Panel: (Invisible) Internet Infrastructure Labor

This panel looks at information infrastructure labor in order to understand the work that is often invisible to many Internet users. Through this inquiry, we aim to open up the black box of the how the monolithic Internet works. We aim to show how the work of some becomes invisible to others and how these labor relations produce Internet infrastructure.

"Information labor" has historically been underexamined in studies of "information revolutions," (Blok, 2003: 5). Downey has examined information labor in studies of "Telegraph Messenger Boys" and gives a helpful framework for thinking about labor "within their internetworked institutions" in relation to occupational identities, products, changing technical systems and production of technological spaces (Downey, 2002: 13). Downy revealed the dual roles of messenger boys as workers and commodities that were an integral part within changing business strategies of telegraphy and telecommunication industry. Information labor is not isolated in these internetworked institutions, it is involved in popular discourses about jobs and technical systems. Downey's messenger boys are examples of how one person's work can be invisible information infrastructure to others.

As Downy contextualized the invisible messenger workforces in the era of telegraph and telecom, researchers are looking at various forms of online activities from a labor perspective, considering value creation and opportunities for capital accumulation in activities such as: (a) participation in communities; (b) use of Google, YouTube, Facebook and other online social media platforms; and (c) creation of media/content (e.g. Sholtz, 2012). Some arguments about "digital labor" have endeavored to blur the line between production and consumption, complicating traditional labor frameworks. Other arguments have centered on how "value" is created online and whether this "work" is exploitative or agentic or whether it is even "labor" at all. In general, "digital labor" includes participation in communities, social media platforms, and internet culture production, but not to the work that is involved in maintaining the underlying Internet on which much of this activity happens.

In this panel we aim to extend analysis of "digital labor" and "information labor" to Internet infrastructure labor. Scholars who write about Internet infrastructure, those who Sandvig calls "relationists," note that infrastructure is often invisible, but also importantly relational — one person's infrastructure is another person's daily work (Sandvig, 2013). While the relational framing of infrastructure can be problematically recursive, here we attempt to stabilize "infrastructure": if we think of the Internet infrastructure relationally, the concern of this panel is invisible work in Internet infrastructure that facilitates the "digital labor."

We take from scholars like Terranova and Downey a political economy framework, and from "infrastructure studies" the imperative to "get in the guts." We focus on specific labor in order to "make comprehensible the invisible negotiations that are producing the infrastructure" (Sandvig, 2013).

Panelists present papers that address and are not limited to the following questions:
- How does Internet infrastructure work become invisible?
- How does labor shape how the Internet infrastructure works?
- What does a labor perspective bring to infrastructure studies?
- What are the social and technical divisions of labor?
- How are Internet infrastructure laborers bound to the understandings of the Internet itself?
- How is Internet infrastructure labor bound or in opposition to traditional ideas of "class"?

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Laboring Behind the Search Box

Shinjoung Yeo
University of Illinois at Urbana-Champaign
Graduate School of Library & Information Science
USA
yeo1@illinois.edu

Abstract

This paper illustrates the labor processes of the search engine industry by offering analysis of emerging labor organization and occupational structures. The industry is known for the creation of and reliance on highly skilled and highly paid workers; however, it is likewise crucially dependent on a growing class of low-waged contingent workers such as quality raters who evaluate search engine results pages for proposed changes in search algorithms. Moreover, the industry counts massively on an entirely different category of labor – unwaged user labor in the form of Internet users themselves. These two groups' much-needed work in the development of the industry is rendered mostly invisible and obfuscated by seemingly magical technology, but this paper will demonstrate a distinctive hierarchy and division of labor within the search engine industry labor force.

Keywords

google; search engine industry; labor; unwaged labor; quality raters; occupational structure

According to one IT industry expert, the search engine is a key piece of 21st century infrastructure: "building and maintaining a search engine is so expensive and labor intensive that it requires the same kind of planning and upkeep that, say, the Golden Gate Bridge does" (Dagan, 2010). This statement defies the popular notion of the search engine industry as the emblem of the "new" information economy, which, unlike the industrial capitalist economy, needs very little in the way of human labor. Yet, technology as a social process embodies human labor, and the search engine is no exception – every link on the Web and each keystroke on a computer contain human labor. Search engine technology is so seamlessly embedded in our daily lives, however, that it masks a whole series of complex labor processes that enable it.

There is a growing interest among scholars on the implications of the social and political functions of the search engine (Introna & Nissenbaum, 2001; Hargittai, 2003, 2004; Hindman, 2008; Halavais, 2009; Vaidhyanathan, 2011); however, relatively little research is available on search engine industry labor processes. Addressing this gap, the paper will clarify the social relations between capital and labor and offer an analysis of labor and occupational structures in the industry.

The common myth of the search engine industry is that it is generally reliant on highly-skilled workers as the industry has shifted from human edited-directories to automated crawler-based technologies. Yet, the need for and use of human labor have by no means been eliminated; on the contrary, it has intensified.

In fact, the industry relies on an array of highly skilled and educated employees. And it has been absorbing "highly skilled" IT workers – software engineers, research scientists and engineers,

product managers, financial analysts, and the like.[1] However, beneath this small segment of highly-skilled workers there are legions of low-paid contingent workers that support the industry. Huws (2003) describes them as process workers who work under strict direction and tight control and are isolated from their co-workers.

Google, for instance, has long attributed the supremacy of its search results to its automatically configured algorithm. Yet, Google has acknowledged that the company hires a great number of human evaluators to pretest its algorithm (Levene, 2010). They are often referred to as "quality raters" whose major tasks are to evaluate search and/or advertising "relevancy" before the company releases an alteration to its algorithm. The average salary for quality raters is $13-16/hr with no benefits or job security.[2]

So far, there are no official numbers on how many quality raters are employed by the industry. Some claim that Google employs more than 10,000 quality raters (Schwartz, 2007); however, the company has so far avoided the provision of that data. While the nature of the job for quality raters is described by Google as flexible and self-directed, it is tightly managed as the raters perform their tasks based on a 125-page manual of specific guidelines. Quality raters are not exclusive to Google or to search engine companies; they are a standardized workforce in many Internet companies that rely on search as a basic function for access and revenue generation. These low-wage quality raters consist of a new category of workers and are an integral part of the search engine industry workforce.

If quality raters are at the bottom of the hierarchy for wage-labor that supports the search engine business, there is an overlooked and even larger workforce that is unwaged: a great mass of user labor in the form of Internet users themselves. The value of this unpaid labor has long been acknowledged by capital, and whether or not users are aware of it, if they function to valorize capital investment, they are considered productive workers (Douglas & Guback, 1984, p. 238).

Search engine firms depend on user labor for the most capital- and labor-intensive part of their work – providing feedback on algorithms, creation of content, and constant testing of new products. Unwaged users work side-by-side with paid workers as they perform various tasks and their labor is systematically incorporated into production processes. For example, Google changes its search-ranking algorithm 500 – 600 times annually.[3] One of the numerous factors determining algorithm changes is user search activity. This activity signals Google to tune the search algorithm in order to match user queries with context-appropriate advertisements.

As of 2012, Google had 173 million unique visitors per month, with an average of 101.5 minutes per visitor per month in unpaid labor.[4] This equates to an additional 1,829,115 workers per month working full time for Google – the ratio of unpaid-full-time to paid full-time is almost 1000:1. 1.8 million people are not categorized as a productive force in classical economic terms or included in the generation of GDP, but their activities are as vital as the 11,665 full time Google employees in research and development – if not more so – as their activities contribute to

[1] See 2011 Silicon Valley Information and Communications Technologies Study on changing workforce in Silicon Valley at http://www.work2future.biz/images/documents/TechStudyFullReport_03.pdf

[2] The job site *Glassdoor* lists $13-16 for the average hourly wage for quality raters/ads quality raters. See at http://www.glassdoor.com/Salaries/quality-rater-salary-SRCH_KO0,13.htm

[3] See more detailed history of Google algorithm changes at http://www.seomoz.org/google-algorithm-change

[4] See 2012 Nielsen US web ratings at https://docs.google.com/spreadsheet/pub?key=0AuZLaKQQs5xpdGdJNFZEdHhLUXJLa240WmsyZmFWbFE&output=html

Google's revenue generation. The role of this user labor in profit-making for the search engine industry is not a secret. In 2005, Microsoft Chairman Bill Gates somewhat ironically pointed out that Google doesn't share ad revenues with end users who help them get the revenue, saying, "Google keeps all of the money with [sic] itself" (Ribeiro, 2005).

In the search engine industry, there are no longer human indexers per se as search technology has become automated; however, their work has not been entirely eliminated; rather the automation has led to the emergence of a new class of low-waged workers. More importantly, the industry is able to rely on a small, highly-skilled and highly-paid workforce as it has externalized many of its labor processes by incorporating a vast pool of unpaid user labor.

The search engine industry has often viewed this as the path forward for the "new" information economy in which workers are not exploited but rather are empowered, highly-paid and engaged in creative work. Many celebrate this new information-based economy as the driving force behind the prosperity of workers and the building of a more egalitarian society. Yet, the actual emerging labor structure and organization of the search engine industry give us quite a different story.

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"Platformizing" Higher Education: MOOCs and the Changing Labors of Educators

Shreeharsh Kelkar
Massachusetts Institute of Technology
Program in History, Anthropology and Science, Technology and Society
USA
skelkar@mit.edu

Abstract

This paper tracks the development of an infrastructure (or a *platform*) for higher education. It asks: what does the platform mean to the different actors involved in its production and how is it maintained as a lived infrastructure through their labors? I investigate the changing labors of two roles in the Massive Open Online Courses (MOOCs) ecosystem: platform-builders (programmers and others) and educators (teachers). I suggest that the overarching vision of the MOOC system means that the primary labor of platform-builders is seen to be building *technical interfaces* to the platform, maintaining and improving the core infrastructure as well as managing their *organizational* relationships to other actors. The job of course content creation is seen as the domain of educators, whose labor shifts towards issues of media production and designing assessments; in both these activities, they use their imaginations of their students as well as "data" about students understood through "analytics."

Keywords

platforms; internet labor; digital labor; knowledge infrastructure; cyberinfrastructure.

Introducing the MOOC Eco-System

STS scholars have become broadly interested in how particular kinds of knowledge infrastructures/cyberinfrastructures are made, and how they, in fact, become infrastructures i.e. invisible, and taken for granted (Bowker & Star, 2000; Jackson, Edwards, Bowker, & Knobel, 2007). This paper tracks the development of an infrastructure (or *platform*) for higher education in the United States and abroad. It asks: what does the platform mean to the different actors involved in its production and how is it maintained as a lived infrastructure through these labors? I investigate ethnographically the changing labors of two actors in the Massive Open Online Courses (MOOCs) ecosystem: platform-builders (programmers and others) and educators (teachers).

The seemingly precipitous advent of the Massive Open Online Course (or MOOC), has brought the trend of "platforms" (Gawer & Cusumano, 2002) dramatically to the field of higher education, as colleges and universities have seized upon shared platforms as a way to increase flexibility and access, build economies of scale (Archibald & Feldman, 2010), as well as to promote pedagogical innovations. The MOOC ecosystem consists of a variety of stakeholders: in terms of roles these include students, educators, programmers, media producers, employers, psychometricians, computer and "learning" scientists, among others; in terms of institutions, these include colleges and universities, tech companies and start-ups, textbook publishers, media production companies, and even advertisers. What kinds of labors by different actors produce the lived reality of the platform?

I focus on edX, a MOOC platform—although jointly created by MIT and Harvard—that functions as an independent non-profit. edX is seen by its makers as just a "publishing platform"; the creation of course content is seen as the responsibility of the individual institutions of learning affiliated to edX. Practically this has been accomplished by creating separate sub-organizations within the university in charge of generating this content. Thus, MIT has its own internal organization called MITx (itself part of an Office of Digital Learning) whose task it is to look for courses and materials that can be "published" on edX. ("Feed the beast" was the expression used in one meeting).

Each of these sub-organizations (HarvardX, MITx, BerkeleyX, etc.) has several other duties. They need to create standard infrastructures for making course materials (shooting video, editing, paying professors and TAs, taking care of IP issues, etc.). Occasionally, when a course demands new technical infrastructure, they make a formal request to edX to develop it (for that particular course). Whether such a request gets implemented—sometimes by joint work between their programmers with those of edX—depends on the relative strength of the sub-organization with respect to edX. This ecosystem is shown in Figure 1.

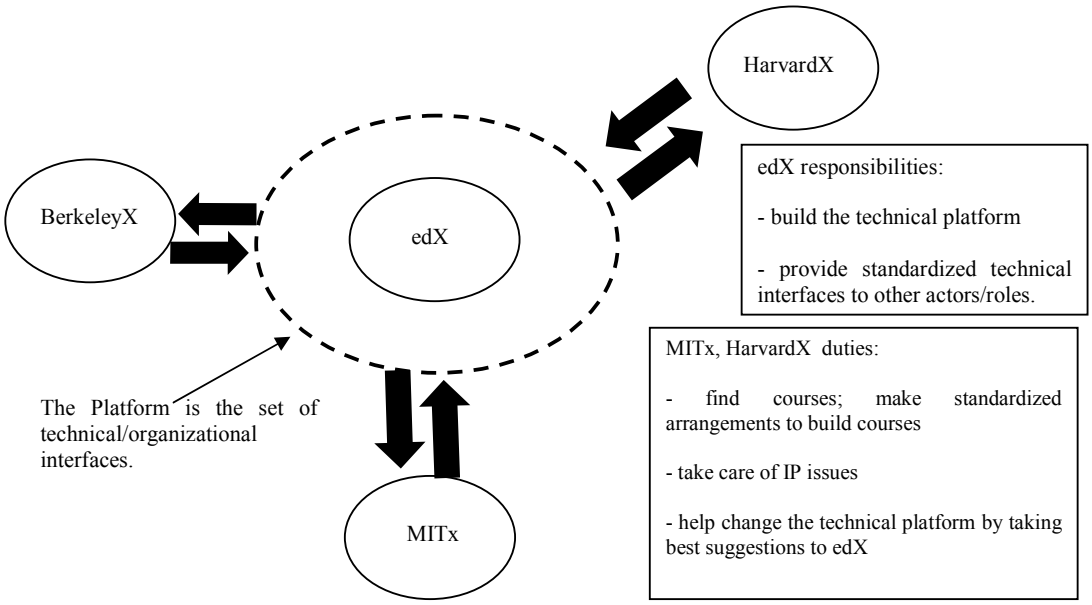

Figure 1: The edX ecosystem. EdX and its sister organizations have seemingly parallel duties: publishing and content creation respectively.

Changing Labors

How does the development of the platform shape the labors of platform-builders (i.e. the programmers and other employees of edX), and the educators (housed in the sister institutions)?

Platform-Builders

For the technical platform-builders, the task becomes to develop standardized technical and organizational channels of communication between themselves and actors in other roles. Their goal seems to be to distribute innovation, yet retain overall control.

For example, consider Studio, a "web-based tool that allows for the self-service authoring of courses for the edX platform." Often referred to as a CMS (Content Management System) or an LMS (Learning Management System), Studio allows educators to create their course website i.e. arrange the lectures, quizzes and other supplementary material (and preview their work) so that it becomes ready for publishing. Yet, as an edX employee pointed out in a session devoted to teaching how to use Studio to educators, Studio can only be used after the "hard work [of designing the class, shooting the videos, etc.] has been done." Studio provides a graphical user interface (GUI) for the layout ("authoring") of the course content. Rather than using an arcane edX XML mark-up language, educators can now create their course websites in an intuitive WYSIWYG (what you see is what you get) form

As a "course-writing" tool, Studio is a technical intervention that shifts the labor of "course writing" within the system from the platform-builders to the educators (or from edX to its sister organizations). This is seen as preparatory work for an imagined future where edX hosts hundreds of courses. In

another sense, Studio is a tool of standardization. It constrains educators to act in very particular ways. It is part of edX's *branding* efforts: to make all edX courses look and feel the same by black-boxing a certain range of options (multiple-choice questions, equation-based problems, etc.) for easy use. Yet, it also allows non-programmers an easy way to author a course. Finally, Studio is also an *organizational* interface connecting edX with its sister organizations in a structured way.

Educators

The labor of educators is also transformed. First, they need to become media producers, finding the resources to film and to edit video. edX takes no responsibility for these aspects; instead it is the affiliated university that will determine the kinds of labor related to filming. Second, educators need to spend time "authoring" the course using Studio. Here, educators are mainly doing the following: (1) they are imagining their students through Studio, and (2) they are also tinkering with the edges and limits of Studio, constantly imagining what the possibilities of interactivity are.

The conflicts in the authoring process are often a result of a clash of imaginations. To go beyond the standardized forms of expression requires educators to tinker with the boundaries of Studio; to make substantially different forms of content, educators need to demand access to the innards of Studio and the technical infrastructure through organizational channels. This process of authoring the course thus involves communication between three kinds of practitioners: the platform builders, the educators and the students through the technical infrastructure of Studio and through the "data" and "analytics" provided by the platform itself.

Conclusion: What is a Platform?

This paper has outlined one way in which the advent of MOOCs has shifted the labors of platform-builders and educators. Platform-builders see their task as creating well-defined technical and organizational interfaces between themselves and other actors (in terms of different individual and institutional roles). Educators become media producers and content creators, often interacting with the platform through standardized channels, and imagining their students in complex "data"-mediated ways.

What might this story tell us about the lived reality of platforms? Tarleton Gillespie (2010) has pointed out how the idea of a platform performs a kind of discursive and ideological work, serving to align the interests of multiple, often conflicting, stakeholders. From a labor perspective, I hypothesize that the platform should be seen as an aggregation of *socio-technical interfaces* (formal and informal) that allow communication between actors in different institutional roles in specific ways. The creation and use of these interfaces is shaped by how the future is envisioned, and conflicts between actors are often at heart debates over the differing visions of the future and their role in it.

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Locating the Internet in Infrastructure

Ashwin J. Mathew
University of California, Berkeley
School of Information
USA
ashwin@ischool.berkeley.edu

Abstract

The virtual space of the Internet is often considered to be disjoint from the physical space of the material world. In this paper, I offer an analysis of the mechanisms through which this virtual space is actively produced over physical telecommunications infrastructure through social practices, institutions and technologies which allow location and place to be obscured on the Internet.

Keywords

infrastructure, labor, practice, governance

Introduction

On January 27th 2011, Egypt disconnected itself from the Internet in an attempt to maintain control over information flows during the revolution, hoping to disrupt coordination amongst activists, and prevent the transmission of first-hand accounts and images of unfolding events. While highlighting the critical role played by protesters in the streets, international news reports called attention to the effects of social media in facilitating coordination, and dissemination of information.

In this instance, and many more besides, a common theme repeats itself: the conception that the technology of the Internet allows social formations and practices to transcend the limits of physical space. This is a separation which Castells (2000) memorably framed as an opposition between the "space of flows" of the network society, and the geographically limited "space of places". However, as a long tradition of literature in critical geography suggests, space is not passively occupied, but rather actively produced by through human activity (Lefebvre, 1992) and patterned with spatial relationships of power (Massey, 1994), with spatial fixes of capital and infrastructure needed to allow human activity to overcome space (Harvey, 1999). This raises the question: what are practices and systems of power which allow the everyday experience of the Internet to appear separate from the material world and the physical infrastructure through which it is produced?

To address this question, I begin with a key difference between virtual and physical space, the problem of location; after all, political action via the Internet can support actions against powerful actors most meaningfully when it is difficult to locate and identify those engaging in them. To understand the effect of disjuncture between virtual and physical space, between the digital and the material, we must engage with the mechanisms through which physical location is elided in the virtual space of the Internet. I argue that the logic supporting this elision is built into the core technology through which the Internet is constructed, the Internet Protocol (IP).

In this paper, I will offer three important analytics of information infrastructure labor through which the politics of the Internet Protocol – and accordingly, the politics of the production of virtual space – may be understood: technical standards, resource allocation mechanisms and topological arrangements.

Method

This research is based on a study of the practices involved in managing a technology called the Border Gateway Protocol (BGP), which is the technical standard through which networks interconnect over IP to form the Internet. After all, the Internet is not one network, but rather a complex system of interconnections amongst approximately 43,000 individual networks[1] around the world.

My research involved ethnographic fieldwork amongst communities of network administrators, analysis of technical standards documents detailing the technologies used by network administrators, and analysis of policy documents produced by Internet governance organizations. I focused on meetings and communications of the North American Network Operators Group (NANOG), which is perhaps the most influential professional organizations of network administrators in the world. I also attended meetings of the Internet Engineering Task Force (IETF) which sets technical standards for the Internet, and the American Registry for Internet Numbers (ARIN) which is one of five Regional Internet Registries that allocate critical Internet resources (such as IP addresses) around the world. I conducted 37 interviews in person at these meetings, at my interviewees' offices, and by phone.

Ordering the Internet

In computer networking classes, Internet technologies are presented as a multi-layered stack, with the physical layer at the bottom (e.g., copper wires, Ethernet cables, wireless signals), followed by a networking layer (implemented as the Internet Protocol), above which the transport and application layers operate (providing services such as email and the World Wide Web). The networking layer is the first moment of abstraction from material infrastructure, representing a critical site for the work needed to stabilize and order the Internet.

I began my research as a series of interviews with network administrators focusing exclusively on the practices involved in managing their interconnections with other networks. My initial assumption was that I would find well-defined practices which network administrators need only implement in their networks to ensure success. While this is certainly true to a degree, I rapidly discovered that the world of network administration was far more complex than I had anticipated.

My first revelation came in the form of how social this world is: to be a network administrator is to work with other network administrators to maintain systems within a network, and interconnections across networks. This is relational labor, which is as much a social relation amongst network administrators as it is a technical implementation of network interconnection: administrators establish relationships with one another as they work to interconnect their networks. In aggregate, this manifests as the community of network administrators who meet three times a year at NANOG meetings, and are in constant conversation via the NANOG email list. Following the topological arrangements of the Internet involves following these infrastructural relations.

As I began to understand these practices further, and as I studied BGP in more detail, I discovered that these relations were reinforced by an expectation of trust built into the BGP technical standard (Mathew & Cheshire, 2010). When one network claims to a neighboring network that it can carry traffic to a particular destination on the Internet, BGP offers no mechanism to reliably establish the veracity of these claims. While work is in progress to implement stronger security mechanisms, it became apparent to me through my interviews that the close-knit nature of the IETF community which originally defined these standards was in part a cause for the "trusting" nature of BGP, and the social relations that it entails.

Finally, I studied the management of globally unique IP address space, as a critical resource needed to make a

1 From the CIDR Report, http://www.cidr-report.org/as2.0/ , last retrieved March 12th 2013.

network visible on the Internet. The five Regional Internet Registries (represented by ARIN in North America) control the allocation of IP address space around the world, with board and council members of these organizations elected by the network operators that they serve. These organizations follow the principle that IP address space is not property to be bought and sold, but rather a resource which is held in common. Accordingly, IP address space is allocated by an organization's need, rather than by purchasing power, embedding the management of IP address space in social relations rather than a "free" market.

Conclusion

As this brief account illustrates, the apparent disjuncture between physical and virtual space is made possible through the relational labor that actively produces and maintains the IP layer of the Internet. This is a distributed system of social relations and practices operating the topological arrangement of the Internet, anchored by centralized institutions managing common technical standards and resources. Indeed, I argue that the democratic qualities often attributed to the Internet are in no small part premised upon the qualities of openness and trust embedded in the institutions, practices and technologies which actively produce this global virtual space.

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The Cultural Work of Microwork Infrastructures: Hacking Amazon Mechanical Turk

Lilly Irani
University of California, San Diego
Department of Communication
USA
lirani@ucsd.edu

Abstract

This paper focuses on Amazon Mechanical Turk as an emblematic case of microwork crowdsourcing. New media studies research on crowdsourcing has focused on questions of fair treatment of workers, creativity of microlabor, and the ethics of microwork. This paper argues that the divisions of labors made possible by sociotechnical systems of microwork also do cultural work in new media production.

Focusing on the story of a hackathon at a crowdsourcing conference, the paper will draw from infrastructure studies and feminist STS to examine Amazon Mechanical Turk (AMT) and the kinds of workers and employers produced through the practices associated with the system. Crowdsourcing systems, I will show, are mechanisms not only for getting tasks done, but for producing difference between 'innovative' laborers and menial laborers – differences that build on old and gendered of divisions of labor that, through infrastructure, can be reproduced at global scales. The arrangement of immaterial workers – microworkers and the programmers who employ them – in AMT suggests two complications to accounts of immaterial labor: first, immaterial labor can only be produced through material, computational and spatial infrastructures; second, the vast discursive, technological, and economic separations by which workers and AMT programmers are constituted complicate hopes for solidarity among immaterial laborers.

Keywords

Crowdsourcing, Amazon Mechanical Turk, gender, labor, infrastructure

Introduction

'You've heard of software-as-a-service. Well this is human-as-a-service.'

– Jeff Bezos announcing Amazon Mechanical Turk in 2006

In 2006, the CEO of Amazon addressed an auditorium of technologists, reporters, and professors. The (mostly) men in the room had assembled at MIT – a symbolic and well-funded space of elite technological production – to hear the Technology Review keynote and to hear 'what's next;' the MIT Technology Review Emerging Technologies conference convened significant technocultural clout, torquing investments and setting agendas. Bezos, known to many as an online retail wizard, spoke on stage to introduce a series of technology infrastructures that would come to be known as 'cloud computing.' Among the centralized data storage and data processing services offered from Amazon's data centers, Bezos introduced a twist on digital data services. Amazon Mechanical Turk, would enable technology builders to farm out massive volumes of small data processing tasks, including transcriptions, image labeling, pornography categorization, and informational research tasks. The body of computers doing this work would be not legion microchips, but rather legion human workers scattered across the world. Amazon's services, in turn, would put these tasks in a an online marketplace at the price set by the client; there, thousands of people at their computers all over the world would connect to Amazon to pick out and perform these tasks. Like 'cloud computing' services more generally, Mechanical Turk offered immediate, on-demand provisioning of computational power accessible through computer code. In this case, however, the computational power was human.

In years since, the crowdsourcing sector has grown with the appearance of a number of new companies: Samasource, a crowdsourcing company that hires as a form of socioeconomic

development; MobileWorks hires woman in India but promises living wages; CloudFactory, a company operated by Americans in Nepal, offers visual interfaces for 'programming' human data processing done by a Nepali workforce. These services, along with Amazon Mechanical Turk, assemble cognitive pieceworkers in service of employers and their computer systems. The pieceworkers work on tasks in batches; the employers can put these batches out automatedly through computer code they write. The infrastructural work of making people's labors accessible as computer-invokable resources does ideological work in emphasizing crowdsourcing as a tool for technological innovation, rather than a new form of factory organization.

Related Work

This paper focuses on Amazon Mechanical Turk as an emblematic case of microwork crowdsourcing. In new media studies, research on crowdsourcing and related phenomenon have interrogated how value accumulates through web and crowdsourcing practices. For example, Fish and Srinivasan argue that crowdsourcing systems employ low-paid or unpaid workers for work that that produces surplus value by those commissioning the work (Fish & Srinivasan 2011). Gehl argues that the Web 2.0 users essentially function as data processors, annotating and evaluating the deluge of data stored in the web's archives; Gehl argues that those who own and organize the archive deploy epistemological and financial power (Gehl 2011). These authors focus on how large-scale data processing systems distribute the power to capitalize on the labors that constitute them. A second strain of work asks of the desirability and fairness of microwork created and performed in crowdsourcing systems. Zittrain suggests that crowdsourcing systems create workers who often do not know the trajectories and purposes of the larger products for which they labor; the crowdsourced worker cannot, in this argument, be a self-possessed ethical actor (2009). Horton surveys workers and argues that workers by and large find employers on AMT to treat them more fairly than offline employers (2011). Fish and Srinivasan direct researchers to ask not only of contractual fairness, but of the creativity and agency workers can display in their jobs. Both strains of research – that focused on accrual of value and that focused on fairness – inquire into the qualities and ethics of crowdsourced microwork. These questions are crucial but this paper takes a different tack.

Infrastructuring Microworkers and Producing Hacker Subjectivity

At the last crowdsourcing industry conference I attended in San Francisco, a number of microwork startups organized a CrowdHack – an event where organizers fueled programmers with food, air conditioning, wi-fi, and electricity. Several teams spent the day intensely coding, absorbing the energy of their fellow hackers, and developing prototypes of computer applications incorporating human computation. A panel of crowdsourcing company employees chose winning applications that demonstrated the potential of human computation as technological infrastructure. Applications included a weather mapping service based on crowd generated weather observations, an application that asked the crowd to judge moles for signs of melanoma, and even an application that paid workers in India to go outside and remove trash from the street. Coleman (2010: 52-53) argues that hacker conferences are a 'ritual condensation and celebration of a lifeworld' in which hacker life is lifted out of its routines, reorganized, and intensified to achieve personal transformation and group solidarity. Viewing the CrowdHack through this lens, we see that hackathons are not only about the production of software technologies, but also a site where masculine technological peer prodcution is staged through the infrastructuring of tens of thousands of microlaborers. Assembled at the hackathon are the 'innovators' – the engineers, the designers; at hand but at a distance, the crowdworkers are present only when summoned as task requests and data inputs into the code the programmers write. The bodies of microworkers are not in the room. Within the copresent space of the hackathon, programmers act out optimistic 'making' in a space where they see only their peers.

The divisions and distancing of labor made possible through crowdsourcing, then, serve ideological purposes. In the extended paper, I will show how these ideological purposes are key to the appeal of crowdsourcing. Distancing contingent workers behind a minimal interface or behind lines of code fits

them into existing organizational ethos in new media production (see Turner 2009; Turner 2006). This paper draws from infrastructure studies (Bowker & Star 1999; Star & Strauss 1999) and feminist STS (Suchman 2006; Nakamura & Haraway 2003) to ask what kinds of relationships do infrastructures promise between users – here, the employers – and the infrastructural technology – here, the workers or 'human-as-a-service'? By investigating together the workers, employers, and the technologies that make their relations possible, this paper takes a sociotechnical approach (see Niederer & van Dijck 2010). Crowdsourcing systems, we will show, are mechanisms not only for getting tasks done, but for producing difference between 'innovative' laborers and menial laborers – differences that build on old and gendered of divisions of labor that, through infrastructure, can be reproduced at global scales.

Acknowledgments

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License

The Grunt Work of Geek Hobbyists: Incentivizing administrative labor in virtual world building

Aleena L. Chia
Communication and Culture
Indiana University
Bloomington, Indiana, USA
achia@indiana.edu

Abstract

This paper demonstrates the flows and disjunctures in intersecting systems of administrative labor, which are voluntary and networked, and which collectively sustain communities of gamers engaged in a roleplaying property in digital, tabletop, live-action forms. I will use ethnographic engagement with actors and artifacts in a variety of digital and material settings, to argue that the communicative labor of roleplaying gamers is comprised of content creation and infrastructure maintenance – the administrative grunt work of sustaining an emergent fictional world and its attendant communities of practice. Accordingly, content and infrastructure, as well as its fiction and sociality, feed ambivalently off each other in asymmetric ways, taking the form of an incentive scheme that interlocks democratic and meritocratic organizational logics in contradictory yet productive ways. Crucially for communicative labor debates, hobbyist paradigms adopted by geek communities of practice translate assessments about labor and expropriation into discourses about contribution and identity.

Keywords

digital labor; ethnography of infrastructure; geek culture; massively multiplayer online games

This paper addresses negotiations within gaming communities and with corporations in virtual world building as a way to assess modes of engagement based not just on competition and commodity exchange, but also on complementarity and mutual obligation. It is based on a year of participant observation with the Mind's Eye Society, a non-profit organization of over 3500 live-action role-players who participate within the same narrative continuity and who have organized nationally to negotiate with the transnational company responsible for extending a transmedia gaming property - saturated with up to twenty years of affective, social, and material investments - from books, television, and video games, to an upcoming MMO. Participant observation and interviews at gaming and industry events in cities on the East Coast, Canada and Iceland, as well as virtual ethnography (Hine, 2000) of adjacent online communities associated with the gaming property allow me to theorize the mutual adaptations between a kind of civic subjectivity and corporate governance in and around virtual world gaming, as they unfold against post-Fordist frameworks of productivity in which productive and consumptive practices and identities merge in diverse and unpredictable ways.

I assess the challenges and opportunities of such a model of engagement as it develops within, through, and in relation to bureaucratic systems such as interest-based non-profit organizations and technical systems such as massively multiplayer online games. My ethnographic case suggests that members of this non-profit organization see their gaming practices as forms of civic engagement in which the spaces and rhythms of narrative worlds are tethered to the formal administrative structures and less formal practices, rituals, and networks of associational life – which collectively form the vital infrastructure of this community of practice (Lave & Wenger, 1991). On the one hand, this associational life is governed by frameworks of representative democracy and ideals of collective decision-making. On the other hand, these trademarked narrative worlds are built around social hierarchies designed to incentivize a spectrum of volunteer contributions vital to the NPO's functioning and identity.

This associational life (Puntnam, 2000) is governed by formal frameworks of representative democracy codified in organizational bylaws, ideals of collective decision-making (in relation to overall direction of the organization) codified in the membership handbook, and rules of civility and

accountability codified in a code of conduct. There seems to be a tension between these stated ideals and frameworks and a rigid chain of command in relation to daily operations. In addition to administrative efforts to exist as a NPO, and logistical efforts to enable physical meetings of small and large scale, a lot of volunteer effort is expended on cohesive storytelling that integrates coordinators and storytellers in 51 regions, who report to 8 regional coordinators, who report to 1 national coordinator. It is this cohesive storytelling that allows members to travel to other games while participating as the same character in a consistent narrative universe. Unsurprisingly, this takes layers of networked administrative tools (such as forms, briefs, reports, and databases) for standardization, systematization, and integration. This process of scaling up to their current size has been met with increasingly volunteer burnout and overall attrition - the club has been shrinking for years.

Perhaps recognizing the immense efforts required for its existence, the organization has formal social hierarchies designed to incentivize a spectrum of volunteer contributions. This incentivization system is interesting because of its creation in associational life as reward for volunteer efforts, which is translated into power in the narrative worlds. This incentive system forms the formal currency that crosses clearly demarcated associational-narrative boundaries; a more informal currency is that of social and cultural capital which are partially validated through semi-formal practices of peer-evaluation and which translate into both rank within the association and power within the narrative worlds. Notably, both associational and narrative levels of engagement are distinct yet integrated, and are collectively sustained by a community of practice that uses the tensions between democratic and meritocratic governance to fuel interest and participation in its activities.

These gaming practices exist within frameworks of productivity where the dichotomy of consumption and production – long problematized by scholars who described consumer capitalism as an integrative circuit where the corollary of productive labor is the national responsibility to consume (Mumford, 1967) – becomes indistinct. This circuit is further integrated under post-Fordist informational capitalism (Bell, 1973), where cultures of workplaces in knowledge industries takes on play-like qualities such as flexibility, autonomy, (Castells, 2009) and expectations of psychological fulfillment (Florida, 2002). Conversely, consumption takes on work-like qualities, such as repetitiveness, entrepreneurship, and promises of monetary compensation (Kücklich, 2005). This hybridity sets the scene for practices of collaborative storytelling where playful work and professional play feed and flow into each other within corporate strategies, industry blueprints, sociotechnical systems, and human lifeworlds. However, according to theorists of immaterial labor, these frameworks of productivity do not simply capture flows between processes and synergies between purposes. They also attempt to contain the disparities and disconnections endemic to a capitalism which pries economic value from the interstices of consumption and production, which rationalizes all spheres of human experience, which integrates the subject - burdened by the necessity of labor and responsibility of consumption - more tightly into the circuits of capital, so much so that life itself is put to work (Zwick et al, 2008).

These tensions are however complicated by the norms of a hobby-oriented way of life adopted by self-identifying science fiction, fantasy, and gaming geeks, for whom a spectrum of activities - such as fan practices and multi-platform gaming - entail unpaid work to be fun and require paid work to defray costs. For members of the NPO, this hobby-oriented way of life is taken for granted, and renders dichotomies of labor and leisure, expropriation and exchange irrelevant. Instead, geek hobbyists experience content and infrastructure as inextricable – both of which are understood not as labor or leisure, but as necessary contributions for the perpetuation of their individual and collective identities, as well as of their whole way of life. This community of practice and its engine for unpaid labor now seems to be the model for community development adopted by the game company for adaptation to their upcoming massively multiplayer game. However, tensions have arisen as the NPO negotiates its place within a proprietary virtual world in which self-governance and corporate governance will necessarily overlap.

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Invisible Work, Visible Success: Paraguay Educa's Hidden Labor for One Laptop Per Child

Morgan G. Ames
Informatics and Computer Science
University of California, Irvine
Irvine, California, USA
aoir@morganya.org

Abstract

This paper discusses the social and technical labor that has gone into making the One Laptop Per Child project in Paraguay a relative success, as well as some of the ongoing challenges the project faces. This labor is juxtaposed against the practice of naturalizing computer use to visitors, matching what they expect to see, but downplaying the significant and ongoing labor that must be invested in projects like this to achieve even incremental results. This juxtaposition suggests that such practices, though common in educational reform and development projects, ultimately undermine the success of these projects by not calling attention to the behind-the-scenes infrastructural investments, the realistic scope of progress, or the ongoing challenges the project faces.

Keywords

OLPC; sociotechnical infrastructure; development project; invisible labor.

Introduction

The One Laptop Per Child (OLPC) project represents one of the largest experiments in laptop-driven learning currently underway. Hailing from the MIT Media Lab, roughly 2.5 million of OLPC's "XO" laptops are in use around the world today, 85% of them in Latin America. Though failing to reach its goals of hundreds of millions of laptops in use, the project is credited for launching the "netbook" movement, inspiring many spin-offs, and drawing attention to global education and development debates.

In 2008, two Paraguayans founded Paraguay Educa to bring OLPC's distinctive laptops to their country. Though suffering some initial setbacks, they secured funding to purchase and distribute 4000 OLPC XOs to every student and teacher in ten schools in a small town 50 kilometers east of the capital Asunción in April 2009. They expanded to 9000 laptops in 36 schools – all public and private schools in the area – in May 2011.

In September 2008, they explained their hopes for the project in a local newspaper (ABC Color staff, 2008). Their vision of creating technologically savvy, passionate learners with their own laptops was largely drawn from OLPC's own promotional materials (OLPC staff, 2011). Paraguay Educa and OLPC agreed in 2008 that OLPC's "XO" laptop could itself make up for the lack of local educational opportunities and produce children who are adept at the kind of mathematical and critical thinking valued in computer engineering cultures (Negroponte & Bender, 2007; Papert, 1993). In this view, the computer itself had the power to change a learning culture via the individual interactions between itself and a child (Papert, 1980, pp. 9, 37).

I interrogate this vision based on ethnographic fieldwork of Paraguay Educa's project in 2010. I observed classrooms several days each week, visited the homes of students, attended local meetings and events, and conducted 133 interviews in Spanish and Guaraní with students, parents, teachers, and other local actors. I supplemented this fieldwork with laptop usage and breakage reports, attendance records, and scores on a cognitive exam of reading and mathematics, as well as visits to the larger OLPC projects in Uruguay and Peru.

Paraguay Educa's Infrastructural Work

How independent could OLPC's laptop be as an educational tool? By the accounts of researchers and journalists, the projects of 15,000 laptops in Birmingham, Alabama (Warschauer, Cotten, & Ames, 2011) and 980,000 laptops in Peru (Cristia, Cueto, Ibarraran, Santiago, & Severin, 2012; Derndorfer, 2010) have struggled from the lack of social and infrastructural investment beyond handing out the laptops themselves. In many schools in these areas the laptops are not used at all, suggesting that more is needed than just the laptops to promote learning or even use.

Paraguay Educa chose a different path, investing in significant infrastructural resources from the start. Schools lacked computers, printers, copiers, projectors, intercom systems, or even classroom power outlets before the project started. Paraguay Educa cooperated with local government, schools, businesses, and volunteers to install a power outlet in each classroom to charge laptops,[1] a desktop computer as a "school server" (placed in a cage to prevent theft), wireless routers (also placed in cages, though this reduced their range), and WiMax antennae on a narrow towers of welded steel trusses in cooperation with Personal Telecom, who donated connectivity to the project. Paraguay was also one of the few projects that contributed to the development of OLPC's primary software distribution, led by one of the co-founders, a talented programmer.

The most difficult part of the technical infrastructure to procure was laptop repair parts: OLPC did not sell them, so Paraguay Educa purchased a small supply from Uruguay, who had in turn purchased them from the manufacturer directly. Because laptops were owned by students, not all could afford repair parts, and some of the more commonly broken parts, especially chargers and screens, were unavailable.

Social support proved more complicated. An initial teacher training session in December 2008 (Paraguay Educa staff, 2008) provided teachers with more training than most OLPC projects, but still left them struggling with even basic operations (Warschauer & Ames 2010) and with few ideas for how to use the laptops in the classroom. One school director said that she and her colleagues "thought the laptops were just a toy for games," especially when they saw their students and their own children using them to consume media off the Internet, if at all. As a result, even with teacher training, the laptops were not used much during the first year.

Paraguay Educa saw that the laptop was not by itself sparking the kinds of exploration they had hoped for, and in summer 2010 hired full-time trainers to help teachers use the XO in the classroom. Having full-time trainers in every school stimulated classroom laptop usage, according to teachers' and students' usage reports, my own observations, and teachers' recollections at the end of the 2010 school year. Even with two adults, one experienced, in the classroom, teachers often found the laptops frustrating to use, due to broken hardware and missing software. Instead of using the more innovating programs on the laptop, such as Scratch or Turtle Art, many used programs like Write or Paint that could easily be replaced with pencil and paper for students who did not have a charged and working laptop in class for the lesson.

Rendering Work Invisible

Despite the significant amount of sociotechnical infrastructure put in place by Paraguay Educa for the project, the narrative that was presented to visitors was one of "natural" success. When a high-ranking official visited Paraguay Educa in October 2010, several months into my fieldwork, his school visit was padded with the best students across all schools and enjoyed a student-teacher ratio of less than 2:1, not the more common 20:1. His visit made apparent the problems with first impressions and staged events by providing evidence of participants' desires to *perform success* to visitors.

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[1] OLPC founder Negroponte boasted in 2005 that the then-unfinished XO laptops could be charged by an integrated hand crank and even showed off a non-working mock-up with one, but the hand crank was never included on any production machine. All XO laptops I encountered were charged with AC adapters that shipped with the laptops.

This desire in part stems from the pressure on development projects to set and then achieve unrealistically high goals. Unfortunately, OLPC and Paraguay Educa both, along with many NGOs and nonprofits, are caught in a catch-22: they must set lofty, but often unrealistic, goals and to attract the interest of investors. Myopic projects are often rewarded under this model, while sustained investments in the local community and the ongoing success of the project – as Paraguay Educa is *actually* providing – are not.

Moreover, the complexities and difficulties of projects like Paraguay Educa's are hidden away, as well as the real incremental progress they are making, which would seem paltry in the face of hyperbolic promises. This research suggests another course, honestly acknowledging sites for improvement as well as the tremendous amount of work – social, infrastructural, and ideological – needed to produce even incremental social change. As NGOs take on more functions formerly expected of states in many parts of the world (Ferguson, 2006), moderating expectations, promoting transparency (as this research strives to do), and learning from "failures" become ever more important.

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Recognizing Invisible Infrastructure:

Data Centers and Hurricane Sandy

Megan Finn
Microsoft Research New England
USA
megfinn@gmail.com

Ashwin Mathew
UC Berkeley
USA
ashwin@ischool.berkeley.edu

Kate Crawford
Microsoft Research New England
USA
kate@microsoft.com

Abstract

The impact of Hurricane Sandy in October 2012 on data centers in Manhattan forced a reconsideration of internet infrastructure, its capacities and vulnerabilities. In this paper we consider data centers which were in "Zone A" — the flooded parts of Lower Manhattan that lost electric power. Data centers constitute part of the Internet that is invisible to Internet users, but for data center workers they are a place of . Sandy revealed the extraordinary labor required to keep a data center running during a disaster, as some workers ate and slept at data centers. Additionally, what data centers operators might consider infrastructure, buildings and power, became unreliable during Sandy when building basements flooded, ruining back-up generator fuel pumps, and data center the operators could not get fuel. This paper considers the type of "care work" required in data centers, and analyses the unstable parts of data center infrastructures that became more visible during Sandy.

Keywords

Cyberinfrastructure; data centers; labor; disasters; information labor.

Introduction

During the peak of Hurricane Sandy, if you visited sites such as Huffington Post, Gawker, or Buzzfeed, you would have been diverted to emergency backups and limited temporary sites: these services were "down." Huffington Post continued reporting on the storm and on the impact of the storm using other media: "We're having technical difficulties due to power outages. Working to get site back up. Newsroom still monitoring #Sandy. Will keep tweeting."[1] DataGram Inc. hosts parts of the Huffington Post website. DataGram had offices located at 33 Whitehall Street in Lower Manhattan, inside of the area flooded by Hurricane Sandy. Many buildings, including 33 Whitehall lost power after Hurricane Sandy. It is routine for data centers to have a lot of redundancy, including redundancy of power. So after the power was shut down, DataGram successfully used their backup diesel power generators. However, the generators relied upon fuel pumps and other electrical equipment that were located in the basement of the building, which was eventually flooded, cutting off all power, making it impossible for DataGram to run as expected.

Although it was unusual for a data center such as DataGram to go down, the breakage made visible the various companies, laborers, and physical infrastructures that underpin a widely read site like Huffington Post. The vast number and complexity of data centers is generally obscured from everyday interactions with the Internet. These data centers are part of the "information infrastructure" that are "pervasive enabling resources" for the Internet (e.g. Bowker et al, 2010: 98). A quality of information infrastructure is its transparency. Researchers have observed that information infrastructure "becomes visible upon breakdown," suggesting that looking at infrastructures during disasters could be used as a

[1] @HuffingtonPost, Twitter, October 30, 2012.

"method" for "seeing" infrastructure (Star, 1999: 382). DataGram is supposed to be invisible to Huffington Post readers, but Sandy made this data center part of the news when its power went out, as people tried to understand why typically reliable nodes of the Internet were vulnerable.[2]

Data Center Labor

Data centers are designed with the aim of never going down, or at least, to have sufficient redundancy such that any outage will not be visible. A challenge for data centers is temperature — computers both generate a lot of heat and work best at certain temperatures. Both computing and cooling are costly, and data centers are often measured by how much electric power they consume in ratings such as "Power Usage Effectiveness" or "PUE." Data centers are also rated on how reliable and redundant their equipment is. For example, the highest rating for a data center is "Tier IV." A Tier IV data center is said to be "2N" because it has two independent power and cooling sources. These ratings and PUE highlight the design of data center facilities.

Beyond physical facility design, Sandy showcased the centrality of human labor in keeping the data centers operable. For some data centers, there are specific procedures for acute events like Hurricane Sandy. Remote employees of data centers may be flown to a data center location to stay at nearby hotels so that local employees did not have to leave their families and communities. This practice differed by company such that some companies relied exclusively on local staff. As we learned from our observation work at data center operator meetings, data center executives felt that getting employees to nearby hotels during Sandy was not enough, as nearby roads can be blocked with trees and debris, stopping workers from getting to the data center. Thus, many data center operators said that having food on hand to feed data center workers who would stay overnight during Hurricane Sandy was one of their main "lessons learned." While data center operators focused on getting employees to the work sites, data center workers had work under extraordinary circumstances to keep their centers up and running. For local employees, staying at the data center meant time away from their own homes. One data center executive said, "We appreciate the commitment and dedication from our staff, many of whom have left their families and homes to keep our data centers safe and operational."[3] Our research considers how the labor involved in the kind of 24-hours a day maintenance required for data centers can be understood within the history of "care work" (e.g. England, 2005) which is often gendered as 'women's work', while data centers are very male-dominated workplaces. The kinds of selfless dedication to the needs of others, in this case the data needs of clients and the wider Internet, raises interesting new perspectives on care work and data labor.

Data Center Infrastructure

The term "data center" covers many different types of companies, labor, and machine configurations. In the most abstract sense, data centers can be thought of as places that house machines — many computers that store data or serve web pages. Some companies (such as Google or Microsoft) own their own data centers. Other companies rent space for their computers in spaces owned by other companies, like DataGram. And other companies, like Huffington Post rent the machines from DataGram who rent space in 33 Whitehall. If a company owned the building that their computers were housed in, they would have control over the design of all aspects of a data center, especially electrical wiring, but this is not always the case.

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[2] Pavley, John (2012) 'HuffPost CTO On How Hurricane Sandy Took Down The Huffington Post', video interview, 30 October, http://www.huffingtonpost.com/2012/10/30/huffpost-cto-on-how-hurri_n_2044667.html?utm_hp_ref=tw (accessed March 13 2013)

[3] Rich Miller, "Generators Keep NJ Data Centers Humming," October 30, 2012, Data Center Knowledge, Accessed November 14, 2012 from http://www.datacenterknowledge.com/archives/2012/10/30/generators-keep-nj-data-centers-online/.

The relationships between the data centers and the owners of buildings, what were considered "infrastructure" by data center operators, were tested after Sandy. One of the most widely discussed stories involved a building in Zone A on 75 Broad Street that housed several data centers, including one owned by Peer1. During Sandy, the basement of 75 Broad Street was flooded. Though the backup generators were on the roof, the fuel pumps were stored in the basement and so the fuel pumps did not work after the basement was flooded. Customers of Peer1 worked along with day laborers to carry fuel up seventeen flights of stairs for the generator.[4] These workers were essentially performing part of the data center infrastructure. Getting fuel for generators became a problem for data centers that were not flooded as well. Ports were closed, roads were blocked, and the gas and diesel stations that were open had long lines. One company bought a fuel truck in Texas, and had the driver fill the truck and drive it to the data center site, so that there was back up fuel available.[5] While data centers designers spend a lot of effort considering where power is coming from, the storm asked them to reconsider the limits of infrastructure, both human and non-human, during and after a disaster event.

Method

This paper uses multiple sources to construct an archive about what happened to data centers and their workers during Hurricane Sandy. We have four types of primary sources we draw from: data center discussion boards, blogs, podcasts, and the data center trade presses; and data center operator conferences.

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