Computers Get Personal

How technology met cultural attitudes, a competitive market, and innovation, to result in the modern personal computer.

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For
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The History and Philosophy of Science

Made with a Mac

The personal computer was not just a technological invention or innovation. Its inventor was not a single person. The personal computer was not a product destined for instant success. Popular history on the subject has injected the idea of the rebellious genius that were was the sole bearer of the modern personal computer. However, the modern personal computer was a result of a mixture of several advancements in technology spanning at least thirty years, cultural emphasis on the attitude of individualism, the legitimization of microcomputers into the workplace, standardization in software, and the development and marketing of Graphical User Interfaces. These four elements came together between 1975 and 1985, and the modern personal computer was born.

Early personal computers were hardly the desktops that have become an essential tool in the modern home and office. One of the first personal computers, the Altair, debuted in 1975, and looked very different from the modern desktop; it was a metal box with toggle switches and lights. When an average person is asked about computers, what images come to mind? Perhaps, he or she pictures a dreaded machine that is grudgingly used when a job requires it. Maybe, one thinks about a device used to relax, alone, with a game of minesweeper or solitaire. He or she may be an avid gamer or a computer engineer. No matter where on this scale one falls, the computer still plays a role in most people's life. What images of come to mind when one is asked to picture a computer? Perhaps his or her computer of choice is a Dell. Maybe, it is an HP. It could be a Mac. It may be a desktop monitor with a tower. It may be an all-in-one. It may be a laptop. No matter what model of computer a person pictures, the basic image remains the same. A

computer for most people contains a keyboard, a monitor, a mouse, an internal hard drive, and some software to make it run. A computer may be used for nothing more than a word processor, or a quick game of FreeCell. Computers may be a company's lifeline or just used for internet surfing. Depending on the individual, a computer may be any one or all of the previously mentioned ideas. A person's conception of a computer and what it does is often a matter of opinion and perspective. In fact, early computers were not machines but a person who performed computations.[1] These generalizations reflect how a person's perception of a computer depends on his use of the machine.

The history of computers is also an area where simple generalizations are rooted in one's own experiences. If a survey was done to determine who people believed was the inventor of the personal computer, several different answers may emerge (though most would probably have very little idea). Popular names from the computer industry of today may be spouted out as an inquisitive answer. Bill Gates of Microsoft may be an answer. Perhaps, Steve Jobs, the C.E.O. of Apple Computer, or Apple's co-founder, Steve Wozniak, would be mentioned. This may be because a person's historical perception is often based on popular culture. Several recent commercials by Apple Computer depict two main characters that are meant to represent Apple computer and a "Windows" based machine interacting with each other. The implication is simple; a PC and a Mac are the only two choices in the computer market, and their rivalry is long standing. A made-for-television movie from the late 1990's, *Pirates of Silicon Valley,* depicted the early start-up

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[1] Paul E. Ceruzzi, *A History of Modern Computing 2nd ed.*, (Cambridge, Mass.: MIT Press, 2003, 2.

of Microsoft and Apple and is also a cause for the misconception of the history of the personal computer.

If the question were rephrased from the "inventor of the personal computer" to the "father(s) of the personal computer," the debate would not be less difficult. The father of the personal computer would have to be defined in terms of what part of the computer is most important for the development and wide spread use of computers. Perhaps the developers of transistors would enter into the discussion. It may be that those who placed the transistors into a piece of silicon, or those who and made the first microprocessors deserve the title of "father of the personal computer." After all, the personal computer was first called a microcomputer before it was thought of as being personal. Was technology the most important part of the Personal Computer Revolution, or was it the software built to use with the technology that made the computer a household commodity? People wish to read in their history books the very Greek idea, that all things are simple and beautiful. They wish to have a simple answer to historical questions. So, a simple answer to the question, "Who is the father" of a particular historical watershed is preferred over the murky answers that tend to surface after much research.

Pairing an invention with an inventor seems like an easy task for a historian, but the history of science and technology is not that simple. When asked, "Who invented the cotton gin?" the answers will come back with remarkable consistency, "Eli Whitney." However, Whitney was hardly the inventor of the cotton gin.[2] The history of computers is

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[2] See Angela Lakwete, *Inventing the Cotton Gin, Machine and Myth in Antebellum America* (Baltimore: Johns Hopkins University Press, 2003).

also an area where popular conceptions of history may influence the academic field. However, because the field is so young, corrections to the popular culture view of the development of computers is able to take place fairly easily after the errors are acknowledged.

There are two places to begin a study of the development of personal computers. Examining the popular culture misrepresentations of the history of computers is an important first step in the process of uncovering the history of the personal computer. A "dramatic license" may be used for several reasons, and therefore, historically based movies usually get some areas of the story wrong. However, historical movies have a grain of truth at the core of their plots, which gives one a place to begin a historical discussion. The second and more important area to examine is the historiography of the development of the computer. The history of the computer is not very old, and the history of the personal computer, or microcomputer, has barely been scratched. Because of the limited number of monographs written on the subject, less academically noteworthy histories must be considered. Among these written accounts are autobiographies, which contain obvious biases, and pictorial histories.[3] By focusing on the misrepresentations of

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[3] Pictorial histories are often overlooked in the historiography of the computer, but because modern computers do not resemble the mainframe computers of the 1950's or even the first microcomputers, pictorial histories are important. However, pictorial histories focus more on the photographs than the history, and so, some suffer from factual errors. For an example see, Gordon Laing, *Digital Retro: The Evolution and Design of the Personal Computer*, (Alemeda, California: Sybex, Inc., 2004), 9. Laing cites the magazine that the Altair appeared in to be *Practical Electronics,* when it was *Popular Electronics*. The error is small but represents how caution should be used when researching with a pictorial history.

popular imagery and the historiographical information, the intricate picture of the developmental processes that lead to the personal computer begins to come into focus.

The history of computers intersected with popular culture when a fictionalized drama about the development of the personal computer industry premiered on television in 1997. The movie *Pirates of Silicon Valley*, based on the book *Fire in the* Valley by Paul Freiberger and Michael Swaine, was actually more of a depiction of the founding and rising of Apple Computer and Microsoft. Actors playing the parts of Apple co-founder Steve Wozniak and current Microsoft C.E.O. Steve Balmer narrated the story. Thus, the story is seemingly told from an insider's perspective. Steve Jobs, the founder of Apple, is portrayed as a spirited dreamer determined to be a "revolutionary," while Microsoft cofounder Bill Gates is a quick-tempered computer geek with an ability to recognize trends in the computer industry and then "pirate" the technology for his company to sell.[4]

Steve Jobs is portrayed as a visionary and egomaniac throughout the film. The first scene in the movie begins with Steve Jobs giving a speech regarding the filming of Apple's famous Macintosh commercial which he states, "We are here to make a dent in the universe." When the film depicted the debut of the Apple I, Jobs can be heard explaining that people are looking at a revolutionary piece of technology that should be compared to Alexander Graham Bell's telephone. He also said, "It's the first computer you're ever going to want to buy." When Jobs met Mike Markulla, who offered him $250,000 as venture capital, Jobs, initially taken back, explained that what he and

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[4] *Pirates of Silicon Valley*, Produced by Leane Moore, Turner Network Television, 1 hour 36 minutes, 1999, video cassette.

Wozniak were doing was not just business but "practically spiritual; this is about over throwing dead culture, dead gods." The scene continued with Jobs refusal to be called employee number two. Jobs's character then began spiraling out of control with outbursts and rants. The movie incorrectly depicted his controlling nature and chaotic leadership style as the cause of internal turmoil at Apple.[5]

In the film, Bill Gates's success is not attributed to his innovation but to his ability to market the technology of computers. An early line by Gates reiterated the Microsoft mindset that was portrayed throughout the rest of the movie. He said, "Its our job to find out what this guy (Ed Roberts of MITS) doesn't know he needs, but does need and make sure that he knows that he needs it and that we're the only ones to give him the answer." When Microsoft's initial business proposal to IBM was dramatized, the Steve Balmer character did an aside monologue to explain to the audience that what they did was "historic." Gates persuaded IBM to merely license a disk operating system (DOS) that Microsoft did not, at this time, own. Gates also convinced them to allow Microsoft to sell DOS to other companies.[6]

Finally, established computer companies, such as IBM, HP, and Xerox, are portrayed as companies unable to recognize the trends in the computer industry. An HP executive passed on Steve Wozniak's computer idea quipping, "What on earth would ordinary people want with a computer?" As already illustrated, IBM allowed Microsoft to

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[5] Ibid.: While Jobs style may be partially responsible for Apple's loss of market share, he is hardly the sole blame for Apple's turmoil. See, Jim Carlton, *Apple: The Inside Story of Intrigue, Egomania, and Business Blunders*, (U.S.A.: Crown Publishing, 1997).

[6] *Pirates of Silicon Valley*

sell their operating system to other companies believing, "sales are in the hardware not the software." Xerox executives are shown to reject the Graphical Interface developed at their Palo Alto Research Center, by smugly remarking, "You expect Xerox to sell something called a mouse?"[7]

The film still has important insights for the history of the personal computer. Personalities may be exaggerated. Technological innovations may be overlooked. Companies may be caricatured as heading toward extinction without realizing it. Yet, the events depicted present a dramatization of actual steps in the development of personal computers. Microsoft and Apple are both very important to the history of personal computers. The ingenuity of Apple and the standardizing of the industry by Microsoft are integral to the actual history of the modern PC. After IBM only leased the Microsoft operating system instead of buying it, prices of the PC were free to drop and hardware technology expanded because IBM did not control the industry.[8] Therefore, beginning with a look at the popular view of the history of the personal computer is a much-needed step in writing and researching the history of the personal computer. The film gives one a place to begin asking questions and making corrections to the history of the PC. Because the movie is based on secondary historical sources, criticisms of the film shown here, reflect criticisms of the early written accounts of the history of the PC.

The academic history of the personal computer is an extremely young study in the history of science. In 1997, two years before the television premier of *Pirates of Silicon*

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[7] Ibid.

[8] Ceruzzi, 279.

Valley, Martin Campbell-Kelly and William Aspray stated, "No historian has yet written a full account of the personal computer, mainly because historians generally avoid writing about recent events on which they lack a proper perspective." Campbell-Kelly and Aspray did not revise their statement when they released the second edition of *The History of Computing* in 2004.[9] Their remarks are not without credit. As leading researchers in the field, the Campbell-Kelly/Aspray team is well read in the literature, both primary and secondary sources, and they are qualified to make such assertions. While Campbell-Kelly and Aspray assert that no definitive history has yet to be written, they are the first to admit that there have been many attempts to write the history of personal computers. The problems with most histories of the personal computer that have already been written is that they suffer from either a lack of research or they suffer from the same misrepresentations that that have previously been discussed regarding the historiography of Eli Whitney and the cotton gin.[10]

Campbell-Kelly and Aspray focus largely on the technological developments of computers. In regards to the personal computer development, the authors "redress the commonly held notion that the computer transformed from the mainframe to the personal computer in one giant leap."[11] According to the Campbell-Kelly model, the personal, desktop computer, which people think of today, is not related to the era of early

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[9] Martin Campbell-Kelly and William Aspray, *Computer: A History of the Information Machine 1st and 2nd ed.* (Boulder, Colorado: Westview Press) 1997, 2004, 207.

[10] Campbell-Kelly, 207.

[11] Campbell-Kelly, xvii.

commercial data processors. Campbell-Kelly and Aspray's contention that "the personal computer grew out of an entirely different culture" is only partially correct.[12]

Paul E. Ceruzzi's *History of Modern Computing* contains a more encompassing view of the personal computer revolution, although Ceruzzi does not like the term "Computer Revolution."[13] Ceruzzi's work, similarly to that of Campbell-Kelly and Aspray, is also very technologically oriented. However, Ceruzzi asserts more connections between the mainframe and the personal computer than Campbell-Kelly and Aspray. The calculator industry directly affected the personal computer's development, according to Ceruzzi. Yet, Ceruzzi correctly acknowledges the divergent paths of the two technologies. The cultural implications that helped the personal computer be developed are more accurately explored in Ceruzzi's work than most. Finally, Ceruzzi spends part of his argument explaining the development of software and its dramatic impact on the computer industry. By combining technological developments in hardware with software development and the culture of the computer users of the 1960's and 1970's, Ceruzzi's thesis is perhaps the most accurate, and it allows one to explore certain themes in greater depth.

Ceruzzi explored the software developments of the 1960's and 1970's, but he accepts the change in the way people used a computer as a given process of technological advancement. Regarding the implementation of Graphical User Interfaces (using a mouse and pictures on the monitor) Creruzzi asserts, "the roots of computing—the

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[12] Ibid. 185.

[13] Ceruzzi, 3.

microprocessor, the Altiar…the Apple II, BASIC…Visicalc…the IBM PC, the floppy disk…and MS-DOS," all which will be discussed in more detail later, "owed *nothing* (sic) to Xerox-PARC research," the developers of the original Graphical Interface.[14] When Ceruzzi explored the rise of the World Wide Web, he focused on the technological development, which accurately fits with the rest of his narrative. However, Ceruzzi does not step back from his technologically based study to explore the dramatic impact that Graphical Interfaces had on the computer industry. A more accurate thesis of the later events in the history of the personal computer is obtained by using Neal Stephenson's essay, *In the Beginning… was the Command Line,* as a supplement to Ceruzzi's chapter eight. Stephenson explores how the GUI replaced the command line and what that really means for computer science and the history of computers. The admittedly biased and subjective essay illustrates how Graphical Interfaces place another layer between the user and the computer, and more importantly for Stephenson, what using a computer was like before and after the GUI.[15] Ceruzzi is correct in asserting that "the roots" of the microcomputer did not come out of the work done at PARC, but the modern personal computer did.

As already mentioned, the academic history of personal computers is limited, but there are several popular histories that are useful. Many of the early books about the personal computer are first hand accounts of the early years of the personal computer revolution. The first hand accounts are limited to the author's unique personal

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[14] Ceruzzi, 273.

[15] Neal Stephenson, *In the Beginning... was the Command Line*, (New York: Avon Books, 1999).

interactions with specific pieces of technology and thus ignores other influential pieces of the puzzle. *Stan Veit's History of the Personal Computer* is one first hand remembrance account of the early years of microcomputers that is more encompassing than most because of Veits particular connection. Stan Veit began a computer store in New York in the late 1970's. His own story is one that resembles the story of Michael Dell of Dell Computer; Veit began to build computer kits into functional computers with the idea that people would be more likely to buy a computer with expert advise rather than a kit that had to be assembled by the buyer.[16] Veit is credited by readers for incorporating several obscure models of personal computers into his account of those early years.[17]

A quick internet search for books on the history of the personal computer will return several results. Books range from academically accepted monographs, to pictorial histories, to biographies and autobiographies, to books that are written like Greek tragedies in regards to the "rise and fall" of a particular computer company.[18] Interestingly, a similar search ten years ago would only produce a very small fraction of

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[16] Stan Veit, Stan Veit's History of the Personal Computer: From Altair to IBM, A History of the PC Revolution. (U.S.A.; WorldComm Press, 1993).

[17] Amazon.com user reviews "–http://www.amazon.com/review/product/ 156664030X/ref=dp_top_cm_cr_acr_txt?%5 fencoding=UTF8&showViewpoints=1" <accessed 1 December 2008>.

[18] For an example of an authorized Bibliography See Steve Wozniak, (with Gina Smith), *iWoz: Computer Geek to Cult Icon: How I Invented the Personal Computer, Co-Founded Apple, and Had Fun Doing It*, (New York: W.W. Norton and Company, 2006); For an unauthorized Biography See, Laurie Rozakis, *Steven Jobs: Computer Genius,* (Rourke Enterprises Inc., 1993); For an example of a computer company history see Albert Yu, *Creating the Digital Future: The Secrets of Consistent Innovation at Intel,* (New York: The Free Press, 1998; Owen W. Linzmayer, *Apple Confidential 2.0: The Definitive History of the World's Most Colorful Company*, (San Fransisco, California: No Starch Press, 2004);

the current results. Thus, in the last ten years researchers are more willing to write about the development of the personal computer as public interest in the subject has increased. To satisfy this increased interest in the personal computer industry a vast array of articles have appeared and several people have written books. The previously discussed movie, *Pirates of Silicon Valley,* is both another attempt to satisfy the public curiosity in the history of computers and a reflection of what has been classified as "bad history."[19] What makes these histories "bad" is the distortion of several personalities, such as Bill Gates and Steve Jobs as "visionaries who clearly saw the future and made it happen." Furthermore, large computer companies that were already established during the late 1970's and early 1980's are reported to be "slow-moving, dim-witted, [and] deservedly extinct."[20]

Simplistic answers to questions are usually preferred. History is rarely accommodating. It is easy to give credit to living icons of the personal computer industry like Bill Gates or Steve Jobs. Their success warrants attention. They have made billions of dollars through computer innovation. They were working with computers before those students who are majoring in computer science at their local university were even born. Furthermore, they are not relics, but are still active in the field. Steve Jobs brings thunderous applause when he presents the newest electronic gadget at an annual Macworld conference. However, the simplistic explanation that Jobs and Gates were visionaries seeing the coming tide of the information age, or that they were

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[19] Campbell-Kelly, 207.

[20] Ibid.

revolutionaries who were destroying the old computer world and bringing the power of information to the people, is not the case. They were merely a small part of a larger movement that began years, perhaps centuries, earlier. However, the microcomputer that eventually became the personal machine owned by several million people around the world was both an extension of earlier technology and a fundamental change in the way in which that technology was used and perceived.

The personal computer was first and foremost an extension of previous technological innovation. The development of the computers, from large machines filling an entire room, to individual desktop workstations, was a process that began centuries earlier. From the abacus in the third century AD, to Blaise Pascal's adding machine in 1642, the continuous invention of machines to compute has helped people find ways to make calculating simpler, more accurate, and more available.

Several companies moved to the forefront of the computer technology market in the middle of the 20th century. Hewlett-Packard (HP), International Business Machine Corp. (IBM), Tandy Corporation, Fairchild Semiconductor, Xerox, and others became established office supply and electronic providers. IBM, became synonymous with computers.[21]

In the 1950's computers were being used, but they were not the computers that we see today. However, the technology that was incorporated into the large machines has certain limitations that effected the development of modern personal computers. One of the first working computers was unveiled to the press in 1945; it was the ENIAC (the

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[21] Campbell-Kelly and Aspray, 9.

Electronic Numeral Integrator and Computer). It was over 8 feet high and 80 feet long, and cost approximately $500,000![22] Other such computers were manufactured and called mainframes. Early computers used vacuum tubes, which could be turned on and off. The position of the vacuum tube, either on or off, can be corresponded to the numbers one (1) and zero (0). Using these numbers in a set of eight digits, any mathematical equation can be represented. This was called binary code. All computers are based on binary. For example, the number 1 in binary is "00110001," while the number 2 is "00110010." Through binary code the user can communicate to the computer any number(s) or letter(s) and tell the computer what to do with that information.[23] Early computers were little more than large adding machines with rudimentary input in binary.

The technology of modern computers is built on binary language, which has certain ramifications. The amount of information that a computer can handle is limited to the number of vacuum tubes (later transistors on a microchip) that the computer has. Therefore, based on this technology the amount of information that a computer can handle or compute is finite. During the early years of computers the task for developers was to increase the speed and size of computers, so that more complex calculations could be done faster. This is still the goal of modern computers, and thus, the technology improves while the initial root of the technology remains the same.

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[22] *Core Memory: A Visual Survey of Vintage Computers*, Pictures by Mark Richards, Text by John Alderman, (San Fransisco, California: Chronicle Books LLC, 2007), 16.

[23] Ruth M. Davis, "Evolution of Computers and Computing," *Science* vol. 195, 18 March 1977), 1096-1103.

These large computers were constantly being made faster, more reliable and more efficient. Computers became commercially successful. IBM quickly moved to the lead in the industry. By 1955 the orders for the IBM 700 series surpassed the previous giant, the UNIVAC (Universal Automatic Compiler).[24]

Because computers of the 1950's were large and sometimes unreliable, scientists searched for substitutions for vacuum tubes. Using vacuum tubes in the internal workings of the computers meant that the mainframes would not be small enough or cheap enough for private use. A substitute had already been invented three years after the debut of the ENIAC but the transistor's potential was not unlocked until years later.

A small article buried on page 46 of the *New York Times* on July 1, 1948 described a new "gadget" that would later be considered one of the most important inventions of the 20th century. [25] In 1951, just three years later, AT&T's Bell Laboratories, led by William Shockley, presented the world with the first reliable junction transistor. His transistor was a type of three-layer germanium inside a metal case.[26] Transistors were more efficient than vacuum tubes. A transistor could do the same operations as a vacuum tube but at a fraction of the size, and it did not have the disadvantages of the vacuum tube, such as overheating, fragile containers, and the need for large supplies of power.

Transistors replaced vacuum tubes in radios and televisions during the late 1950's and early 1960's but entered slowly into the computer market. Gordon Teal, formerly of

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[24] Campbell-Kelly, 107; "Should it be lease of Buy" *Duns Review,* July 1977.

[25] "The News of Radio," *The New York Times*, 1 July 1948, 46.

[26] "New Phone Device-Smaller Transistor Uses Less Power and is More Efficient," *The New York Times,* 5 July 1951, 18.

Bell Laboratories, realized the potential of the transistor in computation machines. Teal left Bell Labs and began working at Texas Instruments (TI). He improved the junction transistor by making it with silicon instead of germanium.[27] Silicon is the second most abundant chemical element on earth, second only to oxygen, which meant an abundant supply could lower costs.

In 1952, G.W.A. Drummer suggested a new approach to the transistor. Jack St. Clair Kirby used Drummer's ideas and put all the transistors and resistors and other parts that make up an electronic circuit onto one piece of semi-conductive material. Kirby's invention would be called an integrated circuit (IC) and debuted in 1959.[28]

The IC's found their way into the handheld calculator industry by the early 1970's. Robert Noyce of Fairchild Semiconductor, built on Kirby's approach and made a more practical IC that was adopted by Texas Instruments. The IC's were nicknamed "chips."[29] Noyce then co-founded Intel with Gordon Moore of "Moore's law." Moore computed that through the advancement of technology a chip's capacity would increase exponentially.[30] While Texas Instruments explored the use of ICs in calculators, the integrated circuit allowed smaller computers to be made.

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[27] Ceruzzi, 179, 183.; See also, "Gordon Teal" <http://www.pbs.org/transistor/album1/addlbios/teal.html> (accessed 1 December 2008).

[28] David J. Eck, *The Most Complex Machine*, (Wellesley, Mass.: A.K. Peters Ltd., 1995), 147.; Campbell-Kelly 199-203.

[29] Eck, 148.

[30] William H. Gates III, *The Road Ahead*, (U.S.A.: Penguin Books, 1996), 31.; Campbell-Kelly, 203.

While calculators and personal computers are both descended from the large mainframe computers, the personal computer is not a descendant of the handheld calculator. To continue the metaphor, the personal computer and the handheld calculator are cousins of each other. Both were born out of the same advancements in technology but with different purposes and different outcomes.

While transistors were being improved during the 1950's - leading to the calculator industry and eventually the personal computer industry - another phase of the computer industry emerged which led to the personal computer but not through technological advancements. The next major phase in computers after the large mainframes was the minicomputer of the 1960's. Minicomputers did not utilize the IC, but they were smaller than mainframes and less expensive. Minicomputers were basically small mainframes that were meant to be less complicated and as a result were not as fast. The primary function of a minicomputer was to be more affordable than a large mainframe.[31]

In1959, Digital Equipment Corporation (DEC) launched the minicomputer industry with its first in the PDP series, the PDP-1.[32] PDP stands for Programmed Data Processor. As the name suggests, the PDP was far away from a personalized computer. A minicomputer was not designed to play games, surf the web, or be a word processor like modern personal computers; minicomputers ran computational programs. After the debut of the PDP-1 other companies, like Hewlett-Packard and Data General entered the

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[31] Campbell-Kelly, 198-202.

[32] *The Computer Glossary, 7th ed.,* s.v. "DEC."; Campbell-Kelly, 199-202.

minicomputer market.[33] In 1965, DEC unveiled the PDP-8, which set the standard and legitimized the minicomputer. The price tag for the PDP-8 was $20,000 further placing the machine well out of the hands of the average individual computer enthusiast.[34]

Individuals, however, did get an opportunity to use these machines even if they did not own them, and thus, the minicomputer helped set the stage for a computer that would be used for personal interests. Minicomputers, like mainframes, did not have a keyboard or a monitor; they were "huge and cumbersome and absolutely compelling," according to Bill Gates in a reference to a minicomputer. Parents from Gate's school system in Seattle purchased time on a minicomputer for student use. Without a screen one would have to type the commands on a typewriter type of keyboard and then have the computer compile the data and the end result would be printed out. For young computer enthusiasts "a game of tick-tack-toe that normally would take thirty seconds with a pen and paper might eat up most of a lunch period. But who cared? There was something neat about the machine."[35] This attitude attracted many young engineers, or future engineers, to the computer industry. Thus, the minicomputer phase of computers, technologically, did not advance the computer to the personal desktop, but the less expensive machine did attract many individuals to computers. These young enthusiasts sought a way to make the computer even more personal and designed for an individual.

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[33] *The Computer Glossary, 7th ed.,* s.v. "PDP."; Campbell-Kelly, 199-202.

[34] Campbell-Kelly, 199.

[35] Gates, 1.

Compared to the large mainframe computers like the IBM 700 series, a minicomputer was small, but it was still a relatively large machine. Minicomputers were meant for multiple users and specific tasks usually in industrial applications.[36] Minicomputers sold from $20,000 to $250,000, and it took up as much room as an average sized closet.[37] Because the minicomputer was smaller and less expensive than a standard 1950's and 1960's mainframe, more people were able to get access to them. Thus, the computer and the idea of computers increased in popularity.

The minicomputer seemed to fill the gap between the high end military and large corporation usage in computers and the individual usage. However, the minicomputer was far from personal. Because big businesses bought IBM mainframes, the established electronics providers did not envision a reason for computers to be made for a single user, especially with the handheld calculator industry seeking ways to bring simple calculations to the personal level. IBM, the name equivalent to the computer industry of the 1950's-1970's, found little reason to develop a computer for personal use. One must understand that the use of computers during the 1960's was still basically a machine to input formulas and do complex calculations for engineering purposes. The revolutionary way the modern personal computer is used today is one of the most important aspects that separated the personal computer from the calculator and earlier computers.

The minicomputer expanded the popularity of computer science and set the stage for the computer to become personal. However, it would not be the established computer

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[36] *The Computer Glossary, 7th ed.,* s.v. "Minicomputer."; Carol W. Brown, *The Minicomputer Simplified*, (New York: The Free Press, 1980), 10.; Campbell-Kelly, 224.

[37] Brown, 11; Campbell-Kelly, 199.

and electronic companies that led the way with the incorporation of new technology to make the computer an individualistic machine. In order for the computer to become a personal machine the computer would have to be more affordable and much smaller in size. Intel, as previously discussed, was working with transistors, integrated circuits and the microchip. The development of the microchip intersected with the increasing popularity of the computer, and in the 1970's, the microcomputer industry began. "Microcomputer" is the term for what would become the personal computer because it was built around a microprocessor—the central processing unit of the computer.[38] Microprocessors, specifically those used in the handheld calculators of the early 1970's, accomplished calculations similar to what the room-sized, vacuum tube filled ENIAC did in the 1940's.

The calculator industry has its own rich history that is somewhat concurrent and somewhat divergent from the history of computers. The history of the calculator is too extensive to be repeated here, but the history of the calculator does have implications for the personal computer. The calculator made electronics more personal. They incorporated the microprocessor as early as 1971.[39] Electronic calculators replaced mechanical ones, but people at this time were not comfortable with electronics. In fact, people were in some cases scared of new technology. In an effort to overcome the electronic calculator, the Otis King calculator, one of the last slide rulers, was advertised as a devise that had

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[38] Arthur L. Robinson, "Computer, First the Maxi, Then the Mini, Now it's the Micro," *Science* vol. 186 (1974), 1102-1104.

[39] "Vintage Calculator Timeline," http://www.vintagecalculators.com/html/calculator_time-line.html (accessed 1 December 2008)

"no batteries to run down [and] no complicated circuits to go wrong."[40] While electronics were not completely trusted in 1973, they were surpassing mechanical devises. The microcomputer fit into this era of the development of individualistic electronic technology.

The microcomputer industry began in the early 1970's, but this phase of computers was unique. While IBM and other computer electronic companies focused on large computers—the mainframe and the minicomputer—or the calculator industry, the personalized microcomputer was largely unused by established companies. To fill this void a large number of start-up companies began to sell computer kits.[41] The kit was sold to hobbyist and designed for the user to put it together.[42] The microcomputer kit era had a couple of important ramifications. First, the kit was not meant for everyone and therefore the average buyer was a computer enthusiast. Because the kit required assembly, the buyer was forced to learn about the internal workings of computers. Thus, the buyers were poised to develop technology to work with the computer kit. Most computer kits did not sell well, that is, until the Altair 8800 debuted in 1975. Micro Instruments and Telemetry Systems (MITS) built the Altari around the Intel 8080 microprocessor. At $397, the Altair sold for a fraction of the price of other computer kits. The Altair appeared on the cover of *Popular Electronics* in January of 1975, and the term "Personal

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[40] "Otis King Advertisement" <http://www.vintagecalculators.com/731027_142_EC.jpg> (accessed 1 December 2008)

[41] "Microcomputers Catch on Fast," *Business Week*, 2 August 1982, 53.

[42] Ibid.

Computer" was coined by its founder Ed Roberts.[43] The term "personal computer," however, was not widely used until 1981 when IBM released the "IBM Personal Computer." *Popular Electronics* referred to the Altair as a "minicomputer," but it was built around a microprocessor and could be programmed; it was a microcomputer.[44]

Popular conceptions of the history of the personal computer, such as *Pirates of Silicon Valley*'s interpretation, cite the Altair's debut as the beginning spark for the personal computer revolution. However, as previously illustrated, the Altair did provide a piece of the puzzle, but the problem of the beginning of the personal computer revolution cannot, and should not, be attributed to a single piece of technology. The technological advancements of the 1950's-1970's were not enough. The personal computer kit was a result of the advancements in technology mixed and melded with individualistic ideas.

The Altair was a commercial success with computer hobbyist who wanted to put a computer kit together and explore its intricacies, but this is not the only reason that the Altair has been given a prestigious place in the popular portrayal of the history of personal computers. The Altair attracted a particular computer hobbyist who became the wealthiest person on earth by establishing a computer company initially to work with MITS on the Altair. Bill Gates and his friend Paul Allen began Microsoft, originally spelled Micro-Soft, and sold Ed Roberts of MITS the needed software to make the

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[43] H. Edward Roberts and William Yates, "Altair 8800, The Most Powerful Minicomputer Ever Presented—Can be Built for Under $400," *Popular Electronics,* January 1975, 33-38.; Gates, 16.; *The Computer Glossary 7th ed.,* s.v. "Altair."

[44] H. Edward Roberts and William Yates, "Altair 8800, The Most Powerful Minicomputer Ever Presented—Can be Built for Under $400," *Popular Electronics,* January 1975, 33-38.;

machine work well. Without ever seeing an Altair up-close, Gates and Allen wrote a form of BASIC (Beginners All Purpose Symbolic Instruction Code) while studying at Harvard. The two sold their program to the MITS group in Albuquerque, New Mexico, and then moved to New Mexico to work on software for the Altair.[45] Gates and Allen's computer language turned the Altair into a workable, more easily programmable computer instead of "a box with lights and switches."[46] Two fundamental changes in the industry were made when Microsoft sold BASIC to MITS. First, software, which initially was free, was now a commodity to be bought and sold.[47] Secondly, Microsoft showed that the computer hardware was not the only important component to the personal computer revolution.[48]

The software industry became an integral part of the personal computer revolution, but before the software industry could make such an impact the hardware portion of the computer still needed some advancements before the personalized computer kit could become the modern personal computer. The Altair had no keyboard; the input method was the toggle switches located on the front of the box. The Altair had no monitor, and thus, it did not resemble what people today envision as a modern computer.

Computer kits of the late 1970's became more and more popular. The industry grew very fast after the Altair's debut. In 1978, *Radio Electronics* compiled a list of

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[45] Ceruzzi, 235-236.

[46] *Pirates of Silicon Valley*

[47] Ceruzzi, 236.

[48] Ibid.

personal computer manufacturers. While Apple and Microsoft both played important roles in the development of the modern personal computer they were neither alone nor were they the only innovators. Although many companies failed, the following list illustrates the popularity of microcomputers by 1978:

Apple Computer
California Industrial
Canada Systems Inc.
Central Data Co.
Compal (Computer Power and Light)
Compucolor Corp.
Comutalker Consultants
The Computer Faire
Computer Shop
The Computerist
E & L Instruments
Electronic Control Technology
Electronic Control Technology
Electronic Systems
Franklin Electronic
General Micro-systems
Bill Godbout Electronics
The Health Company
Imsai Mfg. Corp
Infinite Inc.
I O R
Ithaca Audio
Jade Computer Products
Lexington Books
Logical Services Inc.
Marinchip systems
Micronics, Inc.
Midwest Scientific Instruments, Inc.
Mountain Hardware, Inc.
NBL
Netronics R&D Ltd.
North Star Comptuer Inc.
Noval Inc.
OAE (Oliver Advanced Engineering)
Ohio Scientific
Osborne & Assooc.
Parasitic Engineering
PCS (Processor Control Systems)
Percom Data Co. Inc.
Personal Computing Co.
Power-one Inc.
Quay Corp.
Realistic Controls Corp.
Rondure Company
SD Computer Products
Seals Electronics Inc.
Shugart Assoc.
Smoke Signal Broadcasting
Solid State Sales
Southwest Technical Products Corp.
Sylvanhills lab Inc.
Systex Enterprises Inc.
Szerlip Enterprises
TEI Inc.
Thinker Toys
Vector Electronics Co. Inc.
Vector Graphics Inc.
WWW Enterprises
Wave Mate

While Apple computer tops the alphabetical list, this list also illustrates that many computer companies of the late 1970's are not ones with which most people are familiar. The list does not represent every company that dealt with the personal computer but those who willingly responded to R*adio Electronics*' request for information. Each company did not sell an entire kit but was involved in technology specifically designed and used in microcomputers.[49]

The personal computer was a result of ingenuity in the hardware and software industry coupled with an increased interest in technology and personal usage of technology. Although the popular history of the personal computer has been criticized for portraying Steve Jobs or Bill Gates as visionary characters that single handedly launched the personal computer, they should receive due credit, as they were able to market the technology well. Microsoft's connection with MITS and the Altair was not the connection that made Microsoft a billion dollar industry; it was their connection in the early 1980's with IBM that led to that. However, IBM did not enter into the personal computer market until other commercially successful companies illustrated that the personal computer technology was viable. Steve Jobs' company, Apple Computer, had several innovations and took the lead in the personal computer market by the end of the 1970's.

Steve Jobs and Steve Wozniak both grew up in "Silicon Valley" in southern California. Both were around computers and electronics as they grew up. Both worked for established electronics companies. Jobs worked for Atari, and Wozniak worked for

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[49] *Radio Electronics* June 1978, 59-68.

Hewlett-Packard.[50] Because of their lack of formal training, Jobs and Wozniak were unable to move up in the companies. Wozniak worked for HP's calculator department.[51] Thus, the connection between calculators and the personal computer is further reinforced, since Wozniak sought more than an adding machine but based his computer ideas on the microprocessing technology of the calculator. Jobs' worked to improve video games at Atari. He suggested that the company look into development of personal computers, but due to a number of reasons including Jobs' lowly position with the company, Atari dismissed the suggestion. While in their 20's, Steve Jobs and Steve Wozniak started Apple Computer.[52]

Though Steve Jobs' often receives a great deal of credit for the foundation of Apple Computer, Apple's cofounder Steve Wozniak deserves a great deal of credit for his engineering ingenuity. Wozniak stated that he was simply an engineer and wanted little else.[53] Therefore, the early credit for Wozniak was in his work and not from external sources. Jobs, on the other hand, became the front man of Apple Computer.

Wozniak and Jobs were both attendants at the Homebrew Computer Club, a group of people interested in computers who would get together and show what they had done with electronics. Wozniak's key improvement in the personal computer kit was the direct connection of a monitor and a keyboard. The Apple I was a motherboard connected to

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[50] Dan Dorfman, "Move over, Horatio Alger—Computer Technology is Spawning Overnight Millionaires in California," *Esquire,* 6 June 1978, 9-11.

[51] Ibid.

[52] Rozakis, 18.

[53] Steven Wozniak, www.Woz.org <accessed 1 December 2008>

other internal computer parts with a keyboard for input and designed to be hooked to a television set as a monitor.[54]

Because Wozniak worked for Hewlett-Packard, he was under contract; everything he invented had to be approved by HP. Under the contract, HP had the right to own and market any invention. After all, most of the circuitry and parts were from storage rooms of HP for the purpose of talented engineers to invent just as Wozniak had done in his spare time.[55] HP declined Wozniak's offer to produce personal computers. A letter to the editor of *Radio Electronics* can sum up the late 1970's attitude about personal computers from the perspective of electronics companies such as IBM, HP, and Atari in 1978. The author wished to address the issue of "one product doomed for failure—the home computer."[56] Jobs and Wozniak were not deterred by the lack of interest in the personal computer by large companies. The hobbyists with whom they associated were the first target consumers. The Apple I was sold to computer hobby shops who in turn sold them at a retail price of $666.66.[57] The affordability of the Apple I reinforced that the intended consumer was an individual, and the product not meant to be solely bought by corporations.

After gaining some venture capital from a millionaire named Mike Markulla, Apple computer began to produce a computer that was more practical for personal, home

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[54] Rozakis, 21.

[55] www.woz.org; *Pirates of Silicon Valley*.

[56] Art Kleiman, "Computer in Every Home, Fact or Fantasy," *Radio Electronics,* August 1978, 14.

[57] Wozniak, *iWoz,* 180.

and office use. One of the most important advancements was not technological at all. Apple incased the Apple II in plastic, which made it look easier to use. The concept was that people would be less afraid of a computer if it was unassuming and looked like a regular household appliance. Technologically, it was also one of the first to come with a disk drive.[58] The personal computer industry was exploding in the late 1970's, and Apple was on the forefront of the industry.[59]

The personal computer industry did not establish itself merely on technology like the initial computer revolution of the 1940's and 1950's did. Software was an essential part of the personal computer's development and success. For example, Microsoft did not sell hardware only software, and their software was a key in the selling of the Altair. However, one of the most important software innovations for the personal computer was the program Visicalc. Visicalc was a spreadsheet program. The program was landmark because it was so useful in the business world. The work of an accountant could be cut dramatically. Previously, changing one figure in a set would require recalculating all of the data. With Visicalc one could instantly see the changes as the new information was input. Computers went from a "hacking toy" to a useful business tool.[60]

Although Visicalc helped turn the personal computer into a business tool, businesses were not yet ready for the individualized computer because IBM, the name businesses trusted in the computer industry, did not sell them. When IBM entered the

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[58] Linzmayer, 13.

[59] Campbell-Kelly, 220.; Linzmayer, 12-20.

[60] Campbell-Kelly, 220.

personal computer market in 1981, the most important thing that it did was legitimize the personal computer for business use. With "Big Blue" controlling the mainframe market, simply putting the IBM logo on the side of the computer made it a legitimate tool.[61] The IBM/PC was introduced on August 12, 1981 and came fully equipped with 64 kilobytes of memory, a floppy disk drive at a cost of $2,880.[62] With personal computers entering the workplace, more people were exposed to the technology. Thus, the personal computer became the home computer as more people began to realize the potential of a computer for personal use away from work.[63]

After the debut of the IBM/PC the technology of the personal computer was set on a track that would only alter in sight terms. The machine was still based on the binary language of the 1940's computers. The speed of the personal computer is based on the processor speed and the amount of RAM (Random Access Memory) that the computer has. The amount of information that the computer can handle at one time is limited to the amount of bytes that the computer's hard drive can handle. With each new computer model the RAM or the hard drive capacity or both is increased. Some things have changed over the years like the input method (a mouse along with the keyboard), or the way in which information is transferred (floppy drives to compact discs to flash drives), but the root of the technology remains constant and moving toward a finite end.

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[61] Ibid., 229.

[62] Ibid.

[63] "IBM Joins the Race in Personal Computers," *Business Week,* 24 August 1981, 38-39.: "How the PC Project Changed the Way IBM Thinks," *Business Week,* 3 October 1983, 86.

Even though the personal computer of today is built on the same technological principles of early machines, the PC was still a revolution in the way computers were used and perceived. The personal nature of the computer was developed with the minicomputer and the computer literate enthusiasts of the late 1970's, but the average person was still not proficient in computer science. While business employees began to use computers at work and became more comfortable with computers, using the personal computer was still a daunting task for many. The solution to the problem was not a hardware innovation, but rather, it was another software solution.

The first of the two major steps to make the computer a machine for everyone was Microsoft's business deal with IBM. Microsoft was not a company that built computers; they wrote software. Microsoft worked with several computer companies including Apple and Commodore, but by 1981 Microsoft was ready for the next step—a connection with IBM. Microsoft sold IBM an operating system to run on their machines. IBM, however, agreed to license Microsoft's Disk Operating System (DOS or MSDOS) instead of buying it outright.[64] Therefore, Microsoft was able to lease DOS to other companies. IBM's belief that sales were in the hardware and not the software was a business mistake that led to an important step in the history of personal computers. Small computer companies competed with IBM by building an "IBM clone" and ran the same operating system that IBM was using.[65] As businessmen used an IBM/PC in their work place they could buy a computer for the home use from another company at a cheaper price with the

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[64] Campbell-Kelly, 226-227.

[65] Campbell-Kelly, 229.

same look and feel of an IBM. The industry was standardized around the IBM/PC and competition for customers ensued. IBM did not have the same stranglehold on the PC market that it held on the mainframe market three decades earlier. (It may be argued that Microsoft became the IBM of the PC market.)

One of the first companies to make a viable IBM clone was Compaq. In 1983 Compaq released a portable computer. The portable model sold $111 million in its first year.[66] The market for personal computers was well established and growing. The "Me Generation" sought individualism in many areas and inspired a personalized machine. The personal computer flourished after IBM legitimized the PC for business use and IBM clones, competing in the personal computer market, drove prices down and Microsoft standardized the software industry. Desktop workstations (a popular name for the personal computer as it could now fit on top of a desk) were increasing in business use and home use. The PC was so influential that *Time Magazine*'s "Man of the Year" issue in January of 1983 was changed to "Machine of the Year," and the IBM/PC graced the cover.[67]

Just as Visicalc helped turn the personal computer from a toy to a tool, a software innovation marketed during the early 1980's helped bring the personal computer to more homes. The Graphical User Interface (GUI) was more than just a software program, it was a new way to interface, or input and access information, with the computer. In order

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[66] *Core Memory, 145.*

[67] Roger Rosenblatt, "Machine of the Year—A New World Dawns," *Time Magazine,* 3 January 1983, 12-13.

to understand how important the GUI was to the modern personal computer one must understand the way in which early personal computers were used.

Before GUI, command line interface was the standard. Users typed commands into the computer with no icons or mouse pointer. A standard DOS prompt would look similar to this:

C:\>

One would type commands. For example, to move a file from one location to another (from one folder to another folder) the command typed in at an MS-DOS prompt would be:

C:\> copy c:\directory\filename.ext a:\directory

In the previous example, the file called "filename.ext" (where ".ext" would represent the type of file it was, and one would have to know this information) was moved from a directory (folder) on the hard drive (c:\) to a directory located on a floppy disk (a:\). Such long commands required the user to study the computer manual before even beginning to use the computer. A GUI uses icons (representational pictures) that perform the same action described above by simply clicking on a picture of the file and dragging it to its new location.[68] Computers that were "user friendly" premiered in the early 1980's and the final piece of the modern computer was put in place. However, the GUI was not a sudden invention.

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[68] Campbell-Kelly, 236; See also, Neal Stephenson's *In the Beginning… was the Command Line*.

Researchers for Xerox had been working since the 1970's on a project for a new type of interface (the GUI). The researchers at Xerox's Palo Alto Research Center (PARC) worked on a computer called the Alto which used pictures or icons to represent certain aspects of the computer. By using a "mouse" (another input device used along side a keyboard) the "point and click" was born. New York executives of Xerox did not see the potential for the GUI project. Due to high cost and lack of marketing, the Alto was a disappointment.[69] Xerox later released the Star 8010, which contained many features of the Alto, but the very expensive price of a "year's salary" did not make it affordable for home use.[70]

Jobs and others from Apple were intrigued by the work done at PARC and arranged a meeting with Xerox. The GUI was impressive, and the Apple team recognized the potential to expand the marketability of the personal computer. Apple began to develop a computer that "change[d] the way people look[ed] at computers."[71] With a Graphical interface one could be computer illiterate and still use a computer.[72] In January 1983 Apple released a new product complete with mouse and fully functional Graphical Interface, the Apple Lisa.[73] The GUI made the future of personal computers—including the World Wide Web—possible. However, the Lisa's price tag did not help it become a

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[69] "Where User Friendly Began," *Business Week,* 28 March 1983, 138.; Campbell-Kelly, 239.

[70] Ceruzzi, 262.; Campbell-Kelly, 239.

[71] Campbell-Kelly, 236-237.

[72] David Thomas, "Apple Upstages Rival," *Maclean's,* 31 January 1983, 35-36.

[73] Campbell-Kelly, 271.

commercial success, yet Apple already had plans to release a computer with a GUI that was affordable for everyone.

The Apple Macintosh debuted in 1984 with a "user friendly" GUI and was sold at nearly ten per cent of the price of the Lisa. Although the Mac was not compatible with Apple's most popular product, the Apple II, it was one of the most important steps in the advancement of the personal computer. The Mac was revealed to the world in a fantastic way—a rarely aired commercial directed by Ridley Scott was played during Super Bowl XVIII.[74] By airing the commercial during the Super Bowl, Apple was telling the world that the computer was for the common man, it was made for everyone. The commercial also commented on the IBM (and IBM clone) domination of the market. With Microsoft standardizing the industry, the Apple operating system became an outsider in the computer industry. The commercial implied that individuals had a choice, they could follow the crowd or they could step outside to the fringes and be on the forefront of computer technology.

Apple was unable to overtake Microsoft's standardization of operating systems. Apple did not widely license others to run their operating system (OS). Apple attempted to keep control of their hardware and software, a business plan that allows for better, more stable computer systems, but one that would ultimately allow Microsoft's OS to dominate the computer market. Microsoft developed an answer to the Mac's GUI. The

[74] Campbell-Kelly, 241.

tension between Microsoft and Apple began to heat up in the mid-1980's due to the GUI and OS development of both companies.[75]

Gates was intrigued with the Lisa's Graphical interface. Seeing the trend in the personal computer market, Microsoft began a project that eventually would be called "Windows."[76] The Windows system was strikingly similar to Apple's Macintosh system. The movie *Pirates of Silicon Valley* dramatized an exchange between Gates and Jobs with Gates shouting, "You and I are both like guys that had this rich neighbor, Xerox,… and you go sneaking in to steal the T.V. set only when you get there you realize that I got there first—I got the loot Steve!" While the dramatization suggest a stealing of work, the truth seems to be that both companies (as well as others) were working on the technology of the GUI and that Xerox's research at PARC, after it was not utilized by Xerox, was up for grabs to anyone that could adapt it to an inexpensive computer and market it well.[77] Apple adapted the technology first, but because of Microsoft's connection with IBM and the IBM clone market, the Windows system quickly became the GUI with which people learning to use a computer became familiar.

So many computer companies emerged during the 1970's that tracing the history of all of them is difficult, which is why the definitive history of the personal computer

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[75] Stephenson, 22-23.

[76] "A Software Wiz Kid Goes Retail," *Business Week,* 9 May 1983, 35-36.

[77] "Product Review: Microsoft Windows," *Creative Computing,* February 1984, 74-77.; Microsoft Advertisement in *Scientific America,* 16 May1983, 115.; "Where User Friendly Began," *Business Week,* 28 March 1983, 138.; Campbell-Kelly, 243-246.

"has yet to be written."[78] The successful companies receive a great deal of credit, and rightly so, as the story of Microsoft, Apple, IBM, Xerox, is the best starting point for a history of the personal computer. However, as the field grows, more and more companies' individual history will come into play. Overlooked and small start-up companies should be studied at a greater length as historians begin to peel back the many layers of the history of the personal computer.

People are interested in the history of computers. Popular culture portrayed an abridged and dramatized version of the events in *Pirates of Silicon Valley*. Steve Wozniak was a judge in a contest held by the Boston Computer Museum to name the first personal computer. The contest explored many obscure computers like the Kenbak-1, the winner of the contest.[79] Computers such as the Kenbak-1 are often overlooked because a lack of commercial success leads to a lack of preserved information. The future of the history of the personal computer will be a study of tiny advancements in technology while still focusing on the successful and semi-successful computers such as the Apple II, the TRS-80, Commodore's PET, the Altair 8800, the IBM/PC, and the Apple Macintosh. It will be more difficult to judge the impact of some of the unsuccessful computer companies as the technology that they showcased was readapted or bought outright by the established companies. For example, the innovations of Steve Jobs' second computer company, NeXT, was ported over to the Apple models after Apple bought the company.[80]

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[78] Campbell-Kelly, 207.

[79] John Blankenbaker, "The First Personal Computer," 26 September 2007, < http://www.kenbak-1.net/> (accessed 1 December 2008).

[80] Laing, 184-185.

Who is the father of the personal computer? That question may not be answered very easily. The personal computer was not an invention by any one person. The modern personal computer was a result of four distinct parts culminating in the late 1970's. First, technological development that began with adding machines and the large mainframes of the 1940's, was a foundational element of the personal computer's development as well as a limiting factor. The transistor led to the integrated circuit and the microprocessor which allowed personal computers to be made small enough and cheap enough for individual purchase. Secondly, personal interest in computers expanded when the "Me Generation" attitude of individualization interested with computer technology via the minicomputer. Thirdly, software developments of the late 1970's allowed personal computers to flourish. Visicalc pushed the personal computer into the business market which attracted IBM's interest. The entrance of IBM in the PC market legitimized the microcomputer as a useful business tool. Finally, the development of the Graphical User Interface made the PC a truly personal machine that individuals could easily use with little training. It was the emergence of these four elements, the slow-but-steady technological developments that were merged with genuine innovation coupled with properly-timed marketing meant to strike at a society embracing strong economic individualism, that came together in the late 1970's and early 1980's and allowed the modern personal computer to emerge.

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Science on Stage:
An Experiment in Theatricality

A Historiographic Examination of the Interaction Between Growing Consumer Culture and 19th Century Specialized Science

Science on Stage:
An Experiment of Theatricality

One cannot fully explore scientific advancement without studying the impact science had on society.[1] While abstract ideas were helpful to those in the ivory towers of academia, it was the visual show of practical science that grasped the public's attention. Science became more specialized in the nineteenth century.[2] Thus, a historian studying the intersection of science and society may approach change with a common question relevant to several scientific fields of study. The rise of what may be described as "theatrical science" in Victorian society provides such an opportunity. New ideas about electricity, chemistry, and medicine were presented to the public not just through publications, but also through performances. Science was put on stage, which began an experiment with theatricality.

The traditional approach to scientific history emphasized the scientific accomplishments and experimental process[3] but overlooked the role of theatrical science, a reference to the performances of lecturers and showman, which was an integral part of public science.[4] Theatrical science was an important part of the adaptation of science to the changing society of nineteenth century Europe because the history of science is not

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[1] Jan Golinski, *Science as Public Culture: Chemistry and Enlightenment in Britain, 1760-1820* (Cambridge: Cambridge University Press, 1992).

[2] R.C. Olby et al., eds. Companion to the History of Modern Science, (London: Routledge, 1990), xix.

[3] For an Example of the Traditional approach see Ivor B. Hart, *The Great Physicists* (1927; reprint, Freeport, New York: Books for Libraries Press, 1970), 108.

[4] For an example of history focused on the perspective of this intersection see René Taton, ed., *History of Science: Science in the Nineteenth Century*, trans. A.J. Pomerans, (London: Thames and Hudson Limited, 1965).

fully explored without researching society's acceptance of scientific ideas.[5] Science cannot exist without a society to influence and motivate it.[6] Examining the nineteenth century from the perspective of theatrical science allows a greater synthesis of the cultural history and scientific history of the time period.

The consumerist society prevalent in the later part of nineteenth century Europe was extremely influential on the careers of scientists, their discoveries, and the presentation of discoveries.[7] In Britain especially, scientific institutions needed to compete for patrons who sought public entertainment and were swayed by advertisements.

The connection of science and society is the essence of this essay; however, within this broad topic, the focus is primarily on how historians have examined theatrical science. Theatrical science played an important role in both controversial public debates and studies of experimentation with electricity. In regard to the overall study of public science in nineteenth century Europe, successful performance lectures of this period reveal the dual nature of nineteenth century science as a transport into modernity and a mode for social mobility and popularity. The term theatrical science is most appropriate because, while the science and experimentation is of the utmost importance, successful lecturers, such as Michael Faraday, realized the potential of performing lectures in such a

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[5] Roger Cooter, *The Cultural Meaning of Popular Science: Phrenology and the Organization of Consent in Nineteenth-Century Britain* (London: Cambridge University Press, 1984).

[6] Jan Golinski, *Science as Public Culture: Chemistry and Enlightenment in Britain, 1760-1820* (Cambridge: Cambridge University Press, 1992).

[7] Iwan Rhys Morus, *Frankenstein's Children: Electricity, Exhibition, and Experiment in Early-Nineteenth-Century London* (Princeton: Princeton University Press, 1998).

way that the science was presented clearly and interestingly to those outside the scientific community.

The theatrics that one employed in a debate profoundly affected the position taken by society, and in turn the time and finances provided to a research topic. Public discourse, therefore, should also be studied as part of theatrical science. In a performance lecture, the speaker persuaded the audience through a series of experiments that both dazzled and educated them. In some cases, such as the controversies concerning mesmerism or anesthesiology, the performance lectures and public debates took place simultaneously.

As noted earlier, scientist who experimented with electricity easily adapted theatricality into their presentations. Social mobility was a reason for Michael Faraday's career choice as well as others.[8] Faraday moved into elite society by gaining a favorable reputation within the scientific community.[9] In researching the impact of theatrical science, one should not attempt to diminish the scientific achievements of great scientists, but incorporate the role of public science into an investigation of science in the nineteenth century. Early authors focused on the use of science for social mobility without exploring how this was accomplished. Recent scholarly works explained how the presentation of science, its acceptance in society, and ultimately, its correctness, all impacted the historical and contemporary view of scientists and scientific ideas. Historians James Secord and Iwan Morus have acknowledged the role of theatrical science as a way to gain

[8] Hart, 108.

[9] Ibid.

popularity within the scientific community and society as a whole.[10] They built their arguments on the works of previous historians like Ivor B. Hart and D.K.C. MacDonald who explored more narrowly the accomplishments of those in the physical sciences,[11] although their works were divergent from the traditional approach.

In 1927, Ivor B. Hart published a book titled The Great Physicists in which he explored the careers and accomplishments of scientists from Pythagoras and Archimedes to Lord Kelvin and James Joule. According to Hart, Michael Faraday exemplified how social mobility was achieved through scientific endeavor. Faraday's early life was one of poverty, but his apprenticeship as a bookbinder "opened out for him visions of a larger world."[12] Hart contributed Michael Faraday's love for science to a book entitled *Conversations in Chemistry* as well as small experiments at home. It was "the attending of popular science lectures [that] served both to fan his hopes and ambitions and to increase his distaste for bookbinding."[13] Nearly all historians who have written about Faraday's early life noted the influence of the lectures of the Royal Society on the young Michael Faraday.[14] He took notes at one of Sir Humphrey Davy's lectures and sent them to Davy with a note that asked for consideration if a scientific opportunity presented

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[10] James Secord, *Victorian Sensation: The Extraordinary Publication, Reception, and Secret Authorship of Vestiges of the Natural History of Creation*, (Chicago: University of Chicago Press, 2000); Iwan Rhys Morus, *Frankenstein's Children: Electricity, Exhibition, and Experiment in Early-Nineteenth-Century London* (Princeton: Princeton University Press, 1998).

[11] Hart, 108.; D.K.C. MacDonald, *Faraday, Maxwell, and Kelvin* (Garden City, New York: Anchor Books, 1964).

[12] Hart,108.

[13] Ibid.

[14] Hart, 108.; Taton, 194.; MacDonald, 18.

itself.[15] Hart identified performance lectures specifically, and public science in general, as influential on Faraday, but he did not delve into the performances of Faraday which would have allowed for a more clear understanding of Faraday's reputation as an ideal performer of theatrical science.

D.K.C. MacDonald provided an abridged biography of Michael Faraday, James Clerk Maxwell, and Lord Kelvin in his book, Faraday, Maxwell, and Kelvin.[16] MacDonald, who published his book over thirty years after Hart's The Great Physicists, was an early acknowledger of the influence of theatrical science. Reputation was an important motivator of scientific discovery, according to MacDonald. An example of this frame of mind was shown when he stated, "It is often assumed that scientists generally are unemotional…but the very urge that will make men devote long hours to work that is demanding and exhausting…is bound to be emotional."[17] MacDonald continued, "It seems a very natural and normal consequence of the fact that it is men who are doing the science, were it not for the emotional urge to lay bare something which no one else has done before, there might be no psychological drive to make men do science at all. …If men did not care deeply about being credited for their discoveries, they might well have no desire to make any at all."[18] Therefore, he asserted that scientific discoveries were the result of people seeking fame and popularity and not simply science for the sake of science. MacDonald argued that fame was an important factor in the choice of science as

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[15] Ibid.

[16] MacDonald, 33.

[17] Ibid.

[18] Ibid.

a career. Fame may come in two forms. The first form of fame was the acknowledgment from history that one's achievements were in fact profound. The second form, one that was directly concerned with the area of public science and performance lectures, was the fame cast upon one by his/her contemporaries. A scientific achievement displayed theatrically in a performance lecture was an attempt to accomplish both forms of fame.

MacDonald, though not directly making theatrical science part of his thesis, was one of the earliest authors, within the historiography of nineteenth century science, to explore the intersection of society and science through the lens of theatrical science. In regards to performance lectures, MacDonald suggested that Faraday was a "very attentive" listener to the lectures and a student of the "art of lecturing."[19] Faraday acknowledged the opportunity performance lectures provided to educate society, as well as for the scientist to illustrate his accomplishments. Faraday wrote about the way in which a scientist evolved from experimenter to educator. He was a leader in initiating the "Friday Evening 'Discourses'" as well as the "Christmas Lectures for Children," which were public lectures that have continued through today.[20] Scientific achievements as well as understandable lectures for society were important to the process of becoming a recognized scientific leader. Faraday understood the importance of popular acceptance of scientific theories; therefore, he believed that making the lecture relevant to the people observing was an important aspect of lecturing.[21] Thus, society and science, according to MacDonald and Michael Faraday, intersected in the arena of theatrical science.

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[19] Ibid, 46, 48.

[20] Ibid.

[21] Ibid, 47.

Crosbie Smith did not follow MacDonald's initial inquiry into the world of public science. Crosbie Smith's essay concerning energy in Companion to the History of Modern Science stated the "energy revolution" or the "replacement of the concept of force with the concept of work" was the greatest development in physics between Isaac Newton and Albert Einstein.[22] Smith argued, the "'Energeticist' school of physics… aimed to replace mechanics as the fundamental science" during the nineteenth century.[23] Smith suggested the role of public lectures to be a forum for scientific discussion. James Joule's disappointment with electromagnetic engines was expressed at a public lecture in 1881.[24] The role of the lecture was suggested by Smith to be a forum by and for scientists and not an important part of the history of science.

Smith's article followed Hart's and MacDonald's traditional approach by exploring only minimally the role of theatrics and popular science. However, in the same book, Steven Shapan argued that public science was crucial to society's acceptance of controversial ideas. The editors of Companion to the History of Modern Science chose Smith's article to represent the age of experiments with electricity, even though its 1990 publication was twenty-five years after editor René Taton's Science in the Nineteenth Century. Taton attributed the intersection of science and society in Europe as main reason that European science led the rest of the world in the nineteenth century. To him, the

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[22] Crosbie Smith, "Energy" in *Companion to the History of Modern Science*, ed. R.C. Olby, et. al. (London: Routledge, 1990), 326.

[23] Ibid, 339.

[24] Ibid.

second industrial revolution, as well as the government financing of scientific endeavors, was crucial to the progression of science in Europe.[25]

Taton recognized that a critical part of the intersection between science and a growing and industrializing society was the art of theatrical science. While Taton did not go into great detail about the performance lectures, he did devote a portion of the section titled "Society and Science" to popular science. Like MacDonald, Hart, and others, Taton referred to popular science as the study of how a society adopted scientific information. Taton, unlike other historians discussed, briefly wrote about scientific societies outside of England and France. The Swiss Natural Science Society and the Gesellschaft deutscher Naturforscher und Artze in Germany held lectures that were "extremely well attended and played an important part in the scientific revival of the German-speaking world."[26] Taton argued that popular science in general and the performance lectures held by the societies were used to "arouse public interest in current scientific problems and research, and hence, to gain government and private support of science."[27]

Taton suggested that the conservatives within the establishment opposed the scientific revolution of the nineteenth century. It was the impact of scientific societies and public lectures that swayed public opinion to the side of reformers of scientific societies and universities.[28] Unlike MacDonald, Taton focused more broadly on the role of public science in general, as opposed to the specific nature of performance lectures, as a tool to

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[25] Taton, 549.

[26] Ibid, 550.

[27] Ibid.

[28] Ibid, 552.

promote an individual's career. In fact, E. Bauer, the author of "Electricity and Magnetism," in chapter four of Science and the Nineteenth Century, detailed the accomplishments of Michael Faraday without an examination of his lectures, the effect of these performances on society, or the theatrical science that influenced him as a young man.[29] Taton's editorial additions to the essays in Science in the Nineteenth Century, however, clearly showed that he believed that the intersection of society and science, in general, was of great importance for a historian to understand nineteenth century science or society. He stated "the main cause of Europe's scientific supremacy in the nineteenth century was her continued political and economic superiority over the rest of the world."[30] The support given by European societies and governments was crucial to their position of world domination in the area of nineteenth century science.

In her 1998 book Mesmerized: Powers of the Mind in Victorian Britain, Alison Winter argued that the historiography of Victorian science had been narrowly defined. Winter sought to move the study of the practice of mesmerism, which historians have seen "at the fringes of society,"[31] to a position of greater importance within the historiography of nineteenth century science. Mesmerism, to Winter, occupied a "central place among the preoccupations of Victorian culture."[32] The debate over mesmerism's place within science, according to Winter, was "pivotal" in the change of authority for medicine and science. According to Winter, the mesmeric debates, experiments, and

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[29] Ibid, 194.

[30] Ibid, 548.

[31] Alison Winter, *Mesmerized: Powers of Mind In Victorian Britain* (Chicago: University of Chicago Press, 1998), 4-5.

[32] Ibid, 4.

performances reflected several aspects of Victorian society from race relations to class distinctions to the role of science and the authority of medical practitioners.[33]

Because the practitioners of the mesmeric debates varied, and the places in which the debates took place were numerous, the debates over mesmerism and the use of anesthesiology illustrated the intersection of science and society. Mesmerism was practiced and debated "in universities and mechanics' institutes, country houses and cottages, vicarages and town halls, pubs and hospitals…[and among] the aristocracy to their servants, the industrial middle classes and the 'operatives' who worked in the factories, the preachers and their congregations, the doctors and their patients."[34] The performance lecture was an essential place of debate. Winter noted, "During the 1840s itinerant lecturers fanned out across the country."[35] One may argue that mesmerism should not be classified under the category of theatrical science since it was the very acceptance of mesmerism as science that was debated; however, as Winter's central thesis outlines, not only was a large portion of society involved in the debates, but the scientific community was also interested in the argument.[36] Doctors attended the public performances. Lecturers who performed at public demonstrations often engaged their skeptics who sat in the audience.[37]

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[33] Ibid, 16.

[34] Ibid, 4.

[35] Ibid, 5.

[36] Ibid, 16.

[37] Ibid, 167.

Mesmerism and the controversy over the use of anesthesiology lent itself to performance lectures nearly as easily as the nineteenth century experiments with electricity and magnetism. The central question that the mesmeric debates attempted to answer became, "What shall be considered science?" The theatrics involved were a central part of the debate to Winter. Thus, science and society collided in the central question of authority over scientific matters, and this collision took place on the stage of theatrical science.

In Uneven Developments: The Ideological Work of Gender in Mid-Victorian England, Mary Poovey explored the use of anesthesia in the nineteenth century. Poovey studied how the outcome of the debate reinforced gender roles in Victorian society. Poovey noted the lecture as a forum for discussion but placed far less emphasis than Alison Winter on the role the performances played in influencing society's opinions. The professionalization of medicine and the declining role of midwifery were explored. Women were the subject of the arguments in regards to childbearing but were excluded from the ability to "represent themselves" in written literature.[38] Poovey suggested that science and society were in fact intersecting but women were mere observers. Women were subjects in the demonstrations but were not demonstrators. Women were in the audience of performance lectures but not performing on the stage of theatrical science.

It is not that historians have completely overlooked the performance lectures or theatrical science in the historiography of nineteenth century science, but that they have only given minimal attention to the subject. Hart and MacDonald acknowledged the

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[38] Mary Poovey, *Uneven Developments: The Ideological Work of Gender in Mid-Victorian England* (Chicago: University of Chicago Press, 1988), 43.

lectures as influential in a young scientist career choice. Taton recognized the importance of popular science in the battle between the conservative authorities and the revolutionaries of science in the nineteenth century. Winter's thesis rested on the idea that performances in debates over mesmerism were responsible for society's interest in the debate. Historians of science acknowledged the performances as a way to elaborate on scientific achievements, but few have studied the performance itself as a factor in the popularity of a scientist, or the acceptance of a scientific idea. One may argue that this was because the science itself has since been proven correct.

Early authors in the historiography of nineteenth century science, such as Hart, seemed to believe that science and experimentation were more important historically. However, James Secord, Iwan Morus, and Jan Golinski, all writing within the last twenty years, have fully embraced the role of community in the study of the history of science by encompassing the role theatrical science played in the interaction between the masses and the scientific community. Their arguments followed the lead of others who began to criticize the gulf within the history of science "between the sociology of collective behavior and the history of scientific ideas."[39]

In The Cultural Meaning of Popular Science, Roger Cooter suggested that historians began to reevaluate the societal context in which the history of science had been written. Science does not exist without the culture's perception of it. Cooter's interest was the way in which the culture assimilated and disseminated the knowledge of phrenology. He considered phrenology to be more scientific than mesmerism and more

[39] Roger Cooter, *The Cultural Meaning of Popular Science: Phrenology and the Organization of Consent in Nineteenth-Century Britain* (London: Cambridge University Press, 1984), 2.

controversial than the later debates over Darwinism.[40] Cooter argued that his study of phrenology's historical value was rooted in the assumption that "the knowledge and the society it inhabited," were one in the same and that neither can be studied alone.[41]

Eight years after the publication of Cooter's book, Jan Golinski published Science as Public Culture. Golinksi, like Cooter, credited articles from Steven Shapan as a starting point for questions concerning the place of science in the public arena.[42] Golinski viewed theatrical science as a fundamental component in the acceptance of scientific ideas. She argued, "The persuasiveness of particular claims is not a result of what was said, but also of how it was said, where, and by whom….Rhetoric is one of the requirements for the construction of science in the public domain."[43] Golinski examined late eighteenth and early nineteenth century chemistry with this insight in mind. She explored the career of Sir Humphrey Davy, the mentor to Michael Faraday, and called Davy "the public face of genius" while exploring how he was able to "create" an audience.[44]

Davy's popularity was discussed in chapter seven of Science as Popular Culture, and it was a key portion of Golinski's overall argument. However, Davy was followed by his successor Michael Faraday, and many agree that Faraday surpassed his teacher in the laboratory and in the eyes of Victorian society. Before the circumstances of Davy or

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[40] Ibid, 10.

[41] Ibid, 8.

[42] Ibid.; Jan Golinski, *Science as Public Culture: Chemistry and Enlightenment in Britain, 1760-1820* (Cambridge: Cambridge University Press, 1992), 1.; See Steven Shapan, "Science and the Public" in *Companion to the History of Modern Science*, ed. R.C. Olby, et. al. (London: Routledge, 1990), 990-1007.

[43] Golinski, 3.

[44] Ibid, 990.

Faraday's rise in popularity may be discussed, it is important to note the way in which the historiography of nineteenth century science has incorporated Golinski's ideas and methodology.

James A. Secord explored the intersection of science and society in much the same way as Golinski.[45] Secord studied the public reception of a pre-Darwinian naturalistic book with an eye focused on the way in which things were presented to and assimilated by society. The intersection of society and science came from more than public lectures, according to Secord in Victorian Sensation: The Extraordinary Publication, Reception and Secret Authorship of *Vestiges of the Natural History of Creation*. "Lecture demonstrations" were only a small part of the overall intersection of society and science that also included journalism, panoramas, museums, "and in the evolutionary narrative of *Vestiges*."[46] Advancements in travel and communication were responsible for "transforming opportunities for making money from the display of knowledge."[47] Secord used the term "commercial science" for showmanship and performance lectures, as well as, "authorship, editing, reviewing, specimen dealing, industrial consultation, instrument making, [and] museum curating."[48] The author agreed with Golinski and others that the Royal Intuition was a preeminent institution in urban social life, and Secord noted that the lecture in particular was "a mainstay for those who

[45] Secord, 437.

[46] Ibid.

[47] Ibid.

[48] Ibid.

pursued science for pay."[49] Further illustrating the intermingling of science and society, Secord declared that during the week of Easter "theaters were open only for science shows."[50] Scientific knowledge for the populous was a sign of respectability, thus the theaters did not show frivolous events but instead showed theatrical scientific exhibitions.

The performance lecture was not a venue only used by the great scientists like Faraday and Sir Humphrey Davy. Secord examined the lecture circuit traveled by far less notable men. It was those ordinary, and less remembered, scientific men who made the display of theatrical science a more controversial factor. Secord explained, "The distance between pulpit and platform was short, and the audiences were often identical."[51] John Wallis was one such performer; he fought scientific reformers by using theatrical scientific lectures to appeal to public opinion in order to gain support. His only publication "had a limited circulation."[52] His reputation was dependent on his ability to perform and not on his academic works. Thus, unprofessional scientists employed the same theatrical approach in order to popularize their works, as did the notable men of science. Those amateur scientists, who historians may classify only as showmen and not scientists, truly brought a theatricality to the public because their work was not as well accepted within the elite scientific community. The difficult question to answer was whether or not it was the great lecturers, such as Faraday and Davy, who influenced the

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[49] Ibid, 438.

[50] Ibid, 450.

[51] Ibid, 450-451.

[52] Ibid.

amateur scientists to use theatricality to explain their ideas, or if amateurs influenced the scientific elite.

The title of Secord's book clearly stated his intention to discuss the book *Vestiges of the Natural History of Creation* in regards to Victorian society, but Secord also gave an interesting and original view of the intersection of science and society. Secord gave considerable attention to theatrical science or what Secord referred to as "commercial science." The popularity of *Vestiges* in Victorian society was due to the fact that the book was not only read, but by using *Vestiges* as a starting point for performances, panorama, and pictorial presentations, its ideas were "seen as a museum of creation."[53] Secord cautioned, "We are used to seeing the Victorian world through the printed word, but the visual field of contemporaries was dominated by shows, exhibitions and pictorial representations."[54] Books and other printed publications were not sufficient sources for a study of that era. Victorian society learned about new scientific ideas through theatrical scientific displays, just as the ideas in *Vestiges* were popularized by theatrical means and not just the printed book.

Iwan Morus, perhaps more than any other author discussed, contributed a more general view of the intersection of society and theatrical science to the historiography of nineteenth century science. Morus's 1998 book, Frankenstein's Children, explored the world of electrical experimentation and public performances with far greater accuracy than previous works. He built on the framework begun by Cooter and Golinski. Morus's

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[53] Ibid, 440.

[54] Ibid.

goal was to "provide a sensitive cultural history of electricity's place in the first half of the nineteenth century…[and] carry out an experiment in the sociology of scientific knowledge."[55] In fact, James Secord acknowledged Morus as one of the best scientific historians because Morus recognized the connection of exhibitions and science in Victorian society.[56] Morus argued that the history of science is best understood through a "detailed understanding of the complexities of the local culture."[57] Morus pointed out, "Experiments in early nineteenth century London were performed in every sense of the word. Electricians needed to define themselves…they had to fashion themselves in such a manner as to conform to or even construct their potential constituencies' notions of the kind of person an experimenter should be."[58] Thus, theatricality became a part of the scientific process, at least in the acceptance of new ideas, for both masses and the scientific community.

Morus formed a synthesis between Secord, Winter, and Cooter's view of the practitioner of theatrical science and the view of D.K.C. MacDonald and Jan Golinski. Secord and Winter both attributed the place of theatrical science to be the main profession of those involved in pseudoscience. Golinski and MacDonald saw the performance lecture as an important aspect in the career of a scientist who was to be remembered. Morus thus explored the "two distinct trends of experimentation, emerging in conflict

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[55] Iwan Rhys Morus, *Frankenstein's Children: Electricity, Exhibition, and Experiment in Early-Nineteenth-Century London* (Princeton: Princeton University Press, 1998), ix.

[56] Secord, 440.

[57] Morus, *Frankenstein's Children,* xi.

[58] Ibid.

with each other."[59] The two competing views of popular science, to Morus, resulted from the conflict between the artisan and middle classes. Those from the Royal Institution viewed the lecture for elite audiences to be distinct and separate from the laboratory experiments. Lower class mechanics or instrument makers performed lectures and experimented with "considerably less clear-cut" distinctions.[60]

Morus, like other historians of nineteenth century science, argued that no study of electricity and experimentation could be done without a look at Michael Faraday. D.K.C. MacDonald's brief look at the "art of lecturing" in the life of Michael Faraday paled in comparison to Morus's examination. Morus suggested that Faraday "self-fashioned" and "carved out for himself" a position by which others were measured. "Faraday used his resources to make experiments, to make an audience for his work, to make himself such that he could capture that audience's interest."[61] Comparing Faraday's career with his mentor Sir Humphrey Davy, Morus agreed with fellow historian of science Jan Golinski that each man "employed strategies" to develop his career.[62] Morus suggested that laboratory genius would not have been sufficient for Faraday to rise into high society, and the author highlighted several occasions when Faraday honed his skills at performance.[63] Morus devoted considerable time in his study of Faraday's career to how he performed a

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[59] Ibid.

[60] Ibid.

[61] Ibid*,* 13.

[62] Ibid*,* 15.; See Golinski, chapter 7.

[63] Morus, *Frankenstein's Children,* 19.

lecture in order to emphasize the importance Faraday himself placed upon the art of theatrical science.

Morus also compared Michael Faraday to William Sturgeon in order to illustrate the different styles and approaches to the theatricality of public science. Sturgeon criticized Faraday's approach to the performance. Faraday used minimal props and instruments in his lectures. Information was "disembodied facts absent from the labor that made them."[64] Sturgeon utilized the inner workings of the apparatus used in an experiment to advance his explanations during a lecture.[65] To Morus, Faraday strategically "went out of his way" not to publicly debate those who argued against his work. Faraday's lectures at the Royal Institution were almost beyond contestation due to the method of performance that he used. Therefore, to the dismay of opponents like Sturgeon, Faraday created for himself a reputation that almost commanded the acceptance of his findings without discussion.[66] Morus's conclusion to the competition between Sturgeon and Faraday reflected the basic ideas for which Morus contributed to the historiography of nineteenth century public science. Morus argued that Sturgeon failed "because the audience he cultivated could not be maintained."[67] His experiments were worthy of consideration. His career, until the end, was a "resounding success," but this scientist's final outcome was determined by the intersection of popular science with

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[64] Ibid.

[65] Ibid, 52.

[66] Ibid, 53.

[67] Ibid, 69.

society. His theatrical style did not prove to be as well devised as that of his rival Michael Faraday.[68]

Morus continued his arguments in his 2005 publication When Physics Became King, where he focused on the reasons that theatrical science became so popular. "Exhibitions played a crucial role throughout nineteenth century culture," explained Morus, due to the "rising middle classes [who] flocked to a whole range of public entertainments."[69] A new "world of display" was brought about by advertisers' attempts to draw the customer. Theaters, panoramas, dioramas, and magic shows were all in competition with performance lecturers for an audience.[70] Therefore the most successful and well-known scientists were those who not only contributed new ways of looking at the natural world but also explained those new ideas to middle and upper class socialites. In fact, the heightened sense of commodity and marketplace in the nineteenth century helped secure the scientist's place in society. Inventors sought the stage of performance lectures in order to secure buyers for their new invention. While scientists such as Faraday and those from the Royal Institution saw themselves as educators to the public, the stage of theatrical science was, for Victorian society, a place of exhibition, demonstration, and solicitation.[71]

Scientists and amateurs used theatrical science both formally and informally to showcase new theories and inventions to the public. The formal discourses held on Friday

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[68] Ibid.

[69] Iwan Rhys Morus, *When Physics Became King* (Chicago: University of Chicago Press, 2005), 88.

[70] Ibid.

[71] Morus, *When Physics…*, 113.

evenings showcased the latest discoveries from Michael Faraday and others from the Royal Institution. The "electrical soirees" held by the wealthy amateur electrician John Peter Gassiot "were less formal but almost as prestigious." Least formal of all were the displays of new inventions at the Adelaide Gallery.[72] Morus explained that competition among the various types of performance lectures resulted in the question of whether or not "entrepreneurial activity should be a bar to inclusion in a gentlemanly scientific culture."[73] Morus did not answer the question; however, he suggested that professional scientists did not look favorably upon those who sought wealth through invention. Morus proved that society and science were intertwined during the nineteenth century, and the art of theatrical science played a principle role in this intersection.

Theatricality and showmanship permeated the sciences as Morus, Golinski, and Secord have demonstrated. The debates over anesthesiology provided a trial ground for historians to begin reevaluating the place of theatrical science in the scientific debates. Because the experiments took place in such a wide variety of locations and the debates impacted society on so many levels, future scholarship should note the theatrics involved in the debates and exhibitions as a factor in the outcome of the debates.

The historiography of physical science in the nineteenth century began with the assumption that the scientific discovery and the impact on the future of science were the only important factors to be considered. However, in the last twenty years, the role theatricality played in the process of disseminating information to the public has been

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[72] Ibid, 114.

[73] Morus, *Frankenstein's Children,* 164.

explored more significantly. The rise of great physicists like Davy and Faraday were a direct result of the showmanship associated with performance lectures and theatrical science. The elite scientists of the Royal society considered themselves to be above the influence of society, yet it is the collision of the nineteenth century consumer oriented society with scientific development that created theatrical science which sparked a growing interest in science at the turn of the century.

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Multiple Conflicts in the Word of Galileo Galilei: The Historiography of the Galileo Affair

Historians traditionally have cast the Galileo affair in terms of guilt or innocence, asking whether or not Galileo was wrongly convicted.[1] Because the heliocentric view, which Galileo taught and for which he was tried, has since been proven correct, many historians have labeled Galileo as a martyr for scientific truth against religious oppression. According to Maurice A. Finocchiaro, "the most common interpretation of the event continues to be cast in terms of what it shows about the relationship between science and religion."[2] Historians with a bias in favor of Galileo or one favoring the Roman Catholic Church in this debate assumed a conflict between science and religion. Historians molded the relationship between science and religion, or between Galileo and the Roman Catholic Church, into a model consisting of battling combatants.[3] Finocchiaro's compilation of primary source documents has been called "a very useful collection…[that] should provide an interesting and well rounded introduction to Galileo studies in both secondary and post-secondary institutions in the English-speaking world."[4] Finocchiaro's purpose was to fill the void within the collection of primary source material in order for students of the Galileo affair, especially English speaking students, to study this "controversial and important topic."[5] Perhaps Finocchiaro's purpose was also to encourage scholars to expand the already lengthy historiography of the Galileo affair, which Finocchiaro considered to be an "oversimplification."[6] However, the conflict between Galileo and the Church has been modeled as a complex relationship. The political struggle within the Church, the debate between Galileo and other scientists or philosophers, the Catholic Church's position as a social and authoritative institution, were all contexts in which the conflicting narrative of the Galileo affair has been studied since 1980. Although conflict played a dominant role in the Galileo affair for most historians, the conflict took on

[1] Stillman Drake, *Galileo*, (Oxford: Oxford University Press, 1980), 1.
[2] Maurice A. Finocchiaro, ed. and trans., *The Galileo Affair: A Documentary History*, (Berkley: University of California Press, 1989).
[3] Drake, 2.
[4] George Ouwendijk, Review of *The Galileo Affair: A Documentary History* by Maurice A. Finocchiaro, *The History Teacher*, Vol. 25, No. 2 (February, 1992), 254.
[5] Finocchiaro, Galileo Affair, ix-x.
[6] Maurice A. Finocchiaro, "Science, Religion, and the Historiography of the Galileo Affair: On the Danger of Oversimplification," *Osiris* 2nd Series Vol. 16, Science in Theistic Contexts: Cognative Dimentions. 2001. 114-132. In 2001, twelve years after his documentary history was published, Finocchiaro published this article critiquing what he called the "oversimplification" within the historiography of the Galileo affair.

differing forms. Finocchiaro lumped historians, like Stillman Drake and Rivka Feldhay, into the category of those supporting a "conflict thesis."[7] However, while Drake and Feldhay wrote with an eye toward conflict, the conflict took on dramatically different roles.[8] Within the historiography of the Galileo affair, varying degrees of multiple conflicts have been illustrated.

Three points of contention have drawn attention by those writing on the Galileo affair. The role the Church played in the affair, the role the Jesuits in particular played in the case, and the amount of zeal Galileo felt for Copernicanism must be addressed for an insightful study of the events. Personal conflicts, such as the one between Galileo and Cardinal Bellarmine, were at the heart of the case for historians like Stillman Drake,[9] while others, Rivka Feldhay for example, saw only a large organizational structure, the Church, at odds with itself.[10] Some suggested that the changing roles of institutions, such as the Roman Catholic Church during the Reformation and Counter Reformation, were the main cause of the Galileo affair. The thesis of a historian studying the Galileo affair was dependent on his/her treatment of these points of contention. The purpose of this essay is to show how the broad categorization of historians' theses into a one group called the "conflict thesis" was, in itself, an oversimplification, because the historians' works that will be examined here were not meant to be definitive histories of the Galileo affair, but rather, they were meant to expand the historiography. By building on the numerous historical works over the years, historians, whom Finocchiaro would group into the conflict model, have expanded our understanding of the worldview and society of Europe at the dawn of the Scientific Revolution.

The Roman Catholic Church played several roles in the scholarship of the Galileo affair. Traditionally, the Church has been portrayed as an institution bent on censuring Galileo.[11] This is the position offered by Giorgio de Santillana (1955) and Jerome Langford (1966). Langford argued that the conflict was not inevitable; Galileo was allowed to teach Copernicanism as a theory but not as proven truth. Santillana's and Langford's respective arguments, which will be considered the "traditional"

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[7] Finocchiaro, "Science, Religion…," 115-116.
[8] For Example See, Stillman Drake, *Galileo*, (Oxford: Oxford University Press, 1980); Rivka Feldhay, *Galileo and the Church: Political Inquisition or Critical Dialogue,* (Cambridge: Cambridge University Press, 1995).
[9] Drake, 61.
[10] See Rivka Feldhay, *Galileo and the Church: Political Inquisition or Critical Dialogue,* (Cambridge: Cambridge University Press, 1995).
[11] Langford, *xii*.

stance, have been challenged.[12] A new thesis[13] that began to circulate in the late 1970's argued that the conflict was between "personal foes of Galileo, and an ambitious priest," and not with "responsible Church officials."[14] Therefore, based on the hypothesis that individuals within the Church were primarily responsible, the Galileo affair may not be studied as a condemnation of the Church alone. The conflict lied within the differing Church "traditions."[15] The Church was cautious about accepting ideas held only by specialists, which "could not be related to reality without further ado."[16] The Church, as a social and political institution, was similar to previous traditional governing bodies or modern scientific institutions. A modern day Galileo would find that his ideas "must fit the ideology of the Institute that is supposed to absorb it and must agree with the ways in which research is done there."[17] The conflict from this perspective pits individuals against Galileo and places the Church in a mediating position. According to Drake, the conflict was not between science and religion but between science and philosophy.[18] This conflict did not exist before Galileo; Galileo created the rift. After all, as Lindberg and Numbers put it, "it was not a matter of Christianity waging war on science. All the participants called themselves Christians and acknowledged Biblical authority."[19] However, this is not to say that the Catholic Church was portrayed in Drake's argument as having played a completely positive role in the Galileo affair. According to Drake, the Church has paid greatly for following Galileo's opposition.[20] However, the argument was a divergence from the traditional view of the Catholic Church as an institution battling to keep scientific truth hidden. Feyerabend summarized his breakdown of the traditional view of the Catholic Church: "the position of the Catholic Church was stronger and more humane than is generally assumed," because the traditional view of the Church as an oppressor was too one-dimensional. The Church sought scientific ideas and theories; the Church did not shun science.[21]

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[12] For another example of an argument against the traditional approach see David C. Lindberg and Ronald L. Numbers, "Between War and Peace: A Reappraisal of the Encounter between Christianity and Science," *Church History* Vol. 55 No. 3 September 1986. Reprinted with permission, and minor editorial correction and revision by the American Scientific Affiliation online at < http://www.asa3.org/ asa/PSCF/1987/ PSCF9-87Lindberg.html>. Though their arguments are not completely in line with those such as Drake or Fayerabend, but they do argue against the traditional approach.
[13] For Example see Stillman Drake, *Galileo*; or Paul Fayerabend, *Farewell to Reason*,
[14] Drake, 61.
[15] Paul Fayerabend, *Farewell to Reason,* (New York: Verso Publishing, 1987). 248.
[16] Ibid, 249.
[17] Ibid, 254.
[18] Drake 66.
[19] Lindberg and Numbers.
[20] Drake, 66.
[21] Fayerabend, 16.

Somewhat of a synthesis between the Church's involvement in the affair as a political institution and the individuals that were in opposition to Galileo was introduced in Pietro Redondi's book *Galileo Eretico* (*Galileo Heretic*). Redondi did not agree with Drake, Fayerabend, or others, in that individuals were responsible for the affair without the guiding force of the Church as an institution. Redondi asserted that the episode was not a personal matter between any individual, or group of individuals and Galileo. The Catholic Church's place in the seventeenth century political sphere and its place as an authoritative figure in society, were at the heart of the conflict.[22] Galileo's sentence was evidence that the trial and other events that have commonly become referred to as the Galileo affair was not a personal fight between Cardinal Bellarmine and Galileo, or between Galileo and Pope Urban VIII, but it was part of a larger struggle within a period of "controversial and polemical theological speculation."[23] It should be noted that historians did not accept Redondi's work favorably,[24] but it did provide a starting synthesis between the traditional view and the hypothesis proposed by Drake and others.

Annibale Fantoli, in *Galileo: For Copernicanism and for the Church* agreed with others that the Church abused its power in both the 1616 Decree of the Index and Galileo's sentencing in 1633.[25] Fantoli found that the Church's position regarding Galileo the individual, not his science, was similar to the way Redondi saw the situation. However, Fantoli elaborated upon Redondi's argument. Galileo was well known throughout Europe. His support by the Church was known. Galileo had established himself as a mathematician and also proved that he was a genuinely devout Catholic. The Pope and Cardinal Bellarmine consulted and gave Galileo a private warning not to teach Copernicanism in 1616. The 1616 decree was meant, according to Fantoli, to silence Galileo "once and for all but without wounding his reputation."[26] Thus, the Church and Galileo were not entirely at odds with each other, but in fact, Church officials at the highest levels sought to protect Galileo if he would stop teaching the heliocentric view.

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[22] Pietro Redondi, Trans. by Raymond Rosenthal. *Galileo Heritic.* (Princeton: Princeton University Press, 1987).
[23] Redondi, 324.
[24] William R. Shea, Review of *Galileo Heretic,* by Pietro Redondi, *Isis* Vol. 79, No. 2. (June, 1988) 349.
[25] Annibale Fantoli, trans. by George V. Coyne, *Galileo: For Copernicanism and for the Church* 3rd edition, (Vatican, Vatican Observatory Publications, 2003), 372.
[26] Fantoli, 178.

More recently, Rivka Feldhay reasserted that the Church as an organization was the single cause of the Galileo affair, though not in the traditional sense asserted by Draper and White. A struggle for supremacy among intellectual elites within the Church caused contention. Neither Galileo nor his scientific view was responsible for the outcome. Galileo's arguments were merely scientific ideas debated among other disputed theological issues. According to this hypothesis, the Church was an institution split not only by the Protestants during the Reformation, but also by an internal political struggle for elite status between the Dominicans and the Jesuits.[27]

Exactly what role the Catholic Church played in the Galileo affair is a point of contention. To Drake and Fayerabend the Church as a whole was not responsible for the ordeal, but rather, it was individual zealots within the church that received that condemnation. The politics at play during the seventeenth century, according to Redondi, created a world of secrets and suspicion. The Church's division amongst the Dominicans and the Society of Jesus caused internal division, and thus, the episode was a power struggle in which Galileo was an unwitting participant. In many traditional accounts the Jesuits were portrayed as the enemy to Galileo.[28] Exactly what role they played is a point of contention.

Feldhay readily admits that her work on the history of the Dominican intellectual and institutional organizations was "very preliminary" in nature. She noted, however, that in order to understand the intellectual world of the sixteenth and seventeenth centuries, one must study the "intellectual and institutional framework in which the Dominicans operated" to which she adds, "no monograph has been written about Dominican education."[29] Her work came largely from original documents, including the *Constitutiones* printed in 1566, 1607, and 1650.[30] Feldhay suggested:

> The Dominican cultural orientation remained anchored in the medieval outlook and its emphasis on the *vita contemplativa.* Institutionally, they favored isolation from the secular world and its influences. Religious fanaticism mounted as they ordered aggressive tactics against anyone suspected of heresy. Intellectually, studies remained oriented towards the contemplative life. Freedom of opinion was curtailed as they impose strict adherence to Thomisic theology and under severe penalty prohibited any deviation from Thomistic philosophy.

[27] Rivka Feldhay, *Galileo and the Church: Political Inquisition or Critical Dialogue,* (Cambridge: Cambridge University Press, 1995). 93.
[28] Feldhay 245.
[29] Ibid, 94
[30] Ibid.

> The Dominicans transformed Thomism from a religious-intellectual system into a binding doctrine, and in so doing conferred on it a status which it had never enjoyed in Catholicism before the Counter Reformation.[31]

According to Feldhay, the Dominicans became a group unfriendly to new learning. This shift in the educational practices of the Dominicans allowed for "an alternative elite" of intellectuals to gain power and status and eventually challenged the Dominicans.[32] The relationship of the Jesuits and Dominicans, according to Feldhay, was an extremely complicated one that must be incorporated into a study of the Galileo case. The Church at the time of Galileo, to Feldhay, was an institution in turmoil from inside and outside of the Church. Galileo therefore, was a prominent person caught in this turmoil.

As previously mentioned, the role of the Jesuits was normally seen as a force in opposition to Galileo.[33] Redondi echoed this traditional interpretation and asserted that the Jesuit idea of science was in combat with Galileo's science into numerous passages. However, a new trend led by William Wallace put the role of the Jesuits as one that was more in tune with the modern science employed by Galileo.[34] To Feldhay, it was a political decision late in the Galileo case that turned the Jesuits away from Galileo and forced them to side with their opponents, the Dominicans.[35]

The Jesuits differed from their Dominican opponents in their view of society and the place of intellect and education. "The Jesuit orientation was directed towards the world, whereas the Dominican orientation aimed at preparing the soul for a separation from the world."[36] This, according to Feldhay, explains why the Jesuits were concerned with non-theological studies that were traditionally considered "lacking in value."[37] The Jesuits viewed the study of these subjects in connection with the "ultimate aim of society" which was "the quest for salvation."[38] The Jesuits, however, were not seeking scientific proof of God or the miraculous. Ultimately, they operated in two spheres. The Jesuits created an intellectual bridge by somewhat combining the two spheres of religious contemplation and secular intellect.[39] This also had an effect on the Jesuit's worldview and their place within secular society. Feldhay stated, "at the dawn of the modern era the Jesuits became a group aspiring to an intermediate

[31] Ibid, 109.
[32] Ibid, 109-110
[33] Ibid, 245.
[34] Ibid.
[35] Ibid.
[36] Ibid, 123.
[37] Ibid.
[38] Ibid.
[39] Ibid, 126-127

status between the world and the church which would allow them to play the role of the guardians of the frontiers."[40]

To other historians, Annibale Fantoli for example, the Jesuits played a slightly different role. According to Fantoli, "These Jesuits were neither 'pure scientists' nor for sure intellectual heroes."[41] The role played by the Jesuits, Cardinal Bellarmine in particular, has been greatly overstated, according to Fantoli. Fantoli specifically critiqued a statement by de Santillana that placed the sole responsibility of the decision in 1616 upon Bellarmine. To Fantoli, the Jesuits did not have the power that has been attributed to them and such arguments have been exaggerations.[42] Stillman Drake supported this view, though not as pronounced. To Drake, the argument was between certain individuals and instead of being a large power play by the Jesuits.[43] However, Galileo's role in his own debacle should not be overlooked.

The zeal Galileo had for Copernicanism was, and continues to be, an interesting debate in the historiography of the Galileo affair. Galileo's faith in Christianity and his faith in Copernicanism were contrasted within the scholarship. In traditional accounts, Galileo was regarded as a zealot for science. For Fayerabend, Galileo represented a "pushy and totalitarian" tradition in opposition to the Church. [44] Both the traditional view of Galileo and Fayerabend's slight revision were contrasted in other arguments. Galileo's faith was an important aspect that motivated his life. The level of zeal for either side of the debate was an important aspect to understand the internal struggle for Galileo. According to Drake, "Galileo's role in that battle is widely supposed to have been that of hurling a defiant challenge to religious faith in the name of science."[45] With that assumption, Galileo's statements about Catholicism were considered not to be genuine.[46] However, Drake rejected the idea that Galileo was a lifelong supporter of the Copernican system.[47] In fact, Drake and others believed Galileo's zeal was "not for the Copernican astronomy, but for the future of the Catholic Church."[48] The traditional view of Galileo was based upon the studying of the published documents after "the wide breach between

[40] Ibid.
[41] Fantoli. 193.
[42] Ibid.
[43] Drake, 69.
[44] Fayerabend, 249.
[45] Drake, 1
[46] Ibid, 6.
[47] Ibid, 3
[48] Ibid, 6.

religion and science had come to be accepted as a matter of fact."[49] The division of science and religion was not a part of the world of Galileo or the Galileo affair, but it was a product of nineteenth century history, when debates over creation influenced the history of science.[50] Galileo was not a zealot for Copernicanism with a "faith that seems to verge on scientific dogmatism."[51] Some have taken this thesis so far as to assert that Galileo was more of a zealot for his faith than for science.[52] Therefore, the conflict lied more in the mind of Galileo than in the external world. The traditional view of the conflict between science and religion would support the idea that Galileo struggled with a choice between his science and his faith. However, Galileo saw Copernicanism as a logical explanation of observations, and the Church as an institution that should have embraced an idea that explained God's creation rationally.

Fantoli's work was centered on this view of Galileo, and thus, the affair, from Fantoli's perspective, was a more complex series of conflicts than previous historians have assumed. In Fantoli's words, "Galileo was… neither a free-thinker who rose up against the 'obscuranism' of the church, nor a man weakened by the trial and condemnation to the point that he preferred to remain on the side of the Church even at the expense of abandoning his new view of the universe."[53] Fantoli analyzed Galileo's oft-cited "Letter to Christina of Lorraine" point by point. Galileo argued that the "Scripture can never lie or err."[54] Galileo stated, "the Holy Spirit was to teach us how one goes to heaven and not how Heaven goes."[55] However, science and religion were not separate to Galileo. Galileo did not condemn the Church's involvement in scientific inquiry; he believed that if Biblical statements are true and science is true, then both will coincide with each other.[56] Fantoli portrayed Galileo not as an opponent of the Church but as an educator of the Church. Galileo sought to reconcile the differences between scientific and theological understanding by portraying both as equally true. Galileo sufficiently proved, to even his opposition, that he was sincere about his faith, "despite his

[49] Ibid.
[50] See the Drapper and White thesis in John William Draper, *History of the Conflict Between Religion and Science.* (New York: D. Appleton and Company, 1875); White, Andrew Dickson. *The Warfare of Science,* (New York,1876).
[51] Redondi, 323.
[52] Fantoli, xvi.
[53] Annibale Fantoli, xvi; Drake, 5.
[54] Galileo Galilei, "Letter to the grand Duchess Christina." Trans by Finocchario, 1989, 92.
[55] Ibid, 96.
[56] Fantoli, 149.

astronomical ideas."[57] The condemnation of Galileo was, from this hypothesis, an abuse of power by the Catholic Church.[58] Galileo, however, should not be viewed in the traditional sense as a martyr for science, but as one who sought to help the Church. Galileo ultimately succeeded, according to Fantoli, though recognition of this success (by the Church) came 350 years after his death.[59]

Galileo's view of the Church's proper role is an interesting part of the debate because this focus allows one to get a glimpse into the mind of Galileo. Fantoli viewed Galileo as one who wished to educate the Church, not in theological matters, but Galileo wished to address the role that the Church should play as modern science began to rise.[60]

Fantoli's arguments were elaborations on previous arguments by historians like Stillman Drake and others.[61] The traditional approach, according to Drake and those like Fantoli who followed this thesis of Galileo, was not representative of the personality of Galileo.[62] Galileo did not divide science and the Catholic Church. Galileo, instead of creating a schism between science and religion, created a rift between modern science and philosophy. It was the philosophers, according to Drake, that sought to discredit Galileo by interjecting Biblical arguments, which Galileo "sincerely regarded as an impious action on their part."[63] The scientific community, which was made up of philosophers, again, as there was no division at this point, created the division between religion and science, a division that Galileo did not see.[64] Galileo, according to this thesis, believed that theologians would "declare that the true sense of the Bible supported which ever astronomical hypothesis was verified by Nature."[65] The question of whether or not a particular Biblical passage declared an astronomical truth was handed to the philosophers instead of the scientists. The division that Galileo created was between the science of Galileo and the science of philosophers, exemplified by the decision to determine not whether a scientific statement was correct or incorrect, but to determine if the hypothesis could be entertained based on Biblical interpretations. The philosophers argued that a statement was not science if it contradicted the Biblical interpretation. Galileo, basing arguments on St. Augustine and Thomas

[57] Ibid, 178.
[58] Ibid, 352.
[59] Ibid, 372.
[60] Ibid, 352.
[61] See Lindberg and Numbers.
[62] Drake, 3.
[63] Ibid, 7.
[64] Ibid, 6-7
[65] Ibid, 66; see also Fantoli, 149.

Aquinas, argued that all scientific statements should be entertained with the understanding that the interpretation of Biblical passages was made by imperfect human beings, but also asserted that matters of faith, like salvation for example, are not scientifically debatable questions.[66]

Drake represented Galileo's view of the Church as one who wished the Church to disengage its devoutness in accepting "one astronomy against another."[67] Galileo did not blame the Church for his condemnation but instead "blamed only some wrong-headed individuals in the Church."[68] Drake asserted, "Galileo's own conscience was clear both as a Catholic and as a scientist." He continued to state that Galileo, though at times may have wanted to stray from his science, "he never so much as thought of turning his back on his faith."[69] Galileo sought to "prevent a mistake by the Church that would eventually tend to discredit its wisdom."[70]

Drake's thesis has been incorporated in other notable works. Fantoli, Feldhay and others have supported their respective theses based on Drake's breakdown of the traditional view. The wedge that split modern science and religion was not Galileo. In some theories it was the philosophers that are responsible for the division.[71] For others, it was the internal power struggle within the Church.[72] Still for other historians, the schism was a result of the struggle for the Church to retain power and status within society.[73]

Maurice A. Finocchiaro labeled the historiography of the Galileo affair as an "oversimplification."[74] He classified the scholarship into the "conflict thesis" and the "harmony thesis."[75] He also argued that two traditional approaches, which are polar opposites from each other, should be avoided.[76] The first approach he called the "anti-catholic" view. The anti-catholic view reported Galileo to be a hero of modern science, and the Catholic Church was a repressive institution.

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[66] Drake, 66.
[67] Ibid, 62.
[68] Ibid, 92.
[69] Ibid.
[70] Ibid, 56.
[71] See Drake; and Fantoli; and David C. Lindberg and Ronald L. Numbers, In very subtle points the idea that the split was between science and philosophy is made but within this article they spend more time breaking down the traditional view than upholding Drake's thesis.
[72] See Feldhay,
[73] See Redondi; and Aurthur Koestler, *The Sleepwalkers*. (New York: Macmillian, 1959.); and Giorgio de Santillana, , *The Crime of Galileo*. (Chicago: University of Chicago Press, 1955).
[74] Finocchiaro, "Science, religion," 114.
[75] Ibid; For original traditional accounts of the "Conflict Thesis" see, John William Draper, *History of the Conflict Between Religion and Science,* (New York: D. Appleton and Company, 1875.); and Andrew Dickson White, *The Warfare of Science,* (New York, 1876).
[76] Finocchiaro, *The Galileo Affair*, 5.

The second extreme may be called the "anti-Galilean" view. Within this viewpoint, Galileo's theories were hasty and unproven and the Catholic Church merely sought to exploit Galileo's methodological faults.[77] Finocchiaro argued against the "myth" used to establish the idea that science and religion are incompatible.[78] He also argued that scholarship focusing on other scientific debates beyond the motion or stationary position of the earth was looking at issues that were not the primary cause of the Galileo affair.[79] Finocchiaro classified Drake and Fayerabend as historians who study the Galileo affair as a "microcosm of the Scientific Revolution…stud[ied] primarily for what it tells us about the scientific knowledge…and how it develops."[80] His assessment of Drake and Fayerabend was well put, but it does not reflect their entire argument or their contribution. The scholarship was not as simplified as Finocchiaro viewed it.

Authors in the last thirty years such as Drake, Feyerabend, Redondi, Feldhay, and Fantoli would all fall in line with the "conflict thesis" (but on opposing sides in the "anti-clerical" or "anti-Galilean" debate). However, the conflict that they write about was not so simple. Drake proposed that the conflict was between Galileo's more modern version of science and the science of the philosophers of his day. Feyerabend saw conflict within the scientific revolution as a whole, a conflict amongst traditions. The conflict for Redondi was a political power struggle in which Galileo, like a pawn being used by the Catholic Church, gets caught. For Feldhay, a struggle for elite status within the Roman Catholic Church between the Dominicans and the Jesuits was ultimately responsible for the episode involving Galileo. The conflict within Galileo's mind between the science of Copernicanism and the theology of the Roman Catholic Church was responsible for creating the personality of Galileo, according to Fantoli. The Galileo affair is certainly not "closed,"[81] even if many authors have interjected views that paint more elaborate pictures than the traditional views of Santilliana, Koestler, and Langford. Future scholarship may lead to a synthesis that encompasses the scientific methodology used by Galileo (its strengths and flaws), the political struggle inside and outside of the church, the divergence between the

[77] Ibid, 5-10.
[78] Ibid.
[79] Ibid, 43.
[80] Ibid, 4.
[81] Fantoli, 373.

traditional philosophy and the science of Galileo's day, and reassessments of Galileo's attitude of the relationship between his science and his faith.

Drake and Fantoli together painted the best picture of the Galileo Affair. The future of the historical debate for the Galileo Affair lies within a speculative study of the mind of Galileo, which is difficult of not impossible to do. However, one must try and reconstruct the view Galileo had of himself, his work, his faith, and his Church. The intellectual world of Galileo may not be enough to gain an understanding of the events. One must also contrast Galileo's views against the views held by certain individuals who were opposed to Galileo. The "conflict thesis" which Finocchiaro described as an "oversimplification" may not be so easily cast aside. Future scholarship may lead to a study of the conflict, or lack thereof, within the mind of Galileo and his opposition. Was science and religion on opposing sides of the intellectual world according to Galileo? Fantoli and Drake suggested the answer for Galileo was no. Studying the letters where Galileo justified his theories with theological arguments, as well as his opponents' theological arguments against him, may lead to a greater synthesis in the study of the Galileo affair. These questions, however, were not meant to suggest that external factors, like those presented by Redondi and Feldhay, are of no consequence. The intellectual arguments presented by Galileo were no doubt a result of the world in which he lived. Galileo is often viewed as a martyr for science silenced by the Church; he may be shown in the future to be much more. The conflicts within the Galileo affair were many and varied; it was not just a division between Galileo and the Church, nor between science and religion. Galileo was a man of science and of faith, a model for both.[82]

[82]Annivale Fantoli's *Galileo: For Copernicanism and for the Church* is probably the closest representation of this thesis. Fantoli includes Pope John Paul II's speech concerning the Galileo affair. Pope John Paul II's thesis is referred to by Finocchiaro as an example of the "harmony thesis." Finocchiaro called Fantoli's book "the most up-to date account of the episode" in a review of Fantoli's book in *Isis,* Vol. 86, No. 3 (1995): 486. Fantoli's arguments, especially regarding his evaluation of Galileo's "Letter to Christina of Lorraine," is an excellent starting point for future studies on the discussed topic.

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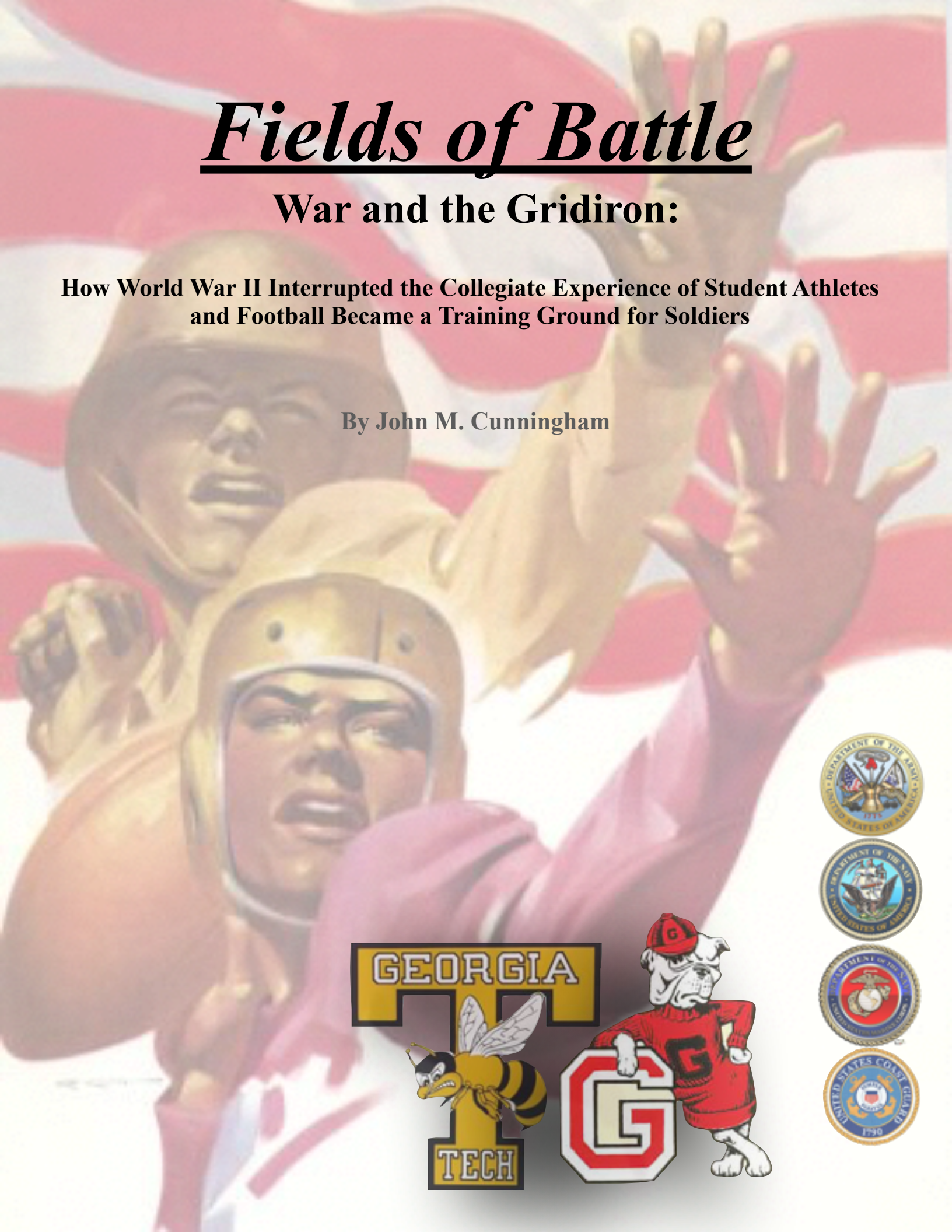
Fields of Battle

War and the Gridiron:

How World War II Interrupted the Collegiate Experience of Student Athletes and Football Became a Training Ground for Soldiers

By John M. Cunningham



Fields of Battle:

How World War II Interrupted the Collegiate Experience of Student Athletes and Football Became a Training Ground for Soldiers

Thanksgiving and football go together in the Southeast. The same can be said of various parts of the county, each with their own style of play, brand of loyalty, and traditional rivalries. Since 1893 the University of Georgia Bulldogs and the Yellow Jackets from the Georgia Institute of Technology engage in a football battle around Thanksgiving. According to Georgia Tech fans, the rivalry stood, in 2008, with 39 wins for the Yellow Jackets, 59 wins for the Bulldogs, and 6 games that ended in a tie.[1] For Georgia fans, the record included two fewer games. Two losses by UGA, during the 1943 and 1944 seasons by a combined score of 92-0, have been dismissed from the rivalry records and minds of the fans of UGA. The dispute developed a few years later when those two losses were marked with asterisks to show that Tech had an unfair advantage due to the Navy V-12 program which gave the school a pool of players to choose from that the Jackets otherwise would not have had. To make matters worse for the University of Georgia Football program, the 1943 and 1944 UGA rosters were composed mostly of freshmen and "4-F's."[2] However, reconstructing the attitude of the players and fans by looking at the way the student body wished to remember the seasons through yearbooks and student newspapers, one will note that these games should not be simply dismissed by UGA fans and forgotten, nor should they stand alongside any other victory in the record books of Georgia Tech. The students at each university during these years of war were focused on much greater issues than an end of season football game. This particular piece of college football history reveals a clearer picture of the war years for the student athlete, whose life plans were interrupted, and the general population whose sons, brothers, and friends were not marching across a gridiron as expected, but rather, they were marching, or preparing to march across Europe. Some government officials, mostly those responsible for the training of naval officers, believed that football and other intercollegiate athletic endeavors would help develop young men into officers that would help America become victorious in World War II. This ideology intrinsically tied the World War II experience of student-athletes and the fans of college football. As boys became men and drafted into service, those who did not meet the physical requirements, the 4-F's, were given an opportunity to play collegiate sports that they may have not received. Therefore, the lessons of leadership, physical wellness, and other life lessons that one may glean from competitive sports became part of their collegiate training as well.

The disputed games of the Georgia/Georgia Tech rivalry are a starting point for an examination of the experience of the college athlete during World War II. The war interrupted the college plans of many athletes. Collegiate, as well as professional athletics were nearly cancelled during the war years.[3] I have chosen several football players from the University of Georgia and Georgia Tech to represent, as case studies, the way in which the war impacted the collegiate careers of athletes, and how the games themselves served as both a distraction from the reality of war and an opportunity to reinvigorate the idealized American spirit.

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[1] *Georgia Tech 2008 Media Guide*, (Georgia Institute of Technology, 2008).

[2] "4-F's" were those individuals who failed the physical requirements for military duty.; *UGA 2008 Media Guide,* (University of Georgia, 2008).

[3] The "Green Light Letter" sent from the office of the White house to Major League Baseball commissioner Kennesaw Judge Landis gave the "green light" or the approval to continue Major League Baseball during the war. University officials expressed similar concerns regarding collegiate sports with the war effort continuing and asked the President for a statement regarding collegiate sports. For the "green light letter see "Letter to Commissioner Kenesaw M. Landis from President Franklin D. Roosevelt, January 15, 1942" n.d. <http://education.baseballhalloffame.org/experience/thematic_units/economics/fdr_letter.html> (accessed 20 April 2009).; For an example of the questions concerning collegiate football during World War II see, Max Kase—Sports Editor, Letter to Mr. Stephen T. Early—Secretary to the President, 15 January 1942, Franklin D. Roosevelt Library Official File 189 Sports.; Max Kase—Sports Editor, Letter to Hon. Franklin D. Roosevelt, 15 January 1942, Franklin D. Roosevelt Library Official File 189 Sports.; Ralph Cannon, Letter to General Stephen D. Early—Secretary to the President, 9 March 1942, Franklin Roosevelt Library Official File 189 Sports.; W.H. Britton—Assistant Football Coach University of Tennessee, Letter to Brigadier General A.G. Surls, 15 May 1942, Franklin D. Roosevelt Library Official File 189 Sports.

While the collegiate experience one year after the bombing of Pearl Harbor still included sport, the 1943-1944 academic year promised to be one of change.[4] On December 4, 1942 the UGA student newspaper pictured twelve Georgia players that would, one month later, lead their team to a Rose Bowl victory, which allowed the team to be selected as the National Champion. However, the same issue of the student produced newspaper, the *Red and Black,* that announced the National Championship title also pronounced the perilous times coming to the University and the athletic teams. The article's opening statement, "We must face facts," set the tone. "If [World War II] continues through next year…practically every physically fit male student now enrolled in the University will be serving in the some branch of the armed forces." However, the article concluded on a positive note. The University would be "loaned" to a Navy pre-flight school that would "take over more University buildings after Christmas [of 1942]," but the future of the school would be "greater after the war."[5]

The American entrance into the global conflict forced American institutions, fans, professional athletes, and college bound student-athletes to adapt to a war time reality. Although, compared to baseball, the historiography on wartime football is sparse, it has not been overlooked altogether. Matthew Algeo's *Last Team Standing: How the Pittsburgh Steelers and Philadelphia Eagles-- The "Steagles"-- Saved Pro Football During World War II,* showed how the NFL adapted to the changes brought about by the war. Tom Perrin's *Football: A College History* focused on the changes that college football went through from it's beginning in the early 1880s, and devoted a chapter to the World War II era. Perrin acknowledged some of the difficulties the college game had to overcome during the war, such as depleted rosters, lack of talent, and general concern focused on the war effort; however, his analysis was more focused on the reinvention of the "T-formation" offense and how the war stifled the creativity and development of the game than on the impact the war had on the athletes and the schools. He did note, however, that some institutions were able to use military trainees, which allowed them to do well in athletics, and how "almost 200 colleges [that did not have military trainees] discontinued football" in 1943.[6] John Sayle Watterson's *College Football: History, Spectacle, Controversy* also dedicated a chapter to the war years. Watterson noted several interesting transformations about the college game. He explained how the lack of men on campus allowed more women to partake in cheerleading.[7] According to Watterson, the lack of players prompted the beginning of the "Ivy League," as school presidents took the opportunity (the lack of quality recruits) to try to reform big time college football by doing away with athletic scholarships and other elements that had crept into the "amateur" game of college football.[8] The war also allowed a joint venture between collegiate athletics and the military. Watterson suggested, "athletes who might have been condemned as professionals before the war now played football on Uncle Sam's 'amateur' teams."[9] It was this joining of military training and collegiate football that created the disputed games between the University of Georgia and Georgia Tech.

When the Navy decided to allow its V-12 trainees to participate in intercollegiate sports, it allowed those V-12 institutions to field highly competitive teams. (This was an important decision for collegiate athletics because the U.S. Army's Specialized Training Program (A.S.T.P.) did not allow the soldiers to compete in intercollegiate athletics.)[10] One hundred thirty-one schools became Navy V-12 institutions. As one of these institutions, Georgia Tech had to undergo changes to its educational structure. V-12 schools were placed on a year-round schedule, with terms beginning on July 1, November 1, and

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[4] For a good example of a change in a University (the University of Virginia) during the war see, Jennings L. Wagoner Jr. and Robert L. Baxter Jr., "Higher Education Goes to War: The University of Virginia's Response to World War II," *The Virginia Magazine of History and Biography* Vol. 100 No. 3 (July 1992), 399-428.

[5] "Academic Program May be Suspended During Duration" in *Red and Black*, 4 December 1942, 4.

[6] Perrin, 213.

[7] John Sayle Watterson, "Saints and Sinners, 1941 to 1950" in *College Football: History, Spectacle, Controversy*, (Baltimore, Maryland: John Hopkins University Press, 2000). 201-217.

[8] Ibid.

[9] Ibid.

[10] Schneider, 262.

March 1,[11] which meant that the football season would be interrupted as the semester ended. The classes prescribed to the future officers left no room for electives,[12] making scheduling practices difficult. However, colleges sought the V-12 status as a way to keep faculty members, and to continue the existence of the college. In addition, "the patriotic satisfaction of doing their part in the war effort was a most important ingredient for all the schools," according to V-12 historian and former V-12 cadet James G. Schneider,[13] Although schools were selected for various reasons, the Georgia Institute of Technology was chosen because of its engineering program.[14] The already existing NROTC unit at Tech was another advantage that the institute had in being selected by the U.S. military.[15]

The University of Georgia also had a strong military presence during the war. The U.S. military used part of UGA's campus for a Navy pre-flight school. The pre-flight school, however, was not considered part of the university. Although it was inconvenient for the students at the University of Georgia to have campus buildings and grounds used exclusively by the military, they also anticipated an improved campus after the war thanks to the pre-flight school. The U.S. military built new facilities and improved many of the existing buildings.[16] However, students often complained about the presence of military trainees. Newspaper articles and University officials often reminded student that the use of the campus by the military aided the war effort. Thus, the outwardly projected sense of pride for helping the war was conflicted throughout the university atmosphere. The preflight students, being moved through the school quickly, were unable to connect to the other students, in part, because they could not participate in the intercollegiate sports program like the Navy V-12 cadets could. The V-12 trainees were, for all purposes, still college students,[17] while the pre-flight cadets were strictly military personnel.

Student life on each campus was a reminder of the need to adapt to the requirements of a nation at war. As the student newspapers and annuals make clear, it was difficult for students at both schools who lost, friends and family to deployment to see men in uniform as it could be a constant reminder of the perils of war and the possibility of loosing a loved one. The university was not a place to escape the reality of the nation at war. Although battles were fought on distant continents, students were confronted with constant reminders of the war effort on their campuses.

However, the yearbooks were most assertive that at each university the student body, in general, supported the efforts of those serving the country in war. The cover of the 1943 GT *Blueprint* was decorated simply with the military insignia of the U.S. Army, Navy, and Marine Corps.[18] The 1942 *Pandora* from UGA was colored red, white, and blue, and dedicated, not to a particular faculty member or student, but to "the recent graduates of the University of Georgia, and especially to the men of the class of 1942 who have already entered, or will enter, the armed forces of the United States in this hour of the gravest national emergency."[19] The 1944 *Pandora* began each section of the noticeably thinner annual with pictures of the campus in Athens, but superimposed over each section was a military themed drawing.[20] The universities each tried to portray the idea that a college education, whether specifically

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[11] James G. Schneider, *The Navy V-12 Program; Leadership for a Lifetime*. (Boston: Houghton Mifflin Company, 1987), 57.

[12] Ibid. 57-58.

[13] Ibid. 10.

[14] Ibid. 15.

[15] Ibid. 11.

[16] *Pandora 1943*, (Athens: University of Georgia, 1943), introduction, n.p.; *Red and Black*, 4 December 1942, 4.

[17] Perrin, 214.; Whether or not UGA used preflight students as players is not clear at this time. Tom Perrin in *Football: A Collegiate History* suggested that the University of Georgia used preflight cadets on the football team. However, much of the research done for this project, including a consultation with Skip Hulett, Head of the Georgiana Collection at the Hargrett Rare Books and Manuscript Library at the University of Georgia, asserted that UGA did not use preflight cadets because of the speed at which cadets came through the school. They were often not considered part of the university.

[18] *Blueprint 1943,* (Atlanta: Georgia Institute of Technology, 1943), n.p.

[19] *Pandora 1942* (Athens: University of Georgia, 1942), Dedication, n.p.

[20] *Pandora 1944* (Athens, University of Georgia, 1944), n.p.

military training or civilian, was, in part, to help the war effort. The college experience, from the classes to the military drills to the athletic competitions, was equated with preparation for one's role in the war first, and private life thereafter.

Football, like baseball, may be *read* with a "special, intensified, narrativity" compared to other sports, specifically other versions of football, played around the world.[21] This concept is necessary to understand how the disputed games during World War II were more than just isolated events. They are, for the historian, a narrative of the wartime experience itself. In a football game, each individual play is a culmination of strategy, practice, and execution; the play itself is a narrative containing a clear beginning, middle, and end; an element absent from the more fluid games of rugby and soccer. The distinct break between the offensive and defensive sides of the football, a result of the rule for possession, is another element contributing to the uniqueness of the American football narrative.[22] It is also an aspect that makes the narrative of football a closer correlation with war. The football narrative may be read from the "primary text," which are the games themselves, as well as the "secondary texts," which are the writings of sports journalists (who were often newspaper reporters, or university officials, but may also have been fans, yearbook editors, or players writing their thoughts). The game itself may be read as an allegory, while the secondary texts are interpretations of that allegory. It is the "negotiations" between the two texts that create the "meaning" of the game.[23] Thus, the World War II college football games are a story to be read.

In the story of the 1943 and 1944 rivalry games between the two Georgia institutions, the struggle was not just between two rival schools; it was a representation of the change in American society brought about by the war. The U.S. military required college boys to become soldiers. The government required campuses to be turned into training grounds. College plans were put on hold. Civilians and soldiers struggled to define their place in the wartime society, and it is the story of the interrupting effect of war that stands out when reading the narrative of the 1943 and 1944 rivalry games between Georgia and Georgia Tech.

Collegiate athletic teams during the war years were classified into two categories by the media. The terms "civilian team" or just "civilians" referred to those schools that did not benefit from the military V-12 program.[24] Although UGA had a pre-flight school, this five-month program did not coincide with traditional higher education. Thus, the military personnel in the Navy pre-flight school endured rigorous physical training and utilized specialized instruction on the campuses, but were not part of the university.[25] The civilians of the University of Georgia were one of the few South Eastern Conference (SEC) schools that remained in athletic competition in 1943.[26] Students entering the Universities of Tennessee, Alabama, or Clemson, expecting the fall gridiron to be a part of the their college experience found athletic programs suspended due to the lack of available male athletes on campus.[27] UGA, however, attempted to compete and fielded a team comprised of "4-F's" and freshmen. The GT Yellow Jackets, on the other hand, were equipped with military personnel from the Navy and the Marines. The civilian teams were often unable to remain competitive against the military supported teams, as would be demonstrated during those war year match-ups. In the two Georgia/Georgia Tech games, the scores were

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[21] Michael Oriard, *Reading Football: How the Popular Press Created an American Spectacle*, (Chapel Hill: The University of North Carolina Press, 1993), 23.

[22] Ibid.

[23] Ibid, 18.

[24] Bill Cromartie, *Clean, Old-fashioned Hate*, (U.S.A.: Gridiron Publishers, 2002), 224.

[25] Henry C. Herge, *The Wartime College Training Programs of the Armed Services*, (Washington: American Council on Education, 1948), 46.; Schneider, 262.

[26] Tony Barnhart, *Southern Fried Football: The History, Passion and Glory of the Greatest Southern Game*, (Chicago: Triumph Books, 2000), 21.

[27] Scott, Richard. *SEC Football: 75 Years of Pride and Passion*. (USA: MVP Books, 2008), 58.

48-0 and 44-0, both victories for the "soldiers and sailors" from Georgia Tech against the "students" from Georgia.[28]

Georgia Bulldog football fans were proud of their 1942 national champions, but they continued to display pride for both the men serving in the armed forces and the boys who replaced them on the field in 1943. Coach William Alexander of Georgia Tech commended the Bulldog team for "having the stuff to carry on despite the lack of material and with no help from the Navy or Army."[29] The Bulldogs faced a stronger opponent in Georgia Tech, knowing full well the likelihood of defeat, or possibly injury. Coach Wally Butts, Georgia's head coach, allowed his team the opportunity to gracefully bow out of the contest against the military personnel from Tech. However, the Georgia team voted unanimously in favor of a game.[30] After losing "a galaxy of stars the like of who Sanford Stadium had never seen,"[31] the University of Georgia played the 1943 football season with a team that had no returning lettermen for the first time in UGA history.[32] They faced opponents of superior strength with pride and dignity, an act, perhaps also in itself, both driven by and, indeed, a narrative of the wartime desire to find the courage face a foe.

The narrative of these games must be studied within a larger context, not just the individual games. Again, war and football stood side by side in the secondary texts of the sport of college football. Throughout the country, the football programs sold at each game often featured covers that directly equated football to a military training ground. One program cover displayed a quarterback preparing to throw a forward pass with a large shadow behind him, his football uniform replaced with a military one, his leather football helmet replaced with U.S. Military issue. He stood in the same pose, but the pigskin was replaced with a grenade. Another one simply showed a drawing of a football player in uniform (his football uniform) giving a military salute. The 1943 Georgia Tech programs pictured the players, not in football uniforms, but, with the exception of three civilians wearing suits, each of the other thirty-one players in military attire.[33] Playing football at a V-12 or other military college was not a way to stay out of combat; it was no less than an officer training ground for the future leadership of the United States military during wartime.

The Bulldogs and Yellow Jackets had several players and former players that represented the spectrum of World War II college athletes. Frank Sinkwich, a two-year all-American, and Hiesman award winner, graduated from UGA in 1942 after the championship season. The *Red and Black* expressed pride in Sinkwich's achievements on the field and for his future in the military. The *Red and Black* pictured Sinkwich under the headline "Bulldog to Devildog," and noted, "he will be playing a major role in the game on Saturday, but in January he will be playing a small role in a much greater game."[34] Charley Trippi, a sophomore star on the 1942 UGA team was drafted into military duty. The future NFL player did not wear a Georgia uniform again until 1945.[35] Johnny Cook, the freshman quarterback for the 1943 team, was pictured one year later in the athletic section of the *Pandora,* not wearing the red and black of UGA, but wearing his military uniform. Each of these three men represent a different aspect of the college athletic experience. Frank Sinkwich was a seasoned star that left for war after battling on the football field. Charley Trippi's UGA football career was interrupted as he shone brightly in 1942 and then returned to shine again for the bulldogs in 1945. And Johnny Cook, the young quarterback who took advantage of the wartime reprieve from the ban on Freshmen players on a varsity squad and led a team of "civilians," reported for duty after only one year on the football field.

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[28] Cromartie, 228, 233.

[29] Cromartie, 224.

[30] Jesse Outlar, *Between the Hedges: A story of Georgia Football*, Huntsville, Alabama: The Strode Publishers, 1973), 78.

[31] *Pandora* 1944, 138.

[32] Thomas Reed, *History of the University of Georgia*, (Athens, University of Georgia Press, 1949), 3639.

[33] Georgia Tech Football Programs 1943, bound, GT Archives; UGA Football Programs UGA Archives.

[34] "Bulldog to Devildog," R*ed ad Black,* November 27, 1942, 7.

[35] *UGA 2007 Media Guide*.

Georgia Tech's wartime football team is not remembered for the players that they lost to the military but for the players that they received as a result of the Navy V-12 program. John Steber, a V-12 transfer from Vanderbilt, led the team in minutes played during the 1943 season. and captained the Yellow Jackets along with Eddie Prokop.[36] The V-12 military-driven team won 15 out of 20 games during the 1943 and 1944 seasons. In 1944, they only lost to V-12 teams from Duke and Notre Dame.[37] In both the 1943 and 1944 seasons, Tech made bowl appearances, winning against the civilians from Tulsa in the Sugar Bowl on 1 January 1944 but upset by them in the Orange bowl in January 1945.[38]

Tech, however, also lost players to military duty during the war. George Manning, a third team captain in 1943, was called to serve his country in active duty and was not able to finish the 1943 season.[39] Perhaps the most famous loss for Georgia Tech was the rising star named Clint Castleberry. Like Johnny Cook of UGA, Castleberry was able to wear a varsity uniform as a freshman due to the wartime rule change, However, Castleberry would only have his freshman year to prove what he could do on the football field. He earned a starting position over future Tech star Eddie Prokop and the previous starting running back, Bobby Shelton, on a team which only lost to the National Champions from Athens. Castleberry finished third in the 1943 Heisman voting behind Georgia senior Frank Sinkwich, and Paul Governali, a senior quarterback from Columbia who turned down professional baseball and football offers in 1943 to enlist as a Marine. With a sense of patriotic duty that seemed to run through those in football uniforms during the war years, Castleberry, left Georgia Tech in February of 1943 just after his freshman season and reported for duty with the Army Air Forces. He would never return to the gridiron. His B26 Marauder airplane was shot down over the Mediterranean, and Castleberry's body was never recovered.[40] His number 19 jersey is the only football uniform retired for the Tech Yellow Jackets.[41] Bobby Dodd, Georgia Tech assistant coach at the time, later said of Castleberry, "he'd have probably been an All-American for three years and the greatest back in Georgia Tech history."[42]

Football players often made excellent soldiers. It has been documented that "the marines who played V-12 football were awarded a total of two Navy Crosses, seven Silver Stars, three Bronze Stars, and various other decorations for heroism and valor in the Battles of Iwo Jima and Okinawa."[43] Players such as John Steber, Clint Castleberry, Johnny Cook, Charley Trippi, and Frank Sinkwich are just a few of athletes-turned-soldiers who wore a Yellow Jacket jersey or the red and black of UGA before donning the colors of the United States Armed Forces.

Bill Cromartie, football historian and author of *Clean Old-fashioned Hate*, eloquently called the chapter of his book concerning the 1943 meeting between UGA and Georgia Tech "Military Might—And Did."[44] The lopsided victories of Georgia Tech over the University of Georgia during the two disputed games may be read, and was read by many at the time, as an allegory of the strength of the U.S. military. The civilians of UGA were "no match for seasoned sailors," reported the editors of the UGA yearbook.[45] The strength of the United States military could often be seen on the football field when a V-12 school played. While every V-12 school did not dominate the competition, and every civilian school did not fall to the service institutions, the military equipped universities provided excellent competition in athletics

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[36] "Steber, Prokop Lead in Time," *Technique,* 10 December 1943, 5.

[37] Al Thomy, *The Ramblin' Wreck: A Story of Georgia Tech Footbal*l, (Huntsville, Alabama: The Strode Publishers, 1973), 146.

[38] Cromartie, 228, 233.

[39] *The Blue Print 1944*, 209.

[40] Thomy, 142-143.

[41] Thomy, 142; Telephone conversation with author by representative from the GT Athletic Association.

[42] Robert Lee 'Bobby' Dodd and Jack Wilkenson, *Dodd's Luck: The Life and Ledgend of Hall of Fame Quarterback and Coach*, (USA: Golden Coast Publishing Company, 1988), 91.

[43] Schneider, 270.

[44] Cromartie, 224.

[45] *Pandora 1943*, "The 1943 Football Season in Brief."

during the war years.[46] As the 1943 game between UGA and GT produced the largest margin of victory in the rivalry's history,[47] the military personnel at GT played the way one would hope a trained soldier, sailor, or marine would perform in a battle of sport. If football was equated as a training ground for war, then the military was expected to win, The "Might" of the U.S. Military was honed on the gridiron and then taken oversees.

The competition on the field may also be read as an allegory about the struggle for military personnel and civilians to find their place during the war, and work together for an American victory. At Georgia Tech, rivalry between the members of the Army and Navy was a concern on campus. University officials also had to deal with tension between the military personnel and the "damned civilians," as the soldiers, sailors, and marines sometimes called them.[48] Sports created a cooperative college atmosphere by giving the students an opportunity to support the common goal of a school victory.[49] While military students outnumbered civilian students at Tech nearly three to one, the social clubs were instructed to keep activities going as best as possible during the transition of Tech from civilian to service school.[50] A Saturday game may have been a unifying and welcomed break, as students—both military and civilian—could take a brief break from war preparation and, together, cheer for their school.

The young men on the Georgia squad represented the courage and tenacity of American civilians during the war. Georgia players could have refrained from football activities as other SEC schools did during the war years. Coach Butts, however, wanted to continue; his players did not let him down, and the fans continued to come to Sanford Stadium. During the time of war both teams' successes, on and off the field were chronicled in student newspapers and in the annual yearbooks. If one is to take the words of the editors of the *Pandora* as representative of the feelings of the student body as a whole then the wartime Bulldogs were meant to be remembered for "victories more important than those reckoned in points and soon forgotten...They lived, indeed, their shining hour."[51] The student body at UGA and Georgia Tech read the narrative of the wartime football games as both a display of trained military might and a show of the courage required of regular (non-military) citizens.

The 1943 and 1944 football seasons was neither a story about a score of 48-0, nor a story of two disputed games. Yet, the score was an important part of the narrative. It was a metaphorical representation of how the U.S. military was well trained and equipped to win battles. The courage and tenacity of American citizens to continue to fight through difficult circumstances was illustrated in the civilian team from Athens. Collegiate careers were interrupted during World War II. Young players with extraordinary talent were unable to pursue the college sports experience the way they had planned before the war began. Charley Trippi played for the University of Georgia during the national championship season of 1942 and then did not return to Sanford Stadium until 1945. Clint Castleberry of Georgia Tech showed great potential on the football field, but his potential was not realized because of his death. The teams as a whole may be looked upon as examples of the wartime American spirit. The civilian team of Georgia portrayed the bravery of those young boys who were called to quickly show the attributes of manhood. Many of them would be called to take that bravery and allow government military training to hone that skill into weapons of liberation. The strength of the Georgia Tech football team, aided by the Navy V-12 program, exemplified the result of that training and strength of the United States Military. The games of the war years should not be forgotten or left out of the win-loss record. The story of men on both sides of the football field represent the idealized wartime spirit of America in the 1940s and, in a small part, the larger story of how life is interrupted by war.

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[46] Schneider, 263.

[47] *The Atlanta Journal*, November 28, 1943, 1.; UGA Media Guide.

[48] *Technique*, July 10, 1943. 1.

[49] Schneider, 270.

[50] *Technique*, July 10, 1943, 1.

[51] *Pandora* 1944, 139.

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