — Quality model
- ISO/IEC TR 9126-4: Software Engineering — Product quality — Quality in use metrics
- ISO 9241-11: Guidance on Usability
- ISO/IEC DTR 19764: Guidelines methodology and reference criteria for cultural and linguistic adaptability in information technology products

1b. Context and test methods — Specifications

- ISO DIS 20282-1: Ease of operation of everyday products — Context of use and user characteristics
- ISO DTS 20282-2: Ease of operation of everyday products — Test method
- ISO/IEC FCD 35062: Common Industry Format for usability test reports
- Draft Common Industry Format for Usability requirements

2a. Software interface and interaction — Principles and recommendations

- ISO/IEC TR 9126-2: Software Engineering — Product quality — External metrics
- ISO/IEC TR 9126-3: Software Engineering — Product quality — Internal metrics
- ISO 9241: Ergonomic requirements for office work with visual display terminals. Parts 10–17
- ISO 14915: Software ergonomics for multimedia user interfaces
- ISO TS 16071: Software accessibility
- ISO TR 19765: Survey of existing icons and symbols for elderly and disabled persons
- ISO TR 19766: Design requirements for icons and symbols for elderly and disabled persons
- ISO CD 23974: Software ergonomics for World Wide Web user interfaces
- IEC TR 61997: Guidelines for the user interfaces in multimedia equipment for general purpose use

(*Continued*)

Table 3.1: (*Continued*)

2b. Software interface and interaction — Specifications

- ISO/IEC 10741-1: Dialogue interaction — Cursor control for text editing
- ISO/IEC 11581: Icon symbols and functions
- ISO/IEC 18021: Information Technology — User interface for mobile tools
- ISO/IEC 18035: Icon symbols and functions for controlling multimedia software applications
- ISO/IEC 18036: Icon symbols and functions for World Wide Web browser toolbars
- ISO WD 24755: Screen icons and symbols for personal, mobile, communications devices
- ISO FCD 24738: Icon symbols and functions for multimedia link attributes
- ISO/IEC 25000 series: Software Product Quality Requirements and Evaluation

3a. Hardware interface — Principles and recommendations

- ISO 11064: Ergonomic design of control centers
- ISO/IEC TR 15440: Future keyboards and other associated input devices and related entry methods

3b. Hardware interface — Specifications

- ISO 9241: Ergonomic requirements for office work with visual display terminals. Parts 3–9
- ISO 13406: Ergonomic requirements for work with visual displays based on flat panels
- ISO/IEC 14754: Pen-based interfaces — Common gestures for text editing with pen-based systems

4a. Development process — Principles and recommendations

- ISO 9241-210: Human-centered design processes for interactive systems
- ISO 9241-11: Guidance on Usability
- ISO TR 16982: Usability methods supporting human centered design
- ISO/IEC TR 9126-4: Software Engineering — Product quality — Part 4: Quality in use metrics

(*Continued*)

Table 3.1: (*Continued*)

4b. Development process — Specifications
• ISO/IEC 9126-1: Software Engineering — Product quality — Part 1: Quality model
• ISO/IEC 14598: Information Technology — Evaluation of Software Products
5. Usability capability — Principles and recommendations
• ISO TR 18529: Human-centered life cycle process descriptions
• ISO PAS 18152: A specification for the process assessment of human-system issues
6. Other related standards — Principles and recommendations
• ISO 9241-1: General Introduction
• ISO 9241-2: Guidance on task requirements
• ISO 10075-1: Ergonomic principles related to mental workload — General terms and definitions

Medical Devices, is a 25-section standard that focuses on topics such as displays, alarms, documentation, hand tools, and mobility. Canada has the CSA Z1004-12: Workplace ergonomics, A management and implementation standard, and CSA-Z412-00 (R2011): Guideline on office ergonomics.

Of special interest to policymaking, two current standards initiatives explicitly address the responsibility of organizations to understand, promote, and account for usability and accessibility. The proposed ISO 27500, Human-centred organisation: Rationale and General Principles, describes the values and beliefs that make an organization human-centered, the significant business benefits that can be achieved, what policies need to put in place to achieve this, and the risks for the organization of not being human-centered. ISO 27501, The Human-centred Organisation: Management of Ergonomics Processes, provides requirements and recommendations for the

management of ergonomics processes associated with various types of design and operational activities.

Examples

In the Scandinavian countries, the trade union movement's positive attitude to new technology led, from the late 1970s into the mid-1990s, to trade unionists and researchers from human factors/ergonomics and computer science cooperating on issues of eye ergonomics, monotonous work, musculoskeletal disorders, and lack of influence over the work environment. This was facilitated by a series of national research programs on workplace information technology (IT) development. In Sweden, investigators from the TCO, the National Federation for Professional Employees, were inspired by the strong user-centeredness taught and practiced by the IT researchers. The poor quality and the worries about emissions from the early visual display units led the TCO staff, supported by the researchers, to initiate a program for awarding environmental labels to good quality displays based on the criteria of eye ergonomics, emission, and energy levels.

In 1992, the local unions and a proactive management at Volvo and other Swedish multinational corporations gave this market intervention a favorable start with the first TCO'92 label. Today there are TCO labels for displays, notebooks, tablets, smartphones, desktop computers, all-in-one computers, projectors, and headsets. TCO labels are now accepted as a de facto standard for emissions, eye ergonomics, and energy consumption of visual displays [Boivie, 2007]. Since 2010, the TCO Certified label has covered social sustainability aspects at manufacturing plants, based on UN and International Labour Organization (ILO) codes of conduct (see www.tcodevelopment.com for more information). Since 2014, TCO Development has promoted the Swedish Users Award software usability and accessibility program, the result of 12 years of research and development cooperation among the two major unions and the HCI departments at three universities [Walldius et al., 2009].

3.2.3 Digital agendas and digital champions

Many countries have used the declaration of a digital agenda as the form with which to present and set goals for the ICT policies. The European Union has published a digital agenda [European Commission, 2015], and many countries in Europe have developed their own individual digital agendas. "The Digital Agenda for Europe (DAE) aims to reboot Europe's economy and help Europe's citizens and businesses to get the most out of digital technologies" [European Commission, 2015]. The priorities of the EU digital agenda include increasing the percentage of citizens using the Internet, increasing regular Internet usage, and getting at least 50% of citizens to utilize e-government services. Because these goals clearly relate to HCI, there is a need and an opportunity for the HCI community to get involved in the development and implementation of digital agendas. The country-level digital agendas may be even more focused than the EU Digital Agenda, on HCI-related issues. For instance, one of the four strategic areas of the digital agenda for Sweden is making sure that ICT is "easy and safe to use," and usability and accessibility are specifically mentioned in the digital agenda. The European commission has been working on appointing digital champions of the various countries. According to Neelie Kroes, the EU commissioner in charge of the digital agenda of Europe, a digital champion should be "a high-profile, dynamic and energetic individual responsible for getting everyone in their country online and improving digital skills." There is currently a digital agenda channel on YouTube, where digital champions from European countries such as Denmark, Slovenia, Italy, Austria, Portugal, and the United Kingdom, are interviewed about their goals for their countries. This is a great opportunity for members of the HCI community to get involved with and influence public policies.

Examples

Sweden launched its digital agenda on October 6, 2011, after a long debate and many rounds of gathering input from all parts of the society [Digitalisation Commission, 2011]. Sweden made use of a process by which organizations could sign the digital agenda; by the time

the agenda was launched, more than 100 organizations, from large companies such as Ericsson, Microsoft, and Apple to small companies, had committed to signing the digital agenda. One part of the agenda was the plan to establish of a Digitalisation Commission, with the role of monitoring Sweden's position in the world when it comes to digitization. In June 2012, Jan Gulliksen, an HCI scientist and researcher, was appointed as the chairman of the Digitalisation Commission. Jan Gulliksen was later named the digital champion of Sweden. His input is vital to the development of digital policies for Sweden.

4

Public Policy Influencing Human–Computer Interaction

4.1 General

There are many different ways in which human–computer interaction (HCI) researchers and practitioners work. Because of the interdisciplinary nature of the field, some people have more expertise in the technology, some are more interested in the human cognition, and some are more interested in design aspects. Phrases such as "design, build, evaluate" often permeate HCI, describing the different roles that HCI researchers and practitioners take on. There are many aspects of this development life cycle that are affected by public policy. For instance, funding agencies decide which topics receive priority for funding and consequently which projects get to start the life cycle. During the design of interfaces, laws may specify aspects of ergonomics or design, such as brightness of a display, color of safety buttons, language (French, English, Spanish), or the level of language that must be utilized in the interface. Laws related to privacy may specify what types of data about users may be collected through the use of cookies or other data logging. When humans are involved in testing and evaluating an interface, laws may specify what rights those humans/participants/users have in the interface evaluation process. Laws may even specify how publications

from HCI projects are ranked, increasing or decreasing the likelihood of continued employment for HCI reseachers. Specific domains of work, such as education, health care, voting, and libraries, may also have specific laws addressing interface development and use in those respective fields. What is clear is that public policies DO have an impact on how we work as HCI practitioners and researchers. The following sections describe how public laws and policies have impacted HCI-related work.

4.1.1 Research with human participants

User studies, including formative evaluations, usability studies, and empirical comparisons, are a vital tool in understanding any interactive system. Consideration of the needs, concerns, preferences, and rights of research study participants is a core principle of responsible research. The ethical conduct of such studies has been the subject of considerable policy discussion. Most countries have laws, regulations, and guidelines governing the treatment of humans as participants in research studies; this process sometimes is referred to as ethical approval (note: both of the terms "participants" and "subjects" are often used, depending on the disciplinary roots). To protect research participants, laws, regulations, and community norms describe appropriate practices for recruiting participants, protecting confidentiality and anonymity, and conducting all aspects of research. Although gray areas often arise, particularly as community practices struggle to adapt to the implications of new technology, these protections have generally been effective in avoiding adverse outcomes and maintaining public trust in research. Individuals with many years of experience in HCI research tend to be familiar with human subjects' protections, but students and those new to the field of HCI often encounter human subjects' protections only in a "research methods" class. This is potentially an opportunity to improve awareness through educational initiatives anytime research is discussed in educational settings.

Human-subjects protections have their origins in concerns over ethically questionable medical and psychological experiments. Questionable studies involved a number of practices that may have been

consistent with prevailing research at the time, such as exposing subjects to danger, withholding critical care from sick patients; exploiting populations that were uninformed, powerless, or had no chance of receiving benefit; and asking participants to complete tasks that caused psychological distress [Lazar et al., 2010, Rice, 2008].

Growing concern over the real and perceived harms resulting from this research led to the establishment of the US government's National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research, which published its report "Ethical Principles and Guidelines for the Protection of Human Subjects of Research" (known as The Belmont Report) in 1979 (US Department of Health and Human Services [HHS], 2014a). The Belmont Report promoted three basic principles of ethical research:

- *Respect for persons*, including consideration of an individual's ability to autonomously decide to participate in research and protection for those who cannot make such determinations.
- *Beneficence*, requiring researchers to protect the well-being of participants by ensuring that research maximizes benefits and minimizes harm.
- *Justice,* requiring that the benefits and costs of research should be shared fairly, without undue burden or loss of opportunity because of economic, racial, educational, social, or health disparities.

In the United States, the principles described in the Belmont Report are enacted by the Common Rule, written in 1991 and revised in 2009. The Common Rule describes policies for the protection of human subjects in research involving or sponsored by the federal government (US DHHS, 2014b). The Common Rule describes requirements for informed consent, requires review, approval, and oversight of research by Institutional Review Boards (IRBs), and describes criteria for approval of research projects. The Common Rule also designates interviews and observations of public behavior — techniques often used in HCI research — as being exempt from ongoing oversight. However, IRB review and approval is required to classify these studies as exempt.

Common Rule principles have become *de facto* requirements for almost all human subjects research in the United States, even if conducted without federal funding.

Although specific rules and procedures vary, similar practices are found across the globe. A 2013 compilation prepared by the US DHHS lists human research standards for more than 100 countries (US DHHS, 2014c). International organizations, such as the World Health Organization, also have developed relevant policies and procedures [World Health Organization, 2000].

Given these differences, HCI researchers conducting studies in unfamiliar locales would be well-advised to be particularly sensitive to local rules and cultural norms that might influence ethics reviews and research outcomes [RTI International, 2005]. Studies involving international collaboration can be particularly challenging, often requiring coordination of review by multiple IRBs, each applying its own national standards.

Examples

Standards and requirements for human subjects' protection continue to evolve around the world in response to problems and changes in technology.

The advent of online social media and "big data" explorations is likely to create new challenges and public concerns. This is evidenced by the controversy over a 2014 paper published by researchers at Facebook, who used (without informed consent and voluntary participation) large-scale manipulation of the emotional content of posts presented to users [Kramer et al., 2014, Waldman, 2014].

These developments, together with related concerns associated with advances in potentially identifiable genetic and genomic research, have prompted a re-examination of human subjects research regulation in the United States. A 2011 proposal from the US Department of Health and Human Services (DHHS) proposed multiple changes to human subject review procedures, including revisions that would simplify review of low-risk research projects similar to those often

conducted by HCI researchers [Thomson, 2012]. After voluminous public comment and four years of discussion, a revised proposal was updated in 2015. Although heavily focused on biomedical research issues, this overhaul of the Common Rule contains proposals that would have a substantial impact on HCI researchers. A new category of excluded research would further reduce IRB review requirements for research involving minimal risk, while some studies might be subject to review only through an online form [Federal Register, 2015]. As the US government accepted comments on this policy through early 2016, it is not yet clear how, if at all, these proposals will change before new regulations are issued.

In the European Union, HCI researchers seeking funding from the European Union as part of the Seventh Framework Programme must comply with established ethical principles and receive ethical approval. The ethical review process includes an ethics screening and an ethics review by a panel of experts from a range of disciplines. As with other jurisdictions, informed consent and data privacy are critical elements. HCI researchers also must comply with relevant European legislation, national legislation and ethics approvals, and where applicable, relevant accepted international standards [European Commission, 2013].

In Brazil, until recently, researchers acting as ad hoc consultants were required to verify whether the ethical considerations have been adequately addressed in the research proposals submitted to the national research council, known as Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq; National Counsel of Technological and Scientific Development). However, CNPq recently changed the form and suppressed the question regarding ethical considerations, without — to our knowledge — openly discussing this issue with the scientific community.

4.1.2 Human–computer interaction research assessments

A question that many HCI researchers face is, "What measurement techniques should be utilized in research?" Another question is

"How should the research, once complete, be evaluated for quality or success?" Government policies generally lack specific qualitative and quantitative metrics for HCI research assessment (although other fields of research, such as health and medical, do have such government assessments). Some in the field attempt to look for statistical significance at the 95% confidence level, but this is not always feasible or appropriate. To improve evaluations and assessments for outcome-oriented effectiveness, the HCI community and policymakers need to address better what type of impacts should be assessed, at what level of assessment, and how such impacts should be identified and evaluated. The HCI community could benefit from an ongoing discussion of which metrics researchers think would be most useful for assessing research quality, outcomes, and outputs. In addition, the HCI community should explore methods for benchmarking research within the HCI field and against other fields within national and global contexts.

Metrics widely known for assessing HCI research performance include (1) standards, (2) ethical and societal impacts, and (3) journal citations. However, these criteria are insufficient for capturing the inputs for public policy decision making and need to be improved, strengthened, and augmented.

(1) Standards for Human–Computer Interaction Research Assessments. National and international government and industry standards exert a great influence on policies for HCI research assessments. Other sections of this report discuss the use of standards for policies and interface development, although not for research assessment. The development of a common standard for measuring the usability of software illustrates how national and international standards often influence how HCI researchers and practitioners measure phenomena.

Examples

The US National Institute of Standards and Technology was a strong leader in creating the Common Industry Format (CIF) in 2001 to measure the usability of software, which influenced how researchers and practitioners measured usability outcomes and how consumers of usability data expected the data to be measured and presented [Lund et al., 2012].

The ISO adopted these same metrics of task performance, time performance, and user satisfaction as ISO/IEC 25062 standard (ISO, 2006). A technical report published in 2010 explains the general framework of the CIF and the potential family of standards related to the specification and evaluation of the usability of interactive systems, the ISO/IEC TR 25060 (ISO, 2010).

(2) Ethical and Societal Impacts. Previously in this report, the idea of a "societal impact statement" was discussed [Shneiderman and Rose, 1996]. As of yet, no specific metrics exist for measuring the ethical or societal impacts of HCI work. HCI research does not need to undergo a regulatory impact analysis, an economic cost–benefit analysis to society of a new regulation, as is required for pending regulations in the United States. However, merely asking researchers and practitioners to address the ethical or societal impact in paragraph form is helpful in promoting consideration of the societal impact of HCI work. In many countries, there is a close relationship between societal impact and research funding (funding is addressed in a later section of the current report). Many funding agencies, such as the US National Science Foundation, require grant applicants to specifically address the "broader impacts" or "societal impacts" of their proposed project.

Examples

Research proposals seeking funding under the European Union's recent €50 billion research-funding mechanism, known as the Seventh Framework Programme, are evaluated not only on their scientific merit but also on their ethical and social impacts [European Commission, 2013].

(3) Journal Citations to Assess Human–Computer Interaction Research. Much has been written about the limitations of journal (and conference proceeding) metrics measuring research impact. Acceptance rates to conferences and journals can be biased, depending on how many articles are submitted, and therefore do not accurately reflect quality. Citations often are viewed as more valuable indicators.

Researchers often check Google Scholar to see the number of citations and calculate a researcher's h-index. However, these metrics focus only on the impact the research has had on other researchers, they do not reflect the impact on actual systems developers, products, potential or actual users, or policymakers [Lazar, 2014]. For instance, other metrics not related to publications, such as patents, software downloads, and citations in regulation or court cases, provide other approaches for measuring impact. Consideration of differences based on discipline (such as the well-known focus of computer science on conference proceedings rather than journal articles) and those based on national or regional cultural, as well as specific university approaches (focus on theory vs. application), complicate the development of a single metric that defines the quality of journal and conference papers. Public policies that try to measure the quality of publications using a single metric generally have not been successful; instead, have hindered HCI researchers and put them at a disadvantage.

Examples

In Brazil, HCI research has been negatively affected by journal citation formulas. Recent publications are rated lower than established publications, and international publications are given higher ratings than those that address local societal needs. As a result, HCI researchers have had difficulty in "scoring" as many "points" as researchers in other areas of computing because the research that focuses on real-world needs, as much HCI research does, receives fewer points. Because published articles are important in faculty hiring decisions, candidates with HCI specialization consequently are at a competitive disadvantage when applying for faculty and research positions at universities [Barbosa and de Souza, 2011].

In the United Kingdom, the Research Excellence Framework (REF) is the latest national grading exercise for academic research (which occurs every 5–6 years and dictates future base funding for institutions). Each institution's active researchers submit their best four papers (journals, conferences, books), which are then ranked on a 5-point scale. HCI has largely been considered in the computing science

category ("Unit of Assessment"). Compared to other areas of computing, a far lower proportion of HCI research has been given the top ranking of "World-leading." In an unpublished analysis, circulated within the UK computing science research community, the destinations of the submitted papers were tabulated, to identify the most frequent journals and conferences. No HCI-related journal was listed in the 20 top-ranked journals, whereas the CHI conference accounted for more papers than the next four conferences combined. The growing assumption is that the HCI community's preference for conferences, rather than journals, for disseminating information, will place HCI researchers at a disadvantage during the next few years of funding. In addition, other countries are giving consideration to being included in the next REF in 2020.

4.1.3 Laws for interface design–accessibility and language

Government policies often influence how interactive systems (and corresponding interfaces) are designed and presented. For instance, for web interfaces, many countries have regulations requiring accessibility and multilingual access. Governments often require that their websites (and other technologies funded by the government, such as operating systems, personal computer hardware, telephones, and even e-books), be accessible for people with disabilities; that accessibility is often ensured by designers following a certain set of design guidelines and/or having users with disabilities evaluate for ease of use. Although these policies and laws often does not require accessibility for all technologies developed (only ones funded by the government or in certain categories of public accommodation), these legal standards might encourage developers to provide accessible tools for all markets.

In some countries, language laws regulate which languages must be available on websites. For instance, in Spain, all Spanish government websites must be in the official languages of Spain. These include Castilian (Spanish) and the official languages of the autonomous communities, such as Catalan (in Catalonia, Balearic Islands, and Valencia), Euskera (Basque country and Navarra), and Galician (Galice). In Canada, all government websites must be offered in both English and French. Within the countries that make up the United Kingdom,

Welsh and Gaelic are sometimes mandated and sometimes offered, even when not mandated, and government information is frequently offered in dozens of languages to support recent and second-generation immigrant communities. There is no legal requirement to offer US federal government websites in anything except for English; however, many US federal government websites offer content in Spanish. Furthermore, under the US Voting Rights Act, election materials, including ballots, must be provided in multiple languages in areas where there are sufficient numbers of people who speak that language.

Another aspect of language is the related topic of "plain language." International plain language groups have agreed that information is in plain language if the people for whom it is intended can find, understand, and act on it to meet their goals. Many countries (including the United Kingdom, Finland, Norway, New Zealand, South Africa, Australia, Portugal, Canada, and the United States) have active plain language programs for government or consumer communication. Legislation and regulations affect government materials, as well as specific industries, such as insurance, finance, and health care. A program in the United Kingdom, Easy Read, aims to make complex government documents and benefits information accessible to people with cognitive disabilities. The use of plain language can help address both general usability and access to information for people with some cognitive disabilities and low literacy.

Interface accessibility is one of the few areas where policy has strongly influenced the work of HCI and user experience professionals while the HCI community has been successful in influencing policies and regulations [Hochheiser and Lazar, 2007]. Therefore, the topic of interface accessibility could fit in Section 3 (HCI informing public policy) and Section 4 (public policy influencing HCI). The majority of accessibility-related content in this report is contained in Section 3 because accessibility is a key area in which the HCI community has been able to have an impact on public policies.

Examples: Language

Multilingual countries usually have public policies that mandate the use of the co-official languages to guarantee the citizens' rights to use

their own language when communicating with the public administrations. The mandatory use of co-official languages includes ICT-related cases, such as public websites or software applications provided by the government, and has a significant impact in the HCI of those systems.

For example, in Spain, Act 30/1992 (regarding public administrations) mandates that the national public administration must allow citizens to use co-official languages if they live in any of the autonomous communities that have co-official languages. Specifically, it has three obligations: (1) to support the co-official languages, (2) to fully translate the home page of public websites to all the co-official languages, and (3) to fully translate all forms and standardized document models related to administrative processes.

Another example can be found in Canada, where the Quebec provincial government published in 2006 the SGQRI 011 standard, which regulates the use of the languages on the websites of the Quebec provincial government. SGQRI 011 defines French as the default language even for multilingual websites, and it recommends disabling the automatic verification of the preferred user language as a means to expose users to the official language of Quebec so that users must explicitly select an alternative language. In France, the Toubon Law forbids the sale of goods and services in France in any language other than French, unless accompanied by a French translation. This law raised several questions regarding the Internet and has heavily influenced the French Labor Code, which has extended that obligation of the use of French to job offers, contracts, conventions, agreements and internal rules, and any other document "required by the employee to perform his tasks" (including software). In 1996, a lawsuit based on the Toubon law was engaged against a Georgia Tech university campus located in the city of Metz, France, whose website provided information only in English. The court dismissed that lawsuit based on technicalities, but afterward Georgia Tech provided versions of the website in French, German, and English. Nonetheless, two important lawsuits based on the Toubon law followed: General Electric Medical Systems (GEMS) in 2006 and Europ Assistance in 2007. Both organizations provided their French-speaking employees with information

systems for work usage only in English. Both companies were ordered to indemnify employees and translate the systems into French. Interestingly enough, potential safety problems related to the use of the English language by non-native speakers created a judicial precedent for reinforcing the need for software translation.

Moreover, full translation of documents in all living languages seems utopian. Even on a smaller scale, such multilingualism is problematic. For example, the European Union recognizes 24 "official and working" languages: Bulgarian, Croatian, Czech, Danish, Dutch, English, Estonian, Finnish, French, German, Greek, Hungarian, Irish, Italian, Latvian, Lithuanian, Maltese, Polish, Portuguese, Romanian, Slovak, Slovene, Spanish, and Swedish. There are two main entitlements for languages with "official and working" status: (1) documents may be sent to EU institutions and a reply received in any of these languages and (2) EU regulations and other legislative documents are published in the official and working languages, as is the *Official Journal of the European Union* (for more information, see Martinez-Normand et al. [2014]).

4.1.4 Research funding

Human–computer interaction research is funded primarily by governments (regional, national, and multi-national), the research arms of large companies, and independent foundations. How governments spend their research funds and which HCI research projects are funded have a big impact on the HCI research community [Evers et al., 2012]. By using the lever of funding, government policies actually choose which directions of research are priorities and will move forward and which areas of research will lie dormant because of a lack of funding. Therefore, it is important for the HCI community to communicate to policymakers their research findings and the relevance of those findings to society to help ensure that policymakers understand the contributions of the HCI community. This can help ensure future funding for HCI research and development.

Examples

The EU Horizon 2020 program, launched in 2013 as a funding program for research and innovation, will provide more than €15 billion to innovative research projects. Among the focus areas, HCI researchers can apply for funding of proposals in the areas of ICT Research and Innovation, Innovation, Security, and Society. Accepted proposals thus far focus on microrobotics for surgical procedures, three-dimensional (3D) printing, tools for brain–computer interaction, and more secure biometric systems for use with smartphones and tablets.

In 2006, the Brazilian Computer Society defined five great challenges to be faced by the Brazilian scientific community in the following 10 years. One of these challenges is "[p]articipative and universal access to knowledge for the Brazilian citizen," which requires strong focus on the user and brings HCI to the forefront. These efforts combined promoted several government-funded research projects in accessibility and in HCI generally [Barbosa and de Souza, 2011].

4.1.5 Data privacy laws and regulations

Public policies related to data privacy affect HCI research involving human subjects, as discussed in earlier parts of this report, as well as the technical and user interface aspects of systems. While data privacy is a broad topic (see Bélanger and Crossler [2011] for more information), data privacy concerns specific to HCI research include concerns about user data collected as part of the operation of a system and data collected for research purposes. In addition, systems that support interaction between users (for example, chat room systems, social networks, or mailing list software) may raise concerns about exposing user information to other users or allowing users to invade each other's privacy. Negotiating the interaction between people, technology, and privacy, is a dynamic process, with ever-changing boundaries [Palen and Dourish, 2003]. Although some privacy concerns may be addressed through an informed consent process, some systems may collect information about third parties who have not consented: for example, life logging cameras may photograph their users' acquaintances. There is

also a complex relationship between privacy and security, which will not be addressed in this document (see Dourish and Anderson [2006] for more information).

Among the many definitions of privacy, one that plays a prominent role in public policy is the notion of privacy as control over one's personal information. The US Fair Information Practices (FIPs) (US Department of Housing, Education, and Welfare, 1973) principles require that individuals should be informed about when their personal information is being collected and given the opportunity to consent or withhold their consent from the collection and use of their information. This is articulated in subsequent guidelines, including the 1980 Guidelines on the Protection of Privacy and Transborder Flows of Personal Data [Organization for Economic Co-operation and Development (OECD), 1980], which requires the purpose of data collection to be specified up front and that data should not be used for other purposes without the consent of the "data subjects," except as required by law. Human rights documents, such as the UN Convention on the Rights of Persons with Disabilities, International Covenant on Civil and Political Rights, and even the Universal Declaration of Human Rights (UDHR), proclaimed by the United Nations in 1948, all discuss privacy as a human right [Lazar et al., 2017].

Because European privacy laws are based closely on the OECD Guidelines, "notice and consent" are legal requirements for European companies and other companies that do business with European customers. The EU requires that notice and consent be given for a wide range of data collection, including the use of most cookies by websites, although exemptions are granted for some uses of session cookies and other short-term cookies [European Union, 2012b].

The United States lacks comprehensive privacy laws but has some sector-specific privacy laws that include notice and consent requirements: for example, in health care, financial services, and telecommunications. In addition, privacy regulation in the United States relies heavily on a self-regulatory approach based loosely on FIPs. Although the FIPs include a number of other important principles, the US approach focuses on a subset of principles referred to as "notice and choice."

Because of legal requirements in some countries and industry sectors and the self-regulatory approach, privacy notices and consent mechanisms have become commonplace, both online and offline. In the United States, banks mail annual privacy notices to their customers, and physicians present privacy notices to patients before treatment. In the European Union, cookie notices pop up on websites, asking users to consent to the use of the cookies. On the Internet, most commercial websites post privacy notices. However, there is a growing consensus between HCI and legal experts that privacy notices are an inadequate approach for communicating about privacy. Privacy notices are long and complicated, full of jargon and legalese, and may change with little or no notice. Websites often include content and cookies from multiple websites, each with their own privacy notice. Mechanisms that allow users to consent or "opt out" of data collection or use are often difficult for individuals to understand and use [Cranor, 2012]. More HCI research about presentation and visualization of privacy choices, would certainly be helpful in understanding how people process information presented to them about privacy.

One reason that privacy notice and consent mechanisms tend to be ineffective is that often they are designed without taking into account usability issues and the needs of users [Balebako et al., 2014]. Notices tend to be written by lawyers, and consent mechanisms tend to be developed for compliance purposes. HCI professionals can play a role in the development of more effective notice and consent mechanisms. Indeed, a number of HCI research papers have examined the usability of website privacy notices [McDonald et al., 2009], smartphone permission notices [Kelley et al., 2012, Felt et al., 2012], and online behavioral advertising opt-out mechanisms [Leon et al., 2012], and have proposed ways to improve notice and consent mechanisms [Kelley et al., 2010, 2013].

To be effective, notice and consent mechanisms need to be designed so that they fit into a user's workflow, allowing a user timely access to information relevant to his or her privacy decision making. It is unrealistic to ask users to spend a lot of time reading a privacy notice or to interact repeatedly with consent mechanisms [McDonald and Cranor, 2008]. HCI designers can conduct studies to determine the most

relevant information to present to users and the optimal time to present it. In addition, they can look for ways to allow users to automate their decision making, delegating privacy decisions to an agent programmed with their preferences or to privacy experts [Cranor et al., 2006].

4.1.5.1 Personal information

Personal information is generally considered information that relates to a person who can be identified from that information or from that information in conjunction with other information. Some types of information, such as names, government identifiers, and contact information, are clearly personal information. Other information, such as an Internet Protocol (IP) address, may or may not be personal information depending on how many users share that address, whether users are assigned an address for a long period of time, and other factors. Because mobile phones can track the geolocation of users, there are many concerns related to mobile phones and privacy [Glisson et al., 2011].

Data privacy laws in several countries require HCI researchers, system developers, and technology service providers to conform to practices that ensure notification of privacy policies, user consent for use of personal data, user control of and access to personal data, and guidelines and regulations for data collection and retention. In general, there are stricter requirements for sensitive data types, such as healthcare information, as well as data associated with children. Even when not required by law, industry guidelines and company policies may limit some types of data use or collection or require informed consent processes [Microsoft, 2007]. Institutional Review Board policies may also require participant consent to collect personal information or prohibit the collection of information about third parties who have not consented to participate in the research.

Examples

French public policies are deeply concerned with privacy and the protection of personal data. In France the independent committee CNIL (the National Committee of Informatics and Freedom; www.cnil.fr) is in charge of overseeing the protection of citizens' rights concerning

the use of their personal information (e.g., identify, history of Internet access). Recommendations defined by the CNIL have oriented public policies since 1978, when the CNIL was created. The CNIL supports recommendations to prevent websites that operate in France from keeping records of personal data (such as addresses and credit cards numbers) without the explicit authorization of users. More strict recommendations apply in the case of the creation of databases containing personal data because no public file may be implemented without a prior favorable opinion of the CNIL. On one hand, this encourages privacy protection, but by in essence discouraging the development of centralized databases, the CNIL potentially hinders the government's attempts at fraud prevention. For example, until recently, students applying for a public university in France had to repeatedly fill in the forms with high school grades. This situation changed in 2008 with the advent of admission-postbac.fr, which centralizes a student's applications to university; however, there is still no automatic transfer of data from high schools to universities, but at least students must now fill in their grades only once [Winckler, 2010].

4.1.5.2 Nonpersonal information

Nonpersonal information, such as information about the behaviors of nonidentified users, raises fewer privacy concerns. Researchers are generally encouraged to remove personal identifiers from their data to reduce privacy concerns. However, even nonpersonal information can be problematic because sometimes it may be combined with other information to identify a user. Thus, researchers and system developers who collect or use nonpersonal information should also take steps to protect that information and consider carefully whether that information can be safely released.

4.1.5.3 Online tracking of user behavior

Websites increasingly use cookies and other technology to track the behavior of users. Online tracking data are used to target ads, customize website content, facilitate online shopping carts and other features, and

analyze website usage patterns. Although some users appreciate receiving ads for products that match their interests, many users find this tracking to be "creepy" and consider it an invasion of privacy, especially when they feel powerless to control it [Ur et al., 2012]. A number of tools have been developed to allow users to opt out of tracking, although most suffer from usability problems [Leon et al., 2012].

Examples

The W3C Tracking Protection Working Group is spearheading an international effort to create privacy standards related to online behavioral advertising. The working group has sought input from industry and privacy advocates on the standards and interface needed for "do not track" (DNT) solutions. The digital solutions proposed by Microsoft, Mozilla, and Google have been criticized for the engineering decisions made in the technologies [McDonald and Peha, 2011].

In the European Union, a recent EU e-Privacy Directive, known as "the EU cookie law," requires all websites to provide clear and transparent information to online users about the use of cookies (http://www.theeucookielaw.com/).

4.1.6 Intellectual property

Intellectual property laws are increasingly having an impact on the work of HCI researchers and practitioners. The two areas of intellectual property law with the greatest bearing on HCI research and practice are copyright and patent law.

Increasingly, HCI work involves the transformation of copyrighted works, including books and other texts, video, and other audiovisual and multimedia content by intermediaries or other third parties who do not necessarily hold the copyright in the work. Making a work accessible — for example, by adding closed captions to a video or converting text to speech — may require making unauthorized reproductions, adaptations, or distributions of the work, which potentially may infringe on the copyright holder's exclusive rights, or where it may

not be clear who has ownership of these transformations [Kushalnagar, 2017].

Many countries have exemptions to copyright law for certain types of accessibility-related efforts, such as the United States' Chafee Amendment, which permits certain entities to create and distribute accessible versions of certain types of books, which may become more widespread under the recently adopted Marrakesh Treaty to Facilitate Access to Published Works for Persons Who Are Blind, Visually Impaired or Otherwise Print Disabled. Many accessibility efforts may also be permissible under the fair use doctrine in the United States, which arguably permits a broad class of activities consistent with accessibility laws, such as the Americans with Disabilities Act, and similar doctrines in other countries.

However, the narrow and/or unclear scopes of these exceptions and limitations and similar doctrines in other countries often present a less-than-certain legal foundation for HCI researchers and practitioners, particularly where accessibility efforts are tied with other purposes, such as foreign language translations. Efforts are under way in the United States and elsewhere to provide more legal certainty for accessibility efforts that ultimately may reduce copyright barriers to HCI research and practice.

Human–computer interaction research and practice may also be impacted by patent law. In many countries, technologies may be the subject of patents held by commercial entities, inventors, or universities, or may require the use of other patented technology. In such cases, HCI practitioners and researchers may need to be aware of potential licensing requirements or patent infringement, and, it is generally a good idea to consult with university or corporate counsel, who will likely have more expertise about intellectual property issues.

Finally, HCI research and practice may be impacted by copyright and patent issues that affect more broadly software and hardware design. Because these issues are highly fact- and country-specific and constantly evolving, a full discussion is outside the scope of this report. However, HCI practitioners and researchers may encounter intellectual property claims made around the use of copyrighted user interface

elements and patented software inventions. This is a complex issue because design-related patents should protect only visual aesthetics, but those aesthetics often represent underlying functionality related to ease of use and user expectations [Risch, 2013]. In the United States, "... there is no clear dividing line between creativity and functionality in the current case law" [Risch, 2013, p. 55]. These issues of what is patentable in a graphical user interface (GUI), came to public attention in the case of *Apple Inc. v Samsung Electronics Co., Ltd.*, in which Apple sued Samsung for infringing upon its patents related to GUI design on smartphones [Risch, 2013]. To put it more bluntly, the HCI community should be involved with intellectual property discussions because there is a question of whether usability of interface features can be patented. Legal issues can also arise out of the reuse of copyrighted source code, including where HCI work incorporates software code or libraries released under open source licenses that impose conditions on downstream use.

4.1.7 Laws and regulations in specific sectors

4.1.7.1 e-Government

Governments are increasingly providing services and information to the public through ICT. There are many benefits to providing information and services through ICT. People who are looking for government-related information can find it much more quickly. Government agencies can update websites more easily than paper documents. Those taking advantage of government services through ICT can save time and frustration, which often accompany waiting in line at government agencies. In addition, government agencies can save resources when transactions can be handled automatically. In addition, ICT for internal government use have the potential to help manage large amounts of information and handle processes more efficiently.

Despite the promises of e-government, there have been several notorious failures in the implementation of e-government systems. The most recent example in the United States was the website for applying for health insurance under the Affordable Care Act (also known

as "Obamacare"). The website was not usable by a significant portion of users when it launched, it had poor interaction design, and there were also infrastructure challenges, such as the inability to support the actual number of simultaneous users. This is only the latest example of e-government systems that did not work as planned and required additional resources to be functional. These challenges have occurred across different administrations and with different political parties in power. In the United States, historic examples include the Federal Aviation Administration's Air Traffic Control software, and the Federal Bureau of Investigation's Virtual Case File [Charette, 2005]. Dada [2006] provides examples of e-government failures in developing countries.

These failures tend to stem from the lack of system integration and integrated testing, and in failing to follow modern software engineering and user-centered design methods when contracting with companies for the development of ICT. These modern methods call for iterative processes of development with significant stakeholder input and feedback. For example, there is an expectation that detailed requirements will be developed over time and that some may change. Successes in e-government, such as the Government Digital Service in the United Kingdom, focus specifically on these two aspects. The following is from the mission statement of the Government Digital Service:

> "We work in small, agile teams of developers, designers, content people and others. We build a minimum viable product quickly, then iterate wildly — always asking how we can make things better for users, who are at the centre of everything we do" [Government Digital Service, 2016].

However, typical government contracting for ICT often assumes that stakeholders and government employees, oftentimes without any training in software engineering, will be able to deliver an accurate set of requirements to a company that often will use subcontractors to build a system with little or no chance for feedback before the contract is completed [Buie and Murray, 2012]. The challenge is that an overwhelming majority of elected officials and political appointees have little or no knowledge of software engineering or user-centered design

methods. Even people responsible for ICT at government agencies may not have any specific training in these methods. As an example, it is rare for government agencies to perform usability tests on competing technologies before deciding which one to purchase. Often major fixes must be made. For instance, "SWAT teams" are assigned to fix major problems, a role that the previously mentioned UK Government Digital Service has played. In the United States, in 2014, a group known as the US Digital Services Team, was formed to play a similar role in fixing failing government websites [Shear, 2014].

In the United States, several laws affect the development of e-government. Perhaps the best known is Section 508 of the Rehabilitation Act of 1973 (part of an amendment approved in 1998), which requires that federal agencies make their electronic and information technology accessible to people with disabilities (see www.section508.gov and other sections of this report). Another law in the United States that affects HCI work as part of e-government is the Paperwork Reduction Act of 1995. This law has been interpreted to require anyone conducting usability testing within the federal government to fill out a form and get approval to conduct the study under the Paperwork Reduction Act because participating in usability testing is considered to be a form of data collection from the public. In addition, any other electronic activity in which the federal government collects data from the public needs to go through an assessment, according to the Paperwork Reduction Act. The E-Government Act of 2002 is another law that was intended to have a much larger impact than has been realized. The law requires the use of Internet-based technologies to improve access to agency data and services. The law also has requirements for privacy concerns, including listing privacy policies on websites and conducting privacy impact assessments.

On an international level, highly developed as well as developing countries have experienced the challenges and opportunities related to e-government implementation and the development of policies surrounding e-government. Analyses of e-government structures across the world indicate that there often is a direct correlation between the policies that govern the development of ICT and the potential for

implementation and success of e-government [Williams et al., 2013]. Despite the best efforts of governments designing a variety of e-government services, there continues to be a challenge with the conversion of services to the adoption of those services by citizens. It has been suggested that the type of process in place for developing e-government policies is directly related to producing a framework for e-government services that is highly used and usable by citizens (something that can easily be informed by the HCI community!). This should highlight the importance of governments focusing on developing a transparent process and participatory evaluation framework for all e-government ventures [Savoldelli et al., 2012].

Developed countries, such as members of the European Union, have been attempting to enhance and improve their implementation and adoption of e-government services. In the European Union, this is evident by the European e-Government Action Plan 2011–2015, which has stated priorities that include improving efficiency and effectiveness, empowering businesses and citizens, and creating enablers and preconditions to better move e-government forward [European Commission, 2014]. Many developing countries have also implemented e-government in one form or another, including even less-developed countries, such as Ethiopia, Mongolia, and Nigeria [Belachew, 2010, Naranmandakh, 2009, Faniran and Olaniyan, 2009]. These countries often face unique challenges, such as lack of infrastructure, funding, and skilled resources, that must be addressed for a robust implementation of e-government that engages citizens. A stable political structure and transparency have also been identified as critical to successful e-government in the developing world [Ifinedo, 2012]. Some examples of e-government in such areas of the world include Bangladesh with its Digital Bangladesh campaign that seeks to use e-government services as a tool for reducing poverty through improved education and healthcare. Although some progress has been made with this implementation, a lack of infrastructure and weak legal and regulatory structures have frustrated the process [Siddiquee, 2012]. As a much larger country, China has aggressively implemented e-government systems, and it has been suggested that one of the keys to a more effective form of e-government in that country

could be accomplished through the application of a performance management model, particularly something known as key performance indices with participant goals [Lin and Fong, 2013]. It is quite likely that such a structured policy approach to e-government is something that would benefit many countries beyond the emerging and developing world. Researchers in the developing world have also discussed the question of moving beyond individual e-government strategies and policies to broader policies that take a regional perspective into consideration [Criado, 2012], which could result in policies similar to those proposed and implemented by the European Union.

4.1.7.2 Public libraries

Public libraries are often in the position of filling the gap — providing access to the Internet for those who cannot afford their own computers, providing help with government services, and providing access to information in multiple formats, increasingly in a digital format [Bertot et al., 2009]. Multiple public policies, at the national, regional, and local levels, influence how information technology is used and how interfaces specifically are presented in public libraries. There are three main areas of public policy that impact how information technology is used in public libraries: accessibility, privacy, and filtering [Lazar et al., 2014].

Because public libraries are inherently government entities, the laws that require the accessibility of government technology (described in Section 4), also cover public libraries. Thus, any technology developed or purchased using government money must be accessible for library patrons with disabilities. This includes library websites, any online databases or subscription services, and e-books and e-reader devices. Printed books are inherently inaccessible for people with print disabilities (those who cannot see printed text, physically handle printed text, or cognitively process printed text), but the move to more digital resources presents an opportunity for public libraries [Lazar and Briggs, 2015]. Rather than suggesting that people with print disabilities contact

a specialized library that offers specialized formats (large-print, braille, and audio books), the local public library, if following appropriate policies, can offer accessible access to digital resources. While the increased use of digital resources at public libraries can improve accessibility for patrons with disabilities, other nonaccessibility concerns occur, such as whether "bring your own device" is an appropriate policy for a public library.

Some countries have a requirement that public libraries receiving certain types of funding install filters so that people cannot access certain types of content on public library computers or using the Wi-Fi network at the local public library. These policies generally have the stated goal of filtering the Internet content physically presented in libraries for content that is considered to be inappropriate. Public libraries can be required (by public policies) to use filtering software, to block specific sites or certain categories of content, such as social networking, peer-to-peer file sharing, games, health information, and pornography. It is not always clear what is "inappropriate," but what is clear is that the filters are often inaccurate in what they filter [Jaeger et al., 2006]. Furthermore, there is rarely any type of transparency, so library patrons are unaware that their search results are being filtered and have no way to determine the algorithms or methods being used to decide what gets filtered (which can relate to the issues of notification discussed in earlier sections of this monograph).

Other public policies in libraries relate to the privacy of patron information seeking records. When patrons use computers and network connections at their public libraries, are they aware that records are being kept of the content that was searched for and the content viewed? The interfaces rarely reflect that records are being kept. Some libraries delete information seeking records as quickly as possible, but if records exist, it is possible they will be requested by a governmental agency. For instance, in the United States, Section 215 of the US Patriot Act (as specified in 2001, with the most recent reauthorization in 2011) compelled libraries to relinquish patron records when presented with a National Security Letter and/or warrant [Lazar et al., 2014].

4.1.7.3 Voting

Voting is an extreme example of user experience in several ways. Elections are part of the core activity of modern democracies, with personal and social significance. However, the actual act of voting is done only episodically after long hiatuses. As a result, voters have both strong mental models and imprecise memories of the details of the interaction. There is a strong expectation that voting should be simple and strong evidence that it is not. This is partly because the syntactic act of marking a ballot or using a voting machine is separated from the semantic meaning of the selection. Recent research, including work at Rice University [CHIL, 2016], work on residual votes by Kropf and Kimball [2012], and the collection of accessible voting research funded by the Elections Assistance Commission from 2010 to 2013 (US National Institutes of Standards and Technology, 2015), shows that voters may misunderstand the instructions, make mistakes under the pressure of the election context, or simply have a weak understanding of how their actions in voting are translated into social meaning. Voting is also extreme in its administrative requirements, including the pressure to run a "good election" and produce results that both the candidates and public accept. The technology and user experience has been the subject of public policy for millennia. The effect of its user experience has an impact on election outcome [Alvarez et al., 2001].

Public policies are integral to the voting process; they affect and are affected by the process. The user interface of voting with allocated pieces of pottery, called ostraca, was adopted in ancient Greece, Egypt, and Rome, to give one voter one vote [Selker, 2004]. The variations of voting policies and their implications interact with culture, tradition, and politics. Policies are put in place in response to various social and political events, but rarely is there any HCI research on the implications for the voter experience or a way to consider possible unintended consequences of changes to the interaction or interface.

Voting customs are shaped by history and culture. A good example is how people are identified as voters. They may be asked to show official identification (ID), dip a digit in ink, or simply sign a roster of voters. In the United States, there is variation among the states.

Until recently, few states required voters to show ID, but in recent years, laws to restrict voter access by requiring ID [National Council of State Legislatures, 2015a] were proposed in more than half the states, although fewer passed.

Election procedures and customs change over time, often with the goal of improving voter enfranchisement and ballot integrity, accuracy, and reliability. For example, in the mid-1800s Australia instituted a private ballot to reduce coercion. The United States waited 40 years to follow their example, introducing the private ballot only after a deeply flawed election in the 1890s [Saltman, 2008]. Other election methods do not make voter privacy a primary goal: Basque voters insert ballots, which are premarked by one of many political parties, in full view of others who can see which ballot was deposited [Goirizelaia et al., 2004].

Local history also affects attitudes toward technology in voting systems. Electronic voting is a good example. In Brazil, trust in elections was so low after widespread ballot stuffing that three arms of its government oversaw a new electronic voting system design that would reduce opportunities for human fraud. Their first version of the system was deployed in 1996. Electronic data transfer was accomplished for virtually every voter in Brazil in 2000. In Estonia, the use of online voting is seen as part of a national effort to be a modern, digital state. However, in the United States and Europe, many jurisdictions reversed early experiences with electronic voting over concerns for digital security.

The United States is a particularly complex environment with all levels of government involved in running elections, including counties (which run the elections), states (with individual election codes), and the federal government (which sets some requirements for national elections). This means that every jurisdiction can determine not only how the election will be run but also the systems and interfaces acceptable for use in elections. Most importantly, the adoption of technologies or election procedures often is governed by state law. For example, only half of the states allow online voter registration [National Council of State Legislatures, 2015b]. Specific systems, from electronic poll books to voting systems, may be covered by state law or have state certification requirements.

Although most elections have simple requirements for a majority or plurality of the vote, state and local jurisdictions can set their own rules, many of which relate to the voting interface. There are many variations on "straight party voting," including whether it is allowed and whether voters can register a preference for a party with exceptions for specific candidates. Some municipalities have followed the lead of Ireland and Australia in using instant runoff voting, in which a voter makes a prioritized list of candidates. A related system, the single transferrable vote, was rejected in the United Kingdom.

After the 2000 US presidential election where there was widespread confusion about the interfaces related to voting, the Help America Vote Act of 2002 established the Election Assistance Commission and charged it (among other responsibilities) with writing guidelines for voting systems. The resulting Voluntary Voting System Guidelines (VVSG) were first implemented in 2005. They are called "voluntary" because each state can choose to adopt them. However, in practice they have a broader impact because voting system vendors want their systems to be able to meet certification requirements.

The US example demonstrates the complexity of voting policy. A number of different US federal laws that govern elections, some of which directly affect the voter/user experience, are discussed here.

The Voting Rights Act, which was first passed in 1965, forbids discriminatory restrictions, such as literacy tests, on voting. It also requires election officials allow a voter who is blind or has another disability to receive assistance from a person of the voter's choice. It was amended in 1975 with the addition of requirements that voting materials be printed in languages other than English (determined by the decennial census).

The Voting Accessibility for the Elderly and Handicapped Act of 1984 (VAEHA) requires accessible polling places in federal elections for elderly individuals and people with disabilities. Where no accessible location is available to serve as a polling place, voters must be provided an alternate means of voting on Election Day.

The National Voter Registration Act of 1993 requires motor vehicle, public assistance, and disabilities agencies to provide voter registration

services. This was intended to increase the historically lower rates of voter participation by people with disabilities.

The Help America Vote Act of 2002 (HAVA) has many user experience-related components, such as requiring jurisdictions responsible for conducting federal elections to provide at least one accessible voting system for persons with disabilities at each polling place in federal elections. The accessible voting system must provide the same opportunity for access and participation, including privacy and independence, that other voters receive. The act requires all voters to be able to review their selections in a "second chance" before final deposit of a ballot. The act also requires that voters can mark a "provisional" ballot for later analysis, even if the poll worker cannot find the voter's name in a poll book.

More general laws also affect voting. The Americans with Disabilities Act of 1990 (ADA) requires that reasonable accommodations be provided in meeting the needs of individuals with disabilities in public places, including polling places.

The US Department of Justice enforces both the Voting Rights Act and the ADA with compliance monitoring and the receiving of the complaints of individuals.

4.1.7.4 Healthcare and electronic health records

Healthcare systems around the world are moving from paper to electronic health records (EHR). In the United States, the 2009 Health Information Technology for Economic and Clinical Health Act (HITECH Act) established the Office of the National Coordinator for Health Information Technology (ONC). It also introduced the term "meaningful use," suggesting that EHRs can improve healthcare quality [Blumenthal and Tavenner, 2010]. Unfortunately, many EHRs have poor usability, making them difficult for clinicians to use [Middleton et al., 2013]. This is in part because of the complexity of the systems, and it is an important opportunity for the HCI community.

Several organizations are working on usability standards for EHR systems, including a project at the National Institute of Standards and Technology (http://www.nist.gov/healthcare/usability/

index.cfm) and work by an industry association, the Health Information Management Systems Society (HIMSS, http://www.himss.org/ResourceLibrary/TopicLanding.aspx?ItemNumber=28200).

One of the dangers of electronic health records is how easily personal information can be shared, compared with more cumbersome paper records. Many countries have laws and regulations to protect the privacy of patient information. Two examples are the Health Insurance Portability and Accountability Act [HIPAA, 2016] in the United States and Data Protection Directive. [United States and Data Protection Directive, 2016] in the European Union.

National agencies also regulate the development and release of new drugs and medical devices. Because of the possibility for causing harm, there are not only general requirements but also requirements for a process for developing and testing new devices [Matern and Büchel, 2011]. There is an ISO standard that identifies how general usability engineering processes and principles apply to medical devices (ISO/IEC 62366 standard; ISO, 2007). In the United States, the Food and Drug Administration (FDA) issues guidelines for industry to follow as part of regulatory approval for medical devices; the guidelines include basic steps, such as defining the context of use and possible risks with summative usability testing [FDA, 2011].

5

Framework and Suggested Actions for Human–Computer Interaction Involvement in Public Policy Internationally

There is a distinction between what professional organizations (such as SIGCHI and UXPA) can do, what individuals can do, and what professional organizations can do to support individuals. Suggested actions for professional organizations related to public policy are to: (1) build a more cohesive reputation in both public policy communities and the general public, (2) encourage individual action by researchers and practitioners, and (3) take actions as an HCI community to increase involvement in public policy.

5.1 Building a reputation as the human–computer interaction community

Other science and technology communities, such as the physics community [Kaarsberg, 1996], have a long-term track record of involvement and responsiveness to public policy. ACM itself has a track record of involvement, but limited policy involvement in human-computer interaction. The HCI community must build its reputation as a cohesive interdisciplinary field of experts who focus on the design and use of computing technologies. Other fields, policymakers, business leaders,

and the public need to understand better the role of HCI in the use of computing technologies to improve our lives. Such an understanding will help policy leaders at the regional, national, and multinational levels make better informed decisions when developing laws and regulations, when prioritizing research funding, and when deciding whether to defer to voluntary, industry-led efforts. The HCI community can help advance this goal by fostering ongoing relationships with key decision makers in the public and private sectors. In addition, when communicating with decision makers, these other communities make consistent and credible policy statements that demonstrate the potential impacts that the research community might have on society. Merely communicating outstanding research results may not be sufficiently persuasive to policy makers looking for practical outcomes that benefit businesses, the economy, or society. Members of the HCI community need to engage, on a regular basis, with regulatory processes, at the regional, national, and multinational levels. Policymakers make decisions based on the feedback they receive from stakeholders during the development of bills, laws, and regulations. The HCI community needs to have an ongoing presence within these processes, linking HCI and policy earlier in the decision-making process to help policy leaders analyze the options, trade-offs, and implications. The HCI community also can help raise awareness of the value of HCI research and development, and how such HCI research contributes to society, both of which are important to fostering more reliable sources of public and private funding.

The computer science community as a whole has had some success in building long-term partnerships and a presence, but this is true only within the US Public Policy community. USACM, the US Public Policy Council of ACM, has been the focus point of this policy outreach, and USACM has also partnered with organizations such as CRA (the Computing Research Association). There are six committees within USACM, and one of those committees, the Accessibility and Usability committee, is the one most focused on HCI. Outside of the United States, the organized HCI community does not have a well-known presence in public policy communities, however, there are individual members of the HCI community who are eager to formally

engage with policymakers. One possibility would be to regularly have local policymakers address and engage HCI-related conferences wherever they are held. Another possibility would be for existing HCI professional organizations to partner with other professional organizations around the world that have existing links with policymakers.

Part of this expanded outreach must be for the HCI community to have a greater identity in the general community (the "lay public") and, more importantly, within the community of policymakers. These two goals are related because more public awareness of the HCI community makes it easier to get the attention and trust of policymakers, who may then be more open to the specifics of our recommendations, which are backed by data and solid research.

Another goal is to increase the presence of HCI content in curricula at colleges and universities. The general public likely has a much better understanding of what software engineers and security analysts do in their jobs than what an HCI professional does. The requirements for HCI-related content in the ACM Computer Science Curriculum (CS 2013) are sparse. The ACM Computer Science curriculum (used by many universities) requires only 8 hours (8 actual hours, not credit hours) of basic HCI (on HCI foundations and on HCI Design Interaction). Of the other two related curriculum models from ACM, only Information Technology (IT 2008) requires a course in HCI, Information Systems (IS 2010) does not require a course in HCI. The HCI community must work on building the reputation of HCI as a distinct and well-recognized field and must work on raising awareness of HCI within the computing field and within the broader policymaking, educational, and public communities. Increasing involvement with computing curriculum models, and increased teaching on the topic of HCI (more than the existing 8 hours) could work towards this goal.

When focusing on building a reputation for HCI within policy communities, it is important to consider all forms of public policy. Many people typically think of public policy in the three branches that many regional and national governments have: legislative, executive, and judicial. Public policy also involves international standards bodies (such as the World Wide Web Consortium [W3C]), the United Nations and

other international organizations, and nongovernment organizations. There are a lot of communities to begin engagement with.

5.2 Individual action by researchers and practitioners

It is important to encourage individual members of the HCI community to take an active interest in all forms of public policy. Importantly, professional organizations can play a role in helping members understand better, research funding trends and understanding current and emergent policy topics relevant to HCI research and development. Educational efforts can also help researchers and practitioners understand how to better communicate, where possible, how their work and their research findings impact the economy, businesses, the computing field, society, and citizens' quality of life. A key point of understanding is that individuals can often take actions in their own personal lives that nonprofit professional organizations such as SIGCHI, ACM, and UXPA, cannot take. For instance, individuals could advise legislators or executive officials, testify on behalf of bills, or take part in legal proceedings as an expert witness.

Education can also help researchers and practitioners understand how to communicate the importance of their work to policymakers and how to be responsive to changes in the policy landscape. To be effective, HCI professionals need to know what research is most useful to policymakers and how research needs to be communicated to policymakers. For instance, policymakers are interested in longitudinal data, looking at trends on a year-to-year basis and over longer periods of time, such as 10–15 years [Lazar, 2014]. This is not something the HCI community typically has done. Furthermore, policymakers want specifics about the context of the research. For example, if you are discussing a specific population, how many people are impacted within a region or a country [Lazar, 2014]? In addition, research must be presented in a digestible way: short abstracts and executive summaries, designed for people without an HCI background are more likely to have an impact than dense, long text with lots of acronyms. In summary, professional organizations can help educate members of the HCI community on how

to more effectively communicate the value of their work and research in ways that are both useful and understandable to the broader computing community, policymakers, and the public. Improved communications can heighten awareness of the significance of HCI.

Policymakers having a better understanding of how HCI contributes to society, can ensure more reliable sources of funding. It has been said that budgets represent the reality of policies. The worst scenario would be for policymakers to have a poor understanding of what HCI work represents and simply cut funding for HCI research because of a lack of familiarity. In contrast, there is increasing funding for cybersecurity and increasing interest in funding for data science with regard to data policies and personal privacy. Ongoing communication and face-to-face meetings between HCI community members and policymakers can help ensure that the policymakers have an understanding of what the HCI community contributes to society.

5.3 Human–computer interaction community action

Over the years, HCI professional groups, including SIGCHI, have served as forums for the exchange of information on HCI-related policy issues. However, this has been limited in scope. Professional organizations should continue their efforts to grow forums for discussing HCI policy-related issues and the impacts of policy on the HCI community. To achieve these goals, professional organizations should facilitate interactions and engage members through education, outreach, and support. Some of these potential actions by professional organizations could include:

- Providing slots for discussing HCI policy-related issues on panels, at special interest group meetings, and during informal roundtable discussions at conferences.
- Inviting local policymakers to serve as speakers at HCI conferences wherever they are held.
- Hosting an annual 2- or 3-day workshop related to a specific HCI policy topic and with the intent of publishing summary white

papers. For example, over a 5-year period, five different topics could be highlighted with summary white papers developed from each workshop.

- Developing educational materials (presentations, YouTube videos, etc.) about HCI and public policy that could be used easily by instructors in HCI-related classes. This could help with the limited amount of public policy information in HCI curriculum materials because it would give instructors an easy way to incorporate the topic into their curriculum.

- Funding events at conferences, individual travel to policy-related events, and other activities designed to address the gap between *interest in* public policy and *experience with* public policy. For the reasons given earlier in this monograph, few people in the HCI community have received formal educational training or have work experience in the area of public policy. Ideas to bridge this gap, including year-long HCI policy fellowships, or other training experiences, could be helpful in increasing the knowledge level of people interested in HCI and public policy.

- Funding individual participation in areas that previously have no HCI involvement. For instance, it has been noted that no one from the HCI community seems to have taken part in any the formation, adoption, implementation, and/or enforcement of international legal instruments. There are certainly human rights treaties that have components related to HCI, such as the UN Convention on the Rights of Persons with Disabilities (CRPD). Article 9 of the CRPD calls upon countries to "Promote access for persons with disabilities to new information and communications technologies and systems, including the Internet." Article 21 encourages countries to "[provide] information intended for the general public to persons with disabilities in accessible formats and technologies appropriate to different kinds of disabilities." The Marrakesh Treaty to Facilitate Access to Published Works for Persons Who Are Blind, Visually Impaired, or Otherwise Print Disabled also relates to the work of the HCI community. In the

future, it is important that there is involvement in these types of treaties and human rights documents from informed members of the HCI community. However, these types of involvement take time, and employers rarely give time off for employees to participate in such activities. The HCI community has a better track record of participating in the formation of international technology standards. It is likely that providing travel funding for participating in standards bodies and treaty negotiations would lead to more participation from the HCI community.

5.4 Summary

In the past, the HCI Community (including both professional organizations and individuals) has had a limited involvement with the public policy communities. There is a great opportunity to use the work and expertise present in the HCI community, to engage more with the policy communities, and inform policymaking. Many of the topics of interest to the HCI community currently have decisions being made in the public policy communities in a way that was not true 20 years ago. There is a small, core group of individuals interested in public policy within the HCI community. Now is the time to take more action and amplify our efforts to engage more actively with the various public policy communities around the world.

Appendix A. History of Policy Involvement from Professional Organizations

It is important to note the contributions to the sphere of public policy made by three computing-related organizations in the area of HCI: Computer Professionals for Social Responsibility (CPSR), UXPA (formerly Usability Professionals' Association), and ACM SIGCHI (Special Interest Group on Computer–Human Interaction).

A.1 Computer professionals for social responsibility

In October 1981, because of concern over the threat of nuclear war, a discussion group formed on an e-mail system at the Xerox Palo Alto Research Center (PARC). Participants saw a need to educate computer professionals, policymakers, and the public about the risks inherent in the use of computers in military and other mission-critical systems. In June 1982, the group adopted the name Computer Professionals for Social Responsibility (CPSR). The meetings soon spread beyond the San Francisco Bay Area, and CPSR incorporated itself as a national nonprofit organization in 1983. CPSR opened an office in Palo Alto at the end of 1983, staffed by the first National Chairperson, Severo Ornstein, and the first National Secretary, Laura Gould, both of whom had recently retired from PARC.

Early on, CPSR developed a reputation for careful analysis and technically sound, reasoned arguments, allowing the group to have a

significant impact on each of its target audiences, collectively referred to as the "four Ps": press, public, policymakers, and profession. When President Ronald Reagan announced the Strategic Defense Initiative (SDI) in 1983, CPSR focused on critiquing SDI, which led to considerable growth in CPSR's influence in policy circles, as well as in its membership and number of US chapters. In the early years, the CPSR message was spread through publications, conferences, and special events. For example, in support of its work on computers in the military, CPSR produced the book *Computers in Battle: Will They Work?* and the award-winning video "Reliability and Risk." However, the group's name suggests a scope of concern broader than just the military. Computer technology affects society in many ways. CPSR's leadership and members recognized the importance of applying the idea of social responsibility to other domains in which computing technology is used. Starting in the mid-1980s, CPSR's program broadened to include electronic privacy, computers in the workplace, and electronic voting. In the 1990s, as the Internet and World Wide Web rose in public awareness and usage, CPSR began efforts to ensure that the information infrastructure remained equitable, open, and accessible to all. Other topics with which CPSR was involved include women in computing, computing in education, Internet governance, computers in law enforcement, and online deliberation and democracy.

In 1991, CPSR's Executive Director Gary Chapman initiated the 21st Century Project to help steer US science and technology policy in socially responsible directions. In 1992, the Project persuaded the semiconductor industry to devote research and development resources to addressing environmental and workplace safety concerns. In 1993, the Project published the book *The 21st Century Project: Setting a New Course for Science and Technology Policy* and cosponsored the first National Technology Conversion Conference. In the 2000s, CPSR became a United Nations-accredited nongovernmental organization. CPSR members participated in the United Nations World Summit on the Information Society and in the UN Internet Governance Forum. One result was the policy declaration "Shaping Information Societies for Human Needs."

Eventually, most of the issues CPSR pioneered were spun out into separate organizations, such as the Electronic Privacy Information Center (EPIC), Privaterra, and the Public Sphere Project; taken up by more narrowly focused organizations, such as Verified Voting and the Electronic Frontier Foundation; or adopted by mainstream technology professional organizations, such as ACM and IEEE (e.g., ACM SIG on Computers and Society, ACM SIGCHI Public Policy Committee, USACM, and IEEE Society on Social Implications of Technology). As a result, CPSR's reasons for existing diminished. CPSR's membership, funding, and activity dropped through the 2000s, and in 2013, the group was dissolved as a separate organization and absorbed into the Public Sphere Project. CPSR now exists more or less as it began: as an online discussion group of technology policy activists. The Public Sphere Project maintains CPSR's former website as an archive (cpsr.org).[1]

A.2 Usability in civic life/UPA/UXPA

In 2001, following the US presidential election, the Usability Professionals' Association (UPA, now known as UXPA) started a project to address the impact of poor usability on democratic processes. The work is based on the principle that usability, accessibility, plain language, and user experience design are critical for democracy, elections, and civic activities.

The project began as an information and outreach endeavor, with members speaking out as public advocates, adding a voice to calls for better accessibility, plain language, and design of the information, interactions, and services that we all use.

The work quickly evolved into a loose network of projects, with UXPA working in collaboration with other projects. Such collaboration included work with SIGCHI on position statements, work with the AIGA Design for Democracy project to improve ballot design, and projects with the Brennan Center for Justice. These projects mobilized

[1]Stanford University also archives CPSR materials at http://searchworks.stanford.edu/view/7652023.

user experience professionals to improve the design and usability of elections and other aspects of civic life.

Members of the Usability in Civic Life project served on two federal advisory committees. Whitney Quesenbery, the project director, was appointed chair for human factors and privacy on the Technical Guidelines Development Committee of the US Election Assistance Commission. She and Sarah Swierenga served on TEITAC, the committee recommending updates to the US Section 508 accessibility regulations. Members also served on industry standards committees at IEEE and on the San Francisco Ballot Simplification Committee.

In 2004–2006, the group held two workshops on ballot usability testing. The first, at the UPA annual conference, led to a white paper that contributed to work on federal voting systems guidelines. The second, held at Michigan State University Usability and Accessibility Lab created a usability test kit for local election officials, the LEO Usability Testing Kit, with the aim of increasing their ability to create usable materials. Members held training sessions at election events around the country.

In 2008, a collaboration with The Brennan Center led to the publication of *Better Ballots* (updated in 2012 with *Better Designs: Better Elections*). The success of this multidisciplinary work led to projects working directly with election officials to improve election materials, including the Minnesota absentee ballot instructions and envelopes.

The group pioneered a technique for gathering usability data, called a flash test, that allows a team of volunteer professionals to conduct rapid, informal sessions to gather data fast enough to have an impact on fast-moving situations.

The Usability in Civic Life project now hosts an annotated bibliography to help designers and researchers address the challenge of having research useful for civic and elections design scattered into many different disciplines, from political science to computer science to work on design, reading, and accessibility. The civic design bibliography is a tagged and searchable collection of material that is the most relevant research from all these fields. The abstracts summarize the main points in the paper, especially when the results include recommended guidelines.

The project still collaborates with Design for Democracy and the nonprofit Center for Civic Design.

A.3 SIGCHI's involvement with public policy

The ACM Special Interest Group on Computer-Human Interaction (SIGCHI) is the world's largest association of professionals who work in the research and practice of human–computer interaction. This interdisciplinary group is composed of computer scientists, software engineers, psychologists, interaction designers, graphic designers, sociologists, multimedia designers, anthropologists, and others who are brought together by a shared understanding that designing useful and usable technology is an interdisciplinary process that has the power to transform lives. SIGCHI has nearly forty active local chapters across five continents to promote local support networks for HCI professionals.

In 2004, five members of SIGCHI (Ben Bederson, Harry Hochheiser, Jonathan Lazar, Jeff Johnson, and Clare-Marie Karat), formed a SIGCHI US Public Policy Committee, which focused on CHI policy issues specific to the United States. Over the years, a number of policy-related events were held at the annual CHI conference from this group, including SIG meetings, workshops, and panels. SIGCHI officially appointed a chair of public policy in May 2010, Jonathan Lazar, who worked to bring the topic of public policy to the attention of SIGCHI members, and had formed a broader SIGCHI international public policy committee, consisting of 27 members of SIGCHI from around the world, who are interested in public policy and meet yearly at the CHI conference for a public policy-related meeting. In 2014, the SIGCHI US Public Policy Committee was integrated into the overall SIGCHI International Public Policy Committee. Aside from conference events, the two related groups wrote a few different reports, including the report that this *Foundations and Trends in HCI* article is based on. Also, from 2010–2015, ACM Interactions Magazine had a forum on "Interacting with Public Policy," coordinated by Jonathan Lazar.

SIGCHI works closely with USACM, the US Public Policy Council of ACM. ACM established USACM in 1994, as a Committee, to serve as

the focal point for ACM's interactions with the US government and the US public in all matters related to US public policy. Two SIG Board representatives serve on the decision making body of USACM that reviews and approves policy statements and activities. There are six committees within USACM, and one of those committees, the Accessibility and Usability committee (headed by Harry Hochheiser), is the one most focused on HCI. USACM already has a number of active listservs on public policy topics, including a listserv on accessibility and usability policy. SIGCHI has, in the past, collaborated with USACM and "signed-on" to USACM policy statements related to regulatory processes on accessibility and usability. USACM has cited and provided SIGCHI materials when communicating with policy leaders, the media, and the public. ACM Europe's new policy entity, EUACM, has been chartered to address public policy concerns affecting the European computing community. While ACM also has regional offices in India and China, there are not currently ACM policy entities for addressing public policy outside of the European Union and the United States.

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