ABSTRACT

CARRINGTON, CLAIRE ELIZABETH. Blasting at Mastery: Math Blaster! as a Media Instrument. (Under the direction of Dr. Nicholas Taylor).

Math Blaster! was an early video game for the Apple II computer, intended to engage and entertain student audiences in elementary schools; however, there exists a connection between the development of games like Math Blaster! and powerful forms of institutional control at play in other areas of technological development. Math Blaster! is also a rich site of converging sociocultural elements, including several threads of power: customizability via user settings, overworked and underpaid teachers tasked with deciding how to implement the game in classrooms, the beginning of an era where administrators would use video games to try and push institutional goals, and importantly, how American society came to greatly value science, technology, engineering, and math (STEM) education. There is incredible value in studying such a powerful media instrument as Math Blaster! as a touchpoint for both the development of new media and education reform. This work utilizes the Foucauldian-based media genealogical method, drawing on unexpected and often nonlinear elements to illustrate how institutions functioned to steer the direction of media technologies. Using poststructuralist theorizations of the apparatus, this work investigates the 1983 game Math Blaster! and the cultural prescriptions that it helped to create and reinforce. Ultimately, the original Math Blaster! game served as an instrument for instilling the values of a STEM education in the elementary school classroom in the context of the Reagan-era Cold War developments, but more importantly, it also had significant power in shaping a genre of gaming that relies on entertainment to instill these values even today.
Blasting at Mastery: *Math Blaster!* as a Media Instrument

by
Claire Elizabeth Carrington

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APPROVED BY:

_______________________________  _______________________________
Dr. Christopher Ingraham                 Dr. Sarah Stein

_______________________________
Dr. Nicholas Taylor
Committee Chair
BIOGRAPHY

Claire Carrington is a student in the Department of Communication at North Carolina State University, where she is completing her Master of Science in Communication and teaches Intro to Public Speaking. She graduated from Campbell University in 2016 with her B.S. in Health Communication and B.A. in Public Relations with a minor in Biology. Her academic interests include critical approaches to technology and science communication, game studies, health communication, and women in STEM education. She plans to pursue work after graduation in a science or technology field, and eventually to continue her graduate studies working towards a Ph.D. with specific attention to the sociocultural roles of certain technologies.
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CHAPTER 1: Introduction

As I sit at my kitchen table waiting for the Sega Genesis version of *Math Blaster – Episode I* to load, I am suddenly met with the tinny digital tones of a heroic-sounding song and the image of a smiling, bright green space-man in a helmet. The screen zooms out, and this protagonist (named Blasternaut, I later discover) stands on a moon with his blue robotic companion. Suddenly, there is a high-pitched whistle. I shift uncomfortably in my seat and adjust my speaker volume as Blasternaut’s ship descends to pick him up. My eyes drift down to the image of a music note at the bottom of the screen, and with one click, the game is silent. I can no longer hear the dialogue between characters, although I have already heard the dramatic story: the protagonist’s sidekick Spot has been kidnapped, and I am tasked with rescuing him by typing the answers to math equations and shooting trash floating through space, which seems oddly disconnected from the storyline and purpose of the game.

*Math Blaster!* was an early video game for the Apple II computer, intended to engage and entertain student audiences in elementary schools. This game was an important touchstone for the development of newer technologies, which now have far more sophisticated ways of controlling—and ceding control over—the experience of those who use them. Early games like *Math Blaster!* provided an initial site to develop and refine particular elements of computer use, and for users to be simultaneously reconfigured by these new elements. It is critical to understand how this reconfiguring occurred so as to better understand how it has translated into broader transformations in technology use. However, there exists a tension between the perceived and actual degree of control users have in these digital spaces. In addition, there exists a connection between the development of games like *Math Blaster!* and powerful forms of institutional control at play in other areas of technological development.
This work began from a kernel of interest in surveillance studies, which are at work (and play) in various forms of modern computer-based digital media, and in user settings menus, which purport to provide a degree of customizability to users who interact with media. I discovered the game *Math Blaster!* while attempting to determine where user settings initially materialized, and I realized that this was the original game where settings menus began to develop into a form we know and take for granted in media today. However, I found myself drawn back again and again to *Math Blaster!*, its wider impacts, and its broader implications, including the story of its use in the classroom. There was a rich site of converging sociocultural elements to explore with this game, including several threads of power: overworked and underpaid teachers who had to determine how to implement the game with new class computers, the beginning of an era where administrators would use video games to try and push institutional goals, and importantly, how American society came to greatly value science, technology, engineering, and math (STEM) education. As computers became a regular fixture in American classrooms in the early 1980s, I discovered that there was a crucial need to take a deeper dive into 1983 elementary schools to see where modern STEM-based educational ideals may have taken root.

What follows is a powerful story that reveals crucial threads of meaning around American cultural ideals, which I utilize apparatus theory and the media genealogical method to investigate. The original *Math Blaster!* game itself served as an instrument for instilling the values of a STEM education in the elementary school classroom in the context of the Reagan-era Cold War developments, but more importantly, it also had significant power in shaping a genre of gaming that relies on entertainment to instill these values even today. It also introduced a generation of students to a new technology that would become increasingly important, as well as
customizable, in the coming years. Although user settings and customizability were still a key part of the puzzle, I needed to look intensively at the educational and political context of the edutainment game *Math Blaster!* in order to understand how this new media apparatus became such a deeply embedded part of our culture. This work then became a media archaeology of *Math Blaster!*, which was among the first computer technologies to offer such a high degree of ostensibly easy-to-use options. I was looking at user settings *before* they were called user settings, and I found a key insight via this exhaustive look at the game’s context: customizability settings in their earliest form were meant to make the game imperative for institutional goals, and to prescribe a certain set of behaviors around computer technology.

In order to investigate this game and the cultural prescriptions that it helped to create and reinforce, I utilize apparatus theory to conceptualize how *Math Blaster!* served as a media instrument building towards a societal ‘solution.’ This theory uniquely allows an understanding of how technologies contribute towards larger structures of power, helping to offer a clearer understanding of how a game like *Math Blaster!* served as part of a whole institutional suite of tools that reinforce governmental prescriptions.

**Theoretical Framework**

According to Packer (2013), “Mediation is the process by which we come to know the world” (p. 12); therefore, it is critical to understand where certain elements of media came to exist in modern forms in order to provide a thorough understanding of how power works within a highly mediated world. In his 2013 work, Packer discusses the importance of investigating the instruments that mediate interactions, since media help create and reinforce knowledge and power. He describes a media instrument as anything that functions to process the world into data, existing as part of a relationship between technology and subjectification (Packer, 2013, p. 14).
A media instrument in this case is something that transforms human experience into the quantifiable, measurable, or knowable. This description does not leave out the digital, and in a richly mediated society where software serves to transform human experience at all levels, it is crucial not to exclude software like *Math Blaster!* from scrutiny as a media instrument. Although an instrument is typically considered to be an object designed with a concrete purpose in mind, media instruments can also be co-opted to function in ways that create and reinforce the boundaries of a media apparatus.

Functionally, media instruments are vital for supporting the processes and goals of a media apparatus. Apparatus, according to Agamben (2009), describes institutions and activities that are meant to alter and/or capture human thought and behavior. A media apparatus is a network where many disparate elements converge, united by the function of supporting knowledge claims and the forces behind them. Instruments work together to bring an apparatus into existence. In addition, according to Packer (2013), apparatuses are “strategically organized to address a perceived problem or urgency” (p. 12). An apparatus purports to provide the ‘solution’ to a perceived social issue. Instruments are an important thread of an apparatus, as they serve to produce and reinforce certain ways of thinking about the ostensible problem that an apparatus is meant to fix. In this case, *Math Blaster!* as a media instrument (and the user settings menus within it) served to reinforce and uphold the belief that teaching students about mathematics was part of the solution to a perceived social problem in 1983, namely that the U.S. was falling behind in education. Institutions saw the apparatus of quantifying education to measure learning outcomes as a solution to address this problem.
Methodology

Now that I have discussed apparatus theory and how *Math Blaster!* functions as an instrument within this apparatus, I will discuss the media genealogical method and how it applies to my work. As a method, media archaeology most broadly helps provide a conceptualization of where and how disparate technological threads in the past converged to establish the present, in an often complex and non-linear way (Monea & Packer, 2016). A media genealogy, as a subset of this method, performs this function while specifically focusing on convergent elements of power. This method allows for a uniquely power-based construction of media history, while simultaneously drawing on unexpected and often nonlinear elements to illustrate how institutions functioned to steer the direction of media technologies. It allows for a more thorough and exhaustive understanding of how technologies came to exist in their modern forms, while troubling the notion that these media spontaneously occurred in a vacuum. This was not the case for *Math Blaster!* and other media like it; a rich history with more gradual and subtle precedents led up to the commonplace nature of settings menus, quantified education, and other converging elements today. With this in mind, I utilize the media genealogical method, guided by Huhtamo and Parikka’s (2011) work, to describe the edutainment game *Math Blaster!*, a media instrument which served to subjectivize teachers and students while simultaneously encouraging a specific set of behaviors and practices around newly-introduced classroom computers. In order to accomplish this, I combed through dozens of texts, explored the original media (*Math Blaster!* and its subsequent iterations), performed exhaustive searches for historical information, and brought together a kaleidoscope of elements that, when viewed from a wider contextual lens, revealed crucial connections between the development of *Math Blaster!* and important sociocultural developments around it.
*Math Blaster!* was an early video game developed for the Apple II computer and widely utilized in schools as a form of entertaining education, or ‘edutainment’ (Rapeepisarn et al, 2006). I argue that *Math Blaster!* and its implementation in the American classroom was integral to the future development of new technological proficiencies and expectations, partially based around manipulation of newly developed forms of user settings. As a result, teachers were required to devote significant labor to become proficient in programming problem sets. *Math Blaster!* serves as an exemplar touchpoint in the history of user settings menus in their modern forms as they began to take a familiar shape, finding ubiquity in other technological media, but it also functioned as a tool for reinforcing the idea that quantifying education would assist with meeting perceived societal problems.

As a method, while performing a media archaeology and/or genealogy, the researcher must investigate many of the nonlinear and differing threads of a technology to establish a better picture of how it developed. This method helps the researcher trouble the idea that technologies simply developed in a singular deterministic way; they are instead portrayed as part of much larger puzzles or circuits of power that pushed their trajectory in one direction over another. Thus, I found that user settings and *Math Blaster!* were entangled in a much broader story: teachers and classrooms, video games, Apple II computers, Reagan-era education reform, and the Space Race that pushed a generation towards science and math education. It is therefore necessary to attend to this instrument’s context exhaustively, both material and ideological. This zoomed-out view provides a much broader picture of what the apparatus of quantified STEM education does to subjectivate students and teachers, in addition to revealing important converging threads of history around *Math Blaster!* User settings as part of the instrument *Math Blaster!* helped to adapt this technology not just for people using it, but for new contexts and
institutions, allowing the subject to engage with the instrument based on the demands of those institutions and not necessarily based on their own needs or preferences. Panning back out to the broader cultural context helps us see some of the specific threads that converged in this instrument to create and reinforce institutional ideals at the time, in order to better understand these ideals at work in computer technology today.
CHAPTER 2: Edutainment: The History of More, Better, Faster Math

In order to contextualize the game *Math Blaster!* and its role in the 1980s classroom, I will now address the trajectory of computers in schools and edutainment gaming, along with emerging social imperatives pushing American public education towards quantified standardized testing. First, I will discuss how computers took root in elementary schools across the U.S., followed by a discussion of quantified outcomes for STEM education. Then, I discuss the possibilities of play for students using computers in the classroom to contribute to new technological proficiencies, and how educational institutions co-opted gaming as part of an apparatus to quantify educational outcomes. Although these institutions sought to make learning outcomes more knowable and measurable by quantifying them, increasingly choosing to measure outcomes via standardized testing and numerical data, and although this is how educational goals are still measured today, I argue instead that measuring outcomes this way leaves out the other crucial proficiencies that engaging with computer technology builds for students.

During the very same year that *Math Blaster!* was released, the 1983 report entitled ‘Nation at Risk’ by the National Commission on Excellence in Education was a crucial turning point in education reform, which led to the establishment of a media apparatus that sought to quantify education in order to prove that student scores and educational outcomes were measurably improving. This report introduced the fear that America’s science and tech innovation would be greatly challenged by other global competitors, and that the United States was slipping far behind in test scores (Cuban, 2001). According to this report, current educational foundations continued to be “…eroded by a rising tide of mediocrity that threatens our very future as a Nation and a people,” (Cuban, 2001, p. 4) which directly represented a push for STEM education in the classroom that would cater to proficiencies in subjects like mathematics. These new technologies would also ostensibly help students in their future careers,
since the technology sector was rapidly growing in Silicon Valley. In addition, new technology
companies like Apple pushed to have their products thoroughly represented in classrooms with
the vague proposal of developing a technological literacy for students in various areas
(Steinkuehler, 2010). Supposedly, video games could accomplish this. Steinkuehler (2010)
describes digital literacy practice as a critical part of cultural participation, with edutainment as
an important stepping stone to accomplish learning new digital skills. Although scholars describe
a place for gaming in education (Gee, 2004; Squire, 2008), none of these approaches address the
issue that there are few, if any, specific and measurable results from edutainment gaming that
appear to support the idea that educators’ original goals for quantifying learning via video games
were successful.

Just four years prior to ‘Nation at Risk,’ Apple was busy at work funding computers in the classroom. Steve Jobs himself lobbied Congress for legislation that would allow major tax
breaks for tech companies willing to partner with schools for the advancement of computers in
the classroom (McCracken, 2015). Although computers have become an important fixture in
many modern classrooms today, the late 1970s saw an important shift in their use in educational
settings. In 1979, Apple partnered with the technology company Bell & Howell to create a
customized Apple II Plus computer for educational contexts (McCracken, 2015); in addition, the
company established the Apple Education Foundation during the same year to provide hardware
and grants to schools. This move allowed computers to become a common addition to
classrooms, with Apple situated as the primary provider for computers in educational contexts.
These events converged to create an environment of educators who felt increasingly pressured to
improve numbers on pages via standardized test scores, with computers as their potential vehicle.
This environment was a perfect staging point for a new game like *Math Blaster!* that claimed to be accessible, convenient, and effective for teaching quantifiable skills.

However, computers may have been provided to schools by companies such as Apple out of an economical rather than pedagogical imperative, where they then found purpose in edutainment games such as *Math Blaster!* for promoting specific educational goals. In *Oversold and Underused*, Larry Cuban (2001) describes the introduction of computers into the classroom as the vehicle for a commercial solution to an ostensible sociocultural problem: the need for more technology in the classroom to improve student-technology proficiency out in the ‘real world’. He outlines the idea that, like most Americans, education reformers in the ‘70s and ‘80s believed that education could be the key to solving social problems, but also for achieving better individually quantified outcomes like improved test scores for students.

The post ‘Nation at Risk’-report environment for educators in 1983 led to a call for higher rigor in the classroom and for more quantitatively measurable standardized tests, directly resulting in more science and math classes to be developed into the curriculum (Cuban, 2001, p. 7). This was precisely the year that *Math Blaster!* was released into an educational system pushing for more, better, faster math. This was also the point when technology corporations became involved in the educational outcomes of school reform, bringing more of a capitalistic bottom-line-driven approach to a school system perceived as ailing in keeping up with worldwide competitors. *Math Blaster!* was part of the private outsourcing for a solution to the problem of a need for reform in the arena of STEM education, developed by a private company that promised to offer exactly that.
Edutainment Games to Solve the ‘Problem’

Even after *Math Blaster!* was released in 1983, and even after the development and release of other educational games such as *Oregon Trail* and the JumpStart media franchise for classroom learning, school reform continued to shape around the technologies that companies like Apple presented. In 1996, President Clinton spoke at the corporate headquarters of IBM, emphasizing the importance of bringing captivating new forms of educational tools powered by the computer into the classroom. The same year, the President described four goals alongside the release of $2 billion as part of the Technology Literacy Challenge Fund (Cuban, 2001). The President specifically stated, “Educational software will be an integral part of the curriculum—and as engaging as the best video game” (Cuban, 2001, p. 16). Crafting new technologies to resemble games theoretically would lead to more engagement, and thus new literacies, with technologies that would be part of students’ future roles in the work force. Even as recently as 2011, President Obama pushed for further development of educational games as a “tool for addressing national problems” according to Steinkuehler, who worked as a senior policy analyst for the White House to develop educational games (Steinkuehler, 2011; Martin, 2012).

As part of the U.S. government investing significant funds to engage students directly with new digital literacies, the assumption was that more access to edutainment games would mean more classroom engagement, which would directly lead to better learning, and in the future, better employees in the workplace (Cuban, 2001). These outcomes traced the path of the development of a series of educational games, of which *Math Blaster!* was among the first, which would supposedly accomplish an improvement in educational outcomes through play. However, this rise of edutainment neglected the role of choice and consent inherent to play (de Castell & Jenson, 2003), becoming another form of rigid lesson enforcement wherein the teacher
became responsible for imparting specific knowledge rather than allowing for critical engagement with subject material (Prensky, 2001; Reiber, 1996). Historical context plays a critical role in how play is perceived in an educational setting, and whether play is considered a frivolous waste of time or an important tool for transmitting cultural knowledge. It is set apart from other day-to-day activities and made separate from the repetition and drudgery of work; play is uniquely representational of fun and fantasy (Huizinga, 1955). In the case of edutainment games, play is shaped through the actions of companies like Apple and education reformers into a tool to connect fun with the decidedly un-magical elementary classroom. This attempt to connect the two materialized in order to push students towards academic goals set forth by educational administrators.

In their 2012 study, Young et al describe major trends for edutainment games, and importantly, their study found “little support for the academic value of video games in science and math” (p. 61). Studies like this show that edutainment games’ attempts to breach Huizinga’s ‘magic circle’ (1955) to make classroom activities more game-like ultimately failed to achieve educators’ initially prescribed goals. Young et al’s (2012) work provided a thorough meta-review of research on video games in classroom settings, and they describe the idea that, despite a variety of edutainment games being developed and offered throughout the last several decades, there were no specifically measurable correlations between these games and improved test scores. Although there are sophisticated tools for quantifying in-game activities, there is little or no evidence that edutainment games produce long-term number-based positive learning outcomes (according to what researchers judged as valuable), including games intended to teach a particular skill or idea. Specifically, in trends of video games about math, they found contradictory results. According to studies like that of Young et al (2012), providing more
computers, and pushing more games along with those devices, is not the answer to achieving significant educational outcomes.

However, these studies specifically describe positive learning outcomes as consistent increases in subject-specific test scores. Rather than direct content transfer, I suggest instead that edutainment games develop a player’s comfort and familiarity with the use of computational technologies. In studies of edutainment games, academic value was measured by how students’ numbers on other quantitative tests increased, or how their subject-specific (e.g. math) knowledge improved based on tests devised by researchers focused on measuring these valued topics. Literature such as the Young et al meta-study (2012) suggests that edutainment games have historically failed at being good education or good games. They are neither.

Indeed, the tools used to measure the learning outcomes of these games in classrooms suggest that either they are not quantifiable, or that computer-based education tools like Math Blaster! are outright failures. There is little evidence to support the idea that a game can directly teach a particular skill or transfer factual knowledge, or that players will leave the game with a skill set correlating to the activities within the game. I argue instead that using tools like computers in classrooms develops a way of thinking with and navigating technologies at work and at home, which builds towards a society that values proficiency in navigating computers. For U.S. schoolchildren in the 1980s and 1990s, becoming familiar with hardware and software interfaces through games like Math Blaster! developed personal computer skills that carried into other arenas, which is perhaps one of the major goals that education reformers could have focused on instead of better math skills. Indeed, perhaps the outcomes that edutainment games accomplish are not reducible or measurable in any meaningful way. The study of games as educational tools faces these methodological difficulties because engagement with a game may
not be a measurable outcome. There are unrealistic perspectives on how games could help with classroom learning, but ultimately, efforts to connect education and gaming through products like *Math Blaster!* have largely not yielded their full potentials or lived up to educators’ expectations.

The 1980s were the time when computer technologies were becoming an integral, even indispensable part of most American workplaces, as they are now. Research has shown that exposure to multiple spoken or written languages from a young age has major impacts on the brain’s ability to support future language-learning (Jasińska et al, 2017; Klein et al, 2014; Hilchey & Klein, 2011). Much like learning another language, interacting with interfaces and user settings menus on computers from a young age via these edutainment games may have been beneficial to the first generation of educational game players by priming them to learn how to adapt to a digital environment based around user settings, even if success in the game’s intended learning outcomes such as mathematical proficiencies were not apparent. The ability to navigate and customize personal use on computing devices is an important skill in modern digital media use, and though unmeasured, this may very well be the primary outcome associated with STEM-based edutainment. Therefore, rather than a hermeneutic approach focused on quantifying in-game content, which is the focus of most educational research on games, we need a post-hermeneutic approach looking at a wider picture of digital skill development.

Post-Hermeneutic Approach to Digital Skill Development

A traditionally hermeneutic look at edutainment might attempt to understand the functions of a game like *Math Blaster!* by interrogating and analyzing the text according to what its creators intended, e.g. its ability to impart math knowledge using game mechanics. According to Partington (2006), Kittler’s post-hermeneutic criticism “switches the textual focus from
‘depth’ to ‘surface’ in an attempt to critique this paradigm” (p. 55). Its starting point is that “hermeneutic understanding is not at all what human beings always do with written or spoken texts, it is not a foundational condition for the processing of significant marks” (Wellbury, 1990, p. x). Since hermeneutic work to measure engagement with the text does not provide enough room to truly understand mediation while focusing on the dialectical interaction between the user and narrative functions or storylines within the game, a post-hermeneutic approach brings the focus to a subject’s surface-level interactions with the platform on which the game resides.

A post-hermeneutic view of Math Blaster! would take into account that it is not direct engagement with the in-game content on the screen, but rather surface-level navigational familiarity with the screen, that deserves interrogation. A post-hermeneutic approach in this regard would also avoid narrowing its gaze to assessing one single technical outcome, such as mathematical proficiency, and instead take into account the ever-shifting ways that engaging with edutainment technology contributes to many different skill sets. In terms of Math Blaster!, this means not looking at what math problems are floating across the screen and how a student chooses to answer them, but instead critiquing an understanding of what it means to develop the skills to interact with this interface. This can be accomplished by looking at what contingent proficiencies and surface-level bodily interactions are doing to the subject. For instance, children who have computers at home with access to this technology from a young age are more likely to develop important cognitive skills (Fiorini, 2010), three-dimensional space tracking (Subrahmanyam et al, 2000), and school readiness (Li et al, 2006) – none of these are content-related skills directly related to mathematics but are in fact derived from embodied interactions with computers.
Although prolonged computer use by children has been implicated in certain potentially negative physical outcomes such as musculoskeletal symptoms and obesity (Harris et al., 2015; Attewell, Suazo-Garcia, & Battle, 2013), familiarity with computers and other important institutional technologies provide children with a crucial stepping stone into future careers, particularly in STEM-related fields; so much so that the lack of access to computer technologies has long been regarded as a condition that exacerbates socio-economic divides (e.g. Celano & Neuman, 2010; Roach, 2003; Zilka, 2016). Projects that bridge the gap between gaming and computing skills more generally can be successfully engaging for students in their future careers (e.g. DiSalvo et al., 2011). According to DiSalvo (2015), “The use of games to make boring activities fun is usually a bad idea,” akin to chocolate-covered broccoli as an overall unappetizing dish (p. 1), yet providing access to computational technology to promote engagement is not necessarily an inherently negative idea. Although it is a fallacy that students will cultivate mathematical proficiencies by shooting trash in space, there is something to be said for developing a familiarity and comfort level with computational media. Indeed, although the original goals of quantification and 1:1 improvement of test scores or math skills were not necessarily the outcomes achieved by edutainment games, *Math Blaster!* was nonetheless an important contributor to an area of study on edutainment that remains relevant.
CHAPTER 3: The Race to Space with the Blasternaut: Contextualizing STEM Education in 1983

The context around this edutainment game’s release is crucial to understanding the role that Math Blaster! and other media instruments like it played in the classroom. There was an enormous societal stake for educators in 1983, for whom the pressure was on: the nation was at risk, supposedly failing in its efforts to keep up with other countries, and there was a very literal race going on around new technological developments to reach space-related goals. Educational institutions needed a way to prove that they were working towards helping students learn and grow in ways that would contribute to propelling the United States forward, especially as it seemed that the country was slipping behind not only in its classrooms, but in other crucial areas of technology. This context contributed to the establishment of a new apparatus that would quantify educational outcomes, in addition to pushing beliefs around the value of STEM education and its role in helping the U.S. move ahead in the space race.

In 1983, the year of Math Blaster!’s release, Ronald Reagan was President of the United States. The Cold War dominated icy global tensions for the country. The year 1983 also followed and continued several decades of the space race between the U.S. and the Soviet Union, during which the two countries competed to achieve major milestones as they reached for the stars (Siddiqi, 2000). It was precisely in this year, not coincidentally, that the original Math Blaster! was released. The story of Blasternaut, the space-faring adventurer who would teach children new math scores, directly correlated with the increasing publicity of space-related ventures. Following the intense years of rivalry between the countries in the 1960s-1970s, during which the U.S. responded to Russian challenges to meet and beat space milestones, there was an increased push for science and math-based learning in public schools. The 1960s and 70s saw a
powerful back-and-forth between the two countries that trailed into the 1980s, as the U.S. and
Soviet Union both remained eager to be the first to reach major space frontier milestones.
Although it had its roots in earlier 20th century Cold War exchanges, the space race was most
intense during this period of time.

However, this particular peak of tensions followed what had been a promising lull in the
Cold War. In the late 1970s, U.S.-Russian joint space ventures began to occur, and it appeared
that perhaps the two countries would see cooperative exploration into the dark unknown of
space. Unfortunately, by 1981, Reagan's administration allowed the U.S.-Soviet space
cooperation agreement to collapse (Sagdeev & Eisenhower, 2008). There was push and pull
between the Reagan administration and the Soviet Union, with the United States asserting its role
as space explorers and dedicating more efforts towards accomplishing space-oriented goals. In
March of 1983, the Reagan administration established the Strategic Defense Initiative, also
known as ‘Star Wars’ after the popular film franchise (The Cold War Museum, n.d.). This
ambitious program aimed to produce missile systems to prevent attacks from the Soviet Union,
aspiring to create science fiction-like weapons like lasers and particle beams. Crucially, it may
have provided a swell of inspiration for education reform in the name of preparing children for
future careers focused on the new frontier of space. In an educational reform environment abuzz
about the ‘Nation at Risk’ report, efforts to improve students’ quantifiable learning outcomes
directly correlated with future jobs in technology industries that would ostensibly help the United
States compete with its global rivals.

Despite the Strategic Defense Initiative’s eventual failure, Cold War tensions trailed past
the year 1983. Reagan indicated the U.S.’s intentions to establish the first permanent space
station with other countries’ participation in the 1984 State of the Union address. This was
perhaps expected to be an important international effort to establish a human presence in space, yet the U.S. did not publicly invite the Soviet government to join the Space Station Freedom project, indicating a continued cold-shoulder approach to international space politics. Against the backdrop of the Space Race, a variety of other crucial cultural events occurred surrounding computer-based media in various capacities.¹

These key events provide more context for the increasing computerization of classrooms and homes, along with a broader public adoption of computer media and a cultural branding for companies like Apple. *Math Blaster!* as a media instrument helped introduce STEM-based institutional ideals into public elementary schools, within the vehicle of computers provided via financial grants and foundations like the Apple Education Foundation. This context also crucially situates emerging forms of edutainment in the middle of a societal struggle for supremacy around new technologies, especially computers.

**A Brief History of Math Blaster! and its Praises**

As a new technology situated in the middle of social tensions around a supposedly failing educational system and the struggle for American supremacy in space, *Math Blaster!* served as an instrument that would help uphold the idea that quantifying education would be an ideal way to achieve institutional goals. *Math Blaster!*’s original version was released in 1983, published by the Knowledge Adventure Company. The Strong Museum of Play’s online archive describes the game’s original release as part of JumpStart, a media series aimed at education for younger audiences. The archive states that the series began as a computer game simply entitled *Math Blaster!* which initially was centered solely around teaching mathematics skills. The game

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¹ For example, the Apple 1984 Super Bowl commercial aired in December 1983 during the Winter Olympics, characterizing this company’s technology as innovative and useful (Stein, 2002). This commercial carefully contrasted with the Orwellian vision of dangerous technological developments for governmental control, working to ameliorate concerns about computers moving into more personal spaces like classrooms and homes.
franchise grew over the next three decades through several iterations to encompass several subjects such as language arts and history. However, the choice to focus on and develop mathematical proficiency first was indicative of prescriptions by governmental institutions around what should be most valued in education.

A variety of different versions of *Math Blaster!* have been developed since its 1983 release, continuing today into many platforms and online gameplay. Over the course of the game series, there have been many changes to the *Math Blaster!*, most notably its shift from a circus cannon shooter to its new story-based setting in outer space. A man blasted out of a circus cannon and a timekeeping seal bouncing a ball in the original *Math Blaster!* were replaced in its second version by a protagonist named Blasternaut (later shortened to just Blaster) and Spot, his robotic sidekick. Other characters appeared and there were many iterations of the story, but the premise remained: "Targeted to children from ages three through 12, these games combine specific lessons with arcade-style gameplay designed to reinforce topics" (The Strong National Museum of Play, n.d.). *Math Blaster!*'s present-day website describes the game’s lengthy lifespan in homes and classrooms, stating that today’s JumpStart.com is "a groundbreaking evolution in children's learning games" and "the epicenter of online gaming for the 3-10 year old demographic" (JumpStart.com). The *Math Blaster!* franchise is currently available on many
platforms including the Nintendo DS, iPad, mobile download, Nintendo Wii, and internet browser.

Although it does not hold the same role specifically in elementary classrooms that it once did, *Math Blaster* has a legacy still visible on the internet and in computer technologies today. Its franchises have persisted into other modern gaming platforms, and the JumpStart group of edutainment games is alive and well on the internet. However, just as edutainment began to emerge and shape the direction of play in the classroom in 1983, reviewers praised *Math Blaster!* for its seemingly endless options to improve upon math learning. These praises were based on reviews by adults, not the children playing the game, and predicated on the assumption that *Math Blaster!* would be a more effective tool for drilling math lessons than previous techniques. In the 11 July 1983 issue of *InfoWorld*, Doug and Denise Green (1983) say of *Math Blaster!*, "Drill-and-practice isn't what it used to be. It's better!" (p. 55). Despite stringent programming requirements for teachers managing lessons in the game, Green and Green, who were on *InfoWorld’s* software review board, praise *Math Blaster!* as a useful product and technical accomplishment. This review and others like it helped push the notion that this game was more accessible, easier to use, and less costly than its other computer-based education counterparts. Further, this glowing review praises *Math Blaster!* as a new and innovative option for helping students in any category of math proficiency. To these reviewers, the game is a magic bullet of sorts, able to be molded and customized to suit any classroom situation in a fun and exciting way. With such high expectations for math education during a powerfully competitive time during the Cold War, *Math Blaster!* successfully entered classrooms en masse, both as a space-themed and ostensibly engaging video game that spoke to larger interests with space, and as a
new medium that offered to fill the need of quantifying education by saving and storing problem sets.

The game boasts a variety of user settings and various menus for both players and teachers setting up math problems, which were part of the power that this instrument offered to provide to users. One of these menus is for the selection of built-in math problem types and has five options, with each arithmetical category spanning five difficulty levels. The Data disk is a separate menu which also provides the option for instructors to create and edit their own problem sets using the Math Blaster Editor. Users are also met with a third menu once they have selected a type and difficulty of math problems, where options include "Look and learn, Build Your Skill, Challenge Yourself, Math Blaster, Load a New File and Stop for Now" (Green & Green, 1983). Reviewers such as Green and Green praise the complex and varied types of settings that allow for a wide variety of customization options, down to personalized problem sets programmed individually by teachers for their unique classroom situations.

Once the player has entered the original game, the goal is to blast a circus performer out of a cannon and into four listed answers for math problems, aiming for the correct one. Meanwhile, the bottom of the screen shows the math problem (Green & Green, 1983). The authors elaborate further on the interface, describing the screen as displaying a seal bouncing a
ball on the left-hand side of the screen, with users prompted to shoot a circus performer from a
cannon to select to correct answer within a limited amount of time. In addition, a balloon is
constantly falling on the opposite end of the screen. Surprisingly, increasing the difficulty does
not lead to more challenging math problems, but instead causes these on-screen elements to
function more quickly: the ball falls faster, the seal bounces more rapidly, and the player must
move at an accelerated pace to accommodate these in-game mechanics. As I opened the space-
based version of *Math Blaster!*, I was also met with an attention-grabbing array of similar
mechanics. I was required to click and shoot pieces of trash in the sky that were supposed to
represent the correct answers to the math problems at the top of the screen, while simultaneously
watching for and defending myself from a bright yellow space alien who would shoot at my
spacecraft. I was supposed to balance choosing the correct piece of trash to correspond with the
math problem above it, supposedly representative of a number, with pressing a button to activate
Blasternaut’s shield when the yellow alien attacked. It was certainly an experience that
demanded significant attention, which could have been a boon for a teacher seeking to distract
rowdy children.

To an overworked and underpaid teacher in 1983, such a complex and choice-driven
game created specifically to engage her students may have seemed like a gift (Associated Press,
1983). Teachers were increasingly blamed for falling test scores and depicted as underqualified
(PBS Online, n.d.); to teachers facing such a quandary, using *Math Blaster!* to teach problem sets
may have seemed like an opportunity to possibly improve test scores and achieve new goals
while simultaneously freeing up teacher time to focus on lesson planning. This was unfortunately
not the case.
Dusting chalk off the chartreuse board lining the front wall of the fourth-grade classroom, an elementary teacher in 1983 might look into the bored eyes of a classroom full of schoolchildren as she wrote out a new problem set with her worn-down chalk stick. To a teacher facing a room full of disinterested students, the newly-introduced computer labs in schools boasting Math Blaster! must have seemed like a technological haven, filled with opportunities for attention-grabbing problem sets that would engage and amaze the children. There was also a computer in the corner of the teacher’s classroom; she puzzled over how to use it during her lessons, since there was only one. Would there be turn-taking? Would her students argue over who got to play next?

However, as she spent the evening reading the complex manual of problem sets and arrived at school early the next day to program her lesson plan’s problem sets into Math Blaster!, she may have realized that this new technology brought with it an entirely new set of coding skills that she would need to master, and the exhaustion that would come along with it. The InfoWorld article she read had said “Neither teachers nor students need special computer skills to use this product,” citing clear instructions and describing the main menu that appears upon start-up (Green & Green, 1983, p. 55). However, as she stared at the complicated manual of instructions, it would seem much like learning an entirely new language.

Although this game is an iconic, historically original member of the edutainment gaming category, Math Blaster! is an infamous example of the incorrect assumptions that more math will equal better math learning outcomes for students, along with less work for teachers. As in Young et al’s (2012) study, there is still no solid evidence to support this idea. In Choosing and Using Digital Games in the Classroom, Becker (2017) describes Math Blaster!’s long history and use in
the classroom, with its beginnings as a drill-and-practice game that was then bundled with a narrative in the 1987 version. She states, “Math Blaster! is one of the games that is commonly named by teachers and parents as an example of a good educational game, though rarely by the children who are to learn from it” (p. 193). Although Math Blaster! has long been an exemplar of the quintessential edutainment game, it is also fundamentally representative of the incorrect assumption that drill-and-practice games would live up to educator expectations about how they can improve math skills. It is repetitive, at times monotonous, and its actual in-game content is only peripherally connected with math, even in its space-based versions. According to Becker, Math Blaster! is even “used by professional game designers as a favorite example of a bad educational game” (p. 193). Math Blaster! has long served as an exemplar of perhaps the first widely available edutainment game, intended to captivate the attention of children in the classroom. However, Becker disagrees with its value as an educational tool. She describes difficulty with focusing on the learning goals in the fast-paced interface, stating that,

"While drill and practice can be very effective for learning basic arithmetic, this game has so much else going on that is unrelated to the math, it is easy to spend that majority of one's time doing things that have nothing to do with the learning goals” (p. 195).

With the distraction of seals bouncing balls, balloons floating up and down, and trash zooming across the screen in later versions (to my bewilderment), the math problems almost seem like a distraction from the other attention-grabbing gameplay actions.

In addition to its peripheral and tentative in-game connections to actual math problems, although Math Blaster! did offer a new suite of tools for customizing and quantifying math-based play, it established a heavy burden of work for the teachers required to manage it. For teachers, who needed to learn new rudimentary coding skills in order to accomplish this work,
there were very strict criteria for entering lists of problems in the original 1983 Math Blaster Editor. This burdensome list of rules required the inclusion of at least five but no more than 25 questions, of no greater length than 18 characters, with answers at a maximum of six characters. The game only permitted two lines of problem instructions, with a max of 28 characters, which severely limited space for teachers to describe what students were supposed to do (Green & Green, 1983). No words were permitted in the problems themselves, only in the already-brief instructions, and the only symbols allowed for use were "+, -, # for division, * for multiplication, \$ and \%” (Green & Green, 1983). Although teachers can delete and insert lines, old numbers remain on-screen if the person programming the game does not immediately list the file. Frustratingly, "You cannot insert and delete characters. You can go to any line to edit, but you must retype the line to make any major changes" (Green & Green, 1983, p. 57). Users may customize and create their own files but must carefully work within the parameters of the questions and answers allowed. If there are not at least five questions with different answers, the game simply crashes.

As a teacher puzzling over how to use the new computer in the corner of her classroom, with its high-tech disk slots and blocky screen, a game like this must have been a mixed bag of experiences at best. While there must certainly have been teachers who took to Math Blaster! quickly and with great proficiency, becoming its early proponents and adaptors, there were undoubtedly also plenty of others who must have been perplexed and overwhelmed. How am I supposed to program these problem sets when I can barely understand the instructions, and I can’t even fix mistakes without deleting the whole line? Frustration. How am I supposed to let my students take turns and get all the problems done? Time limitations. What is the rest of the class supposed to do while each kid uses the computer? No clear instructions. The ostensible offerings
of customizability, choice, and control via games like *Math Blaster!* became imperatives for teachers to spend more time learning how to be ambassadors for a new piece of technology that they were unfamiliar with, in a setting where it did not yet fit, with time they did not have. Yet, teachers who were resistant to this technology were deemed luddites, and those who presented new technologies with anything less than enthusiasm were chastised by administrators and policy-makers in educational contexts (Bryson & de Castell, 1998).

While simultaneously creating more work for teachers who needed to learn how to work within this strict problem-set coding regime, *Math Blaster!* depended on instructors to spend even more of their already-limited time presenting the game to their classes. With limited characters for in-game instructions, teachers would have to serve as the laborers to introduce and explain this new media instrument to their classrooms, with which they themselves had little or no familiarity. *Math Blaster!* failed at serving as an easy-to-use, effective STEM education tool. However, it did serve an important role as an introductory foray into computer use in the classroom. It introduced students to the newly available Apple II computers and began to familiarize both students and teachers with a technology that would become a powerful part of educational (and various other) institutions.
CHAPTER 5: Math Blaster! as a Media Instrument

In keeping with the post-hermeneutic approach developed here, I now turn to a theorization of Math Blaster! as a media instrument, a term used by Packer to indicate an object that functions to bring together and support the disparate elements of a media apparatus, along with serving to quantify and digitize those elements. This theorization allows a better media-theoretical understanding of the broader processes of governance of which Math Blaster! was a part, including increasingly quantified STEM education, new forms of edutainment, and broader social imperatives to improve educational outcomes.

Math Blaster! served a mixed role as a media instrument. It was supposedly easy to use, yet it had a complex set of instructions requiring a significant time investment for the teachers expected to use it. However, it contributed to an important emerging media apparatus: quantified STEM education. The media apparatus perspective, provided by Packer (2013) and with its roots in Foucault and Agamben, assists in establishing an understanding of how media instruments like Math Blaster! introduce and reproduce techniques of governance. In understanding the push for STEM education in the 1980s as an apparatus, media scholars can better theorize how edutainment games function within this apparatus to produce particular relationships and effects between teachers, technologies, schools, and students. According to Packer, the concept of apparatus is a powerful way to conceptualize the relationships between media tools or instruments (like Math Blaster!) and the powerful institutions that rely on them to reify systems of governance. Therefore, Packer’s questions for the apparatus (2013) provide a framework for conceptualizing media instruments such as Math Blaster! that served as powerful vehicles to introduce institutional ideals into other areas. In order to gain a more systematic and media-theoretic understanding of how Math Blaster! and its settings in particular worked to subjectivate a generation of students and teachers, who were learning how to incorporate digital games in the
classroom for the first time, I will now walk through each constituent component of Packer’s breakdown of the apparatus via the eight questions he puts forward (2013). These questions can build towards a post-hermeneutic view of an apparatus by troubling and questioning the autotelic assumptions about media instruments’ functions.

In Packer’s systematic breakdown of how a media apparatus functions, determinators for this apparatus (Packer, 2013) are individuals or institutions capable of making truth claims and granting authority on the subject, creating a narrative around the apparatus or instrument. Technology reviewers such as Doug and Denise Green for the 1983 *InfoWorld* article shape the sense of excitement around this new gaming technology, making authoritatively strong claims about its value in the classroom. In addition, President Reagan’s school reform efforts had a major impact on the validity of learning games such as *Math Blaster!*, which may have been difficult to establish as a valuable classroom medium prior to the push for more technology in schools during the space race. Educational institutions, rife with Apple II computers purchased at a discount or given for free via grants, served as a locus for this inundation of new technology. School administrators also possessed the authority to proclaim *Math Blaster!’s* effectiveness, bolstered by the glowing reviews such as *InfoWorld’s*. Free-floating legitimators established by these figures, which are statements used across and between discursive sites in order to legitimize the claims of an apparatus, include the concept of ‘edutainment.’ This idea came to represent a new view of fun in the classroom to promote learning outcomes such as mathematical proficiency, and the Reagan-era view of eliminating excess bureaucracy in lieu of ‘drill-and-practice’ exercises such as those *Math Blaster!* provided.

However, these legitimations of institutional perspectives on how children should learn and play using *Math Blaster!* as a tool may have contrasted with the actual behavior of children
in the classroom. *Math Blaster!* was part of an institutional suite of tools used to push back against energetic kids, attempting to harness the fun of games to push children to behave. This game found its place in the struggle between the quintessential resistant, energetic elementary school kid versus teachers and school systems that pressured children to sit still and learn, serving to embody both school system and governmental ideals while simultaneously packaging a privileging of STEM and mathematics-based education as a whimsical game. This was particularly important as children’s attention became a valuable commodity for commercial efforts during the late 1980s and 1990s. This emergent “attention economy” (Wise, 2013; Beller, 2006; Goldhaber, 1997) was increasingly apparent in the form of Saturday morning cartoons and television commercials, and *Math Blaster!* represented an effort to recapture that attention and refocus it towards a more ‘socially productive’ endeavor: drill-and-skill math.

Though *Math Blaster!* could be used as a classroom tool to make kids sit still, one of its material functions was also to create a significant burden for teachers who had to spend much time and effort programming their math practice sets into the game using the Math Blaster Editor. The material functions of this instrument specifically include its creation of more work for teachers, its impacts on the affective environment of schools, its power to manage attention and organize behavior and its establishment of a new category of gaming that incorporates entertainment gaming and an educational context. Though its customizable problem sets purported to represent the apex of freedom for teachers using technology, these user settings in reality required significant time and effort for educators to learn and use programming skills.

According to Packer (2013), the processes of subjectification – processes that tell individuals how to organize themselves and others and/or compel them to do so – are “co-constitutive of the apparatus” (p. 27) and help to establish the technological apparatus’ social
hold. Along these lines, *Math Blaster!* conjures the image of a teacher shepherding students into a computer lab, organizing classroom time and space around the game, and ordering students to use these user settings (ostensibly a tool for freedom and customizability) to turn off the volume and quietly play the drill-and-skill math game. The affective environment of quiet clicking helped to prescribe and manage student attention through the game, even as teacher attention and effort were continually managed through the problem sets they must tediously enter according to a strict set of rules. More technology is better, after all, in the Reagan-era classroom.

Packer (2013) also discusses the “conditions of instrumentality and attendant epistemological stakes,” which are how reality comes to be known in newly legitimized ways (p. 27). These conditions serve to translate all into data, and everything becomes known in a quantified form, which is precisely what occurs as *Math Blaster!* travels into the territory of school. Concepts of education are problematized through rigid forms of 'play' and gaming, normally a leisure activity set apart by ways of thinking and behaving (Huizinga, 1955) transformed into classroom work. Ordinary paper mathematical data becomes digitized as quantified problem sets, changing the way that teachers used drill-and-practice work. User settings here are a new tool for prescription of play and for control of student activities by teachers, representing the beginning of the novel digital user settings menu that impacts the entire experience of the game by changing difficulty or sound, recalling previous problem sets, or shutting off the game entirely. In addition to providing options for teachers and students, user settings in *Math Blaster!* organized and prescribed ‘play’ in a rigid fashion akin to the drill-and-skill techniques that the game was attempting to teach. The settings for *Math Blaster!* allowed for custom math sets to be stored, as well as for students’ scores to be directly quantified. *Math Blaster!* directly transformed math performance into a digitally encoded score, managed by the
teacher and stored on data disks, but this direct game data was not yet harnessed to directly measure student scores on an institutional level; it merely provided teachers with a way to see how students in a particular class performed.

Another question for the apparatus (Packer, 2013) involves analyzing the “brute facticity of a media discourse network” and how discursive networks are newly arranged as a result of media instruments (p. 28). Faculty championing a game like Math Blaster! impart culture by stressing the virtuous ideals of a math education and its value to society at large. However, the idea of brute facticity also draws attention to material constraints of the media instrument. A game like Math Blaster! purports to make possible a prescribed, institutionalized "play" programmed into children’s classroom behavior. This is inherently structured in the form of students sitting in front of computers in a school setting – a highly rigid, prescribed, and materially constrained environment. As mentioned earlier, according to institutionally-enforced measures of edutainment and its effectiveness in teaching specific skills, these efforts were fruitless in instilling better math skills. However, Math Blaster! did arrange classroom play around a central machinic element, the classroom computer, which had a powerful influence on the affective experience of the children using it. Surrounded by and embedded in the historical context of newly widespread classroom Apple II computers and a budding space program in the United States, Math Blaster! served as a tool to reinforce the value of an education based around mathematics, contributing to a culture that currently regards a STEM education as best. In fact, as a technology of governance (Packer 2013), Math Blaster! reflects Reagan-era government ideals that learning math and science is the best form of learning. This is evidenced by the game’s transformation from its first version to its second from a whimsical circus game to a
story-based outer-space adventure. The message here: governmental institutions value STEM education.

*Math Blaster!* also governs the “latent creative force of an audience” (Packer, 2013, p. 28) by attempting to capture and harness “fun” for governing education and encouraging/discouraging student behaviors. This question addresses the audience for gaming in this time period, which would have consisted chiefly of individuals attuned to these new technologies. High school students hanging around in arcades would have been an important exemplar of the gamer audience, and as video game play trickled down to younger students, the idea of gaming presented an opportunity for institutions to harness computerized fun in the pursuit of educational control. Although it was packaged in a fun and attention-grabbing shell, at its heart, *Math Blaster!* as a media instrument reduced the virtues of gaming that drew students to video games in general to repetitive drill-and-skill actions. Packer (2013) states that “Media apparatuses hold together governmental formulations, just as they are held together by multiple invested parties and institutions” (p. 28). The invested parties in the school system, seeking use of their classrooms full of Apple II computers and inundated with messages about the important of basics like mathematics from the Reagan administration, hold together the formulation of an ideal based around an education in math. These invested parties attempted to harness the creative force of an audience primed for engagement with computer technology in the form of video games, in order to transmit institutional values. The user settings and options for teachers and students within the game were the mechanical functions that made this possible. In doing so, user settings in *Math Blaster!* as the larger media instrument both prescribed strict parameters for student play and served as a critical site for value transmission.
Overall, this game was a touchpoint of complexity in technological development that governed play in a way that other games before it did not, both for teacher/programmers and students. These settings had the power to shape the affective learning environment through sound or difficulty and appeared to provide a modicum of choice for children (who may indeed have been given a choice in their play difficulty settings) and teachers (who had the ability to use their own problem sets, despite the significant investment of time and effort to program them). In this way, *Math Blaster!*’s user settings menu represented a hallmark suite of options for the institutions using it (and possibly the players as an afterthought), but it was a paradox of an attempt to establish ease-of-use and complicated choices. *Math Blaster!* as a media instrument harnessed the idea that games could be fun and engaging, along with the desire of its audience (students) to play video games, and attempted to push that into the classroom box. Although it failed in its attempts to directly transmit math knowledge, *Math Blaster!* was nonetheless part of a complex arrangement of instruments that reinforced the value of quantified knowledge, and of STEM education more broadly.

Indeed, *Math Blaster!* began to familiarize future gamers with the idea that there could be options to control key features within the game, and it began to familiarize both students and teachers with the crucial interactions that they would need to have with computer technology. However, it also required mastery and proficiency in its specific rule-sets to utilize this newly granted ‘control.’ The domestication of video games for education would play into their wider acceptance in the home rather than the public arcade (Newman, 2017), and into the recent history of computer use. Computation and programming are now an integral part of modern U.S. society, present in nearly everything electronic, and almost always accompanied by a suite of user settings that no longer requires the expertise of a coder. In 1983, customizability in
computer technology meant learning and executing coding processes. However, as of this writing, user settings are visible and customizable in most screen-based technologies. This is a powerful course of development in user choice, which may have had some of its most important roots in a drill-and-skill game explored alongside the adventurous Blasternaut. In 1983, the year of *Math Blaster*’s release, the era of computer technology in the classroom had just been bolstered by grants, tax subsidies, and calls for better, more measurable classroom outcomes. That year, Ronald Reagan’s drill-and-skill education reform and the Cold War provided powerful backdrops to edutainment in schools. It seemed that the computer was the ‘way of the future,’ but public schools now rife with this abundant computer technology needed an instrument through which to use it, a void which *Math Blaster!* and its array of customizable options sought to fill. In addition to filling this role, *Math Blaster!* enforced and reinforced cultural ideals around STEM education, prioritizing math in an effort to show that the U.S. was keeping pace with its global competitors, especially in the context of the space race and Cold War.

In this section, I discussed *Math Blaster!* as an instrument in the context of Packer’s questions for the apparatus, and how it played a key role as part of the apparatus of quantified STEM education. As previously mentioned, one of the critical material functions of edutainment games (and *Math Blaster!* in particular) was creating more work for teachers. Essentially, teachers needed to learn a new set of skills on top of balancing being classroom managers, hubs for social support, researchers, and a number of other roles. Rather than creating new work in the same realm of familiarity for many teachers, however, *Math Blaster!* and its suite of software produced a need for teachers to fill a new role as hybrid coders. Math teachers had to manage classrooms in new and innovative ways, and after the introduction of games requiring the
navigation of a complex set of coding language, they were also subjectivized into newfound roles as edutainment gaming advocates – otherwise, they were branded as ‘luddites’ and threatened with obsolescence. Teachers were responsible for serving as not only classroom managers, but hybrid technology users as they developed coding skills in an effort to utilize these new computer technologies and share them with coworkers.

*Math Blaster!* was a powerful reflection of institutional values, and a control tool for children’s behavior, but importantly, it also became a prescriptive tool for teachers. Using this game and setting it up for a classroom was difficult and time consuming. Teachers had to optimistically present new edutainment games to their students, which may have been challenging to learn to manage themselves. This role was important as a touchpoint for coding translated to a wider public, but these teacher/coder hybrids garnered nowhere near the same level of respect as the well-paid coders of the mysterious black box video games that users play now.
CHAPTER 6: Conclusion

Media instruments serve to bring elements of an apparatus together, or to converge very disparate objects for a specific purpose dictated by powerful institutions. This is fundamentally what user settings do and did within Math Blaster!, and what the game itself did for an increasingly quantified form of public education. They allowed the game to be used in and adapted for the institutional context of the American public elementary school; as a result, they allowed the government, technology industries, and other institutions to compel teachers and students to do work for these institutions. They also compelled a familiarity with new computer technology, both for teachers and students. The media instrument Math Blaster! was one of many tools that pushed a generation towards the apparatus of quantifying education and valuing STEM careers above others. In the context of the space race and Cold War, STEM education would come to represent a solution to the pressure to push America ahead in budding technology industries. Math Blaster! reinforced these ideals, representing an opportunity to use new forms of media to bring students and teachers into the fold of computer technologies while simultaneously providing an ostensibly ‘fun’ way to datafy math learning outcomes.

There are many places where we see the vestiges of Math Blaster! and its edutainment legacy today. As we have seen before and since, video games serve as incubators for new forms of social control. In this case, Math Blaster! was representative of new computer technologies around which teachers had decreasing agency in whether or not to participate, packaged in the form of a fun and exciting game offering choices to students and educators alike. Math Blaster! represented STEM education, which quickly became prioritized in education reform in the 1980s. It also represented quantification of learning outcomes as an idealized solution to the perceived problem of the U.S. falling behind in education. It bolstered competitive beliefs around technology, particularly new computer technology, and tapped into the urgency of the space race.
to push a generation of students towards valuing an education based in STEM as the most socially productive. *Math Blaster!* also served as a powerful new way to turn math performance into a digitally encoded score, and to manage that using computer technology. We can still see vestiges of Math Blaster’s legacy in standardized testing today, and in video games, which serve as tools that transform the digitization and quantification of various parts of subjects’ lives into ‘fun’ and extrinsically rewarding experiences.

In addition to creating options (and obligations) for teachers to create problem sets, *Math Blaster!* as an edutainment classroom game also showed that providing pre-set options was an attractive feature in video games and computer technology more broadly. Although it did not necessarily provide nearly the level of control that its creators claimed, and that control came with the price of learning difficult and time-consuming coding, it did contribute to developing an emphasis of choice in later video games. However, choices in video games are always pre-determined by the creators of these games. Although the gamer/subject is given certain forms of agency over select functions, access to others is always gated. *Math Blaster!* and games like it helped to create a subjectivity for users who grew up around computer technology with customizable user settings, and now expect the world to be customizable and malleable. While a user settings menu does provide a site where users see what they can control, it provides a constrained site for managing features, and assumes an initial (and sometimes inescapable) engagement with the medium. Establishment of these ideas in earlier versions of video games like *Math Blaster!* established a player whose subjective experience within video games has contributed to a mastery navigating digital worlds organized around these very user settings.

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2 Sometimes this gating is behind license agreements or coding walls. While acceptable in certain communities, hacking to get past these walls is generally discouraged and looked down upon, especially from the perspective of powerful institutions like the corporations that create and manage video games.
Without the rigid controls, codes, and menus present in early touchpoints for development like *Math Blaster!*, user settings in other games and digital spaces may have taken a very different visual form.

More importantly, media instruments tell subjects how to use media within existing apparatuses in order to create and reinforce those same apparatuses. While *Math Blaster!* and its array of options spoke to the institutional demands for new mathematical learning rigor, they also spoke to a greater demand for computer technologies to be used. The question of what games like *Math Blaster!* do not permit, despite all of these supposedly new and wonderful forms of control they do provide, leads to the answer that they do not permit an escape from the apparatus in which they function; on the contrary, they serve to reinforce subjects’ obligatory use of their constituted apparatuses. They force various burdens on subjects who must then learn and adapt, with teachers required to learn how to code for *Math Blaster!* serving as an exemplar. Those who would choose not to partake in these instruments are labeled luddites or technophobes, which speaks strongly to the sources of power in a world immersed in and functioning around these technologies. Teachers were given choices within games like *Math Blaster!*, but they were not given choices around whether to use computers and the new arrays of software that purported to give them technological (and curricular) legitimacy. Teachers’ attempts to exercise agency to escape the confines of new computer technologies were regarded with disdain. After all, teachers were given a dazzling array of choices in order to carefully customize *Math Blaster!*, but they were given increasingly less choice in whether or not to use technologies like it. Edutainment games and the new forms of quantification that emerged around them were not optional tools, but culturally required new media instruments.
Ongoing emphasis needs to be placed on exploring this digital subjectivity, centered around interfaces with selectable options and how subjects navigate with/through them. A continual questioning of what options are not present, and the work that users do to subvert these newly emergent forms of institutional control, are an important part of the story of digital spaces. There is incredible value in studying such a powerful media instrument as *Math Blaster!* both as a touchpoint for the development of new media apparatuses, and for digitization of quantified scores in the classroom. A closer examination of the rhetorical functions of framing customizability in computer technologies is needed, especially in terms of menus that seem controllable for users. According to all measurable accounts, edutainment games fail at imparting subject-specific knowledge and improving quantifiably measurable learning outcomes. However, while STEM-based edutainment games may fail at teaching direct mathematical knowledge, they certainly did (and do) familiarize a new generation with a set of media tools in the form of computer use that would be critical for future participation in an online world comprised of data. A continual effort to trace the histories of media instruments like *Math Blaster!* are necessary in order to understand the threads of power that run in and among computer technologies, on which this work has just begun to scratch the surface.
REFERENCES


