From Rule-Breaking to ROM-Hacking: Theorizing the Computer Game-as-Commodity

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ABSTRACT
This paper develops a theory of the game as a commodity form by looking at the unique practices of console hackers and videogame emulation communities. This theory argues for the necessity of understanding a game's system of rules in relation to the material conditions and constraints of the media within which it is constructed and distributed. After deriving the computer game-as-commodity from a combination of institutional and material restrictions and protections on the free-play of the execution of game rules, I provide an account of emulation and ROM-hacking communities as a cultural critique and playful resistance of such commodification within the rigid legal and technological infrastructures of autonomous, executable, and copyrighted machine code. Rather than asking whether videogame emulation is "right or wrong" in the abstract, I examine the legal, economic, and aesthetic implications of emulation practices, asking what the efforts of the emulation and ROM-hacking community have to contribute to the study of console videogames. Finally, I argue that analyzing and embracing the efforts of a variety of practices within the emulation and ROM-hacking communities is helpful and essential to both mapping past struggles and tracing future paradigms of the computer game's contradictory status as a commodity to be consumed and an algorithm to be uncovered.

Author Keywords
Computer architecture, Console videogames, Emulation, Hacking, Piracy

INTRODUCTION: THE SCENE OF EMULATION

Like most modern commercial entertainment industries, the videogame industry has waged war on piracy for the past several decades in order to protect and maintain its intellectual property rights in our age of mass digital distribution. One of the most widespread forms of piracy is videogame software extracted from Read-only memory (ROM) chips and freely distributed across the Internet. A staple among classic gaming enthusiasts is the use of unauthorized videogame emulators to play these copied or downloaded games on systems other than those for which they were designed, most often modern personal computers. Companies such as Nintendo, Sony and the Interactive Digital Software Association routinely warn us that unauthorized videogame emulators are not only illegal, but they inflict serious economic harm upon the game industry as a whole. Still, despite the complex and hotly contested legal issues surrounding emulators and the (often pirated) game software they execute, the success and popularity of console emulators among gamers is largely responsible for recent interest in classic and retro gaming, as emulators give players the means to conveniently play a variety of otherwise-inaccessible games. As was the case with mp3 players and the music industry, the growth of console videogame emulators perhaps reflects new game distribution paradigms that the industry discourages if only because they are late adopters themselves. Indeed, the seemingly endless profitability of classic and retro gaming does not show any signs of slowing down, judging by the recent successes of the Nintendo Wii virtual console, the Xbox 360 LIVE Arcade, and various mobile and handheld gaming platforms that provide endless opportunities to recycle and revitalize classic game properties for gamer generations new and old alike.

This is the standard narrative of the emulation 'scene,' and it is certainly one worth telling. However, I would like to go beyond these standard debates over digital distribution, and argue further that the critical activity and value of emulation communities is far more significant than merely the ability to distribute games through new hardware and communication channels, whether preservation or piracy. What is more seriously at stake in the development of unauthorized console emulators, and what we still find intentionally absent in the recent deluge of retro remakes, classic cartridge ports and arcade compilation packs, is a transformed relation to the game object that is only made possible through a transparent interaction with the underlying rule-producing machine. The key distinction to be made is between the experience of a player-consumer interacting with a fixed commodity object, and that of a player-hacker interacting with a knowable algorithm and transforming it in individual and unexpected ways.

THE HACKER CLASS STRUGGLE

The sort of hacker I wish to characterize here plays

Situated Play, Proceedings of DiGRA 2007 Conference

according to the mantra, “Information wants to be free but is everywhere in chains” [7]. According to McKenzie Wark's *A Hacker Manifesto*, the term 'hacker' is a badge of honor for the proletariat of the information age, our humble protagonist in the narrative of a proper techno-Marxist struggle. The subjected hacker class is pitted against the ruling 'vectoralist' class in an era where hacker-produced information contained within increasingly-complex abstractions (potentials of potentials of production) becomes 'chained down' and codified as discrete objects of intellectual property. Hacking, then, is always in an antagonistic relationship to this system of ownership, and a unifying call to class consciousness hopes to release the subjugated information into a common space where the universal exchange of ideas is free and open to the benefit of all of humanity. “Whatever code we hack, be it programming language, poetic language, math or music, curves or colorings, we are the abstracters of new worlds. Whether we come to represent ourselves as researchers or authors, artists or biologists, chemists or musicians, philosophers or programmers, each of these subjectivities is but a fragment of a class still becoming, bit by bit, aware of itself as such” [7]. For Wark, a hacker is not merely a savvy programmer, or a destructive computer criminal – the hacker class comes into existence in opposition to the development of the totalizing structure of intellectual property itself, and is the very embodiment of this necessary revolutionary struggle.

I think Wark's depiction of the hacker class is prescient and enlightening, and the framework he constructs is useful in that it points out a very distinct feature of the relation of knowledge to production in our digital age: the commodification of information into property no longer tied to a specific material form, but containing abstract value in itself as a protected algorithm embodied in computer code. This, I believe, is one of the most essential and defining properties of the computer game as a medium when compared to its predecessors. Whether or not we wish to heed the unifying call of Wark's manifesto, it is clear that *we desperately need a depiction of the game-as-commodity* in order to adequately account for game creation as the production of a certain use-value, as the commodity form underlies our very conception of a digital game.

Such a depiction is essential not only in order to account for the concepts of hacking, piracy and other forms of resistance and subversion that are necessary outgrowths of the evolution of this protected game-commodity, but also to make explicit as producers and distributors of game-commodities the ways in which, from the very moment of their inception, our game creations are always necessarily set within these complex social networks of possibilities of reproduction, consumption and modification of the rule systems that comprise our games. Any game is simply not fully described unless the material historical conditions of the medium within which it was produced, consumed and distributed are taken into account. In order to achieve our goals as game designers, critics and players, whether shipping a successful commercial title or taking part in a unique or transformative game-playing experience, a game cannot be adequately understood on the basis of its formal system of rules alone, as in the structural projects of early ludologies. Of course, thinking the game as a machine is a necessary first step; what comes next is thinking the broader social machine that defines and protects the material communications and conventions that fix the game as a knowable, static object. One must always take into account the player's constant material relation to the social, political and economic institutional structures that legitimate and motivate the rules.

In the defining processes of rule-formation itself, the meta-game so to speak, sets of restrictive meta-rules either prevent its player-consumers from or encourage its player-hackers to transform, adapt and distribute the systems of rules themselves. It is this interminable set of *a priori* conditions informing the social relevance and mutability of the set of game rules and their operative execution that ultimately structures the game's design and determines its overall cultural and critical impact. Although we tend to assume that computer games have certain fixed, absolute rules embedded in unalterable program code and that's that, such a depiction takes for granted their implicit formation within systems of computer technology and intellectual property.

When we conceive the hacker as a critical subject formed in antagonistic relation to systems of intellectual property, one who challenges and interrupts the cohesion of rule systems embedded within technological commodities, these systems are finally brought to our full attention. That is because the hacker plays with rules precisely on the level in which this form of play is conventionally prohibited in contemporary technological society. In order to develop this point in a general manner not specifically tied to digital technology, I will now describe the historical, institutional formation of the game-as-commodity as a 'corruption' of an ideal game form.

INSTITUTIONS AND THE CORRUPTION OF GAMES

To the hacker, the commodification of game rules into intellectual property provides a material barrier against the spirit of free-play with the rule system, distorting the player's open, playful interactions with the object and therefore exhibiting a sort of “corruption” upon an idealized notion of play. This corruption can be traced to the lamentation of the corruption of play by professionals found in Caillois [1].

Following Huizinga, Caillois traces the corruption of play to the rise of ends-directed game-playing in modern civilization, or play for material gain beyond the pleasure of the game itself. Professional game-players exhibit a

corruption of the institutional consensus surrounding the rule formation, regulation and execution in games. Since the regulation of the rule systems is not performed by the players themselves, they gain opportunities to cheat by exploiting holes and ambiguities within the institutional rule system. "If play consists in providing formal, ideal, limited, and escapist satisfaction ... what happens when every convention is rejected? When the universe of play is no longer tightly closed? When it is contaminated by the real world in which every act has inescapable consequences? ... the tendency to interfere with the isolated, sheltered, and neutralized kind of play spreads to daily life and tends to subordinate it to its own needs, as much as possible. ... The principle of play has become corrupted" [1].

While for Caillois this difference between well-principled and corrupted play "concerns only the players" and is therefore an individual phenomenon, I would like to focus on the institutional formation which gives rise to the corrupted *game*. Rather than lament the emergence of cheaters, hackers, and professional gamers as social aberrations, we can focus on how the institutions themselves construct such deviant categories, and consider how we can possibly thwart such corruptions.

In "corrupt" sports, for example, ossification of the rules takes place through bureaucratic institutions rather than through the collective decisions of the individual players themselves. Rules are no longer constructed to directly serve the intrinsic motivations of the players; they conform instead to motivations of its institutional benefactors. Reform and evolution of the sport's rule structures is still possible; however, this change now takes place through legislation and the economics of entertainment and audience spectatorship rather than through a social negotiation of the rules among the players themselves. Here, resistance can take place through amateurism, which serves as a negation or refusal of the 'corrupt' regulating institutions. Amateur game-playing communities specifically exclude professional activity and therefore encourage a spirit of play not motivated by similar institutional concerns. For example, the informal network of pickup tennis players described in "Unwritten Rules" describes this amateur resistance well [5]. (It is worth noting that the term "hacker" is also used here, under a different definition of the word, to describe these amateur tennis players.) The Olympic games is perhaps an exception to athletic amateurism as institutional resistance, since the institutional motivations of that organization assume an alternative form that still greatly overpowers the hacker desire for less restrictive free-play.

I see such a critique of institutionalized, professional sports as an early form of theorizing the game-as-commodity. So what exactly do institutional sports have to do with commercial videogames? Why not trace the history of the game-as-commodity through the history of commercial board games, a more obvious association? There is an important distinction to be made between the types of objectification found in board games versus institutionalized sports, both of which are manifest in the computer game box you find stocked on the shelf in a store. In the case of a board or specialized card game, a game commodity is generated by embodying the game rules within a tangible, material object, a physical product that can be mass-produced and distributed all over the world in a uniform fashion. However, although the rules of a board game are standardized and distributed as a commodity they are not yet fixed or proprietary, since the execution of the rules is performed and upheld by the mutual consensus of each individual community of players. Consider a leisurely game of Monopoly, and how easy it is to arbitrarily modify the "house rules" during the game to suit a particular social situation. This freedom, the ability to play with the rules or 'meta-game', is still present in card and board games in a way not available to the participants in either organized sports or computer games. The key lies in the procedural execution of the rules: Whereas the rules were formerly maintained by communities of players themselves, in the case of institutionalized sports it is entrusted to referees, and in the case of computer games it is entrusted to the computer architecture.

In other words, the commercial computer game completes the process of commodification started by the combination of commercial board/card games and institutional sports, by further encapsulating the execution of the rules themselves within a controlled commodity object. We could say that most board games are all 'open source' by necessity, in stark contrast to the 'closed source' of most commercial computer games. Whereas the rules of the institutionalized sport are executed through an external, enclosed system of referees or judges, the computer game rules are executed by an external, enclosed computer architecture.

GAME COMMODITIES AND HACKER RESISTANCE

Commercial computer games thus exhibit a corruption of idealized free-play, eliminating the possibility of meta-gaming as a result of the commodification of the execution of rules. This protection of the rule system takes on at least three distinct tactical forms:

1. Obfuscation: With the advent of advanced compiler design and object-oriented programming languages, almost all commercial computer games are compiled into machine code and rendered unintelligible by end-users. The system of rules are therefore rendered literally unreadable, and as a result must be taken for granted.

2. Legislation: In addition to standard copyright laws which protect artistic expression, the Digital Millennium Copyright Act (USA) and other similar international copyright laws now prohibits the "circumvention" of most digital copy-protection mechanisms, regardless of any

potential fair-use of the information contained within the device. The implications of these laws make it illegal to even attempt to gain access to the machine code of a computer game distributed on copy-protected media.

3. Systematic/Protocol: This protection tactic off-loads core components of the rule systems to a machine owned and/or protected by the game developers, so end-users never even have physical access to the underlying machine or its proprietary code. This takes place in MMORPGs, for example, through black-boxed algorithmic interactions over the Internet with a physically inaccessible server machine executing the game rules in a protected environment. In the near future, hardware-level DRM encapsulations may in fact provide the same abstract possibility on a user's local machine.

As mentioned earlier, we can view the forms of resistance such as cheating, hacking and piracy not as social aberrations but as natural outgrowths of these corrupted game forms. Therefore, each of the above three strategies of commodification have their corresponding strategies of hacker resistance. Although commercial game developers usually employ a variety of the above methods to protect rule systems from being modified and illegally distributed or pirated, **all** three of these forms of commodification are always theoretically breakable or bypassable. Examples of confrontations with #3 include attempts to emulate game server protocols through reverse engineering client-server interactions (and then hacking the client software to redirect connections to new emulated servers), such as unauthorized server emulator projects for Everquest and World of Warcraft. Console emulation and ROM-hacking (the physical manipulation of data contained in ROM cartridges) confront methods #1 and #2 directly, engaging the rules encapsulated within the game-commodity at the levels of computer hardware architecture and the related intellectual property debates. I will now describe these three corresponding types of hacker counter-resistance in detail.

1. Transparency: In response to the obfuscation of computer code, hackers make extensive use of the strategy of transparency in their collaborations and documentation. It is therefore no surprise that the majority of successful, long-lasting emulation projects are developed by teams of Internet community developers who make their work freely available, whether in the public domain or under a standard open-source 'copyleft' license. This applies as much to actual emulator source code as it does to the creation of public architecture documents of the proprietary console systems themselves. In order for emulators of proprietary video game hardware to be developed, the systems themselves first must be reverse-engineered and analyzed. The documentation of system architectures that results from these efforts is perhaps the most important product of any emulator development, because good documentation greatly reduces the initial overhead of future emulators to come.

2. Counter-legislation: In response to the heavy legal protections applied and enforced by intellectual property owners to protect the value of their commodities, hackers must be vigilant in their fight to be granted the full public rights and fair-use protections that are available within copyright law. Although the unauthorized distribution of copyrighted videogame software on the Internet is undisputedly illegal, a great deal of other more legitimate companies and technologies that disrupt, emulate, enhance, or alter the normal consumer game-playing experience have accumulated a very extensive and complex videogame case-history. (As the full legal status of the specifics of emulation and ROM-hacking practices is ambiguous, complex and largely untested in court, I will refer to the analyses provided by Pettus [4] for a detailed and thorough analysis.) Some companies producing game-hacking products that have successfully defended their legal rights in court battles include Galoob and its Game Genie line of proto-ROM-hacking devices, and Connectix's Playstation emulator. Also worthy of mention is the Internet Archive's successful lobbying efforts to extend DMCA exemptions to obsolete console videogame systems in order to legalize their emulator-based preservation in its digital archives.

3. Reverse-engineering: Finally, the only way to effectively tackle inaccessible systems or protected protocols is to use standard reverse-engineering methods to reconstruct the protected machine from sets of inputs and outputs using whatever publicly-accessible information is available, building a machine from the ground up that best approximates the original system.

EMBRACING EMULATION

The theoretical basis for computer emulation dates back to the origins of computational theory, in Alan Turing's description of a “Universal Turing Machine”. Turing's thesis famously states that “it is possible to invent a single machine that could be used to compute any computable sequence” [6], which would include the operations of any other computational machine including itself. This theory applies to any general-purpose computer (if we reasonably ignore time and space constraints), and so the feasibility of emulation only depends on the efficiency of the translation of computations involved.

Today's console emulators are a direct offspring of our post-scarcity era of digital distribution and the tactics of transparency it enabled. Although various publicly available emulators were distributed via Bulletin Board Systems prior to the Internet boom of the mid-90s, the growth of Internet communications and continual increases in processor speeds generated a critical nexus of media distribution, collaborative development and real-time functionality that allowed console emulators to become functional, full-featured development projects.

The sorts of projects that have emerged from many of these

communities have shifted from simple production and consumption of cartridge games for an contemporary game-playing mass audience to a meta-gaming or "playing with the rules" within smaller, niche fan communities with more diverse ambitions. This has allowed some very creative types of emulation and ROM-hacking projects to develop. Projects that concern themselves directly with general-purpose console hardware emulation are primarily concerned with reconstructing the game-playing experience; however some noteworthy creative paradigms have even emerged from the development of emulators themselves. Here is a brief list of some of the types of creative achievements that have emerged from these emulation and ROM-hacking communities:

Emulator-assisted manipulation of time and space: With full control over the computer system architecture, a great deal of convenient and playful modifications concerning the execution of the game-rules can be performed. Pause/resume, speed-up/slow-down, instant saving/loading of multiple game states, Internet multiplayer, and gameplay sequence 'movie' recording/playback are some of the more common features found in console emulators. Many of these manipulations have since become standard, expected features in modern game designs.

Data mining and remixing: Selective reverse-engineering of the information contained in a ROM can take any number of forms, from game-specific editor programs to manipulate or view certain variables, art content or level designs, to full-fledged content extraction from a ROM for dissemination and use in general-purpose viewers, editors and players. For example, pixel-perfect sprites extracted from emulator screen captures can be remixed in parodies or other artistic creations in the name of fair use, or a data mining program might enable one to legally view all of the 'unlockable' content in a game without first completing the necessary procedures.

Game ROM-hacks: Reverse-engineered, data-mined content can be manipulated and repackaged within a modified ROM, along with other modifications of the machine code to produce game modifications ranging from simple cosmetic hacks to full-fledged projects featuring new graphic art, music, game mechanics and level designs.

Fan translation ROM-hacks: A great number of ROM-hacking projects involve binary machine-code manipulation of font and text rendering engines in order to produce full script translations, predominantly from Japanese to English or from Japanese/English to various other languages, making many text-heavy games accessible for the first time to unintended international audiences.

"Superplays": Entirely separate from game ROM-hacks but exhibiting an equally substantial element of meta-gaming, "superplays" or tool-assisted speed-runs are carefully recorded sequences of player inputs replayed through an emulator that display super-human precision and creative finesse [3]. The emulated games are initially played at a very slow frame rate or attempts are repeated many times until perfection, and then spliced and sequenced together in order to achieve perfection. As competition to achieve new and better super-human records for speedy speed-runs of popular classic titles builds, the artistic construction of a super-play engages the game from an entirely new, formal perspective, one only obtainable through this meta-gaming on the level of the execution of rules that an emulator affords.

CONCLUSION: THE CRITICAL GAME HACKER

Although the hobbyist rule-breaking performed by emulator and ROM-hacking communities is hardly an example of a full-fledged hacker class waging digital revolution against the totalizing regimes of intellectual property in Wark's sense, its analysis demonstrates several points of critical reflection regarding the legal and technological resistances to playing with the rules of commercial computer game-commodities. This leads us to consider a theory of game rules as fixed objects not only in the sense of legal and technical restrictions on material distribution, but also in the sense of being encapsulated in inaccessible executable machine code. In the practices of console emulation and ROM-hacking, some of these restrictions begin to unravel, often decades after the game's initial creation, as classic games are now being creatively rediscovered and reworked by hobbyist communities. Therefore, to begin with, we can at least grasp the necessity of understanding the videogame landscape in relation to the practices of emulation and hacking efforts that continually contest, transform and redefine the object-status of commercial games people play.

Further, as individuals devoted to the study and analysis of games, we can note the affinities between a hacker's relation to the game-as-algorithm and our own work to challenge assumptions underlying common conceptions of games, analyzing the mechanisms through which they work in culture. Let us take away from these examples the necessity of embracing some of the formative ethical and tactical concepts of emulation and ROM-hacking in our practices of engaging the games we study at every technological and social level of the construction of game rules.

Academic programs in game studies are in the unique position to offer institutional support for hobbyist emulation and ROM-hacking communities, and it is our obligation to utilize the resources of thousands of programmers and gamers in our common goal of reverse-engineering and documenting, recontextualizing and reworking these products beyond mere objects for consumption. For example, a massive arcade emulation project such as MAME [2] could only have been accomplished through the international collaboration of individuals driven by the goal of preservation of early videogame history. To hobbyist

communities where thousands upon thousands of hours are selflessly devoted to such work, a little support can go a very long way, whether it's trivial facilities such as server space or the valuable intangible resources of a university such as academic legitimation or public recognition. When these hobbyist communities are aligned with our own academic interests in the critical analysis and cultural transformation of video games, it is imperative for us to support, collaborate with, and push them in a culturally beneficial direction.

We can also derive several paradigms from emulation community practices that could be productive for game researchers to support and use, and perhaps even helpful for game developers to consider adopting themselves in the long-term. For example, systems to support legacy software for portability and backwards compatibility, the fundamental goal of any computer emulation project, have long been a recognized standard practice in the personal IBM-PC computer industry, and we are even beginning to see similar demand and increasing support on newer consoles.

Nevertheless, I don't expect the contradictory struggle between the commodification of games and the hacker's transparent algorithms to ever reach a full resolution. Instead, the strength with which proponents of open-architecture emulation projects and defenders of intellectual property rights battle each other across diverse legal, technical, and economic landscapes simply demonstrates that there is a great deal at cultural stake in the protection and destruction of game rules and the ways in which we are able to transform them.

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