Going over the top: Online television distribution as socio-technical system

(Forthcoming in *Communication, Culture, and Critique*)

Joshua A. Braun

Department of Film, Video, and Interactive Media

Quinnipiac University

Abstract

This paper examines emerging tensions surrounding the way television content is distributed online, introduces several of the increasingly diverse players in this field, and attempts to cultivate theoretical contributions from outside the standard communication literature as a means of capturing additional nuances of evolving television distribution practices. Specifically, I have chosen to chronicle the period between 2007 and 2009 in the development of two successful television startups whose visions for online distribution were frequently at odds. The first of these is the popular online television portal, Hulu, owned by a number of the U.S.' largest media companies. The second is Boxee, a startup producing software that today runs a variety of Internet-connected set-top boxes for televisions.

Going over the top: Online television distribution as socio-technical system

Distribution as System

In 1975, Williams noted that television, viewed as a technology, cannot be understood apart from the complex of government regulation, financial institutions, cultural expectations, and technical developments in which it is embedded. It is, as Silverstone (1994) went on to observe, a socio-technical system, or rather a series of overlapping ones. Similarly, twenty years ago, in his 1992 book on media systems, Turow described TV, saying that its structure

> is found in the rather predictable relationships that networks, Hollywood production firms, communication law firms, market research firms, pressure groups, and other entities have with one another. An important step toward understanding the structure of an industry and its function in society lies in assessing the events that have caused various relationships to evolve. (p. 49)

At this historical moment, we're experiencing dramatic upheaval and uncertainty in the "rather predictable relationships" between players in the television industry, as well as witnessing the introduction of new tensions and liaisons difficult to imagine in 1992 (Simon & Rose, 2010; Kompare, 2010; Perren, 2010). Television, as a medium, an industry, and as a system, is evolving in important aspects as technical standards change, as online and mobile distribution allow us to watch in new ways and in new places, and as cheap, instantaneous distribution expands the possibility of participation by new parties (Jones, 2009; Simon & Rose, 2010; Kompare, 2010; Newman, 2011).

As video content wends its way to us online, it now goes through intermediaries most viewers have never heard of. Transpera (recently acquired by Tremor Media) for example, is a company that converts streaming video from numerous providers, ranging from Disney to CBS News, into a plethora of special formats tailored to our ever-growing menagerie of mobile devices, and packages advertising with it on its way to the consumer. YuMe is another company with major industry clients. It scans the blogs, homepages, and other sites on which users place

embeddable videos and determines whether a page is "brand-safe" (i.e., that it features no objectionable content) before displaying paid ads with a clip.

Transpera and YuMe are just two among numerous examples of new intermediaries in the distribution of television content online whose workings are largely invisible to users. Online media, like traditional television and other electronic media before them, feel immediate and are often defined by their potential for "liveness" (Gans, 1980; Couldry, 2008; Chamberlain, 2010). This sense of liveness, or "immediacy," to use Gans' (1980) term, is carefully cultivated and has been an important part of television's presentation of itself as a form of shared experience and direct access to world events (Jones, 2009; Chamberlain, 2010). Unlike physical media, and their attendant icons of the paper boy or delivery truck, however, we often have little intuitive sense of the route that electronic media take to get to us. When we can push a button and watch it come off the screen "like sunlight," as one producer put it to me, it is all too easy to forget that online video is distributed—that systems of labor, infrastructures, institutions, economics, and numerous stakeholders are all involved in the route it takes to that screen (Downey, 2001; Perren, 2010). Indeed, just what sort of screen video is delivered to—whether it belongs to a television, computer, mobile phone, or tablet—is a matter of huge concern, and increasingly contention, among media producers and distributors (Hedlund, 2009; Chamberlain, 2010; Perren, 2010).

Scholars of science and technology have often claimed that points of contention and controversy are among the most telling moments in the study of culture—that the norms, assumptions, and expectations of various actors in a social system become uniquely visible when they are breached (Barnes & Bloor, 1982; Collins, 1981, 1992; Collins & Pinch, 1998). For this reason, I would like to unpack an "early" controversy in online television distribution—specifically, I have chosen to chronicle the period between 2007 and 2009 in the development of two successful television startups whose visions for online distribution were frequently at odds. The first of these is the popular online television portal, Hulu, owned by a number of the U.S.' largest media companies. The second is Boxee, a startup producing software that today runs a

variety of Internet-connected set-top boxes for televisions. "Early" is in scare quotes here because television has been circulating widely online since the late 1990s (Simon & Rose, 2010). However, the tensions that arose between Hulu and Boxee from 2007 to 2009 are interesting because they fell near the beginning of the current period of heady experimentation with business models for streaming television distribution (Simon & Rose, 2010; Kompare, 2010; Perren, 2010) and presaged some larger trends and controversies in these industries' approach to online distribution that would arise in subsequent years. Additionally, as we shall see, the interlocking cases put on full display the agency of users—their ability to render the workings of distribution visible and malleable when it suits them—and provide a fascinating example of the ontological shift underway in which audiences for television are increasingly seen as exerting influence not simply as passive viewers, but as users and citizens (Kompare, 2010; Newman, 2011). For these reasons, the cases also provide a particularly rich opening for theoretical interventions aimed at helping media scholars to better grapple with a period of tumultuous change.

The Route to the Screen

Carey (1989) reminds us that we as a culture once associated the spread of information with the physical movement of messengers, before widespread adoption of electronic communication technologies, and the rhetoric of "eclipsing time and transcending space" that accompanied them, ultimately allowed us to largely divorce our notions of "transportation" and "communication." Even as information now follows complex and shifting communication networks, these systems are regularly rendered invisible to the consumer. In other words, the transport of video and information has been considerably "black-boxed" (Latour, 1987). But even in the so-called information age, when communication seems so immediate, information must travel a route to reach us—and tracing that path opens up a host of sociologically interesting relationships. Turow (1992) understands this, and his power-role theory was one of the first communication frameworks to earnestly look at media from a systems perspective. In it, he outlines a range of roles that surround the production and distribution of media products,

encouraging researchers to take an ecological view of the media industries, framing the host of companies involved as actors engaged in an ongoing competition for position and resources.

Even power-role theory, however, tends to limit the roles available in a media ecosystem to those promulgated in a traditional market economy. One of the hallmarks of our contemporary "networked information economy" (Benkler, 2006), however, is that these players exist alongside a host of actors who produce, distribute, and remix content by way of diverse and non-traditional means, motives, and modes of organization (Benkler, 2006; Bruns, 2008; Kompare, 2010; Newman, 2011). It's with this in mind that I wish to go one step further and examine the distribution of online video from the perspective of sociologists of socio-technical systems, an approach brought to the study of earlier television regimes by Silverstone (1994), and one which as we shall see, is a lens that has built into it a unique appreciation of diverse actors and motives.

The history and sociology of socio-technical systems (henceforth "systems sociology") is a mature subject of inquiry within the field of science and technology studies and is addressed by a wealth of scholarship across the field's various theoretical and methodological approaches, including actor-network theory, the social construction of technology, and the sociology of knowledge, among others.

The conceptual tools of systems sociology have also seen adoption in a number of other fields. In organizational studies, for instance, they serve as a means of grappling with the complex, fraught, and technologically mediated nature of organization within contemporary firms (Chia, 1995; Jackson, Poole, & Kuhn, 2002). In anthropology the work of systems scholars has provided a building block in theories of technology use and development (e.g., Hutchins, 1995). Meanwhile, the ideas of prominent systems sociologists such as John Law have made relatively few appearances in the discourse of media scholars (Couldry, 2008).[1] However, lenses from this area of science and technology studies would seem to offer some

[1] For notable exceptions see Silverstone, 1994, Gillespie, 2007, Anderson, 2009, and Nissenbaum, 2011.

distinct conceptual advantages in unpacking our current media moment, particularly when it comes to understanding the sorts of disruptions we are witnessing to traditional modes of distribution.

Largely in the last two years, for example, there has been a surge of interest in the area of online television distribution in the field of television studies. Scholars here have astutely documented the upending of traditional institutional relationships in the media industries (Lotz, 2007, Simon & Rose, 2010; Kompare, 2010; Perren, 2010) and the dramatic importance of the increased agency that new technologies have afforded users and audiences (Kompare, 2010; Newman, 2011). They have also skillfully explored how the the values and politics of many actors are "invested and contested" in the design of contemporary technologies for viewing (Chamberlain, 2010) and speculated on the social impacts of new technologies and systems of distribution (Jones, 2009). Without taking anything away from these insightful analyses, I wish to point out that these sorts of problems, while novel for television studies, are well-rehearsed in—and quite central to—systems sociology, where researchers have thoroughly examined precisely the same themes of controversy in large socio-technical systems (e.g., Bijker, Hughes & Pinch, 1987; Pfaffenberger, 1992; Latour, 1996; Hughes, 1998; Law, 2002a; Law, 2002b); the agency of users (e.g., Pinch & Bijker, 1984; Pfaffenberger, 1992; Bijker, 1995; Kline & Pinch, 1996; Oudshoorn & Pinch, 2003); the politics of artifacts (e.g., Winner, 1986; Latour, 1988; Pfaffenberger, 1992; Bijker, 2006); and the social impacts of technology (e.g., Cowan, 1983; Pfaffenberger, 1992; Gieryn, 2002; Bijker, 2006).

Moreover, while communication scholars over the years have primarily focused on the production of media on the one hand, and its audience effects on the other, historians and sociologists of socio-technical systems have developed an ideal language for looking at the politics of *distribution* and how artifacts are made to move. Systems sociologists have explored, among other things, the construction of power distribution networks (Hughes, 1979, 1983), shipping routes (Law, 1986, 1987), railway systems (Law & Mol, 2002), public transit lines (Bugos, 2000), freeway systems, and digital packet routing (Hughes, 1998). They bring to the

table a wonderful set of analytical tools for making sense of the tumultuous changes to media distribution that scholars of television have come to view as being so central to our understanding of culture in a digitally connected world.

At the same time, communication researchers more broadly have recently begun showing a renewed interest in the mechanics and practices of distribution and to investigate more deeply the movement of ideas, information, and media products online—developing constructs and terms like "spreadability" (Jenkins, 2009), "flows" (Castells, 2000; Baym, 2010), and "information streams" (boyd, 2010). My hope is that an exploration of a number of lenses from systems sociology will add to and deepen this already exciting discussion. Largely for the sake of space, I will take only two concepts from systems sociology: *heterogeneous engineering* and *technological dramas*. These should be more than adequate as proofs of concept with regard to the value of this perspective for discussions of online distribution.

Heterogeneous Engineering

Contemporary media work has an improvisational nature that involves creatively pulling from and recombining available resources (Usher, 2011). This is true not only of media production, but also of media distribution. In systems sociology, the diversity of actors and resources that have to be aligned to create an operational network, like a transit or freeway system, include not just employees or technical resources, but a strikingly diverse range of people and artifacts. Law (1987), for example, summarizes this diversity in his description of the evolution of the early electrical grid as implemented by Thomas Edison and other system builders of the 19th Century:

> Edison's problem...was simultaneously economic (how to supply electric lighting at a price that would compete with gas), political (how to persuade politicians to permit the development of a power system), technical (how to minimize the cost of transmitting power by shortening lines; reducing current, and increasing voltage), and scientific (how to find a high resistance incandescent bulb filament). (p. 112)

This carefully and painstakingly orchestrated confluence of diverse resources is a defining characteristic of socio-technical systems. It is what makes a power grid a "system" rather than an "artifact" in the eyes of sociologists. This collage of people, things, facts, laws, organizations, and financial resources is what systems sociologists are pointing to when they refer to social/technological systems as "heterogeneous" (Hughes, 1987; Sørenson & Levold, 1992; Law, 1987, 2002a, 2002b, 2011).

Heterogeneous engineering (Law, 1987, 1992, 2002b) is a particular lens from this field that conceives of the world as full of systems, competing to draw various actors into stable arrangements that accomplish the objectives of their respective system builders.[2] According to Law (1987), this is at times a zero-sum game, in which the successful *association* of one network may result in the reconfiguration or even *dissociation* (i.e., breakdown or dissolution) of others. In other words, Law (1987) foregrounds the challenges of competition and of entropy in assembling stable social/technological systems. Thinking in terms of heterogeneous engineering, a system is never a done deal, never complete—at any given moment it is only more or less stable.[3]

---

[2] Since its introduction, heterogeneous engineering has been subsumed into the larger framework of actor-network theory (ANT) and has largely been discussed in that context within science and technology studies. However, the construct has considerable utility in its own right, without the scaffolding—and occasionally the baggage—of actor-network theory and its manifold precepts. With that said, actor-network theory is a highly developed and productive set of conceptual tools. For those who are interested, useful introductions to this framework include Callon, 1986; Latour, 1987; Law, 1992; Law & Hassard, 1999; and Latour, 2007. The number of attempts to apply actor-network theory to media is growing, but still primarily focused on media production rather than media distribution. For examples, see Turner, 2005; Hemmingway, 2008; Couldry, 2008; Domingo, 2008; Anderson, 2009; Mould, 2009; Plesner, 2009; Schmitz Weiss & Domingo, 2010. As is evident from this list, the application of actor-network theory to media is a task substantial enough to fill many volumes. Without questioning the value of such an enterprise, the contribution I am seeking to make here is somewhat different. First, as I indicate above, I wish to demonstrate the immediate utility to media scholars of the concept of heterogeneous engineering, which is distinct from the aspects of the theoretical framework focused on by most scholars who have examined ANT in relation to media, and arguably does not require the overhead of actor-network theory as a whole. For this reason, I will largely discuss the concept in reference to Law's original 1987 article on heterogenous engineering, rather than trace the history of the idea as it becomes increasingly imbricated in more complex frameworks. Second, I wish to focus on media distribution rather than media production, and Law's 1987 article laying the groundwork for the construct of heterogeneous engineering also contains a case study with particularly useful parallels to media distribution, which I will illustrate shortly.

[3] While Law's is not a Marxist analysis, Marxist scholars will surely appreciate the resonance here with Gramsci's descriptions of the continual work of the state in maintaining cultural and economic hegemony, which he described as "a continuous process of formation and superseding of unstable equilibria...between the interests of the fundamental group and those of the subordinate groups" (Gramsci, 1999, p. 406). The Marxist fascination with

The advantage of heterogeneous engineering as a framework, with its emphasis on both entropy and heterogeneity, is it foregrounds the fact that the construction and maintenance of particular social and technological arrangements is not a one-time enterprise, but a continual, dialogic process, in which the challenges to be examined are not stable or exclusively social phenomena, as sociologists have at times assumed (Silverstone, 1994). Rather in each unique system we examine, the goal "is to *discover* the pattern of forces as these are revealed in the collisions that occur between different types of element, some social and some otherwise" (Law, 1987, p. 114).

The case Law (1987) initially described in laying out his notion of heterogeneous engineering was that of the *volta*, a portion of the Portuguese trade route to India that required centuries' worth of economic, legal, social, scientific, and technical engineering. The construction of the volta required the enrollment of numerous recalcitrant agents that simultaneously served as resources and shaping forces for the system builders—in this case, merchants seeking to create a working trade route. The winds and currents that helped to carry ships to their destination immensely complicated their return. The celestial charts created in response by astronomers enabled creative navigational solutions to these problems, but were illegible to semi-literate sailors, the training of whom put further stresses on the system. When, finally, all these things were in place, their influence was quite literally inscribed on the map:

> The *volta* can thus be seen as a geographical expression of a struggle between heterogeneous bits and pieces assembled by the Portuguese system builders and their adversaries, that is, the winds, the currents, and the capes. It traces on a map the solution available to the Portuguese. It depicts what the Portuguese were able to impose on the dissociating forces of the ocean with the forces they had available. (Law, 1987, p. 120)

---

bureaucracy and various forms of social order and control open the way to many potential linkages, synergies, and "neat fits" between more traditional critical cultural analyses from media studies and the tools offered up by systems sociology.

The Portuguese were interested in acquiring and distributing trade goods, not television, but there is a universal point here. Again, it's easy to forget that online media products are *distributed*. But while there are differences between information and physical objects (Benkler, 2006), between the Portuguese' desire to accumulate goods and the need of contemporary media workers to push information across services and devices, both trade goods and television programs travel a route to get from one place to another. In both cases the path they take is itself a middle course reflecting the interests and limitations of myriad heterogeneous systems and actors. Portuguese ships traveling the *volta* threaded a needle between an inhospitable desert coast on one side, and unfavorable winds and currents on the other. And their route was equally influenced and displaced by the interests and limited malleability of sailors and royalty, navigational astronomers and shipwrights, at each turn taking advantage of opportunities these agents provided while simultaneously slipping skillfully between the limits imposed by all of them. I want to think of online television distribution in much the same way, as an "inscription on the map of the solutions available" to content providers, illuminating the manner in which the route video and other information takes to our screens is at once the result of heterogeneous resources (at times precariously) lashed together, and the threading of needles—weaving between the limits imposed by all these resources and those enrolled in competing systems.

Technological Dramas

To look at the world through the lens of heterogeneous engineering is to acknowledge the "politics of artifacts" (Winner, 1986)—that working systems choreograph the relationships between technologies and the people who use them. Sociologists and other scholars of technology have long realized that the affordances and constraints built into technologies might further be thought of as attempts on the part of system builders to regulate user behavior (Nissenbaum, 2011). For example, studios and networks that offer up TV shows online are using digital rights management (DRM) technologies to build copy restrictions into media files and place limits on how far their content can spread, geofencing (blocking international IPs from accessing content) to enforce national copyright boundaries on the Web, authentication to make

sure that online viewers are offline cable subscribers, domain blacklisting to ensure that their content isn't embedded on lewd sites or used to build unauthorized mirrors, IP blocking to keep particular users or institutions from accessing or sharing content, and user-agent banning to control what software and devices people use to access content. In the absence of a fixed route to the consumer, the networks place a share button here, a domain restriction there, and so forth, hoping that like bumpers on a bowling lane, these will guide their content in a generally desirable direction.

But Pfaffenberger (1992) notes that "it is specious to...[envision the] technological design process as a conduit through which preexisting political values can be transmitted without being affected or altered" (p. 290). Thus, as we've seen, the engineering of artifacts is inevitably accompanied by engineering via law, rhetoric, commerce, and other channels of influence (Nissenbaum, 2011). Even then, attempts to regulate or prescribe other actors' behavior through technology are inevitably imperfect and fraught with difficulty. At least some users and other groups affected by a content provider's attempts at technological regulation—groups Pfaffenberger (1992) has termed the *impact constituency*—will inevitably push back in creative ways that allow them to better fulfill their own interests. Thus it only makes sense to talk about content providers' efforts to channel information in relation to those of impact constituencies—users and others who are affected by their efforts. It's for this reason that scholars like Pfaffenberger (1992), Law (1987), Silverstone (1994), Gillespie (2007), and Nissenbaum (2011) see regulation as an ongoing back-and-forth that takes place on many fronts. They recognize the process of system building as a dialogic one, in which parties may alternately choose to adjust to, or attempt to reconstitute, the technologically enforced regulations others endeavor to put in place.

The notion of the technological *drama,* as opposed to "text," then, is intended to capture the ongoing tensions and stakes presented by these technologically mediated relationships and the dialogical nature of the systems being enacted and contested. It also denotes the performative nature of our interactions around and through technologies—how they become

props in dialogues that involve an array of legal, commercial, and discursive channels. In other words, as Pfaffenberger (1992) asserts, the way technologies are designed and framed, then subsequently reconstituted, reframed, and worked around by their users matters deeply, because it is a real form of public discourse that is seldom appreciated by scholars or politicians.

This is particularly significant for scholars of media. Pinch and Oudshoorn (2003), for example, argue the field of media studies has often painted the agency of users as being limited to a choice of whether and how to consume and interpret what technologists and the cultural industries offer up. As media researchers begin to more thoroughly plumb the possibility of additional important and technologically mediated forms of user agency (see, for example, Newman, 2011), the discursive and consequential nature of users' interventions into technological development highlighted by systems sociologists stands an important guiding principle, if not a notable conceptual insight. It is with these ideas in place that I now turn to the case of Hulu and Boxee.

Background on Hulu and Boxee

Hulu is a Website, founded in 2007 and launched in 2008, that provides professionally produced streaming video content to users on demand. The site is a joint venture owned largely by NBCUniversal (NBCU), News Corporation, and the media investment firm Providence Equity Partners (Kafka, 2009a; Jones, 2009; Perren, 2010; Kompare, 2010; Chamberlain, 2010).[4] In 2009, Disney also purchased an equity stake in the company (Kafka, 2009a; Perren, 2010). Hulu streams both TV shows and films and sells advertising in the form of short commercial breaks that appear at intervals throughout each program. The television content for the site comes largely from NBC, Fox, and ABC, the broadcast networks owned by NBCU, News Corporation, and Disney, respectively. The site also provides some, but relatively little, cable television content owned by the same partners (Kafka, 2009a). Other major Web destinations, including AOL, MSN, MySpace, and Fancast—some them owned by or partnered with Hulu's

[4] Providence Equity Partners divested itself of Hulu in mid-2012 when Hulu announced changes to its business model.

parent companies—have also formed official partnerships over the years that have allowed them to display Hulu content on their own sites. In 2010, after the period covered by this case study, Hulu also launched a subscription service, and in 2011 it began offering content internationally for the first time.

Boxee is a software company founded in 2007, which produces a (partially) open source software application of the same name. The Boxee software was first made available to the public in 2008 and is based on the open source XBMC media center software (Albrecht, 2008b). It aggregates links to streaming and downloadable video and music from over 300 sources across the Web, making them all playable from within the same interface, along with any media files stored on a computer or set-top box's local hard drive (Albrecht, 2009a). It's essential to note that, in 2009 during the period of this case study, the company had direct relationships with very few of these content providers. Rather, the majority of this material was aggregated from publicly available online sources (Albrecht, 2008b). The software includes social Web features, allowing users to share and recommend content to other friends on Boxee, as well as to their followers on social networks like Twitter and Facebook.

The original Boxee software was cross-platform, and while it was initially available only for Mac OS X and Linux systems, a version was subsequently developed for Windows. It featured a "10-foot interface," meaning that it was designed to be operated from across the room using a remote control. Apple Remotes and similar remotes from PC manufacturers were among the devices that could be used to control Boxee at a distance (Stone, 2009). The company also produced an application that allowed users to employ their iPhone or iPod Touch as a remote, while Android phones and other devices were further supported as remote controls by the open source community surrounding Boxee.

The point of the remotely controllable Boxee interface, as well as its focus on video and music, was to allow users to plug their computer into a modern television set, and effectively use it as they would a cable box to channel surf content from both their hard drive and the Web (Stone, 2009; Jones, 2009; Ronen, 2010). As NPR's Mario Armstrong (2009) put it, "[the video]

could be coming from a Web site, or it could be coming from over-the-air networks. You really don't know. And you really don't care. The fact that it was so simple really just floored me" (para. 20). However, for some users, linking the computer to the television set each time they wanted to use the software proved inconvenient, and in October 2008, a group of open source developers in North Carolina independently created a legal hack that allowed users to install the software on first-generation Apple TV set-top boxes (Stone, 2009). After a large user base showed interest in accessing Boxee in this way, the company began supporting the software hack, making a version of the program optimized for Apple TV, and labeling it an official distribution alongside those for Mac, Linux, and Windows.

Additionally, Boxee turned its software into a development platform, allowing developers from various content providers, along with independent programmers, to create custom plugins for viewing and interacting with content. These extensions are subsequently made available through the program's integrated app store, called App Box, which in 2009 already offered free plugins from a wide variety of popular content providers, including Netflix, MTV, CNN, YouTube, NPR, Flickr, MLB.TV, Digg, Facebook, Tumblr, Pandora, Last.fm, and the BBC, as well as numerous less well-known individuals and brands.

After the period covered by this case study, the company also partnered with hardware manufacturers D-Link and Iomega, which have begun to produce official set-top boxes for televisions running on the Boxee software. In January 2012, after the release of these boxes, desktop computer versions of Boxee's software were discontinued in favor of versions that will run only on the proprietary devices.

Heterogeneous Engineering by the Television Industry

The creation of Hulu was seen by many as the American television industry's response to "piracy" on other video sharing sites around the Web (Russell, 2007; Kompare, 2010; Newman, 2011), and it marks an evolution in the participating networks' approach to the Internet. In 2006, when users began posting clips of NBC shows to YouTube, for instance, the network initially demanded that they be taken down. Seeing how popular the clips became, however, the network

subsequently began posting the same videos to its own site, before finally entering into a full-fledged promotional partnership with YouTube (Goo, 2006). Hulu takes the desire of the networks to control their content online one step further.

Even the awkward combination of economic partnerships (Goo, 2006) and legal action (Chapman, 2007) the networks initially pursued with YouTube did not ultimately give them as much control as they wanted over which of their clips ended up on the site or in what context (Russell, 2007). With Hulu, the networks decided they would instead attempt to draw viewers away from pirated content by hosting higher-quality versions of the same videos themselves, while selling advertising against them in an attempt to reclaim some of the revenue they believed they were losing to other sites (Russell, 2007; Kompare, 2010; Newman, 2011). If, for the moment, we view Hulu as a single technological object, rather than an assemblage of smaller ones, it is what Pfaffenberger (1992) refers to as a *counterartifact*—a technological device constructed in response to another as a means of negating its effects. The networks hoped Hulu would stop at least some viewers from watching illegally uploaded copies of their clips on YouTube—and perhaps even keep them from being shared illegally in the first place (Kompare, 2010; Newman, 2011). Moreover, the problem with video sharing, as the networks conceived it was simultaneously technological, economic, social, and legal (Russell, 2007). Sharing technologies allowed users to easily propagate illegal copies of the networks' content. Audiences watched these copies without generating any direct revenue for the network, making it an economic problem. Moreover, this economic issue was also a normative one, as the networks feared users would become socialized into a culture of illegal sharing and ad-free content. At the same time, the networks recognized the beneficial aspects of the YouTube phenomenon—such as when the social activities of users made the networks' content more popular, and potentially more profitable—and sought to appropriate them (Russell, 2007).

Hence, with the glaring exception of an "upload" button, Hulu has much the same feature set as the UGC video sites—like YouTube and Veoh—from which it hoped to draw viewers (Russell, 2007). Moreover, Hulu's creators realized that one of the key ways in which users

were watching, sharing, and therefore driving views to YouTube was through its embeddable player (Gannes, 2009b). As such, when Hulu launched in private beta during 2007, it already featured an option that would allow users to embed videos on their own Websites. No sooner was it released, however, than embedding became a sticking point in the television industry's desire to exert control the over the flow of its content. Before Hulu was even out of private beta, other sites had begun embedding its videos *en masse* (Albrecht, 2008a).

Two sites in particular—OpenHulu and TV Paradise—effectively billed themselves as full mirrors of Hulu's content. OpenHulu used scripts to screen scrape the embed codes from videos on the Hulu Website, making the videos available outside Hulu's closed beta, and even selling its own interstitial and banner ads (Albrecht, 2008a). TV Paradise did much the same, but went even further, using a creative hack to make the videos available to users overseas, whose non-U.S. IP addresses were normally blocked by Hulu's servers (Albrecht, 2008a). In Law's (1987) terms, the proprietors might be seen as competing system builders, attempting to enroll the technological agents in Hulu's network toward their own purposes, including profit and notoriety. In Pfaffenberger's (1992) terms, they were impact constituencies, unhappy with the way Hulu had restricted access to its content (to beta testers, to Americans) and who in turn engaged in technological acts of appropriation.[5] Initially, Hulu took no action in response—perhaps in part because, even on the unauthorized mirror sites, the embedded videos continued to show Hulu's paid advertisements (Kramer, 2008). However, after several weeks, it hit OpenHulu with a cease-and-desist letter (Gannes, 2008), and both unauthorized sites were eventually disabled remotely when Hulu changed its embed codes, which in turn rendered the unauthorized screen scraping algorithms non-functional (Albrecht, 2008a).

Also during this time, other more reputable companies began engaging in similar embedding. Facebook allowed a third-party application on which users could publicly view Hulu videos during the site's restricted beta (Gannes, 2008). The major video sharing site, Veoh,

[5] For an extended and enlightening discussion of how non-U.S. users in particular have responded, rhetorically and technologically, to geofencing by Hulu, see Newman, 2011.

began offering embeds of Hulu's content without permission, and continued to do so up until at least 2009 (Gannes, 2009b). Hulu at one point suggested that Veoh was violating its terms of use, but never specified how, nor did it apparently pursue any legal action (Kramer, 2008; Gannes, 2009b). For the most part, Hulu's parent companies initially gave the startup some autonomy in deciding which video-embedding sites to take action against, and which to let be (Kramer, 2008). In addition to cease and desist letters, the company also keeps a blacklist of Web domains to which its software will not serve embedded content (Albrecht, 2009e). While this list is primarily used to keep Hulu's content off of porn sites and the like, Hulu has at times used it to bring down larger game, such as when it barred CBS-owned TV.com from embedding its videos in early 2009 (Albrecht, 2009b, 2009e).

Industry observer Liz Gannes (2009b) notes that Hulu's decisions about which embedding sites to call out or block can appear arbitrary at times, and seem to be primarily governed by the company's decisions about which sites look like potential competitors. For instance, in 2009, even while allowing Veoh—which at this point was ailing financially—and a number of other unauthorized sites to continue embedding content, Hulu issued a flurry of takedown demands to new Web video startups, which were gaining traction in the marketplace (Gannes, 2009b). That said, if Hulu enjoys some discretion in determining who embeds what, it is at the pleasure of the television companies who not only own controlling interests in the site, but provide Hulu with nearly all of its content. And, as we shall see shortly, there have been times when these companies have stepped into the picture more directly.

Heterogeneous Engineering by Boxee

When Boxee launched, not only did it not have an official relationship with any major content providers, CEO Avner Ronen was up front about the fact that neither he, nor his staff came from an entertainment or cable background and were learning about the television industry on the job (Albrecht, 2008b; Ronen, 2009b; Stone, 2009). The company's initial plan for a business model was to create a superior user interface for playing back many types of digital media on televisions, and to then license this software as an operating system to manufacturers of

TVs and set-top boxes (Stone, 2009). Many parts of the Boxee software are open source, so external developers have had an influence on its development—including porting the media center to initially unsupported devices like the original Apple TV (Stone, 2009). But the primary goals of development for Boxee itself were to make the user interface as intuitive as possible and to support the types and sources of media most desired by users, so as to grow a user base and feature set that would make the system as valuable as possible to electronics companies (Stone, 2009; Albrecht, 2009a). In heterogeneous engineering terms, devoted users, and the ability to sell them to other actors—namely, device manufacturers—were essential to the system Boxee was constructing; it needed to enroll one set of actors if it was to subsequently enroll the other. As such, for the first years of its existence the company heavily involved users in the design and development process at each stage beginning with the software's initial alpha release. During the period of the case study, the startup's 12-person staff held meetups in New York City, where it is based, to make important announcements and take input from from local users, while remaining in relatively constant contact with its extended user base via Boxee's blog, user forums, and Twitter accounts (Albrecht, 2009a).

From its first release through at least 2009, the most user-requested feature on Boxee was integration of content from Hulu. In response, the developers integrated Hulu's embedded player—along with those of CBS, Comedy Central, and others—into Boxee's interface early on in October of 2008, while the software was still in alpha testing (Ronen, 2008, 2009a). Using their remotes, users could browse and play Hulu's full library with Boxee's 10-foot interface. Moreover, because the developers had done the work of integrating the player with their own software, users could also run through Hulu's various playback options (e.g., set video resolution, auto-play next video, etc) without using a mouse.

By this point, Hulu had graduated from its private beta status to become a publicly available site, so Boxee was not exposing restricted content. The developers made Hulu aware of their efforts (Ronen, 2009a) and were careful to preserve all of the site's branding and embedded advertising (Jayasuriya, 2009). Additionally, unlike the unauthorized mirror sites that

had raised eyebrows previously, Boxee was not drawing pageviews away from Hulu, but was instead a client-side application, which the company and its users asserted made Boxee more akin to a Web browser than a Web server (Jayasuriya, 2009). The Boxee software quickly became successful in the months following Hulu integration. By February 2009, just over two months after the software's beta release, the application had roughly a quarter million registered users (Stone, 2009; Albrecht, 2009d)—at which point, Hulu contacted Boxee and requested to be removed from its service.

Systems in Conflict

At this point, we've begun to see how both Hulu and Boxee attempt to channel flows of information and we can begin to further discuss them in the language of heterogeneous engineering. Hulu is a socio-technical system aimed at making money for the legacy media content providers who own it, while becoming profitable in its own right. The site uses embeddable player technologies initially made popular by video sharing sites in order to give users a familiar interface and tools, in the hopes that it can then capitalize on the same sharing norms that have allowed YouTube videos to go viral. At the same time, it uses legal and technological tools to restrict the flow of content when it suits the company's interests, reigning in competitive uses of its content through cease-and-desist letters and domain blacklisting, while excluding out-of-market users by blocking international IP addresses. A (very partial) list of actors in this system thus far includes media corporations, Hulu executives, software developers, lawyers, advertisers, end users, and myriad Web technologies implemented on both the server and the client side.

Similarly, Boxee can be seen as a socio-technical system aimed at developing and ultimately profiting from an interface with a devoted user base, all of which can be monetized by licensing its software to device manufacturers (Stone, 2009). Boxee may be a technology company, but we've seen how heavily it relies on the social. It uses social networking tools to build its user base and incorporate feedback on usability and desirable content into its software designs. It benefits from the collaboration and association of a larger open source development

community. To succeed, Boxee must successfully associate many heterogeneous actors, including Hulu and other content providers, along with their myriad file formats and player technologies; venture capitalists; social network sites; employee programmers; open source developers; device manufacturers; multiple operating systems and varieties of computer hardware; Web technologies; tech savvy early adopters; and ordinary consumers.

Moreover, given how extremely limited Boxee's relationships with device manufacturers and professional content providers were when the company started, Boxee's main hope for a successful business model lay in its ability to assemble a large user base which it could then leverage to generate interest from these other groups. Between this and the fact that the software was partially supported by an open source development community, Boxee began as a major exercise in participatory design (Flanagan, Howe, & Nissenbaum, 2008). As will become apparent shortly, the large extent to which Boxee's early design was led by and embodied the values of users tended both to draw the company into conflict with traditional media industries and to make it especially resilient in the face of such disturbances.

But why was Hulu pulled from Boxee? If Hulu, as a system, is aimed at exposing as many users as possible to the advertising packaged with its content, and if the Boxee desktop application—being more or less a highly specialized Web browser—carried few, if any, of the offending features that led Hulu to restrict the access of unauthorized mirror sites, why would Hulu restrict Boxee's access to its content? After all, by February 2009, Boxee came with a prospective audience of nearly a quarter million users. To answer the question, we must zoom out a bit to look more closely at some additional actors—some of whom turn out to be system builders in their own right. This will uncover some of the forces arrayed around and against Hulu and Boxee and subsequently inform a more analytically rich discussion of their system-building efforts.

Over the Top.

On February 18, 2009, Hulu CEO Jason Kilar posted an apologetic letter to Hulu's official blog, explaining that the company had requested to be removed from Boxee's software.

Kilar's post suggested that the decision to withdraw was not Hulu's, but that the company's "content providers requested that we turn off access to our content via the Boxee product, and we are respecting their wishes" (para. 3). Boxee complied. Representatives of the two companies subsequently met, but no agreement was forthcoming that would allow Boxee to restore the service in its original form.

It was around this time, early in 2009, that some commentators began wondering if Hulu was becoming too successful for its own good (Albrecht, 2009f). While cable companies like Viacom and Comcast struggled to meet their subscriber quotas during the economic downturn, traffic to Hulu was surging (Albrecht, 2009d; Gannes, 2009a). In February 2009, the number of visitors to Hulu.com grew by 33% in a single month, due in part to the popularity of a Superbowl ad that introduced the service to a wider audience (Gannes, 2009a). Both Hulu's News Corporation and NBCU parent companies, however, own cable channels whose lucrative per-subscriber licensing deals with cable providers far outstrip the advertising revenues drawn from Hulu, which would not even begin to turn a profit until the end of 2009 (Feld, 2009; Jayasuriya, 2009).

In principle, then, Hulu's parent companies might be wary of the startup becoming too successful—the owners of cable channels are understandably very sensitive about upsetting their relationships with cable providers, and if Hulu began making a dent in cable revenues, the site could very well become a point of contention (Albrecht, 2009f; Jayasuriya, 2009; Perren, 2010). It's little coincidence, for instance, that despite the fact Disney, News Corporation, and NBCU all own multiple cable channels, they put relatively little cable cable content on Hulu between 2008 and 2009 (Kafka, 2009a). That said, cable providers would have an exceedingly long way to fall, and Hulu an equally long way to go before online viewing displaced cable as the predominant means of television consumption (Jones, 2009; Logan, 2011). One important obstacle that stood in the way of this happening was the largely constructed divide between television and computer screens that existed in 2009 (Stone, 2009; Armstrong, 2009). As *New York Times* technology writer Brad Stone (2009) put it

> Piping Internet video into a television seems as if it should be simple—after all, a screen is a screen. But consumer electronics and media companies have been moving toward that combination with painstaking caution, both because of technical limitations and to protect their existing business models. (para. 1)

Meanwhile, though it can be viewed on an ordinary computer screen, Boxee, with its 10-foot user interface, Apple TV hack, and built-in support for 1080P high-definition video, was designed above all to allow users to watch Web video on a modern television set in a way that resembled channel surfing on cable. The company's CEO has publicly expressed a desire to make the software "a true alternative to expensive Cable/Sat[ellite television] subscriptions" (Ronen, 2008). And for at least some users in early 2009, this is exactly what it was achieving.[6] Boxee and similar devices arguably have the potential to become what's sometimes referred to as an "over the top" service—a means of receiving cable beyond those offered by existing major providers.

Cable providers, then, turn out to be powerful system builders in their own right, who exert influence on many different actors who might otherwise be aligned differently within the networks of other heterogeneous engineers. And the cable companies are understandably opposed to new forms of competition—so much so that an act of Congress was necessary to open up the traditional cable market to competition from satellite and IPTV providers (Feld, 2009; Ronen, 2010). Unsurprisingly, then, NBCU CEO Jeff Zucker, when asked about Boxee in 2009, explicitly stated that his company was "committed to Hulu being an online [only] experience" (Kafka, 2009c, para. 27). And in that year neither Hulu's parent companies, nor the major cable providers with which they work were amenable to streaming Web content to TV sets. Web entrepreneur and commentator, Marc Hedlund (2009) paints the scene from February 2009 as well as anyone:

---

6 See quotes from Boxee users in Stone, 2009 and the comments thread of Ronen, 2009a for anecdotal accounts.

> Boxee was featured in an awesome New York Times article one month ago, with a picture of their product on a big-screen TV, and Hulu's logo clearly visible in the upper right corner. I can almost hear some lawyer somewhere in Hollywood screaming, "I thought Hulu was a WEB SITE! I do NOT see a WEB BROWSER in this PHOTOGRAPH!" at the sight of it. (para. 8; emphasis original)

Whatever the exchange between Hulu and its corporate parents looked like behind the scenes, the reticence of content providers to upset relationships with cable providers by allowing users to pipe network television content from free Websites to their television sets presaged numerous examples on the same theme that would arise in the months and years to come, such as the networks' use of technological tools to shut off access to their content by Google TV set-top boxes, the rise of "TV Everywhere" authentication models demanding that online viewers be offline cable subscribers, as well as the seeking by both cable and content providers of declaratory judgments in U.S. courts over who has the right to distribute television content online to different sorts of screens, and on what terms. As we shall begin to see shortly, the Hulu-Boxee example turns out to be a prescient illustration of legacy television industries' willingness to engage in heterogeneous engineering—employing legal, technological, and economic tools in concert—to protect their revenue streams and position in the marketplace as distribution moves online.

Dotted Lines and Bottom Lines

While the relationships between media conglomerates and cable providers are sensitive at any time, the clampdown on Boxee also came during NBC's contract renegotiation with Comcast, the largest cable company in the U.S. (and one that would in short order acquire NBCU), prompting some commentators to suggest that NBCU would "probably do anything it can to show Comcast that it's fighting services like Boxee, which threaten cable" (Frommer, 2009a). Other deals were also on people's minds at the time. Hulu was burning daylight on its contract with Fox and NBC to be the exclusive third-party provider of their Web video offerings and some observers at the time wondered whether the networks might turn around and strike a

deal with TV.com or a similar portal once their initial contract with Hulu expired (Albrecht, 2009b).

As it turned out, the exclusive provider contracts were renewed shortly thereafter, and they likely played a role in nailing down a much larger deal by Hulu's corporate parents—bringing Disney in as an equity stakeholder in the company. Disney, which owns the ABC broadcast network, likely would not have signed its own exclusive deal with Hulu had the other networks not shown similar faith by renewing theirs (Kafka, 2009a). And, of course, Disney has all the same sensitive relationships with cable providers that News Corporation and NBCU do. We've begun to see how complicated the the network of financial relationships is in which Hulu is enmeshed. Without leaving these behind, we must also now consider some additional legal and technological factors.

Taming the Torrent

In its quest to be all things to all users, Boxee included support for as many file formats and as many content sources as possible. And, in accordance with its users' desires, among the features in Boxee's wheelhouse was a popular BitTorrent client, which allowed the software to download and play media from torrent files. This in turn could ostensibly mean that along with the all the media available legally in torrent form, users could also use Boxee to download pirated content.

Boxee, in implementing the feature, thus needed to strike a balance between maintaining its image with users as a company whose decisions prioritized their preferences, and avoiding a reputation with prospective content providers as "the BitTorrent client for your television set." Part of this process was rhetorical—the company publicly stated that its goal was to make legally available material easier to access online and to help professional providers monetize their content (Ronen, 2008, 2010). But the delicate balance was also reflected in the design of the software itself. For example, when users launched Boxee's BitTorrent client, they saw a custom feed consisting of only titles legally available from the public domain.

At the same time, several workarounds were available to users who wanted to see more than this legal, pre-approved fare. Users could create and install unauthorized plugins, akin to (but not included among) those available through Boxee's official app store, to allow them to search and download from a broader selection of torrent files. Alternatively, they could also use a different application to obtain the torrent files, and manually place those files into the directory where Boxee stored torrents queued for download; this would cause the Boxee software to download the media just as it would an authorized file. Another workaround involved users manually adding an RSS feed to Boxee containing links to their preferred torrent files. Boxee would then automatically allow the user to download them in the same fashion it did torrent files contained in its own authorized feed. Finally, even without resorting to Boxee's torrent functionality, if users illegally downloaded a song, film, or television program using another piece of software, Boxee could easily play the resulting media file.

These workarounds were well-publicized in tech blogs, as well as by posters on Boxee's own user forums, where they were at times mentioned even by Boxee's staff. In other words, in a bid to encourage the software's adoption, the company included and acknowledged the existence of affordances for users to download and play whatever content they wanted, but was careful not to publicize or streamline this functionality via the software's interface, which explicitly displayed and offered only legal content. We can thus see a good deal of rhetorical work being done here by the interface, through which Boxee threaded a needle between the filesharing demands of a broad user base on the one hand and the intellectual property regime of content providers on the other. This is in keeping with Chamberlain's (2010) analysis of digital television interfaces as being sites where the values and demands of many actors are "invested and contested." And the point is even further illustrated by the way the social features of Boxee's interface work. When the software reports your viewing activity to friends on social networks, it is programmed to obscure the fact that you have viewed an illegal download, using a pirated file's metadata to locate and share links to officially licensed versions of the same content for viewing or purchase online. Thus, the interface charts a creative middle course that protects

the privacy of infringing users while turning these "pirates" into tastemakers promoting sale of content providers' legitimate offerings (Jayasuriya, 2009).

It's unclear, as such, whether BitTorrent figured into Hulu's parents' decision to cut off Boxee—several commentators (Jayasuriya, 2009; Hedlund, 2009) thought it was unlikely, though all admitted this was a possibility. In either case, at the end of 2009 Boxee ultimately trimmed the built-in torrent downloading features from its software, likely in a bid to make the platform more palatable to content providers and device manufacturers as the company's plans of progressing to sales of set-top boxes began to advance.

Tug of War

When Hulu requested that Boxee remove its content in February 2009, the company took it down in good faith. But for determined users, Hulu never really left Boxee. On the same day Hulu support was ended by the company, independent developer Jake Marsh released a third-party plugin for the Boxee software that allowed users to watch Hulu anyway (Marsh, 2009a; Merritt, 2009). Marsh had written a PHP script that screen-scraped links to video content from Hulu's Webpage (or possibly its RSS feed), and assembled them into a custom RSS feed, which when fed into his app, directed Boxee to the desired content (Marsh, 2009b; Merritt, 2009). The plugin only worked on Macs, but users of other systems could also watch Hulu by going to Boxee's control panel and manually adding Marsh's custom RSS feed as a content source (Merritt, 2009).

Less than a month later, concerned about placating its growing, Hulu-hungry user base—and perhaps worried about the awkward position it would be in if large numbers of its users turned to pirating content—Boxee resumed official support for Hulu. Possibly inspired by Marsh, this time Boxee's software pulled in videos through Hulu's RSS feed rather than integrating the site's embeddable player. The interface was not as attractive or usable as the integrated player had been, but the method came closer, from Boxee's perspective, to mimicking the behavior of an ordinary Web browser, bolstering their claim to being an accepted method for accessing Hulu content (Albrecht, 2009d; Ronen, 2009b, 2009c). Hulu quickly responded the

same day by blocking Boxee's access to its RSS feeds, a countermeasure which Boxee had somehow circumvented by that evening (Albrecht, 2009e; Ronen, 2009c).

In its update to users on the situation, Boxee effectively vowed to continue working around Hulu's attempts to blockade it, asserting that it was "no different" than any other Web browser and therefore its access to Hulu in no way violated the law or any of the site's terms of use (Ronen, 2009c). In the post, Boxee CEO Avner Ronen even made a pledge to his users:

> [T]o our users: if you choose to use Boxee as your media browser to view legal and publicly available content on the internet, we will do everything we can to ensure that you can access it, no matter what the source. (Ronen, 2009c, para. 2)

This technological game of "spy vs. spy" continued for weeks, with Hulu continually finding new ways to cut access to Boxee, and Boxee in turn finding creative ways to circumvent them. Of course, keeping users happy with software that sometimes broke multiple times in the span of a single day was a challenge for Boxee. During this time, the company added a prominent status message to its interface, which kept users informed at all times as to whether Hulu was currently available (Ronen, 2009c). It also updated users constantly via its blog and other social media (Ronen, 2009c), even starting an additional Twitter account—@ishuluonboxee—where users could get up-to-the-minute updates on the status of the service.[7] Through these software features and communication channels, Boxee attempted to minimize user frustration with its software, while directing their dissatisfaction at Hulu.

Toward the end of March 2009, Boxee further bolstered its "just a browser" case when it unveiled a new release of the software that included a fully integrated Web browser, built using the same open source XUL interface language as Firefox (Papadopoulos, 2009). The Hulu RSS interface was dropped at this point, and the new browser henceforth became Boxee's official method of implementing Hulu. The Boxee Browser is a great feat of heterogeneous engineering on Boxee's part. In Lessig's (2006) sense, it simultaneously offers up a number of technological,

7 This account is still live at http://twitter.com/ishuluonboxee

legal, economic, and social affordances. The browser is a technological boon for the company in that the ability to display full HTML pages and inline video in principle allows Boxee's software to access any site on the Web, thus opening up a wide range of previously inaccessible content and reducing the need to develop a custom player solution for each content provider (Papadopoulos, 2009). It is also a legal affordance in that Boxee can now claim to be, in the most literal sense, "just a browser," making it relatively immune to claims that it violates commercial sites' terms of use. Because of this reduction in legal risk, Boxee in turn becomes more economically viable to investors, content providers, and device manufacturers. Finally, insofar as users understood the browser to be Boxee's latest answer to their demand for Hulu and an attempt to put their interests first, it furthered the company's social contract with the user base it had so heavily involved in its product development (the same base of users that it also hoped one day to market to device manufacturers).

Discussion

Many Networks

The simple way to sum up this case would be to conclude that both Hulu and Boxee serve multiple constituencies with conflicting interests. But there is a richer and more descriptive language for these interactions. Law (1987) instructed us to look at how different social/technological systems interact—to see system builders as competing to enroll various actors, attempting to associate their own network while dissociating or reconfiguring others. I initially set out to conceptualize how two system builders—Hulu and Boxee—competed to control the flow of Hulu's content. The hope was that following the path of the information flow as these two heterogeneous engineers attempted to influence it would help to uncover the legal, economic, and social interventions that so many authors—Hughes (1979), Law (1987), Oudshoorn and Pinch (2003), Lessig (2006), Flanegan, Howe, and Nissenbaum (2008), for example—instruct us to look for in examining technological systems. And indeed, we saw all these things at work. What became apparent in the process, however, was just how many system builders influenced information flow.

These system builders were not just corporate types, but included various groups of users and developers—different impact constituencies—with varying agendas, all of whom influenced the flow of content and the development of the software platforms. And this brings me to a second point, which is the remarkable impact that individual system builders frequently have online. Many of the sites that appropriated Hulu's content, such as TV Paradise and OpenHulu, were designed by individuals. Similarly, when Hulu and Boxee mutually agreed to discontinue the relationship between their products, rendering them inoperable together, there was Jake Marsh, within hours offering up a plugin and a custom RSS feed that effectively opened a new passage between Portugal and India, a virtual *volta*, as it were. Likewise, small groups of individual developers ported Boxee to Apple TV and helped to disseminate information about how to use Boxee's BitTorrent feature to obtain unauthorized content—actions that drastically changed not only where the flow of information to Boxee originated or how it was delivered, but the entire discourse surrounding the software and the company, which in turn impacted the startup's relationships with other companies/system builders.

Toward an Appreciation for the Kludge

We might typify the attempts of some of these system builders as acts of appropriation (Pfaffenberger, 1992), in which they employed information made available by another system builder in a manner the latter did not intend. Others we might call acts of *bridging* (which can simultaneously be acts of appropriation), in which a system builder creates a flow of information between two or more other previously unconnected systems. What's striking about such strategies in the context given by scholars like Hughes (1979) and even Law (1987) is that they often stand out as kludges—hastily assembled and often temporary solutions, improvised from the resources at hand. Boxee put together technical solutions for pulling in Hulu that sometimes only lasted a few hours. Jake Marsh's Boxee plugin was barely functional when he rushed it out the door (Merritt, 2009). The proprietors of OpenHulu and TV Paradise certainly must have known their services could not operate indefinitely without invoking a response from Hulu. And outside of the local case, the Web famously abounds with hacks, short term fixes, and solutions

to one-time problems. In the early days of Facebook, independent developers frequently released screen-scraping scripts to help users export their contacts from the site, realizing these would only work for a few days or weeks before Facebook did something—intentionally or otherwise—that disabled the hack. Linux forums are full of roundabout fixes for odd software problems, many of which only need to work for a few weeks or months until an announced patch becomes available or the next release cycle of the OS arrives.

Many of the most interesting scholars on the subject of the politics of technology focus on its obduracy. In driving home the point that artifacts have politics and design has implications, they look at how artifacts often stick around in such a way that we must live with the consequences of design (Hughes, 1979; Winner, 1986; Lessig, 2006; Bijker, 2006; Flanagan, Howe, & Nissenbaum, 2008). Law (1987) is only partially helpful here. With his focus on the tendency of actor networks to fall out of alignment and dissociate, he certainly appreciates the fact that attempts at system building can prove ephemeral. But at the same time, he takes the goal of system building to be the formation of a stable network that withstands dissociation. Many attempts at bridging and appropriation, on the other hand, are understood by their designers to be temporary—even intended to be so. And yet we cannot discount these efforts as systems because even kludges require the enrollment of relevant actors and fit the definition of actor networks more generally. And in fact, in an important sense, they do resist dissociation—just barely long enough to do the job for which they were intended. Equally important, kludges may be temporary, but they can produce lasting impacts.

Pfaffenberger's (1992) concept of the technological drama fits a bit more precisely here, in which technologists engage in dialogues, creating artifacts to regulate and counterartifacts to undo or modify regulatory regimes. There is room in this view for stable and heterogeneous networks and systems, but also for more ephemeral technological configurations that serve as salvos in an ongoing dialogue. In particular, Boxee's ongoing tug of war with Hulu, in which service was alternately shut off and restored at frequent intervals over the course of months, has this sort of dialogic quality to it. This is especially true when we add more traditional forms of

dialogue to the picture, such as Boxee's escalating rhetoric during this time concerning its ongoing commitment to users and the logic of classifying its software as a browser.

Conclusion

The field of science and technology studies—and within it, the history and sociology of socio-technical systems—is expansive. While the space of a single article is limited, and the concepts I have so far introduced are few, I hope I have demonstrated the immediate utility that scholarship on systems has to researchers examining the present cultural and industrial upheaval surrounding digital distribution of television and other media. So much has happened in the world of online television distribution since 2009 that an appropriate afterward would be as long as this article. Cable companies have started or ramped up their own online video portals. Hulu's relationships with its parent companies have come under stress repeatedly—it was nearly sold off in the last year, and now appears likely to switch to the authentication business model preferred by cable providers. NBCU's role in Hulu also changed substantially after Comcast purchased NBCUniversal. What's more, the interplay between Hulu and Boxee itself has evolved greatly; their tussle has largely ended with the release of Hulu's "Hulu Plus" subscription service and Boxee's first official set-top boxes. The contractual language surrounding the former, Hulu Plus, greatly clarifies the terms on which users, software vendors, and hardware manufacturers can use Hulu content. Meanwhile, last, but not least, Boxee itself has dramatically changed its relationship with end users, first by rendering the software packaged with its hardware devices much more difficult for end users to modify (largely at the behest of content subscription services like Hulu and Netflix), and finally by discontinuing the PC and Apple TV versions of its software entirely in January of 2012. The Boxee software has, both literally and figuratively, been black-boxed in the form of an onyx plastic cube with a video jack.

The flow of content online—the online video *volta*—continues to be shaped by myriad system builders from major corporations to individual end users, and through the evolution of complex networks of alliances. This in itself—that changes to entrenched models of media distribution are complex and fraught with conflicting interests—is not surprising. However, the

language and insights offered up by the history and sociology of socio-technical systems present us some firm ground on which to stand as we seek to make sense of these fluid systems even as they change tumultuously, and to grapple intelligently with how their complexities are contingently determined.

While media scholars relying on more familiar frameworks have already produced a good deal of valuable research, much of this work has either documented changes to industries with which media scholars have long and great familiarity, or focused on the collection of ethnographic or quantitative data about buzzword practices like filesharing, both of which are highly interesting and necessary. But studies oriented around traditional industries tend to omit the contributions of players coming from unexpected quarters—in an age where kludges matter, an impact can be made not just by a studio or cable provider, but by a hobbyist developer in North Carolina. And trend-oriented studies of filesharing or online streaming tend to document the habits of users and audiences as they become well-established, at the risk of missing the creative, improvisational and dialogic (i.e., dramatic) process by which such routines are hammered out. Constructs like heterogeneous engineering, technological dramas and others from the lexicon built by scholars of socio-technical systems may well offer us a way to handle the evolution, complexity, and unpredictability of rapidly evolving systems of media distribution and render them in conceptual clarity—a promise that should be particularly welcome as we grapple with understanding the present tumult that will shape the terms on which television reaches all our screens in the future.

Works Cited

Albrecht, C. (2008a, March 3). TV Paradise down, OPENHulu not updating. *NewTeeVee*. Retrieved May 30, 2011, from http://gigaom.com/video/tv-paradise-down-openhulu-not-updating/

Albrecht, C. (2008b, June 10). Scoop: Boxee to Go Alpha on Monday. *NewTeeVee*. Retrieved June 5, 2010, from http://newteevee.com/2008/06/10/scoop-boxee-to-go-alpha-on-monday/

Albrecht, C. (2009a, February 6). Why does everyone heart boxee? *GigaOm*. Retrieved June 5, 2010, from http://gigaom.com/2009/02/06/why-does-everyone-heart-boxee/

Albrecht, C. (2009b, February 18). Hulu Yanks Content from TV.com, the Race Begins. *NewTeeVee*. Retrieved June 6, 2010, from http://newteevee.com/2009/02/18/hulu-yanks-content-from-tvcom-the-race-begins/

Albrecht, C. (2009c, February 18). Say Good-bye to Hulu on Boxee. *NewTeeVee*. Retrieved June 6, 2010, from http://newteevee.com/2009/02/18/say-goodbye-to-hulu-on-boxee/

Albrecht, C. (2009d, March 6). Hulu Back on Boxee or, Thank You, RSS! *NewTeeVee*. Retrieved June 6, 2010, from http://newteevee.com/2009/03/06/hulu-back-on-boxee-or-thank-you-rss/

Albrecht, C. (2009e, March 6). Whoops! Hulu removed (again) from Boxee. *NewTeeVee*. Retrieved May 30, 2011, from http://gigaom.com/video/whoops-hulu-removed-again-from-boxee/

Albrecht, C. (2009f, May 12). When You Are Your Own Worst Enemy, What's a Hulu to Do? *NewTeeVee*. Retrieved June 6, 2010, from http://newteevee.com/2009/05/12/when-you-are-your-own-worst-enemy-whats-a-hulu-to-do/

Anderson, C. W. (2009). *Breaking journalism down.* Unpublished doctoral dissertation, Columbia University.

Armstrong, M. (2009, January 7). Gadget Lovers Gather in Las Vegas for CES [Radio segment]. *Morning Edition*. Washington, D.C.: NPR. Retrieved May 2, 2012 from http://www.npr.org/templates/story/story.php?storyId=99071523

Baym, N. (2010). Embracing the flow [Research memo]. *Convergence Culture Consortium*. Cambridge, MA: MIT Press.

Barnes, B., & Bloor, D. (1982). Relativism, rationalism and the sociology of knowledge. In M. Hollis & S. Lukes (Eds.), *Rationality and relativism* (Vol. 22, pp. 21-47). Cambridge, MA: MIT Press.

Benkler, Y. (2006). *The wealth of networks*. New Haven, CT: Yale University Press.

Bijker, W. E. (1995). *Of bicycles, bakelites and bulbs.* Cambridge, MA: MIT Press.

Bijker, W. E. (2006). Why and how technology matters. In R. E. Goodin & C. Tilly (Eds.), *The Oxford Handbook of Contextual Political Analysis.* Oxford, UK: Oxford University Press.

W. E. Bijker, T. P. Hughes, & T. J. Pinch (Eds.). (1987). *The social construction of technological systems*. Cambridge, MA: MIT Press.

boyd, D. (2010). Streams of content, limited attention. *Educause Review,* pp. 26–36.

Bruns, A. (2008). *Blogs, Wikipedia, Second Life, and beyond*. New York: Peter Lang.

Bugos, G. (2000). System reshapes the corporation. In A. C. Hughes & T. P. Hughes (Eds.), *Systems, experts, and computers* (pp. 113–131). Cambridge, MA: MIT Press.

Callon, M. (1986). Some elements of a sociology of translation. In J. Law (Ed.), *Power, Action and Belief* (pp. 196–233). Boston: Routledge & Kegan Paul.

Carey, J. (1989). *Communication as culture*. Boston: Unwin Hyman.

Castells, M. (2010). *The rise of the network society.* Oxford: Blackwell.

Chamberlain, D. (2010). Television interfaces. *Journal of Popular Film and Television, 38*(2), 84–88.

Chapman, G. (2007, May 7). NBC, Viacom join in copyright battle with YouTube. *AFP Newswire*. San Francisco, CA. Retrieved from the LexisNexis Academic Database.

Chia, R. (1995). From modern to postmodern organizational analysis. *Organization Studies, 16*(4), 579–604.

Collins, H. M. (1981a). Stages in the empirical programme of relativism. *Social Studies of Science*, *11*(1), 3-10.

Collins, H. M. (1992). *Changing order*. Chicago: University of Chicago Press.

Collins, H. M., & Pinch, T. (1998). *The golem* (2nd ed.). New York: Cambridge University Press.

Couldry, N. (2008). Actor network theory and media. In A. Hepp, F. Krotz, S. Moores, & C. Winter (Eds.), *Connectivity, networks and flows* (pp. 93-109). Cresskill, New Jersey: Hampton Press.

Cowan, R. S. (1983). *More work for mother.* New York: Basic Books.

Domingo, D. (2008). Interactivity in the daily routines of online newsrooms. *Journal of Computer-Mediated Communication, 13*(3), 680–704.

Downey, G. (2001). Virtual webs, physical technologies, and hidden workers. *Technology and Culture*, *42*(2), 209-235.

Feld, H. (2009, March 22). Cable programers not giving up the fight to save the traditional business model, and they have the clout to do it. *Public Knowledge Blog.* Retrieved June 6, 2010, from http://www.publicknowledge.org/node/2035

Flanagan, M., Howe, D. C., & Nissenbaum, H. (2008). Embodying values in technology. In J. van den Hoven & J. Weckert (Eds.), *Information Technology and Moral Philosophy* (pp. 322-353). Cambridge, UK: Cambridge University Press.

Frommer, D. (2009a, March 6). Hulu gets nasty, blocks Boxee browser from videos. *Business Insider.* Retrieved June 6, 2010, from http://www.businessinsider.com/hulu-gets-nasty-blocks-boxee-browser-from-videos-2009-3

Gannes, L. (2008, January 7). Essay: The end of exclusivity. *NewTeeVee*. Retrieved June 5, 2010, from http://newteevee.com/2008/01/07/essay-the-end-of-exclusivity/

Gannes, L. (2009a, March 23). Hulu Grew 33% in February. *NewTeeVee*. Retrieved June 6, 2010, from http://newteevee.com/2009/03/23/hulu-grew-33-in-february/

Gannes, L. (2009b, November 23). Hulu's New Embed Policy Can Only Hurt It. *NewTeeVee*. Retrieved June 5, 2010, from http://newteevee.com/2009/11/23/hulus-new-embed-policy-can-only-hurt-it/

Gans, H. (1980). *Deciding what's news*. New York: Vintage Books.

Gieryn, T. (2002). What buildings do. *Theory and Society, 31*(1), 35–74.

Gillespie, T. (2007). *Wired shut.* Cambridge, MA: MIT Press.

Gillespie, T. (2010). The politics of "platforms." *New Media & Society, 12*(3), 347–364.

Goo, S. K. (2006, June 28). NBC taps popularity of online video site. *The Washington Post*, D01. Washington, DC. Retrieved from LexisNexis Academic Database.

Gramsci, A. (1999). *The modern prince* [Electronic Version]. In Q. Hoare & G. N. Smith (Eds.), *Selections from the prison notebooks* (pp. 313–444). London: ElecBook.

Hedlund, M. (2009, February 18). Hulu's Superbowl ad and the Boxee fight. *O'Reilly Radar*. Retrieved July 14, 2011 from http://radar.oreilly.com/2009/02/hulus-superbowl-ad-and-the-box.html

Hemmingway, E. (2008). *Into the newsroom*. New York: Routledge.

Hughes, T. P. (1979). The electrification of America. *Technology and Culture,* 20(1), 124–161.

Hughes, T. P. (1983). *Networks of power*. Baltimore: Johns Hopkins University Press.

Hughes, T. P. (1987). The evolutions of large technological systems. In W. E. Bijker, T. P. Hughes, & T. J. Pinch (Eds.), *The Social Construction of Technological Systems* (pp. 51–82). Cambridge, MA: MIT Press.

Hughes, T. P. (1998). *Rescuing prometheus*. New York: Pantheon.

Hutchins, E. (1995). *Cognition in the wild*. Cambridge, MA: MIT Press.

Jackson, M. H., Poole, M. S., & Kuhn, T. (2002). The social construction of technology in studies of the workplace. In L. A. Lievrouw & S. M. Livingstone (Eds.), *Handbook of New Media* (pp. 236–253). Thousand Oaks, CA: Sage Publications.

Jayasuriya, M. (2009, February 19). Studios block Boxee from accessing Hulu content, shoot selves in feet. *Public Knowledge Blog.* Retrieved June 6, 2010, from http://www.publicknowledge.org/node/2002

Jenkins, H. (2009, February 11). If it doesn't spread it's dead (part one). [Blog post]. *Confessions of an aca-fan.* Retrieved October 15, 2011 from http://www.henryjenkins.org/2009/02/if_it_doesnt_spread_its_dead_p.html

Jones, E. (2009, April 26). Network television streaming technologies and the shifting television social sphere. Paper presented at the Media in Transition 6 Conference, Cambridge, MA.

Kafka, P. (2009a, April 27). Why it took more than four months, and millions of dollars, to get "Lost" on Hulu. *All Things Digital*. Retrieved June 5, 2010, from http://mediamemo.allthingsd.com/20090501/why-it-took-more-than-four-months-and-millions-of-dollars-to-get-lost-on-hulu/

Kafka, P. (2009b, April 27). Disney readies pact for movies and ABC shows with Fox and NBC's Hulu. *All Things Digital.* Retrieved June 5, 2010, from http://mediamemo.allthingsd.com/20090427/disney-gets-ready-finally-to-hold-hands-with-hulu/

Kafka, P. (2009c, May 28). NBC CEO Jeff Zucker: Hulu will start breaking even "soon". D7 Highlights. *All Things Digital.* Retrieved June 6, 2010, from http://d7.allthingsd.com/20090528/d7-interview-nbc-universal-ceo-jeff-zucker/

Kilar, J. (2009, February 18). Doing hard things. *Hulu Blog.* Retrieved on October 15, 2011 from http://blog.hulu.com/2009/02/18/doing-hard-things/

Kline, R., & Pinch, T. (1996). Users as agents of technological change. *Technology and Culture, 37*(4), 763–795.

Kompare, D. (2010). Reruns 2.0. *Journal of Popular Film and Television, 38*(2), 79–83.

Kramer, S. D. (2008, January 7). Hulu says Veoh is violating terms of use but no sign of action—yet. *PaidContent.org.* Retrieved June 5, 2010, from

http://paidcontent.org/article/419-hulu-could-take-action-against-veoh-for-mass-embedding/

Latour, B. (1987). *Science in action.* Cambridge, MA: Harvard University Press.

Latour, B. (as Jim Johnson) (1988). Mixing humans and nonhumans together. *Social Problems, 35*(3), 298–310.

Latour, B. (1996). *Aramis, or, the love of technology.* Cambridge, MA: Harvard University Press.

Latour, B. (2007). Reassembling the social. New York: Oxford University Press.

Law, J. (1986). On the methods of long-distance control. In J. Law (Ed.), *Power, Action and Belief* (pp. 234–263). Boston: Routledge & Kegan Paul.

Law, J. (1987). Technology and Heterogeneous Engineering. In W. E. Bijker, T. P. Hughes, & T. J. Pinch (Eds.), *The social construction of technological systems* (pp. 111-134). Cambridge, MA: MIT Press.

Law, J. (1992). Notes on the theory of the actor-network. *Systemic Practice and Action Research*, 5(4), 379–393.

Law, J. (2002a). *Aircraft stories*. Durham, N.C.: Duke University Press.

Law, J. (2002b). On hidden heterogeneities. In J. Law & A. Mol (Eds.), *Complexities* (pp. 116–141). Durham, NC: Duke University Press.

Law, J. (2011). Heterogeneous engineering and tinkering. Paper presented at the International Conference on The Body and Catastrophe, Seoul, Korea.

Law, J., & Hassard, J. (Eds.). (1999). *Actor network theory and after.* Malden, MA: Blackwell Publishers/The Sociological Review.

Law, J., & Mol, A. (2002). Local entanglements or utopian moves. In M. Parker (Ed.), *Utopia and organization* (pp. 82–105). Oxford: Blackwell.

Lessig, L. (2006). *Code: Version 2.0.* New York: Basic Books.

Logan, K. (2011). Hulu.com or NBC? *Journal of Advertising Research, 51*(1), 276.

Lotz, A. D. (2007). *The television will be revolutionized*. New York: NYU Press.

Marsh, J. (2009a, February 18). TV Library 0.1: Miss Hulu on Boxee? Here's your fix! *The Jake Marsh.com*. Retrieved June 6, 2010, from http://thejakemarsh.com/1808/

Marsh, J. (2009b, July 7). Screen-Scraping with CSS selectors in PHP. *The Jake Marsh.com*. Retrieved June 6, 2010, from http://thejakemarsh.com/1982/

Merritt, T. (2009, February 25). Insider secrets: Bring Hulu videos back to Boxee. *CNET*. Retrieved May 2, 2012 from http://cnettv.cnet.com/bring-hulu-videos-back-boxee/9742-1_53-50005334.html

Mould, O. (2009). Lights, camera, but where's the action? In V. Mayer, M. J. Banks, & J. T. Caldwell (Eds.), *Production Studies* (pp. 203–213). New York: Routledge.

Newman, M. Z. (2011). Free TV. *Television & New Media*, published online before print edition.

Nissenbaum, H. (2011). From preemption to circumvention. *Berkeley Technology Law Journal, 26*(3), 1367–1386.

Oudshoorn, N., & Pinch, T. J. (Eds.). (2003). *How users matter*. Cambridge, MA: MIT Press.

Papadopoulos, J. (2009, March 26). Boxee Meetup NYC. *Techspank.* Retrieved April 10, 2009 from http://techspank.com/?p=225

Perren, A. (2010). Business as unusual. *Journal of Popular Film and Television, 38*(2), 72–78.

Pfaffenberger, B. (1992). Technological dramas. *Science, Technology, and Human Values*, *17*(3), 282-312.

Pinch, T. J., & Bijker, W. E. (1984). The social construction of facts and artefacts. *Social Studies of Science, 14*(3), 399–441.

Plesner, U. (2009). An actor-network perspective on changing work practices. *Journalism, 10*(5), 604.

Ronen, A. (2008, October 22). Hulu, CBS, Comedy Central and what's next. *Boxee Team Blog.* Retrieved June 6, 2010, from http://blog.boxee.tv/2008/10/22/hulu-cbs-comedy-central-and-whats-next/

Ronen, A. (2009a, February 18). The Hulu situation. *Boxee Team Blog.* Retrieved June 5, 2010, from http://blog.boxee.tv/2009/02/18/the-hulu-situation/

Ronen, A. (2009b, March 6). New version + Hulu update. *Boxee Team Blog.* Retrieved June 6, 2010, from http://blog.boxee.tv/2009/03/06/new-version-hulu-update/

Ronen, A. (2009c, March 6). The trials and tribulations of innovation. *Boxee Team Blog.* Retrieved June 6, 2010, from http://blog.boxee.tv/2009/03/06/the-trials-and-tribulations-of-innovation/

Ronen, A. (2010, January 20). Coming soon: Boxee payments. *Boxee Team Blog.* Retrieved June 6, 2010, from http://blog.boxee.tv/2010/01/20/coming-soon-boxee-payments/

Russell, T. (2007, October 29). First look: Hulu combines ease of use, content, advertising. *Wired*. Retrieved June 5, 2010, from http://www.wired.com/software/softwarereviews/news/2007/10/hulu_review

Schmitz Weiss, A., & Domingo, D. (2010). Innovation processes in online newsrooms as actor-networks and communities of practice. *New Media & Society, 12*(7), 1156–1171.

Simon, R., & Rose, B. (2010). Mixed-up confusion. *Journal of Popular Film and Television, 38*(2), 52–53.

Silverstone, R. (1994). *Television and everyday life.* New York: Routledge.

Sørenson, K. H., & Levold, N. (1992). Tacit networks, heterogeneous engineers, and embodied technology. *Science, Technology, and Human Values, 17*(1), 13–35.

Stone, B. (2009, January 17). Boxee, used to view Web on TV, generates buzz. *The New York Times.* Retrieved May 2, 2012 from http://www.nytimes.com/2009/01/17/technology/internet/17video.html?_r=1

Turner, F. (2005). Actor-networking the news. *Social Epistemology, 19*(4), 321–324.

Turow, J. (1992). *Media systems in society*. New York: Longman.

Usher, N. (2011). *Making business news in the digital age*. Unpublished doctoral dissertation, University of Southern California.

Williams (1975). *Television.* New York: Schocken Books.

Winner, L. (1986). *The whale and the reactor*. Chicago: University of Chicago Press.