

Lawful Users: Copyright Circumvention and Legal Constraints on Technology Use

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ABSTRACT

The study of human-computer interaction requires consideration of aspects of interactions with technology that may be outside of the control of both user and designer. One example of when a user's question of "can I do this?" may have an answer beyond technological affordances is that of legal constraints. This paper considers an example of this phenomenon: section 1201 of the Digital Millennium Copyright Act (DMCA) in the United States, which criminalizes circumventing copyright protection such as digital rights management (DRM). The DMCA also includes a triennial policymaking process that considers exemptions to the law to protect "lawful users" from adverse effects. Through an analysis of public comments of support for exemptions, this paper explores the ways in which users see the law as a hindrance to desired uses of technology. This analysis sheds light on users' expectations for rights of use, how these expectations clash with policy, and what this might mean for technology designers. Drawing lessons from the infrastructure problem in HCI, this paper concludes with laying out solutions that can both work within policy constraints, and more importantly, work to change them.

Author Keywords

accessibility; copyright; DMCA; DRM; infrastructure; law; ownership; policy

CCS Concepts

•**Social and professional topics** → **Computing / technology policy**; *Digital rights management*;

INTRODUCTION

What factors impact how people use technology? Within HCI, we consider factors such as design, usability, or surrounding social context. However, one aspect that receives less attention, particularly during the design process, is the role of policy [24]. As we work to bridge the socio-technical gap with design

[1], we may also find uses of technology that are already both technically possible and socially desirable, but that are prohibited by law or policy. Though there are a number of contexts within which this is a relevant problem (for example, activist hacking [39]) this paper examines the case of policy that prohibits circumventing copyright protection.

In the United States, section 1201 of the Digital Millennium Copyright Act (DMCA) criminalizes circumventing technological copyright protection: "no person shall circumvent a technological measure that effectively controls access to a work protected under [copyright law]" (17 U.S. Code §1201). It further defines circumvention as an attempt to "descramble a scrambled work, to decrypt an encrypted work, or otherwise to avoid, bypass, remove, deactivate, or impair a technological measure." Common examples include ripping a DVD or jailbreaking a phone. It is also illegal to create and distribute a technology that accomplishes this—e.g., the software that can be used for ripping that DVD. This law therefore presents a concrete example of the law dictating how people can (and cannot) use technology.

The DMCA is also unique in that the law has a mechanism to change itself; every three years, the U.S. Copyright Office holds rulemaking proceedings, in which they consider new possible exemptions to the law. Ordinary users may not always have their voices heard when it comes to ways that policy might limit their interactions with technology. However, because anyone can submit a proposal for an exemption, and then provide comments on proposals under consideration, the DMCA exemption process presents an opportunity for non-institutionally-affiliated members of the general public to assert their interests in policymaking.

For the most recent DMCA exemption cycles, organizations have provided easy-to-access form letters for providing comments on proposals. As a result, the public documents associated with the proceedings include a unique, expansive dataset about ordinary technology users' attitudes about copyright anti-circumvention rules. This qualitative analysis of 1,100 responses to exemption proposals allowed us to answer research questions relevant to both policymakers and technology designers:

RQ1: What are some perceived challenges to technology use under the DMCA?

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RQ2: What ways do people think that they should be able to use technology outside of copyright controls?

RQ3: What are the patterns of rights of use that people think they should have in certain kinds of technology?

This analysis of DMCA exemption comments provides insights into these questions as well as the broader issue of constrained user experiences with technology. However, drawing higher level conclusions from these findings, the discussion focuses on how the HCI community might work towards solutions at multiple levels. Pulling lessons from similar constraints with respect to infrastructure [11], I conclude with approaches for addressing the "policy problem" in HCI. In sum, this paper provides both insights into usability problems that stem from anti-circumvention policies, and a broader look at the multi-layered ways that the HCI community might address these and other "policy problems."

BACKGROUND AND RELATED WORK

HCI and Policy

Since the early days of the CHI community, researchers have recognized the relevance of legal matters to HCI, and the importance of familiarizing the community with the legal context in which they design—for example, copyright protection of user interfaces [36] or legal requirements for making digital interfaces accessible to people with disabilities [19]. Indeed, emerging technologies often push at the boundaries of design and practice, in turn pushing researchers to think differently about what can be built around the range of human experience, but both are often impacted by policy as an external force. New practices challenge designers and policymakers to rethink core assumptions, and emergent policies can shift the terrain in which designers operate, both constraining possibilities and opening up new ones [24]. Whereas designers and systems architects were once primarily subject to regulation only at the time of market entry, they are also increasingly required to account for policy at the beginning stages of design [29]. Moreover, understandings (or misunderstandings) of the law might also influence user behavior in ways that are relevant to user experience designers [12]. Though often under-considered, law is therefore an important component of interactions with technology at both the system and user level.

Additionally, though researchers are often trained to target their research to designers, practitioners, or other researchers, policymakers are also a relevant target audience for HCI and related fields [26]. Indeed, technology regulation would benefit from greater dialogue between those who create technology and those who regulate it, with HCI well positioned to bridge the two [42]. Though limited in the overall landscape of the HCI research community, there are a number of examples of purposeful engagement with policy—e.g., in domains like transportation [23], ergonomics [21], and video games [9]. HCI research can have a direct impact on policy decisions, particularly when purposefully targeted at a policymaking audience; for example, an article [27] that documented the inaccessibility of airline websites informed new policy for the US Department of Transportation [26]. In many cases, HCI

research has "implications for policy" even if not as directly stated as "implications for design."

DMCA Anti-Circumvention

Drafted at a time of significant change around simple-to-copy digital content and increased dissemination of that content via the Internet, the DMCA was an attempt to deliver more legal control over digital content to copyright holders [22]. It was passed and signed into law in October 1998, amending Title 17 of the U.S. Code that has governed matters of copyright since 1947. Though it has a number of provisions (including one that specifically pertains to protection for boat hull designs), the two most important pieces are: (1) Section 512, otherwise known as the "Safe Harbor" provision, which exempts internet intermediaries from copyright infringement liability and created content "takedown" procedures; and (2) Section 1201, which prohibits circumvention of digital rights management (DRM) and other technological measures for controlling use from rightsholders. Though 512 is perhaps the more visible part of the DMCA since it governs, for example, automated takedowns of YouTube videos at the request of copyright holders, and can be highly relevant for user experience on user-generated content platforms [13], this paper focuses on 1201's anti-circumvention rules. Additionally, though this paper focuses on the relevant U.S. law, the World Intellectual Property Organization's Copyright Treaty of 1996 requires adequate legal protection against copyright circumvention; as a result, many other countries have similar laws.

Because these rules concern the process of circumventing copyright and not the actual infringement, traditional defenses to infringement—notably fair use, which provides exemptions to copyright law for content uses such as news reporting and parody [12]—do not apply. Instead, the DMCA established a triennial assessment of the impact of the law—specifically, whether "lawful users" of copyrighted works have been or are likely to be "adversely affected" by the ban [22]. In 2015, the exemptions granted that are most relevant to computing professions covered unlocking of all-purpose mobile devices, jailbreaking to enable owners of devices to run otherwise unavailable software, and allowances for computer security testing [38].

Scholars working at the intersection of law and technology have written extensively about the possible negative impacts of the DMCA absent appropriate exemptions. For example, law professor Pamela Samuelson expands on computer scientist Edward Felten's articulation of the importance of the "freedom to tinker," calling on policymakers to protect the activities that are integral to creativity and innovation yet substantially constrained by copyright law [37]. Others have pointed to the power of technology manufacturers to monopolize markets by requiring users to repeatedly purchase copies of the same software [2], the inability of cybersecurity researchers to find glitches and reasonable alternatives [45], threats to interoperability [17, 41], inability to copy files for backup [41], increased fear from investors about technologies that involve copyrighted content [40], challenges for creating technologies accessible for people with disabilities [18], and poor user experiences due to mismatches between models of ownership [4]

or norms [31] for technology use. An empirical analysis of the first two rulemaking proceedings focusing on legal interpretations found that they were generally hostile to the interests of non-infringing users [22], though by the 2015 proceedings, granted exemptions (particularly around reverse engineering) have shown more steps in the right direction [38].

DRM and User Expectations

The fundamental tension with anti-circumvention rules (particularly in the context of DRM) is one of clashing goals: rightsholders want to maximize profit and preserve their copyright interests, and consumers want the freedom to use their purchased good as they wish [41]. Legal scholars have argued that the current anti-circumvention regime is ineffectual in part because of porous technology that fails to reflect the expectations of consumers, who have their own intuitions about how they can interact with copyrighted works [4].

These expectations are represented as mental models that guide people's understandings of and interactions with technology [34]. Importantly, these models are not always accurate [44]. As Langdon Winner points out, artifacts are designed in a way that can produce logical consequences that are unrelated to professed uses, and even seemingly innocuous design features can mask profound social choices [46]. In other words, people have preconceived notions of how a technology can be used; if the technology itself does not defy this expectation, users are likely to overlook external policies [4]. In fact, relying on policy such as law or terms and conditions to guide allowable use may be essentially useless since policy tends to be difficult to understand even users attempt to read it (which they often don't) [14]. Even users who attempt to integrate policy into how they perceive acceptable uses of technology may have incorrect models of that policy that lead them to break the law without realizing it [12].

An alternative to relying on policy to guide behavior is to regulate within the technology itself, which is the purpose of DRM. Lawrence Lessig argues that regulation by technology is hardly regulation at all, since it changes the field of play rather than the rules of the game [28]. Therefore, users may not see restrictive design decisions as decisions at all, or not guided by external forces, but rather just poor design [20].

DRM and accompanying laws against circumvention are also particularly tricky when it comes to user expectations because they involve the concept of ownership of technology or digital content. "Owning" does not necessarily come with an innate or even determined meaning [25], and the concept is increasingly complicated by the digital. Odom et al. argue that perhaps people need to learn new ways of thinking about digital property, and adjust their notions of ownership according, or alternatively, designers should more carefully leverage existing expectations to translate physical ownership into the digital realm [33]. Indeed, the perfect, profit-motivated world of DRM would do away with "ownership" as a concept altogether, instead exacting maximum profit from each individual consumption of information [25].

This tension between user expectations and what is permitted by policy leads to poor user experiences. Research has

confirmed that DRM-based delivery of content violates consumers' existing expectations of personal use [32], and that side effects such as inconsistency across devices and a lack of interoperability lead to violations of usability standards [6]. Even consumers that might side with copyright owners ideologically on the importance of copyright protection and preventing piracy still find DRM an annoyance [16]. Technological regulation such as DRM presumes the worst of people, blocking law-abiding purchasers from using the content they paid for as they wish, which means that this right is afforded only to those who download the content illegally [41]. As one journalist put it, "DRM is so rage-inducing, even to ordinary, legal users of content, that it can even drive the blind to download illegal electronic Bibles" [3].

Though it is common for complaints about DRM and usability to fall onto the law itself (or copyright owners who choose to implement DRM), these are not the only factors at play. One early examination of DRM services determined that they "crippled" a host of acceptable personal uses; the authors concluded that this problem was not inherent to the policy itself, but rather decision points where the technical architects could have chosen to support personal use and as a result might have designed products that were more responsive to the balance of copyright law [32]. It is therefore important that technology and interaction designers have an understanding of these issues as well.

METHODS

In collaboration with research assistants, I collected data in summer 2017. At this time there had been six complete DMCA 1201 rulemaking proceedings to date, between 2000 and 2015. All documents related to the proceedings, including official notices and decisions from the Copyright Office, all proposals and comments on proposals, and transcripts of hearings, are public record and available online.¹

Traditionally, public comments in response to exemption proposals have come largely from organizations rather than individuals (e.g., advocacy groups, law clinics, lawyers and academics, and corporations). However, in contrast to the first rulemaking in 2000, which received 392 public comments, the 2015 rulemaking received nearly 40,000, drastically up from less than 1000 in 2012 [10]. A reason for this increase is that some organizations provided a means for easy, mass participation. During the public comment period, the Electronic Frontier Foundation and the Digital Right to Repair Coalition provided form letters on their websites that anyone could sign, and sent collections of these to the Copyright Office. Available as "combined comments" on the Copyright Office's website, these documents contain thousands of responses each. Therefore, whereas most of the comments from previous rulemakings are authored collectively by organizations, the 2015 rulemaking resulted in a huge collection of comments from individuals. Though most responses are simply copies of form letters written by those organizations, respondents were also permitted to add their own comments. These additional comments make up the data needed to answer the research

¹<https://www.copyright.gov/1201>

questions for this study—unique information about an individual’s feelings about that particular proposal.

After collecting PDFs of the public DMCA comments, we parsed them into text files of unique content (beyond the form letters), and used these to create a dataset for further analysis.² Table 1 shows each class and how many total combined comments were available (which included those that were simply signed copies of form letters with no additional information), as well as how many comments had unique information beyond the form letters. Some classes had form letters for multiple rounds of comments, in which case all of these were combined. To create a dataset for qualitative analysis, we stratified by proposal class, taking a random sample of 50 comments from each set of unique comments, resulting in a dataset for analysis of 1,100 comments. In summary, the analyzed dataset includes a random sample, stratified across 22 exemption classes, of unique comments by individuals that were added to form letters supporting each exemption proposal.

Exemption Classes

Though there were 27 total exemptions considered by the Copyright Office for the 2015 rulemaking, 5 of those were not included in form letter campaigns by either of the advocacy organizations and therefore did not have combined comments. The remaining 22 are listed in Table 1.

The first 4 classes (1, 5-7) request exemptions for circumvention of access controls that protect audiovisual works embodied on DVDs, Blue-ray discs, or downloaded/streamed video. They are organized by type of use (e.g., by film professors versus remix video creators).

Class 9 would allow circumvention of access controls on (lawfully made and acquired) literary works that are distributed electronically for the purposes of making them accessible for people who are print disabled.

The next 5 classes (11-15) seek exemptions that would permit circumvention of access controls on computer programs that would enable wireless devices such as cellphones to connect to alternate mobile wireless communications networks—often called "unlocking." The specific exemptions cover different types of devices (e.g., a cellphone versus a tablet versus a wearable computing device such as a fitness tracker). Another device-centric type of exemption (15-20) would allow circumvention of technological protection measures that prevent users from running certain software, or from removing pre-installed software, from devices such as smart TVs, cellphones, or tablets, a process commonly referred to as "jailbreaking"; the individual classes cover different types of devices.

Two exemptions (21 and 22) would permit circumvention of technological protection measures on software embedded in vehicles. The first involves computer programs that control the functioning of land vehicles like personal automobiles and agricultural machinery, and would cover lawful diagnosis and repair, or aftermarket personalization or modification. The

²This curated dataset (beyond the random sample analyzed) is available from the author upon request.

second would allow for circumventing those measures in order to research the security or safety of these vehicles.

The next pair of exemptions (23 and 24) concern abandoned video software. The first would allow circumvention of technological protection measures on lawfully acquired video games that require a developer-operated server (e.g., for authentication) in cases where the developer no longer supports that server. The second would allow circumvention of access controls that restrict access to the full functionality of certain (lawfully acquired) music recording software.

The last three exemptions (25-27) all cover miscellaneous software. The first would allow researchers to circumvent access controls to e.g., computer programs and databases for the purposes of good-faith testing, identifying, disclosing, and fixing security flaws and other vulnerabilities. The next would allow circumvention of technological protection measures on computer programs that are used in 3D printers, in order to allow the use of non-manufacturer-approved feedstock. The final proposal allows circumvention of protections for computer programs in medical devices so that patients can seek access to information generated by their own devices or for the purposes of safety or effectiveness research into those devices.

Following the 2015 rulemaking process from which this data derives, the majority of these exemptions (many of which had also been granted at prior rulemakings) were granted,³ though often quite narrowly construed [38]. However, for the purposes of this initial work about copyright circumvention and legal constraints generally, I was interested in user attitudes and experiences across this breadth of technologies and uses, rather than specifics to these individual classes of exemptions. Therefore, though many of the particular circumstances that commenters in discuss are currently legally permissible, these general attitudes, complaints, and assumptions of rights will continue to appear as new technologies and new use cases arise with evolving technology and practice.

Data Analysis

Though the content collected was public and viewable not only to policymakers but to anyone accessing the 1201 website, the commenters who appear in this dataset did not submit their comments with the intention of being part of a research study. Though it is common practice for researchers to collect and analyze public content (e.g., tweets) without consent, there are not consistent norms within the research community about whether it is acceptable to use verbatim quotes from public content or even what constitutes "public" [43]. Therefore, decisions about collection and analysis of public content should take into account more than its "publicness" and also consider factors like the context of the study, the sensitivity of the content, and the expectations and intent of the content creators [15]. I made the decision to collect and analyze this data, and to use verbatim quotes in reporting, based on this particular context. My hope is that this study serves to further highlight

³Exemption classes there were not recommended included two not in this dataset (8 and 10, for space and format shifting of audiovisual and literary works), as well as 15 (unlocking consumer machines such as appliances), 18 and 19 (jailbreaking for e-book readers and video game consoles), and 24 (abandoned music software).

| Class | Name | Total | Unique |
|-------|--|-------|--------|
| 1 | Audiovisual works - educational uses - Colleges and universities | 1575 | 215 |
| 5 | Audiovisual works - derivative uses - multimedia e-books | 1408 | 114 |
| 6 | Audiovisual works - derivative uses - filmmakinguses | 1565 | 143 |
| 7 | Audiovisual works - derivative uses - noncommercial remix videos | 1574 | 150 |
| 9 | Literary works distributed electronically - assistive technologies | 1292 | 130 |
| 11 | Unlocking - wireless telephone handsets | 2572 | 527 |
| 12 | Unlocking - all-purpose tablet | 2309 | 208 |
| 13 | Unlocking - mobile connectivity device | 1895 | 133 |
| 14 | Unlocking - wearable computing devices | 1632 | 157 |
| 15 | Unlocking - consumer machines | 1589 | 185 |
| 16 | Jailbreaking - wireless telephone handsets | 2087 | 249 |
| 17 | Jailbreaking - all-purpose mobile computing devices | 1884 | 206 |
| 18 | Jailbreaking - dedicated e-book readers | 1608 | 159 |
| 19 | Jailbreaking - video game consoles | 1647 | 156 |
| 20 | Jailbreaking - smart TVs | 1724 | 164 |
| 21 | Vehicle software - diagnosis, repair, or modification | 2582 | 555 |
| 22 | Vehicle software - security and safety research | 1816 | 145 |
| 23 | Abandoned software - video games requiring server communication | 1283 | 212 |
| 24 | Abandoned software - music recording software | 1530 | 144 |
| 25 | Software - security research | 1546 | 149 |
| 26 | Software - 3D printers | 1577 | 162 |
| 27 | Software - networked medical devices | 1659 | 166 |

Table 1. Numbered exemption classes, noting the total number of combined comments and the number of unique (beyond a form letter) comments available for each

the concerns of commentators that they had already chosen to express. The subject matter is also not inherently sensitive or personal, and I took this into account when choosing illustrative quotes.

I collaborated with a research assistant to conduct a qualitative thematic analysis of the comments in the dataset [8], beginning with inductive, open coding. We independently familiarized ourselves with the data and iterated on a set of initial codes based on random samples of 100 comments each. We then came together to discuss and derive initial themes based on the research questions. We both contributed to analyzing the remainder of the data, meeting periodically to iterate on codes and to discuss edge cases, relying on my legal expertise during this process. The final step of the analysis was to synthesize these themes into the ones illustrated in this paper's findings, and to choose the most representative quotes from the data.

In interpreting this data, it is important to note the limitation of a focus on U.S. law, meaning that it is likely that the vast majority of these comments come from people residing in that one country. Though anti-circumvention laws exist in a number of other countries as well (and of course, DRM itself is part of technology all over the world), and therefore many of the usability issues associated with the DMCA impact many people beyond the United States, this data likely provides limited insight into attitudes beyond that context.

FINDINGS

As reflected in the background and related works section, legal scholars have written extensively about the potential adverse effects of DMCA 1201, and these arguments are also reflected in the proposals and hearings of prior exemption proceedings. The data for this study, rather than focusing on the official

proposals or hearings, captures instead comments from the general public, which were analyzed independent of these existing arguments. We focused on aspects most salient to designers, such as usability and expected use. Unsurprisingly, these findings do track to existing arguments about adverse effects; for example, Pamela Samuelson's conceptualization of what a legal "freedom to tinker" might entail includes ideas of intellectual freedom to create and share knowledge, privacy and autonomy interests, the right to repair, and positive impacts on innovation [37].

The comments on exemption proposals show patterns of arguments that largely relate to ideas of right to use, as well as values around freedom and innovation. Following are exemplars of the major themes in the analysis. The exemption class (see Table 1) for which each comment was written is indicated at the end of the quote (e.g., (c-1)).

Metaphor

Metaphor has long been an important concept in HCI research and practice. As a way of linking the highly technical to a user's everyday life, using real-world metaphor in design by mapping familiar objects to unfamiliar concepts is common advice for interface designers [7]. However, when users rely on metaphor to form their own mental models about how systems should behave, these metaphors are not always appropriate. For example, folk theories can be derived from metaphors, and potentially resulting in mental models that are not quite accurate [44].

The rest of the themes discussed in this findings section represent commenters' attitudes and arguments that directly answer the research questions. However, metaphor was an important overarching theme in this data because it helps explain

why these attitudes exist and also represents an important and frequent rhetorical device in this data.

The use of metaphor was extremely common, most frequently comparing the technology in question (whether a phone, a vehicle, a videogame, etc.) to other types of property. As one commentator expressed:

Property ownership is property ownership. Why is software different? (c-21).

The particular characteristics of these other types of property are telling, and connect to the other themes uncovered in this data. For example, comparing owning technology to owning a house highlights the importance of being able to make improvements and changes:

The seller only has the right to sell to me if I choose to buy from them. They DO NOT have the right to tell me how to use it. It would be like me buying a house from a contractor and them telling me I could NOT make ANY changes to it (paint walls, change the layout, change faucets or what have you). (c-6)

Another frequent use of metaphor was to highlight the distinction between owning and leasing/renting. You cannot, for example, paint a car that you are leasing, but once you pay off the lease, you are free to modify the car. However, as a number of commentators pointed out, the same does not apply to a phone:

Buying a phone is like buying a car with an Auto Loan. The car is not mine until I pay off the loan. If I pay off my commitment on my phone, it becomes mine, and I should be free to do with it what I please and have access to it's full value. (c-11)

As a rhetorical device, metaphor also seems to be a way of illustrating absurdities, or ways that the current way of doing things under the DMCA is unreasonable. For example, this commentator used a simple type of physical property as a comparison to highlight a silly idea and then state that the current rule is "no different":

It would be no different than Nike suing you because you cut the sleeves off a shirt you own by them. (c-14)

The specific points made with metaphors track to the rest of the themes discussed here—though most frequently, metaphors around ownership. The frequency with which metaphors are employed in these arguments also suggest that they could be contributing to mental models; that is, thinking of a phone the same way you think about a house or a shirt or a car will influence what rights you think you should have in that phone. The law around digital ownership is often at odds with these traditional models.

Ownership and User Rights

A common theme across all exemption types is that owning a technology or a piece of content should provide certain rights of use. In the simplest terms, as one commenter wrote:

I should be allowed to do whatever I want with my property. (c-21)

This commenter also evoked concepts from the first sale doctrine in copyright law, which allows lawful owners (not the original copyright holder) to "sell or otherwise dispose of" a copy of a work [35]—i.e., when you purchase a Harry Potter book, you do not require JK Rowling's permission to sell that book to someone else. As with other exceptions to copyright law such as fair use, though most people would be unfamiliar with the law itself, there are common intuitions [12]. Even when digital goods complicate these kinds of rights, they remain intuitive.

Moreover, the concept of ownership is deeply tied to the idea of exchanging money for goods. Many commentators compared a "loss" of rights (though perhaps more accurately, their subsequent understandings of them) to a kind of theft. As frequently expressed by the use of metaphor, owning something is different than, for example, leasing or renting it.

I work hard for my money ... When I pay for a product, it should be 100 percent mine, to do as I want. Having even a portion of that product taken away, is equivalent to taking part of my hard earned money. (c-1)

To "do as I want" is a key concept here. Prior work has shown that people have a strong desire to be accountable for their own possessions [33], which is often complicated when those possessions are digital. The comments here strongly support the "right to repair" and "freedom to tinker" values [37]. Often referred to as a "right," this is one of the defining characteristics of ownership according to this data.

If I buy a product and wish to modify it to fit my needs, environment, security, and/or profession - that's my right because I bought that product. I did. Otherwise lease or rent it. (c-14)

These understandings of what it means to "own" something and what rights that should bestow upon the owner can result in mis-matched expectations. As explained by this commenter, they were surprised by their inability to modify their phone:

I have purchased only two smartphones in my life, both "unlocked." However even when I pay full price up front I found that I'm still prevented from modifying the phone. I found that it wasn't possible to delete some apps. Why should I be forbidden from deleting bloatware when I paid for the phone up front? It's time for the American public to have rights and for corporations to have rules THEY have to follow when they chose to take our money. (c-11)

Because of what this commenter thought that they knew what "owning" a phone should entail, they encountered what likely at first seemed like a usability problem: their inability to delete apps. This lack of functionality can lead to the same kind of user frustration that poor user experience design can, regardless of the root cause.

Functionality

A fundamental principle of technology design is that people should be able to use that technology. One common impact of anti-circumvention rules as reflected in this data is that they

stifle the functionality of technology, either making it less effective or entirely ineffective, and also inhibit the ability to make it more effective. For example, this commenter highlighted several ways that their phone would be more functional if unlocked:

By unlocking my phone, I am able to (1) move without a tracking device on my hip, (2) use the phone's full potential, and (3) triple the battery life, to more than 48 hours. (c-11)

This argument is particularly striking in the context of privacy and control, and a number of commenters assumed "bad faith" on the part of companies. Most frequently in the context of phones and software, companies are seen as enforcing anti-circumvention rules in order to force consumers into buying new products:

An example is Microsoft's Windows XP operating system. Even though I own a legal copy of the software I cannot use it on the internet without Microsoft trying to cripple it! This is unfriendly and predatory behavior that essentially demands I spend money on their newer products when the old product still does what I need!!!! Software does not "wear out" as hardware does... (c-15)

Upgrading technology can be one (often undesirable) solution to this problem, though in some cases, anti-circumvention rules render technologies literally not functional, as is the case for abandoned video game software. In these circumstances, the games require online servers to play (even when they are not always multiplayer games), and when the servers are shut down, the game is inoperable even when installed locally:

Consumers who legitimately purchased games on the open market are now denied the ability to play these same games, not because the associated purchased hardware (computer, gaming console, etc.) has failed or become unusable but rather that the company owned and operated servers to which those games were made dependent [made them inaccessible]. (c-23)

The desire to take action to make technology remain functional tracks strongly to the concept of ownership discussed in the previous section—that once you own something, it should be yours to keep. To explain this attitude using a metaphor of my own, what if your air conditioner stopped working and had to be replaced, but you weren't allowed to replace it? You would just have to buy a new house.

Accessibility

Closely related to the concept of functionality is that of accessibility. Circumventing copyright is often required in order to make content accessible to, for example, screen readers. Without this practice, technology literally becomes non-functional for people with vision impairments:

The biggest problem is that everyone has disabilities, often unforeseeable by the manufacturer, that are helped by the use of technology. If you don't let people with disabilities customize their devices, they may not be able to use them. (c-5)

Though there is more recourse under the law for this particular problem (in part because of anti-discrimination laws), it is still a problem built in to the underlying anti-circumvention laws and requires exemptions. It is also necessary, because without these exemptions there might not be incentives for companies to allow such uses:

Big companies don't always have an incentive to cater to small subsets of the population. Exemptions allow companies to protect their copyrights, and to allow those who are print disabled a chance to not be shunted from the e-book market. (c-9)

Again, accessible technology is seen as a right, as important as the technology being functional overall. Across this dataset, the arguments around accessibility were particularly passionate:

To repeat, it is a BASIC HUMAN RIGHT that you're denying visually impaired people. How dare you. DON'T BE SELFISH AND PROFIT-ORIENTED. WE HAVE RIGHTS TOO. (c-9)

Innovation

Finally, beyond basic rights of use that involve making technology functional and/or accessible, these rights were also framed as including innovation. An argument that appeared frequently in this data was that inhibiting certain uses around technology stifles innovation and creativity—that innovation comes from our freedom to re-purpose devices and re-use device parts or software in new ways. Sometimes framed as the "freedom to tinker" [37], this is another strong moral argument—even a patriotic one:

It is unamerican to prevent us from tinkering. What do you think Ben Franklin would say?" (c-21)

The idea that copyright law stifles innovation is not a new one, and not confined to the context of anti-circumvention. Similar arguments appear around content re-use, and fair use as a different type of copyright exemption is intended in part to solve this problem [12]. However, people tend to make even stronger moral arguments around invention, as opposed to art, as it is seen as the source of progress:

We live in a modern changing world, if people are not allowed to try new ideas and enact their own change the world as a whole wont be able to progress at the same rate, being limited by corporations." (c-23)

Overall our economy would benefit tremendously if everyone doesn't have to start from scratch and can build on work that others have already started. It would benefit the entire society if people are allowed to be creative. (c-7)

Rather than focusing on individual rights as seen in the previous themes, the right to innovate is seen as affecting society as a whole. In this way, it often comes off as even more fundamental. To answer a research question posed at the start of this paper, part of the "rights" that people should have is not just to use their technology, but to create new ones in a way that benefits everyone.

THE POLICY PROBLEM IN HCI

Overall, these findings based on analysis of comments regarding DMCA exemption proposals reveal that people have specific ideas about what rights they should have in technology and content they own. It also reveals specific patterns of arguments as to why they should have these rights—most commonly, related to issues such as personalization, upgrades, and in general simply the ability to make the technology work at its highest level. Though this analysis is based on a non-representative sample of the general population (both those who care enough to participate in the process and who are most likely aligned with the views of advocacy groups like EFF), it represents a large number of consumers who feel they are being wronged by the laws in place and by the corporations influencing these laws.

These findings should be of interest to the HCI community because the field cares about the challenges that people have interacting with technology. They illustrate how in some cases the problem at the core of "I want to do this and I can't" is not one of technical functionality or interface design but one of rules and law—as well as cases where rules or law are contributing to poor functionality or interfaces. Policy is an under-considered component of HCI, so one goal of this work is to present a rich example of how the law impacts technology use, and in particular, the negative ways that it can impact technology users. Technology designers should be aware that there are sometimes mechanisms outside their control that impact how their technology can be used.

Policy is also not the only type of external influence. Edwards et al. laid out the "infrastructure problem" in HCI—that even the best user experience designers may have to fight an uphill battle against layers of underlying infrastructure such as libraries, toolkits, and standards that may not be designed with the full range of user concerns in mind and are typically inaccessible during a user-centered design process [11]. Most often, HCI practitioners create user experiences within the constraints posed by this existing infrastructure, which creates the problem of constrained possibilities—that design choices by the infrastructure may entirely preclude certain desirable user experience outcomes [11].

This analysis of the infrastructure problem in HCI concludes with possible approaches for addressing it [11]: (1) surface, applying superficial layers of user experience to shield users from poor infrastructure; (2) interface, focusing on reducing problems caused by mismatches between user models and functionality with attention to the interface between the infrastructure and what it supports; (3) intermediate, supplying new infrastructure technologies that are more amenable to positive user experiences (but still constrained by more fundamental layers); and (4) deep, seeking to directly influence the architecture of the infrastructure itself.

Policy such as DMCA anti-circumvention rules can create a similar problem of constrained user experiences, which means that designers most often work within these constraints. As prior research has shown, not only can DRM violate user expectations, but it often results in poor user experiences [32, 6]. A surface solution fails to address constrained possibilities, ex-

cept to the extent that it leaves them constrained—for example, the absence of a "download" button on a user interface, even if expected. In other words, this is not so much a solution as the creation of a different problem.

Like surface solutions, interface solutions do not actually tackle the constrained possibilities, but instead present them in a more understandable way, which can help to solve problems caused by mismatches between conceptual models and system functionality [11]. This type of "seamful design" reveals human-salient aspects of infrastructure rather than masking them, in a way that users can perceive and appropriate the abstractions [11, 5]. An interface solution to a policy constraint would work to increase intelligibility and support end-user comprehension of the system—emphasizing what the user can and cannot do, and ideally, why. For example, for the user frustration of not being able to delete certain apps from their phones—what if the interface design separated these apps from the rest in a way that makes it obvious they are a permanent part of the phone? Though this a solution that designers can employ in the face of unmovable constraints, it only addresses usability problems and not the deeper issues revealed by the analysis in this paper. At best, this type of interface solution provides a "band-aid" for actual problems.

Intermediate solutions involve developing new frameworks that sit on top of underlying levels of infrastructure and can support user experiences [11]. In terms of policy, an individual or company cannot decide to make their technology exempt from anti-circumvention rules, though they can decide not to use certain types of technological protection measures in the first place. However, as pointed out by commenters in this data, there are not necessarily incentives for this practice. So whereas an excellent solution to the problem of abandoned video game software being unusable would be to not use online authentication at all, this would require the game company to concede the copyright control that that practice gives them. However, in this context, HCI practitioners or researchers at companies that hold intellectual property may be uniquely suited to influence these decisions—for example, by making arguments about usability, based on the kinds of issues the findings from this paper explore. Therefore, an understanding of the relationship between usability and policy is critical for those trained in HCI who will go on to have on-the-ground influence at the companies making these decisions.

With respect to intermediate solutions, we could also consider the concept of multiple layers of infrastructure in terms of the technology-level policies that interact with broader laws. Policy-based constraints often come in multiple layers—for example, law versus platform policy versus community guidelines [13]. Policies such as end-user license agreements can also help scaffold users towards more accurate mental models in the same way that interface design might. To the extent possible under higher-level policy constraints, the policies for use that technology designers have control over could better support desirable uses. Though these solutions might come into conflict with the known problem of users not reading policies [14], an example might be a clear policy that explains at the time of purchase how a video game will be unusable if

it falls out of fashion and is no longer supported. Again, this does not address the underlying policy problem, but it might result in less consumer frustration if they are able to make an informed decision based on knowledge of that constraint.

Finally, deep approaches to the infrastructure problem focus on influencing those who create the infrastructures that we rely upon, in order to help them create technologies that are more usable and useful [11]. Therefore, the deep approach to solving the policy problem is to advocate for policy change. This approach is particularly important because some of the themes illustrated in these findings go beyond usability frustrations. For example, the desire to innovate is a principled position that cannot be supported with an interface tweak.

As a solution, this is a big step beyond the superficial surface solutions that only hide the problem by creating new ones, interface solutions that decrease frustration but do not address the underlying problem, or even intermediate solutions that create better policies on top of poor ones. Deep solutions are arguably both the best solutions and the hardest ones, particularly since they often goes far beyond the usual skillset of interaction designers or other technologists. However, it does not require, for example, running for public office (though some advocacy groups are encouraging and supporting more scientists down this path [30]). In addition to consumer advocacy organizations like the Electronic Frontier Foundation, organizations like the Computing Community Consortium provide a collective voice to policymakers for computing researchers. HCI practitioners and researchers can also work directly with these advocacy groups as a pathway towards policy participation.

Moreover, with respect to the specific topic of this paper, copyright anti-circumvention, the rulemaking process provides a direct line to policy change. In this context, HCI researchers and practitioners could be more directly involved, perhaps going beyond submitting individual comments that might get lost in a sea of thousands, and work directly with law clinics and advocacy groups who create more substantial analyses. In fact, to move beyond this particular legal constraint and to think about the policy problem at a larger level, we should be working with these groups on a breadth of policy issues that impact the ways that people interact with technology.

RECOMMENDATIONS AND CONCLUSIONS

This work considered copyright anti-circumvention laws as an example of a legal constraint of technology use that is relevant to HCI researchers and practitioners. Though many of the particular circumstances that commenters in this data discuss are currently legally permissible (because of successful exemption proposals during this process), these general attitudes, complaints, and assumptions of rights will continue to appear in the context of copyright circumvention as new technologies and new use cases arise with evolving technology and practice. Because of this continued evolution in technology, designers will have to deal with this problem before future exemptions might come into effect or even come up for discussion. Moreover, like many parts of the law [14], documentation for DMCA rulemakings are dense and difficult to read, which means that even after an exemption is granted,

users may not feel completely safe relying on that exemption [38]. Therefore, it is important for technology designers to be aware of these potential constraints on desirable use, and the patterns of rights that impact user models for what they should be able to do.

As foreshadowed in the introduction, this paper provides both insights into usability problems that stem from anti-circumvention policies, and a discussion of the multi-layered ways that the HCI community might address these and other "policy problems." With respect to the former, there are two potential implications for design: (1) In general, consider in the design process the ways that policy might influence use; and (2) In more specific cases, consider the values (as explored in these findings) that people have for their "technology rights," and decide to design for them, or to explicitly *not* design for them. In other words, one option is to take the interface approach to the infrastructure problem in HCI; when working around a constraint, increasing intelligibility in design can help reduce mismatches between mental models and functionality [11]. However, this requires that designers have an understanding of both the real policy constraints and the ways that users interpret and react to them. Therefore, an additional recommendation is that user experience research should be more attentive to how policy might impact technology use, even if it is not top of mind for all users. As noted in previous work on misunderstandings of the law in the context of technology, designers should be thinking about not just what the law is, but what their users think the law is, as that also influences behavior [12]. These findings, particularly those around metaphor that point to patterns of mental models for "rights" in technology use, illuminate the foundation for many of these tensions.

However, this "implication for design" is only, as noted earlier, a "band-aid" for the real, underlying policy problems. In fact, in some cases, following this recommendation may do more harm than good, since surface-level or interface solutions might crowd out more meaningful solutions at the deep or even intermediate levels. Will slapping a band-aid on a bad user experience or even explaining to users why it is bad blind users to the real problem and subsequently impede progress towards real policy change? These design recommendations are therefore a "better than nothing" solution.

Accordingly, my recommendations sit more firmly in broader implications for practice and policy: HCI researchers and practitioners should take a "deep" approach to the policy problem in HCI, which means working towards policy change. Our contribution as a stakeholder group is particularly important since policymakers are not always the best equipped to understand technology. Therefore, it is often left to advocacy groups to attend to laws that may be outdated or not in the best interests of technology users. The HCI research community is uniquely well suited for determining how policy may or may not be in the best interest of user experience.

This research, and copyright circumvention as a specific example, should be part of a much broader research agenda for HCI. For example, specifically with respect to copyright and the DMCA, future work could consider deeper dives into

specific exemptions rather than overall patterns of attitudes. These public comments represent a wealth of information about user experience for those interested in particular use cases or technologies—e.g., accessibility, video games, or software vulnerability. Moreover, the DMCA is only one example of a type of legal constraint, and there are others in the United States and beyond.

Edwards et al. conclude that the infrastructure problem in HCI can be addressed with the expansion of the HCI methodological toolbox to address system infrastructures that are typically outside the realm of user experience [11]. I end with this same call to action: though the challenges of legal constraints on technology use can be partially addressed through thoughtful and policy-aware design, the real solutions to the policy problem in HCI require working for change beyond design.

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