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The Nintendo Entertainment System and the 10NES Chip: Carving the Video Game Industry in Silicon

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Abstract

This essay makes the argument that the numerous "networks" or "inter/intranetworks" that structure the video game industry have lived local effects for those involved in the production of video games. In particular, this is most visible in the realm of console video game development but is visible in many other contexts as well. It uses the Nintendo Entertainment System (NES) as an index into this complex and highly structured world that frequently disappears from developers perception. The essay uses largely historical data drawn from patent filings, Securities and Exchange Commission (SEC) filings, and court cases to analyze these networks. The essay argues that these inter/intranetworks, as constructed, have been instrumental in the way that the game industry now finds itself structured and that as the industry has "matured," the networks have become less accessible and less interoperable.

Keywords

video games, game development, game developers, nintendo, nintendo entertainment system, NES, game industry, actor-network theory, inter/intranetwork

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Ethnographers, anthropologists, or anyone who has performed fieldwork as an active component of their research methods can likely identify exceptional moments when an informant, event, or site pushes them to think outside of their existing analytic frameworks and methodologies. For me, this came 6 months into what would become a 3-year ethnographic foray into the daily lives and worlds of video game developers at studios in the United States and India. In March 2005, at the Game Developers Conference (GDC) in San Francisco, California, hundreds of game developers crowded into what has become a perennial "Rant" session sponsored by the International Game Developers Association (IGDA). The session was titled, "Burning Down the House: Game Developers Rant," and the events of 2005 were different (Zimmerman, Hecker, Laurel, & Spector, 2005). Something noteworthy happened. It takes something special to shake game developers such that a rant later becomes known by its radical similarity to events leading up to the American Revolution. When Greg Costikyan[1] took the stage, few knew what was about to transpire, but few have forgotten, it has since been called, "The Rant Heard 'Round the World."

> Nintendo is the company that brought us to this precipice. Nintendo established the business model under which we are crucified today. Nintendo said, 'pay us a royalty not on sales, but on manufacturing.' Nintendo said, 'we will decide what games we'll allow you to publish,' ostensibly to prevent another crash like that of 1983, but in reality to quash any innovation but their own. Iwata-san said he has the heart of the gamer, and my question is what poor bastard's chest did he carve it from?
>
> My friends, we are f***ed! We are well and truly f***ed. The bar in terms of graphics and glitz has been raised and raised and raised, until no one can any longer afford to risk anything at all. The sheer labor involved in creating a game has increased exponentially until our only choice is permanent crunch and mandatory 80-hour weeks, at least until all our jobs are outsourced to Asia. (Davis, 2006)

As game developers all around me stood and cheered, it was a particular portion of the speech that sent me reeling, "Nintendo established the business model under which we are crucified today." It was at this moment that I began to appreciate the importance of those historical structuring elements that I had net yet teased apart in my analysis of the worlds of video game development work and the video game industry. It sent me searching for details on what this business model was and why crucifixion had become the dominant metaphor. The majority of this essay focuses on testing out some of those historical structuring elements, but it remains continually interested in the lived effects that persist even now for video game developers. They persist so dramatically that developers stand and cheer when they are ranted about.

It is important to keep this historical material in conversation with the ethnographic, because if it were not for my time, stumbling through the world of video game developers that I would not likely have asked questions about the numerous

black boxes, networks, humans and nonhumans, that for the most part have undergone so little study. Game studies researchers study the virtual peoples and virtual worlds of games. We examine the lines between the real and the virtual. We read and interpret the images presented on the screen. We talk about the rhetoric of games. We study the effects and uses for games. We talk about games, play, magic circles, and fun. Occasionally, we get around to talking about user modifications (MODs) and the modders that make them. Sometimes we muddle our way to hacking and hackers.[2] However, we have not spent enough time looking at the folks who make games or at the broader system that they are a part of.[3]

It is in this interest of keeping the historical, technological, and social in conversation that it makes sense that my methods and theoretical frameworks draw largely from the field of science and technology studies (STS). So, while in this essay I examine primarily court cases, legal documents, and Securities and Exchange Commission (SEC) filings, ultimately these are used to help illuminate those structures Greg Costikyan was speaking about and other developers seemed to feel so strongly about. Ultimately it is these structures that come into view, frequently embodied by technologies that recede into the background.

The essay makes the argument that the numerous "actor-networks"—social, technological, historical, economic, and so on—systems that structure the video game industry have lived local effects for those involved in the production of video games. This is most visible in the realm of console video game development but is visible in many other contexts as well. Although actor-network theory mobilizes parts of my analysis, it is more focused on what has been called "heterogeneous engineering," because of its particular attention to how "vigilance and surveillance have to be maintained, or else the elements will fall out of line and the network will start to crumble" (Law, 1989). I introduce and deploy the framework of the inter/intranetwork as a means to analyze and understand these structures. Through examining closely how Nintendo has managed and structured their networks gives us insight into how networks are structured and managed through social, legal, economic, and technological mechanisms. The ability to access and produce within these actor-networks fades quickly from view once a developer or development company has gained access to them. As such, it is indicative of the kind of work necessary for analyzing the complexity of networks that seem to pervade the worlds of "new media" producers.

Tracing the Inter/Intranetwork

The structuring effect of the actor-network is particularly interesting. In some cases, "network" approaches to understanding work, the economy, production, or society fail to actively engage with the structuring effects, or more generally "power" in a very untheorized sense (Contu & Willmott, 2003). The "flows" of knowledge, which are then networked, are also structured (Castells, 1998). However, in many cases, concern over these issues rapidly recedes into the background as the "open"

or "flat" aspects of this structure are highlighted (Friedman, 2005). "Access" or "breaking in" is such a key aspect of the game industry and game development work more generally, yet it is frequently glossed over in research, which attempts to examine the networks of game production. These studies rarely look closely at what is necessary for a developer to gain access to these networks (Johns, 2006). The concept of the inter/intranetwork is a useful tool for thinking about the structuring effects of networks. The structure that has emerged is "networked" but, more explicitly, networked in a fashion I have termed "intranetworked," or closed off. Much like a corporation's private internal network, or "intranet," it is tightly controlled and connections to the broader world or "Internet(works)" are highly monitored. Although it would be folly to assume that "everyone else" is on the Internet in a literal sense (most Internet Service Providers such as Comcast, Verizon, or America Online, operate as intranetworks), figuratively that is how it is imagined.

I use this concept in conversation with prior work in the anthropology and sociology of science and technology (or STS) that uses "actor-networks" as a means to analytically understand how science and scientific practice unfolds. Although actor-networks provide some insight, I have become critically interested in why particular nodes become obligatory passage points, or why entire networks become closed off from other nodes in the network. Rather than viewing it as a reason to jettison the framework (Latour, 1999), I find it more productive to seriously pursue greater precision.

> If technoscience may be described as being so powerful and yet so small, so concentrated and so dilute, it means it has the characteristics of a network. The word network indicates that resources are concentrated in a few places—the knots and the nodes—which are connected with one another—the links and the messages—these connections transform the scattered resources into a net that may seem to extend everywhere. (Latour, 1987, p. 180)

Sociotechnical networks that technologies are enmeshed with have dramatic implications on the various possible futures of networks. Although the analysis within this essay may sound deterministic, it has more to do with the kinds of networks that have brought together in chorus, which makes this particular system so rigid (Latour, 1991). As other scholars within the field of STS have demonstrated, it is the coming together of technological, political, economic, and cultural configurations that make these systems rigid. In particular, the film and music industries have made use of similar network configurations (Gillespie, 2007). Put back in connection with the early writings on actor-network theory, it has a great deal to do with how and where shifts in the network happen hand-in-hand with the social and technical.

> The network approach stresses this by noting that there is almost always some degree of divergence between what the elements of a network would do if left to their own devices and what they are obliged, encouraged, or forced to do when they are enrolled within the network. (Law, 1989, p. 129)

Video game development too has become highly structured, and the networks of the video game industry are structured in a inter/intranetworked fashion. This process is neither simply social nor simply technological. This is what makes this kind of analysis particularly useful. Networks may seem to extend everywhere, but accessible to only specific individuals and organizations. Publishers consolidate their interests by acquiring smaller (moderately) successful game development studios. Console manufacturers (who are also frequently publishers) do this as well. Frequently, just as often, new connections end up closing off networks. This often results in islands disconnected from the mainland. Even independent studios tend to operate only in concert with a small number of other studios if any at all.

The inter/intranetwork stands in stark contrast to how networks are frequently talked about, particularly in the context of the New Economy. Too often there is an exuberance for the possibility, over the impossibility. For example, it could be noted that "[i]nformation circulates through networks: networks between companies, networks within companies, personal networks, and computer networks" (Castells, 1998, p. 177). However, just as important is the disconnect, when information does not circulate. Sociological inquiries into New Economy work has drawn heavily upon the network metaphor and actor-network theory, creating confusion between the two terms. In the worse cases, these approaches can end up emphasizing the limitlessness of networks over their ever-important structuring effects.

> Networks are open structures, able to expand without limits, integrating new nodes as long as they are able to communicate within the network, namely as long as they share the same communication codes. (Castells, 1998, p. 501)

Although Castell does talk about the importance of communication codes, the emphasis of the passage is on the limitlessness or integrating capacity. But what if the communication codes themselves are closed and proprietary, as those in the video game industry are? What technologies do codes connect with? How were the codes and technologies developed? What about entirely unpublished codes that must be rediscovered by many aspiring developers looking to enter the video game industry? This lack of openness and collaboration is fostered by the highly restrictive legal agreements and sense of secrecy, which dominates the video game industry.

Numerous independent developers and even those simply struggling to bring developers together outside of the United States' East and West Coast face similar barriers. If you are not part of the game development world, the only way you can get in is to create a game, but it can be difficult to develop a game without connection to those existing networks. Instead, you must fumble your way until you have learned enough on your own to prove your worth, at which time interested parties would rather move to where the networks have already been established. These closed intranetworked social structures "increase the experience of labor market inequality" and "workers unable to access or maintain these networks may be at a disadvantage" (Neff, 2005, p. 138).

Our inter/intranetworks are not without differential power relations. In the move from despotic power relationships to hegemonic relations, a new kind of measure seems to be ever more predominant. Anthropological analysis of networks among high-energy physicists demonstrates similar boundary marking and maintenance by practitioners.

> Networks of exchange link otherwise autonomous units at every level of social organization. The primary commodities exchanged are students, postdoctoral research associates, and 'gossip' (oral information about detectors, proposals, data, organization of groups and labs, and the location and professional genealogies of individuals). The boundaries of the networks as a whole are closed, marking off the outsiders. . . . The boundaries of the community as a whole are negotiated with great circumspection. (Traweek, 1988, p. 123)

The use of reputation networks as a mechanism for structuring numerous resources within a section of networks is consequential for any social network. The same is true for labor and knowledge production networks. If the practices of a given subsection of the inter/intranetwork are not meeting the expectations of other components of the network, their reputation, and subsequently their income will begin to fall. Although these networks are social, they are also technological, corporate, and intricately connected to complex legal and legislative systems. In effect, the network structure has systematically blocked out those mechanisms by which access for developers both foreign and domestic can be granted. More and more work is only being done from within the networks. Those hoping to ''break-into'' the network must battle numerous difficulties in what is largely being touted as a ''flat'' economic system. However, this is simply not the case. It is this kind of complex corporate, social, technical, and legal network that the game industry so difficult to work within.

Tracing a Few of the Networks of the NES

The Nintendo Entertainment System or NES is an important time/place/technology to start tracing networks from. In part because of its place in the hearts and minds of so many gamers and more importantly game developers. Although Nintendo first emerged as a force to be reckoned with during the time of Atari, the NES is particularly important because it brought about massive change to the way video games were developed, sold, marketed, and in the very technological core of game consoles. For the most part, these changes were nonobvious to the user. The only visible difference was the emergence of the Nintendo Seal of Quality. It was placed on ''official'' game titles released for the NES. These were the games licensed by Nintendo (Figure 1).

Nintendo's logic was clear. They believed that the low quality of games released for the Atari were partially to blame for the ''crash'' that came shortly after the

Figure 1. The Nintendo seal of quality for NES games in North America.

release of several games that were massive economic failures. By offering their "guarantee" of quality gamers should feel safe investing their money into the games. If it were simply a quality control issue, you would have likely simply had two groups of games for the NES, those "guaranteed" and those which were not. But that is not what happened. "Unlicensed" games were few and far between. The only games available for the most part bore the seal of Nintendo. It is what lies behind the seal of quality, which endures even today on all games released for Nintendo's current generation of consoles that makes all the difference in the world. The very term "licensing" suddenly entered the minds and vocabulary of game developers. It is in this web of connections, this network, which we find the real power of the seal. However, it is not just about connecting the seal up with these other components, it is about the ways in which these networks structure the very work of producing games which is so dramatic.

In December 1985, shortly after the release of the NES in the United States, Nintendo filed for a patent, the only public record of the technological device that had been developed. Without this filing, the innovation would be largely undocumented, yet another one of the pieces of the "Black Art" of video game development. This microprocessor, this piece of code carved in silicon, was about to change the world of video game development forever, code can be legislation simply of another kind (Lessig, 1999, 297).

This deceptively simple description; a semiconductor lock and key. A silicon lock and key to ensure the "authenticity" of an external memory device. This is what added force to the seal. The key and seal worked together. To get the key you needed a seal. To get the seal you needed Nintendo. If you have any doubts about Nintendo's intentionality with regard to why this method was developed, one need only to look as far as the court cases that quickly followed for those companies who did not care to work through the system they designed. Their own testimony indicated that the 10NES chip as it came to be known was designed specifically as a means to enforce licensing agreements (Figure 2).

> United States Patent Number 4,799,635—System for Determining Authenticity of an External Memory used in an Information Processing Apparatus.
>
> To verify that the external memory is authentic, duplicate semiconductor devices, for example microprocessors, are separately mounted with the external memory and in the main unit, respectively. The semiconductor associated with the external memory device acts as a key device and the duplicate device mounted in the main unit acts as a lock device. (Nakagawa, 1985)

It is interesting to note, that at this moment the interest was in protecting Nintendo's ability to say who could make and release games for the NES, rather than on copy protection. Interestingly, the NES's Japanese counterpart, the Nintendo Famicom did not contain the 10NES lockout chip, and while this did result in some levels of piracy, which Nintendo combated with the seal of quality without technological or legal networks, it also resulted in a longer life cycle for the console. Well after Nintendo had released the Super Nintendo Entertainment System, games were still being released for the Famicom. Many of them were unlicensed, but gamers continued to buy them, keeping the console in the living room well beyond Nintendo's expectations.

> Nintendo designed a program—the 10NES—to prevent the NES from accepting unauthorized game cartridges. Both the NES console and authorized game cartridges contain microprocessors or chips programed with the 10NES. The console contains a "master chip" or "lock." Authorized game cartridges contain a "slave chip" or "key." When a user inserts an authorized cartridge into a console, the slave chip in effect unlocks the console; the console detects a coded message and accepts the game cartridge. When a user inserts an unauthorized cartridge, the console detects no unlocking message and refuses to operate the cartridge. Nintendo's 10NES program thus controls access to the NES. (Atari et al., 1992)

Although this technological legislation encouraging developers to work directly with Nintendo was dramatically different from how things had been managed for previous consoles, it was in many ways only the beginning. Which leads us to two questions, "Why not pick the lock?" which can in many ways be answered by the second, "Why the patent?" The answer is foreshadowed by our actor-network foundations, "vigilance," and "surveillance."

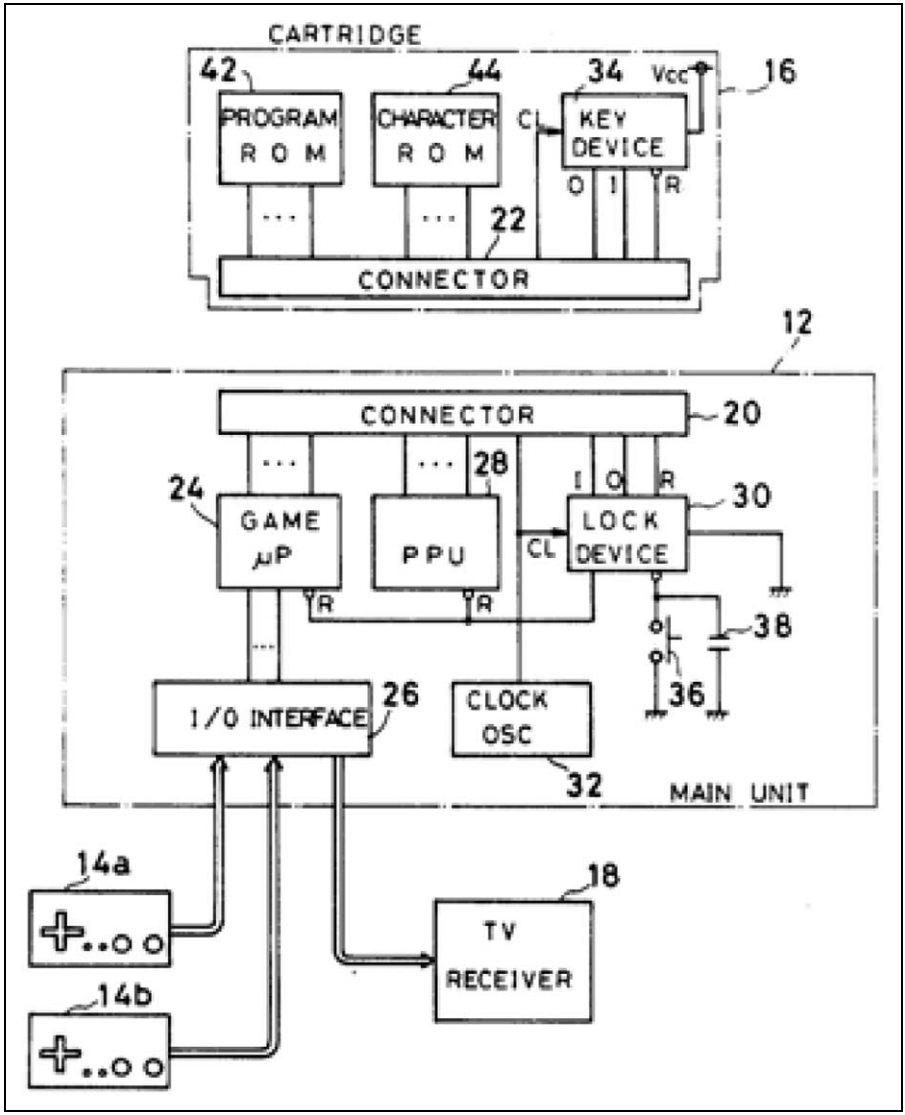

Figure 2. The lock and key of the 10NES patent.

Disciplining the Networks of the NES

Nintendo learned a great deal from Atari's past experiences[4] and knew that the kinds of people interested in making games were a resourceful bunch. Developers would figure out a means to circumvent production protection technologies. A simple

technological device while capable of influencing the way in which games were developed for the new NES was not enough to ensure control over the rights of production. This power is simply out of the hands of most organizations. To exert that kind of control requires the mobilization of government intervention, which is why Nintendo turned to the U.S. Patent and Copyright systems. To exert control over the networks which Nintendo hoped would form around the NES, code was not a sufficient form of legislation. The patent office provided one legal means by which force could be mobilized against those wishing to get around Nintendo's seal of quality. They were also careful in their copyrighting of the code that composed the 10NES chip. This provided them a second means of mobilizing the state to enforce compliance with their rules which they could not. Those wishing to pick the lock were now subject to litigation, and while it was still possible to reverse engineer the patented technologies, those doing so must do so carefully so that when they were sued, they could properly defend themselves in court.

Although several companies did manage to circumvent the lockout capabilities of the NES, it was largely not the case. Nintendo based most of their litigation on copyright claims rather than on patent infringement. In Nintendo's most publicized legal loss, Galoob demonstrated that their Game Genie product for the NES made no use of copyrighted Nintendo technologies. Rather, the Game Genie merely altered the code being transmitted from cartridge to console. The Game Genie did not circumvent the 10NES lockout chip, instead using the key device in the cartridge to allow normal booting of the NES. However, the far more common case was that companies attempting to market games outside of Nintendo's new rule system paid the price.[5] The most famous of these cases involved both patent and copyright infringement. Nintendo versus Atari and Tengen became the precedent for many of Nintendo's future legal claims.

> Atari first attempted to analyze and replicate the NES security system in 1986. Atari could not break the 10NES program code by monitoring the communication between the master and slave chips. Atari next tried to break the code by analyzing the chips themselves. Atari analysts chemically peeled layers from the NES chips to allow microscopic examination of the object code. Nonetheless, Atari still could not decipher the code sufficiently to replicate the NES security system.
>
> ...
>
> In early 1988, Atari's attorney applied to the Copyright Office for a reproduction of the 10NES program. The application stated that Atari was a defendant in an infringement action and needed a copy of the program for that litigation. Atari falsely alleged that it was a present defendant in a case in the Northern District of California. Atari assured the ''Library of Congress that the requested copy [would] be used only in connection with the specified litigation.'' In fact, no suit existed between the parties until December 1988, when Atari sued Nintendo for antitrust violations and unfair competition. Nintendo filed no infringement action against Atari until November 1989.

> After obtaining the 10NES source code from the Copyright Office, Atari again tried to read the object code from peeled chips. Through microscopic examination, Atari's analysts transcribed the 10NES object code into a handwritten representation of zeros and ones. Atari used the information from the Copyright Office to correct errors in this transcription. The Copyright Office copy facilitated Atari's replication of the 10NES object code.
>
> After deciphering the 10NES program, Atari developed its own program—the Rabbit program—to unlock the NES. Atari's Rabbit program generates signals indistinguishable from the 10NES program. The Rabbit uses a different microprocessor. The Rabbit chip, for instance, operates faster. Thus, to generate signals recognizable by the 10NES master chip, the Rabbit program must include pauses. Atari also programmed the Rabbit in a different language. Because Atari chose a different microprocessor and programming language, the line-by-line instructions of the 10NES and Rabbit programs vary. Nonetheless, as the district court found, the [F.2d 837] Rabbit program generates signals functionally indistinguishable from the 10NES program. The Rabbit gave Atari access to NES owners without Nintendo's strict license conditions. (Atari et al., 1992)

Why was Atari trying to get around the limitation? Why not just talk to Nintendo? There is of course the possibility that Atari was simply bitter, having gone from the leader of the video game industry to a player forced to work within the rules of another company. It is possible that Atari simply wanted more of the money coming to them rather than going to Nintendo. What neither of these answers give us however is any insight into the world in which Atari, Tengen, and Nintendo were operating in. We have no insight into why companies were feeling compelled to work around Nintendo rather than with them.

By reading further into the case, we learn more about Nintendo's licensing practices. Up until the introduction of the NES, companies were largely able to create games without licensing. The seal of quality changed all that. The inter/intranetworks of the NES had quickly become much more rigid. Those who are left outside the intranetwork formed by Nintendo were left with very few options. It is at this point that one can perhaps understand the frustration that companies were having with these structures. These networks were so well controlled that Atari was simultaneously seeking an antitrust suit against Nintendo (Atari et al., 1992). An excerpt from this court case provides insight into just how rigid even the intranetworks had become.

> In December 1987, Atari became a Nintendo licensee. Atari paid Nintendo to gain access to the NES for its video games. The license terms, however, strictly controlled Atari's access to Nintendo's technology, including the 10NES program. Under the license, Nintendo would take Atari's games, place them in cartridges containing the 10NES program, and resell them to Atari. Atari could then market the games to NES owners. Nintendo limited all licensees, including Atari, to five new NES games per year. The Nintendo license also prohibited Atari from licencing NES games to other home video game systems for two years from Atari's first sale of the game. (Atari et al., 1992)

Table 1. Screen Digest Sales Data 2006–2008 (Weber, 2007)

Year	Console Game Sales	PC Game Sales
2006	$11.2 Billion	$3.9 Billion
2007	$12.2 Billion	$3.7 Billion

What can be learned from this quote is significant. Publishing companies are given five games per year, and they must be paid for at manufacture. This is the game that so many people were having no fun playing. A publishing company's entire earnings were limited to five games a year, and those companies bore all of the risk associated with the costs of production. Nintendo was the only company unhindered by these limitations on production. If you attempted to change the rules, you were met with not only the ire of Nintendo but the force of the state apparatus. The legal ramifications of copyright and patent systems were leveraged by Nintendo to alter the entire playing field of the video game industry. Over the years, things have changed, Nintendo no longer places such severe restrictions on the number of games a publisher can create in a year. That can be demonstrated by looking at the number of games released for consoles each year by different publishers. That number has more to do with the amount of risk a publisher is willing to take, rather than an arbitrary distinction. Because the entire manufacturing run must be paid for in advance, and all marketing for a game must be covered by the publisher, creating games for consoles, while lucrative, is also extremely risky. With all of these limitations, why such an intense focus on the console industry by video game developers? What is it about the console video game industry that matters so much? Quite simply, because this is also where the most money gets made. Not just the most money but much more money by an order of magnitude (Table 1).

It is important to emphasize that this is not just about the structure of the video game industry and its relationship with console manufacturers. The assumption might be that this is just about making games, and eventually, if you want to put it on a console, you must go to Nintendo, or Sony, or Microsoft, or some publisher and demonstrate that your game is worth the risk. However, given the inter/intranetwork context, the answer begins to shift. This has become an exclusive game. Corporate consolidation of video game studios under umbrella publishing companies has severely limited the ability of many developers to gain access to the networks necessary for creating games for consoles.

Working the Network of the NES

Ultimately, however, this story does come back to the ethnographic. The networks of the NES offer us and me insight into why developers have become frustrated with existing situations. At the same time, developers have not just "traded their allegiance for televisions" but for a slew of new and interesting technologies. The NES

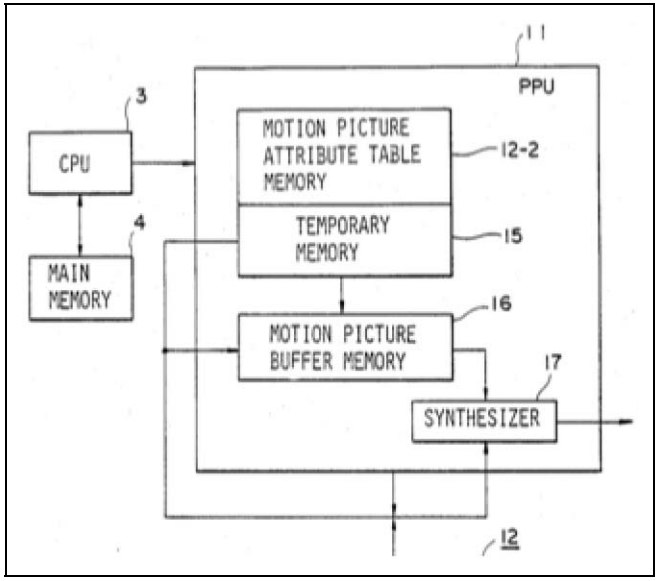

Figure 3. The picture processing unit for the NES.

in particular was so chock full of new and interesting technologies that developers were happy to buy into these licensing schemes as a means of inserting themselves into the networks which were emerging.[6] One particular innovation that separated the NES from previous generations of consoles was its use of a new (and patented) technology, a precursor to the now ubiquitous graphics processing unit, or GPU. Nintendo modified the way graphics were processed and delivered to the television screen on the NES. This innovation improved and simplified the way graphics were stored and delivered to the screen. It also allowed the CPU of the console to spend more time doing game-related operations and less time doing graphics-related operations. This picture processing unit or PPU was a major design innovation for the NES. Many tasks that had previously been the responsibility of those writing the instructions or code for the console were suddenly capable of being handled by the hardware of the NES, the scrolling of background layers or the rendering of sprites to the screen (Figure 3).

> . . . a central processing unit for controlling the overall operation of the system under the control of the operator, and a picture processing unit for combining motion and still picture patterns to form a video signal to be supplied to the T.V. set . . . . (Ueda & Yagi, 1987)

The PPU changed the way that resources were allocated for games. Pixel memory differed from system memory. Sprites could be loaded into memory in a different

location from that of running game code memory. But this also altered the way games were developed, how could one create these games without the same technologies in place on PCs? Thus, the NES also heralded the birth of a now ubiquitous game development technology, the "DevKit."[7] DevKits were introduced so that game developers could create games for consoles where the hardware differed significantly from that of PCs. Nintendo developed technologies to bridge the gap between the PCs where code was typically written and the consoles, which ran the code. The complexity of these devices has increased dramatically as the complexity of consoles has risen.

DevKits are also distributed with the software packages that simplify the process of game development. These range from software development kits (SDKs) that provide a set of software resources that developers can draw on, to software tools that combine art, code, and data into a format that can be delivered and run on a DevKit. Without these resources, the process of creating games can be much more complex. On a simple system such as the NES or Game Boy Advance, some of these limitations can be overcome by hobbyists, but the resources typically available to developers are off limits. DevKits have become a foundational technology that for the most part remains invisible in our analysis of game and game development worlds. These highly networked technologies that so significantly structure the everyday worlds of developers have receded from view. Perhaps, most importantly however, access to these devices is so closely guarded that even photographs of them violate the nondisclosure agreements to which they are also connected. The DevKit embodies or at least signifies a developers acceptance into the inner circles of the video game industry (Figure 4).

Although many of the technologies that compromise consoles and PCs have actually converged, the "lockout chip," 10NES or otherwise, perseveres. It is the main limitation between the worlds of developers and getting their games onto consoles.[8] It is the limitation that prevents new publishers from challenging existing ones. The distribution of DevKits fits nicely into the way the networks have been structured throughout the video game industry. The big players are leased these DevKits for large sums of money. They use them or distribute them to developers making the games for the consoles. Even in consoles purported to use "standard CD-ROM" drives (Malliet & Zimmerman, 2005), place similar limitations on developers. It has actually be more complex as of late, with the introduction of the Digital Millennium Copyright Act (DMCA) and the introduction of encryption schemes to console game systems.[9] These technologies and legal systems continue to dramatically structure the networks of the video game industry.

Conclusion

The actor-network has long been a useful core category used by social analysts looking to understanding productive practice. What this text does differently is take the issue of access and visibility within networks and bring it to the foreground. The

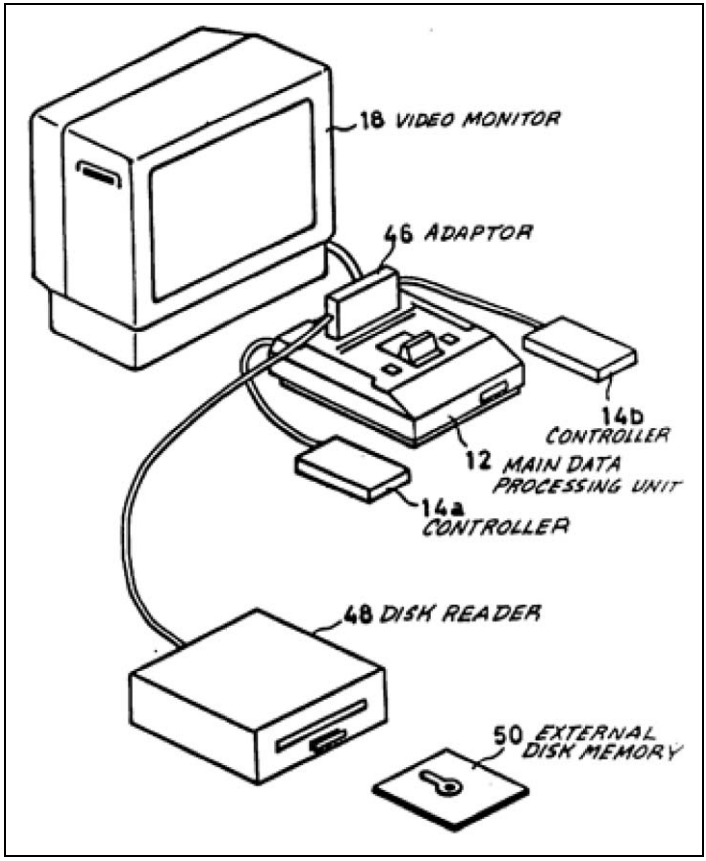

Figure 4. The birth of the "DevKit." The Famicom combined with a disk drive served as the NES DevKit for many developers.

inter/intranetwork by its marking of "inside" and "outside," denoted by the slash, encourages us to constantly pay attention to the restrictive capacities of networks. Too often networks are talked about as inherently open, better, or different than hierarchical systems, yet networks can be just as hierarchical. There is nothing fundamental about networks that make them naturally flat or more open. They must be constructed in ways that enable flatness or openness.

Again, my argument is mobilized by this distinction not that "inside" is good and "outside" is bad or vice versa. Both the internetwork and the intranetwork are necessary and useful in the context of video game development. The good/bad distinction is made more carefully. Intranetworks are expanding at an explosive rate because of corporate consolidation. Internetworks are shrinking and being used as sites for offloading labor and risk. Rather than both being used productively to foster

and encourage creative collaborative practice, inter/intranetworks are being used to shore up existing sites of power and control.

The inter/intranetwork also offers social analysts a reason, perhaps even demanding, that they begin paying attention to the structure of networks, technical or social ones. Perhaps, drawing parallels between Network Neutrality deployed in a social context rather than simply in a technical one might help illuminate for politicians why it is such an important issue for technologists. Although social analysts have found the core category of the network useful, we ought to push the metaphor further. Protocols, routers, switches, hubs, access, and the inter/intra distinction all offer new tools for thinking about power in the context of networks.

The most apparent structures that game developers encounter on a regular basis are their connections with publishers and console manufacturers. These relationships are heavily managed and controlled. Although these networks of inaccess frequently delineate those studios that have proven their ability to develop video games, it does not indicate that those who fall outside lack those capacities. The Lead Designer of the game Puzzle Quest, notes how despite the breakout hit of the PC based demo, they faced constant roadblocks from publishing companies. The game has since been ported to the Nintendo DS, Sony Playstation Portable, and Xbox 360's Live Arcade. A game that almost did not make it out of prototyping because of publisher resistance has gone on to be hugely successful.

> No matter how much experience we had developing games, and no matter how many previous titles we could show off that had won Editor's Choice awards and 90 percent review ratings, no publisher wanted to deal with a PC developer in the console space until we had a game that was about 75 percent complete and that we could demonstrate. (Fawkner, 2007, p. 42)

The ability to participate in the broader video game industry is structured by inaccess to console hardware and distribution markets. The console space dominates the imagination of game developers in part because of the massive amount of money that circulates through it but also because it is a social indicator of having breached the intranetworks of the video game industry. It is a status marker. Despite a game studio's success at creating games, its access to these worlds may be severely restricted. These relationships can provide resources game developers can draw upon. They can also be used to constrain and push developers into situations where destructive relationships internally and externally wear down the talent and drive of those working on games.

The overarching argument for this essay has been that as the industry has "matured," the networks have become less accessible and less interoperable. Consequentially, this trajectory is one that limits developers more than they might like to believe and in ways many are unwilling to criticize. At the same time, however, it is the part of the game industry, which disappears from their perception. Once a company has gained access to DevKits and SDKs, they recede into the

background, despite the fact that they were once one of the major gatekeepers of access to industry networks. Far too quickly developers allow themselves to forget just how difficult it can be to work amongst the structures of the industry.

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Notes

1. Greg Costikyan is an interesting figure in the video game industry, who began as a board game developer and has worked on numerous video game projects. He has also been a caustic and amusing commentator on the video game industry. His website can be found at http://www.costik.com. He is also the Editor in Cheif of Play This Thing, a site devoted to non-mainstream games: http://playthisthing.com.
2. Of particularly early note is an examination of the labor politics associated with video game development hobbyists or hacker/modders (Postigo, 2003, 2007). This work drew heavily on previous work looking at work and production in the online/digital context (Terranova, 2000). The "immateriality" of it all is precisely what makes it exceedingly important for localized and situated accounts of production work in the video game industry.
3. A recent article on the IGDA website and corresponding academic article in Convergence, Deuze et al. point to the lack of academic attention to the worlds of game developers, a sentiment that I whole heartedly endorse (Deuze, Martin, & Allen, 2007). Analysis of the legal and commercial complexity of the video game industry is also deeply important to understand the context.
4. An excellent historical account of the rise and fall of Atari and the 1983 video game industry "crash" which I refer to as "experience" can be found in (Kent, 2001).

5. There are of course more examples of companies which managed to circumvent Nintendo's lockout mechanisms. As near as I can tell based on unscientific searches, 87 unlicensed titles have been released, compared to the 670 licensed titles (Nintendo, 2003).
6. Hegemony as defined by Antonio Gramsci operates through process of coercion and consent. So too does the imbuing of networks with power relations. Without our acquiescence these systems of control will fail. A very readable introduction to this concept can be found (Simon, 2001). Although at moments it may seem that I am leveling all blame at the console manufacturers, in fact I am not. In the context of the video game industry, there is no boogie man, rather the boogie man is constructed through the construction of these systems, which ultimately we allow to be constructed.
7. The "DevKit" is distinct from "development kits" as defined by some authors (Postigo, 2003, p. 603). There is a slippery and important language to keep in mind. SDKs or software development kits are distinctly different, though intertwined with DevKits. DevKits typically have accompanying SDKs. However, it is possible for companies to release SDKs without having DevKits. The hardware of the DevKit is in part what distinguishes it from an SDK. It is also access to documentation and other resources like online discussion forums.
8. It also strikes me as uncanny current "trusted computing" endeavors by PC and Software companies as making an appeal to the 10NES worlds of game development where you can be much more sure that a user has paid for what they are playing. "The 'trusted' part of this system is that this device obeys rules established by the copyright owner when they first make the song available." ... "The rhetoric is classic command-and-control, a far cry from the delicate balance of copyright" (Gillespie, 2004, p. 241).
9. The DMCA has come under particular scrutiny recently because of its relationship with digital rights management (DRM). For more information on the DMCA, see (DMCA, 1998). It is my position that DRM technologies were actually a collective invention of the video game industry. Although users interested in playing music files seem to have gotten the bulk of the attention, game content has long been restricted and many users fail to see their rights extend to game content. Although this is good for the video game industry, I would posit that our inconsistency or inattention is especially problematic because it erodes the foundations of our argument. Some in the video game industry have noted this, though seem unsure what it means (Fahey, 2007).

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Bio

Casey O'Donnell is an assistant professor in the Telecommunications Department at the University of Georgia. His research examines the complex sociotechnical intersections/interactions that occur during the design and development of video games. This research examines the power dynamics that occur in both professional organizations and formal and informal ''independent'' game development communities. His research has spanned game development companies from the United States to India.