

Lucerna

A University of Missouri-Kansas City Undergraduate
Research Journal Presented by the Honors Program

volume five issue one

including papers from:

Jennifer Garnett

Thomas Nienaber

Elaina Newton

Paige Snyder

Nicholas Ball

Derek Jenkins

Kathyrn Hembree

Brodie Barnard



L U C E R N A

AN UNDERGRADUATE JOURNAL
PRESENTED BY THE
HONORS PROGRAM

The University of Missouri-Kansas City

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A N O T E f r o m t h e E D I T O R

This is now our fifth year of publishing *Lucerna*. I hope you will enjoy reading this as much as we have enjoyed putting it together. I would be remiss if I did not thank the previous editors who laid the foundation for this edition and the many volunteers who helped make this journal possible. I also owe much gratitude to the editorial staff this year for all their help. The help and advice of our faculty advisor Dr. John Herron is greatly appreciated. Also, this edition would not have been possible without the help of the Honors Program Director, Dr. Gayle Levy, and its secretary Sally Mason. Both of them have been untiring in their support. Lastly, we should thank the Arts and Sciences Student Council for the funding to make this publication possible.

I believe the papers contained herein represent the best work from a variety of disciplines. The diverse topics chosen by the authors provide a very enjoyable read. The research presented in these pages, from the undergraduates here at the University of Missouri-Kansas City, provides a very inspiring and informative collection of papers. I am very humbled by the amount of excellent material presented outside my own comfort zone.

I thank all those who submitted their work to *Lucerna* this year. We had many more good papers than we could possibly publish. I wish the best to all those who submitted in their future endeavors.

Enjoy!

Ad Maiorem Dei Gloriam

Sincerely,
Thomas Nienaber
2010 Editor-In-Chief

E D I T O R I A L B O A R D

Editor-in-Chief _____ ✕ _____ Thomas Nienaber

Thomas graduated in May 2010 with a major in biology and a minor in chemistry. He is currently applying to medical school and hopes to be able to study abroad. Having attended high school in Australia, his ambitions for med school are to return to his adopted home “Down Under.” As Kansas City is his real home, UMKC was the logical choice for his undergraduate studies due to its research focus in the Biological Sciences. Thomas was a volunteer for *Lucerna* as a freshman and helped read and proof papers. Since then, he has always been involved in one capacity or another. The Honors Program enabled him to meet other like-minded students, take a more active role in his studies, and to engage in biological research. In his leisure time, Thomas enjoys reading, especially if there is a mystery involved, model trains, teaching, and working with computers.

Graphic Design Editor _____ ✕ _____ Corey Light

Corey is a studio artist and art educator. The Honors Program has given Corey a chance to develop in a cooperative academic environment while meeting dedicated students and staff. He enjoys designing and laying out *Lucerna* because he’s always excited to present the best of UMKC to the public. He spends his days entrenched in graphic design and photography, hoping to continually enhance the visual landscape in the future. Corey is the Editor-in-Chief of *Dossier Magazine*, a collaborative and comprehensive arts publication at UMKC.

Executive Secretary _____ ✕ _____ James Comninellis

James chose to major in history. He has a passion for Medieval History and came to UMKC because it has several professors specializing in the area. He participated in Honors because he was looking for a way to get involved that centered on academics. He joined *Lucerna* because it seemed the experience would aid his academic future. James enjoys reading, playing the violin, and boxing. After graduation he plans to pursue master’s work, possibly in theology.

E D I T O R I A L B O A R D

Treasurer _____ ✕ _____ Sara Tucker

Sara is pursuing a major in middle school math education and a minor in mathematics. She chose UMKC because of its wonderful education program, great diversity, the fact that it is close to home yet still far enough away to feel independent, and a GREAT scholarship! She has always been involved in honors classes and programs. Sara wanted to continue this, and joined the UMKC Honors Program. In addition, the honors-only study abroad program was something she was interested in. She wanted to get involved with Lucerna when she first heard about it her freshman year, but was unable to participate until now. In her free time, Sara loves taking pictures and scrapbooking. After she graduates, Sara plans to teach in a middle school in Kansas City, Missouri.

Managing Editor _____ ✕ _____ Michele Smith

English with a Creative Writing emphasis is Michele's chosen major. Her long-term goal is to become a successful lawyer. Since Michele knew that the admissions process for law school would be competitive and that she wanted to attend an excellent law school, she implemented a plan designed to make herself a compelling candidate. Michele improved her grade point average significantly while at Penn Valley Community College and was inducted into Phi Theta Kappa. Once she transferred to UMKC, she wanted to continue that effort by joining the Honors Program. Becoming a part of the Lucerna staff was her contribution to the Honors Program and an opportunity to stay focused on writing. In her free time, Michele enjoys reading books about theology, African American history and politics. She also enjoys listening to music, with an emphasis on jazz, gospel and spirituals.

E D I T O R I A L B O A R D

Assistant Managing Editor _____ ✕ _____ Heather Inness

Heather is an English Literature major. She has lived her whole life in Kansas City and was offered good scholarships at UMKC. She thought joining the Honors Program would be a good opportunity to meet people and could not resist the priority registration. Heather was a reader for Lucerna her first year; she enjoyed it and thought she would try a more involved role this year. Her hobbies include reading and participating in Internet fandom communities. Heather would like to work as an editor for a publishing house.

_____ ✕ _____

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Jennifer Garnett

Tattoos: Skin Deep Storytelling

✧

In any major city of the United States, there is a tattoo shop full of first time or tenderfoot customers and returning patrons.¹ They are looking for that perfect design to add to their collection, or looking for a piece that reflects their personality. Both types of customers are looking for a piece of art that they will live with the rest of their lives. Has human flesh become the newest fad for canvas? Have we come to an age that has accepted the tattoo as a piece of art? Exploring the Western World's historical responses to tattooing provides evidence for the influences of contemporary designs and applications. Body modification and, more specifically, tattooing has become the "new" art form, in conjunction with its growing community of artists and patrons and the intricate designs introduced through the medium.

The earliest known practice of tattooing was found in the Ötztal Alps between Austria and Italy in 1991. The body was carbon dated to circa 3300 B.C. Consisting of a few lines and dots, the Ötzi iceman was tattooed in several regions of his body. Professor Konrad Spindler, an Austrian archeologist, attributes the designs on the man to being ornamental, having magical qualities, or perhaps to medicate or prevent ailments, as well as social status.² Egypt and Libya have also been sites of the ancient art of tattooing. The pieces found there have been attributed mainly to religion. A female mummy from Thebes (Dynasty XI 2160-1994 B.C.), known as the primordial Priestess of Hathor or Amunet, had markings that were "seemingly abstract: a series of dots, dashes and lozenges and for this reason are often dismissed as random and

meaningless."³ They actually held meanings of protection and fertility. Other evidence recognizes the use of animals, beasts and fish within tattoo designs on Eastern Europe and Western Asian inhabitants of both genders between 600-200 B.C.⁴ The traditional ancient significance for tattooing included connection or sacrifice to a deity, ornamentation that would not be lost, physical or medical protection, and passports to the afterlife.⁵ The basic guidelines of these traditions have been followed throughout the history of tattooing amongst nearly every culture that practiced or practices the art. During the Western Expansion, the methods and meanings of tattooing in primitive cultures attributed to the contemporary understanding of tattooing. The evolution of Christian societies made tattooing fall out of popularity by calling it sinful. The art of tattooing was considered a primitive, pagan practice, and not suitable for civilized cultures.⁶

The earliest and most popular influence of tattooing for the modern Western world was the visit that Captain James Cook of the British Navy took with his crew to the Polynesian islands in 1769.⁷ The Polynesian art of tattooing can be traced to the 2nd millennium B.C.⁸ The origin of the word tattoo is derived from the Spanish seafarer Alvaro de Mendana who, in 1595, mentioned the artistic decorations that covered the entire bodies of the islanders. He noted the word describing the practice: "tatau," a Tahitian word meaning "to inflict wounds."⁹ Prior to this they were merely called pricks or marks in the West.¹⁰ Joseph Banks, a naturalist with Cook's expedition, describes the visual resemblance of the "black stain," also referred to as *Moko* or *Amoco*, lines around the thighs and spirals on the buttocks, as having an effect of "striped breeches." They used a "flat bone or shell, the lower part of which was serrated to form from three to twenty teeth... bound to a handle, this implement was dipped into 'the blak liquer' and, by a sharp tap on the

3 Lloyd 22

4 Lloyd 24

5 Lloyd 23

6 Ibid.

7 DeMello 45

8 Ibid.

9 Groning 93

10 DeMello 45

1 Ford

2 Lloyd 21

handle, pierced the skin with some blood.”¹¹ They would carve into the skin with an *Uhi*, cutting tool, and a *He Mahoe*, mallet, and rub a mixture of pigment made from resin, caterpillars or even gun powder into the wounds.¹² Banks’ notes also include lines, stars, other geometric shapes, animals and human figures worn by both genders. Women stained their lips with little design elsewhere, while men increased their collections every year. Later, sailors brought metals to the islands which replaced the use of bone or shell for the tools. The introduction of metals also made it possible for finer and more intricate work.¹³ Members of Polynesian society regarded the work as a skilled art form. “The [tattoo artist] was considered by his country-men a perfect master in the art of tattooing, and men of the highest rank and importance were in the habit of travelling long journeys in order to put their skin under his hands.”¹⁴ Social status and wealth attributed to the quality and quantity of work on the recipient. Outside of the Polynesian society, Buddhists learned their craft from tattooing those who could not afford the professional work of the Polynesian community, which contributed to the importance of the art in East Asian societies.¹⁵

The practice was eventually destroyed by missionary activity throughout Polynesia. Missionaries wanted to civilize these people by “prohibit[ing] tattooing, polygamy and other habits considered uncivilized.”¹⁶ Even with these restrictions placed upon them by the church throughout the 18th and 19th centuries, sailors returned to the Americas and Europe with Polynesian tattoos, as well as with tattooed Polynesians to exhibit. Displays of these individuals were huge moneymakers and solidified the art as a primitive function among the common masses in pubs, dime museums, as well as fairs, and influenced the civilized culture to view the natives as “tattooed savages.”¹⁷ The first record of an extensively tattooed person on display was Prince Giolo,

11 Lloyd 35-36

12 Lloyd 40-41

13 Lloyd 41

14 Ibid.

15 Ibid.

16 DeMello 47

17 Ibid.

known as the “Painted Prince,” who was traded and sold like a slave in several areas of Europe and eventually died of small pox.¹⁸ From the 17th century to the 19th century, tattoos were seen as a mark of savagery, yet the explorers and sailors “eagerly received tattoos from native practitioners.”¹⁹

Displaying tattooed natives in the United States did not start until much later with exhibits of “native villages” in World’s Fairs and other exhibitions. The first tattoo artists travelled alongside the exhibits to provide souvenirs for the experience. In 1876, the Centennial Exhibition in Philadelphia displayed Alaskan, Hawaiian, and Samoan families in “authentic cultural environments.”²⁰ In 1893, the Columbian Expo in Chicago had a midway with exotic peoples from colonies around the world. These sorts of exhibits paved the way for human oddities including tattooed people and freaks to be shown at world’s fairs and later on at carnivals and circuses. By 1901 the first full “Freak Show” arrived at the Pan American Exposition in Buffalo.²¹ One of the main attractions for these freak shows were the presence of a person completely covered by tattoos. The most popular were of the female gender, not only because of the mark of savagery put upon the object of the male gaze, but also because this provided men with the opportunity to view a female in little clothing when it was customary for them to be almost completely covered. The first female tattooed spectacle was Irene “La Belle” Wood in 1882. The most famous was Betty Broadbent, who ran away from her family to join the circus in 1927, and by 1939 was Ringling Brothers and Barnum and Bailey’s “youngest tattooed woman” at the age of 18.²² Popular tattooed men included Prince Constantine in 1873 (of Barnum and Bailey’s Circus) and the Great Omi in 1934 (of Ripley’s Auditorium Theatre).²³

Alongside these exhibits of savages, tattooing was being modified “to fit local sensibility emphasizing patriotism rather than exoticism” within

18 DeMello 47-48

19 DeMello 49

20 DeMello 48

21 Ibid.

22 Braunberger 12

23 DeMello 56

the United States. The first known professional tattoo artist in the U.S. was Martin Hildebrandt, who set up shop in New York City in 1846. He got his start tattooing soldiers from both sides of the Civil War, and “was instrumental in establishing the U.S. tradition of tattooed servicemen.”²⁴ His daughter, Nora, was the country’s first tattooed lady, but she was outshone by the, more popular Irene “La Belle” Wood.

In 1891, “Professor” Samuel O’Reilly patented the first electric tattoo machine in New York. His design was based on the perforating pen invented by Thomas Edison.²⁵ This machine allowed the use of multiple needles for outlining and shading, which, in turn, led to the use of color. Tattoos were hence cheaper, less painful, and faster to produce. “Early mechanical tattooing dove-tailed smoothly with the principles of the emerging pop culture dynamic of the age of the machine... Patrons who were engaged in the most ancient of corporeal rituals were seduced by the mechanical aura of modernity to physically interact with the visual elements of their changing society.”²⁶ This new method allowed tattooing to become readily available to the lower classes of society. Because of this, the upper classes eventually abandoned the practice, leading to the association of tattoos to the lower walks of life.²⁷

The popularity of tattoos continued with the military, especially the Navy. Typically, the artists had no artistic training and learned most of the techniques on the circus and carnival circuits. Times of war were the most profitable for the tattoo artist with patrons wanting to establish their patriotism and memorialize their loved ones at home. Men’s magazines like *Popular Mechanics* and *Popular Science* were the primary vehicles promising easy money by correspondence courses and instructional information sent to the home. Milton Zeis advertised correspondence courses at his “School of Tattooing,” and Percy Waters offered instruction with apprenticeships in the early part of the 20th century.²⁸ Apprenticeships have not changed much since then. They included, then like now, tracing flash designs, cutting stencils, cleaning

24 DeMello 49
25 DeMello 50
26 McCabe 50
27 DeMello 50
28 DeMello 51

equipment, fixing machines, making needles, and running errands with little or no pay. Other popular tattooists of the early 20th century included Captain Coleman, Paul Rogers, Robert Shaw, Bert Grimm, Charlie Wagner, “Lew-the-Jew” Alberts and Sailor Jerry Collins.²⁹

Flash designs became popular because they were drawn by famous artists and displayed on the shop walls, in the form of flash pages, for patrons to choose from. They were good for the artistically untrained tattooist, but bad for the patron who had limited choices and customization was rare. Many of the designs on these flash pages have become classic and popular with specific social groups. Artists would trace new designs from customers and incorporate them into their collections. Images included on flash were pin-up style girls, military insignia, ships, jokes, cartoons, fierce animals, knives and skulls.³⁰ Influences of other cultures were plentiful. Servicemen would come home from abroad with designs from other cultures. One significant contribution to contemporary tattoo designs was Sailor Jerry’s work. Sailor Jerry, a merchant marine in World War II, was influenced by Far Eastern imagery. He incorporated dragons and other Asian themes into his flash; however, his designs at the time were not as popular as the familiar patriotic themes.

The period between the World Wars was known as the “Golden Age” of tattooing. Shops became “homes away from home” where military servicemen could meet, swap stories, and compete with the amount and size of their tattoos.³¹ Women began to be denied tattoos unless they were 21, married and had the consent of their husbands, or were proven lesbians. This period had the highest social approval for tattoos because of their patriotic motifs. Military men continued to get tattoos most often, and were trendsetters in style, imagery and placement. The placement and explicitness of tattoos could cause a soldier to be discharged from the armed forces, so servicemen adapted their choices or altered already existing tattoos.³² Any sailor “worth his salt” had a

29 Ibid.
30 Ibid.
31 DeMello 58
32 DeMello 51

tattoo for whom they represented achievements and a sort of protection. Superstitious and mystical ideas were tattooed on popular areas of the body while tattoos visible beyond the edges of the uniform were and still are prohibited. Some of these designs included pin-up girls on the calves or hula girls on the bicep so one could make her dance. Old staples were chest pieces of ships or eagles. A sailor would be worthy of receiving a bluebird on the chest after 5,000 miles at sea; the second after 10,000. Once they crossed the equator, they earned Neptune on their leg. And to keep them from drowning at sea, one would get a rooster on one foot and a pig on the other.³³

The popularity of tattoos began to diminish in the 1960s with the lack of enlisted men looking at the military as a career. The Navy also began to actively oppose them. Tattooing was banned in areas of the United States with outbreaks of hepatitis C and regions where tattooists disregarded pre-World War II laws promoting cleanliness and age restrictions.³⁴ The Nazi practice of marking prisoners also made tattoos of returning men ill-favored. The middle class began to reject tattoos, which marked the practice as deviant. “Scientific” studies were published that associated deviance with tattoos. Society began to attribute tattoos with gangs and convicts, while imagery and style became adapted to individual subgroups.³⁵

There were three major categories of tattoos associated with society’s outsiders: bikers, Chicanos, and prisoners. Biker tattoos were almost exclusively black and fine lined, as were prison tattoos (most bikers received their first tattoos while in prison). Harley-Davidson logos, V-twin engines, skulls, and text like “Born to Lose” or “Live to Ride, Ride to Live” were most popular. The majority of these tattoos were placed in the most visible areas of the body like arms and legs.³⁶ Chicano tattoos were similar to biker designs and began with the Pachuca gang culture of the 40s and 50s in the Southwestern states. They were usually crafted by hand with a sewing needle and India ink and thus were black with

33 DeMello 64
34 DeMello 66
35 DeMello 67
36 Ibid.

fine lines. Popular images were Christ, the Virgin of Guadalupe, and women with boldly shaded text.³⁷ Prison tattoos used the same method as Chicano tattoos and identified specific social networks within and eventually outside of the prisons. Other countries forcibly tattooed detainees, like Japan, England, Cuba, and Nazi Germany, while American inmates marked themselves voluntarily. The most popular prison tattoo is the tear drop directly below the eye, representing the number of terms spent behind bars, and in some cases, how many murders the person had committed.³⁸

In the 1960s, Sailor Jerry opened up a shop in Honolulu’s Chinatown. Sailor Jerry never forgave the Japanese for bombing Pearl Harbor and took this non-acceptance to a new level. Oriental style tattooing was flourishing within Chinatown, and Sailor Jerry decided to “beat them at their own game” by incorporating U.S. imagery into the impressive color and shading used by the Japanese. He also took the Japanese incorporation of the entire body into consideration for his designs. His designs influenced other popular artists like Cliff Raven and Ed Hardy.³⁹

Today tattoo regulations vary from state to state but most demand that the applicant be licensed through the health department. Currently, apprenticeships include first aid and blood-borne pathogens training, and future tattooists learn that tattooing minors is prohibited without parental consent.⁴⁰ In the 1960s, Lyle Tuttle of San Francisco, California, helped with the updating of regulations.⁴¹ He promoted the cleanliness of needles and machinery as vital for preventing the spread of disease.

Sailor Jerry’s inspiring designs, along with the outsider sub-cultural styles, have influenced contemporary designs. Modern day tattoo designs include cultural influences from across the world representing past and present relationships through heredity as well as interest. Tribal, Sanskrit, or celestial, nearly any design idea, from an historical painting to a child’s face, has been put on human skin somewhere.

Tattoo designers have a lot more room to explore ideas, and they are

37 Ibid.
38 DeMello 69
39 DeMello 73
40 AAA Tattoo Directory
41 DeMello 78

not restricted to the flash designs that adorned the walls of early tattoo shops, yet you will still find shops today that practice in the traditional manner. Most patrons have ideas of what they want and ask that the tattoo artist design them. They are no longer forced to receive sample designs. Today, every portion of the body is considered for designs. “Sleeve” designs cover the whole arm, and “suits” cover the majority of the body. Normally these are created all at once and applied in several sittings. The tattoo artist and the patron collaborate on the design and then if the patron likes the idea they start “slinging ink” or “pounding skin.”⁴² “There is no art more personal than a tattoo. It’s an expression that is not commissioned for a corporation or a museum or gallery, or for other, richer people. It’s for you alone. It emanates from and conveys your deepest wishes, dreams, fantasies, fears, spiritual beliefs... It commemorates big moments in your life. You are the inspiration for the image.”⁴³ The tattooist’s practice has changed from offering a service to creating a piece of art that actually means something specifically for the patron.

In his book *Customizing the Body*, Clinton Sanders includes some characteristics to consider when questioning whether tattooing is an art form.⁴⁴ He says that art must have an historical or cross-cultural connection to creative practices, uniqueness, and must display aesthetic characteristics and evidence of technical skill. He also says that it must be collectible. Within the tattooist sphere, one that has several tattoos by the same artist is called a “showcase.”⁴⁵ Sanders also suggests that the artist must have a reputation and use conventional materials. In some locations, artists still practice ancient forms of tattooing, using Polynesian techniques for example. Being the focus of academic discussion and critical attention, purchased or collected by affluent consumers, and displayed in museum and gallery settings are characteristics that describe forms of art as well. Tattoo artists today have artistic backgrounds and many have advanced degrees that focus

on the elements of art and even tattooing itself. Conventions and shows occur throughout the world where tattoo artists meet and display their works and abilities. In recent years, tattoos have begun to be accepted as an art. Intricate designs and the amazing uses of colors and shading have made bodies seem like “canvases” to be displayed in galleries. In several areas of the world, there are human tattooed skins displayed in museums, such as the pieces in the Science Museum of London. Cultural and social influences contribute to the art of tattooing, which seems to be a characteristic of fine art. This is significant evidence that this “new” art form has entered the art world.

42 Ford
43 Shapiro 98
44 Sanders 156
45 Ford

- AAA *Tattoo Directory: Tattoo Regulations by State*. Web. 21 November 2008. 22 March 2010.
- Braunberger, Christine. "Revolted Bodies: The Monster Beauty of Tattooed Women." *NWSA Journal* 12.2 (2000): 1-23. Print.
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Thomas Nienaber

The Effect of Dynactin Mutations upon Vesicle Trafficking in Living Cells using RNAi

Introduction:

All human cells transport materials from the cell surface to the interior of the cell by forming vesicles under the cell membrane. These vesicles are moved, through endosomes, to the Golgi, and they are sorted and processed along the way. The transport of the vesicles inside the cell is referred to as trafficking. There are two cellular protein complexes that transport vesicles along microtubules during trafficking 1) dynein, which transports materials from the cell surface to the Golgi and 2) kinesin, which moves materials from the Golgi to the periphery of the cell.

Microtubule-based cytoskeleton

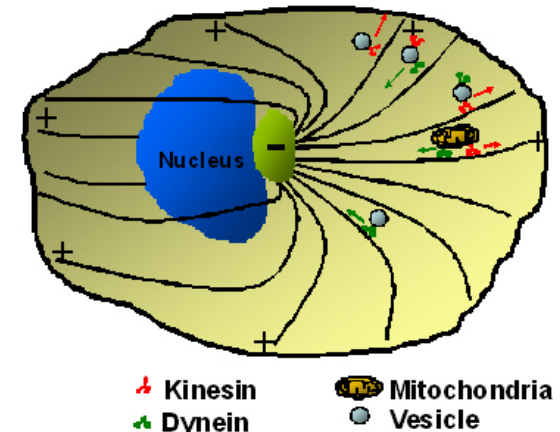


Figure 1: A sketch showing the directionality of dynein and kinesin.

If either of these two "motors" malfunctions, materials cannot be transported correctly and the cell cannot function correctly. Previous work in the lab of Dr. Stephen King at UMKC done in vitro, has shown that the molecule dynactin helps dynein stay on the microtubule tracks,

as dynein moves vesicles inward. In particular, the King lab has shown that the p150 subunit of dynactin plays an essential role in dynein-based trafficking.

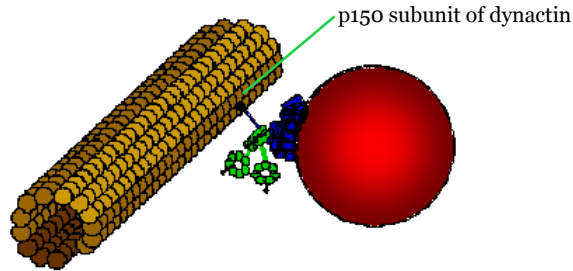


Figure 2: If dynein (shown in green) becomes dissociated from the microtubule, dynactin (in blue) acts as a tether to make dynein more processive. For more detail, see Figure 11 in the Supplemental Images

Based on the *in vitro* experiments there would be a significant decrease in the distance in the cells that have mutant p150, compared to the WT cells.(see Figure 3)

Dynactin effects on bead motility

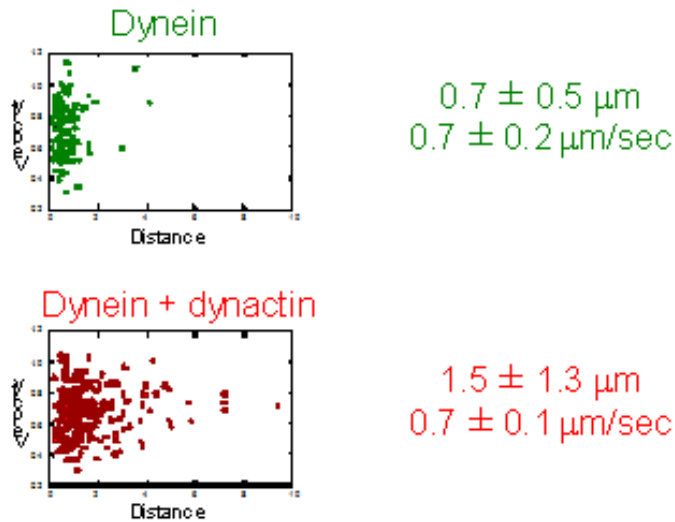


Figure 3: Dot plots showing the affect of p150 mutations *in vitro*.

Recently, it has been shown that a variety of neurodegenerative diseases result from mutations in the p150 subunit of dynactin. This work focuses on mutations of the p150 subunit of dynactin, which we believe to be linked to Amyotrophic Lateral Sclerosis (ALS) and other human motor neuron diseases.

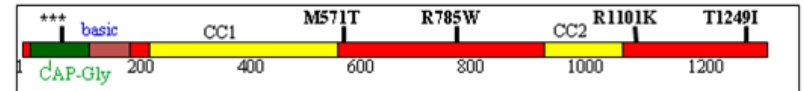


Figure 4: p150 polypeptide sequence The p150 domains discussed in the text include the CAP-Gly and basic microtubule binding domain (MTBDs) and two predicted coiled-coil domains (CC1 and CC2). Amino acid positions of four identified human mutations are in bold, *** show the position of the G59S, G71R, G71E, G71A, T72P, and Q74P mutations.

ALS or “Lou Gehrig’s Disease” is a condition that is associated with the degeneration of motor neurons. In humans, the motor neurons are responsible for the transmission of signals along nerve fibers between the brain and muscles. If a trafficking defect occurs in nerve cells, it could be particularly harmful to humans as it may result in the death of the nerve cell and ultimately the complete paralysis of the patient.

For this work, cellular trafficking in live cells with the Wild Type p150 was compared to that of cells with the mutant p150. Distance and velocity of the movements was measured for both dynein and kinesin. The percentage of movements, that is, the number of movements/the total number of vesicles was also calculated. Fluorescence microscopy techniques were used to actually see the trafficking of the fluorescent cargoes and computer analysis software was used to characterize and quantify the amount of cellular trafficking between the different conditions.

Methods:

Control experiments were conducted primarily to observe dynein/dynactin-based vesicle movements in Wild Type (WT) MRC5 cells. Dr. King’s lab has selected these MRC5 cells to study because they are very flat, which makes it easier to observe individual fluorescent vesicles

moving along microtubules inside them. The cells were placed at low temperature (4°C) in protein-free media for five minutes. This low temperature is used to slow the initial step of membrane transport, and the protein-free media will ensure that the cells deplete the external supply of free proteins. This treatment enhances the cells ability to take up our fluorescent marker, which is attached to bovine serum albumin (BSA) in preparation for a ‘pulse-chase’ style experiment. Texas Red-BODIPY-ceramide (TR-BODIPY) was used as a fluorescent marker. The Texas Red portion is a fluorescent moiety that is attracted to a particular ceramide sphingolipid. TR-BODIPY can bind to any membrane, but has a particularly high affinity for Golgi membranes.

While the cells were still at 4°C, the TR-BODIPY-BSA was added to the media for five minutes of incubation during which the BSA bound to cell surface receptors. The cells were then rinsed twice with protein-free media and then placed into a specialized live cell viewing chamber with complete media, in preparation for a ‘pulse-chase’ type experiment. The cells were warmed up to 37 °C to allow the TR-BODIPY-BSA to be internalized by endocytosis into endosomes. In the endosomes, the BSA was cleaved from the TR-BODIPY and the TR-BODIPY was transported, in transport vesicles, to the Golgi . Since the vesicles are spheres of membrane surrounding the material being trafficked, the trafficking of each of the vesicles can be seen, due to the bright fluorescent TR moiety.

The next step of the project was to eliminate the WT p150 and introduce the mutant p150, instead of WT p150. To replace p150 levels in living cells, a siRNA approach was used, in which a plasmid was transfected into the cells (two days before imaging). This plasmid contained genes expressing a Blue Fluorescent Protein (BFP) from a CMV promoter and a small RNA against the 3’ UTR region of p150 that targets p150 mRNA for degradation, via standard si knockdown (see Figure 6). Thus the WT p150 was eliminated from the cell and we could identify those cells by their blue color (because of the BFP).

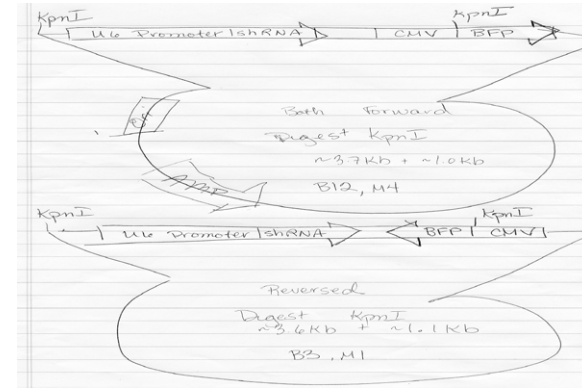


Figure 5: A drawing which shows the plasmid containing the BFP and the RNAi against the untranslated region of p150.

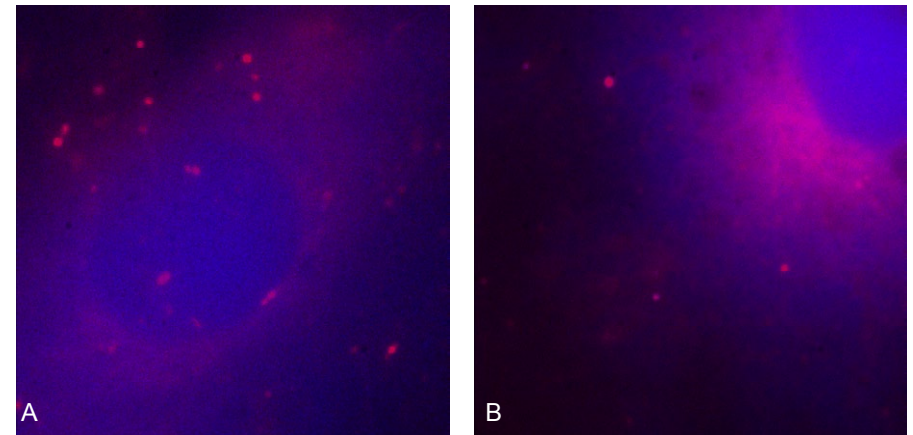


Figure 6: Two cells showing expression of the BFP, but with very different Golgis and percentage of vesicles. (A) at time 28 min., corresponds to video 1, (B) 41 min. corresponds to video 2. The bright spots are the vesicles.

These movements of the fluorescent vesicles were recorded on the departmental High Resolution Microscope in 50-second movies of 500 frames each. In WT cells, the trafficking was robust for up to 60 minutes. These movies were then analyzed using MetaMorph imaging software to determine the frequency of motility events and the distance and velocity of each individual movement. The movements can be seen as Figure 7

demonstrates. The program will help track the vesicles and produce a Kymograph (Figure 8). The Kymograph is a graph of the intensity of the fluorescence along the line drawn on the movie. The top of the graph corresponds to frame 0, time = 0 seconds, and the bottom is frame 500, time = 50 seconds. Thus, the distance and slope of the graph will give us an indication of what trafficking occurs in the cells. Once the kymograph (Figure 8) has been made, the actual distance in microns and the velocity in microns/sec. can be calculated (see Figure 9). These calculations take into account the number of pixels that correspond to one micron from previous calibrations of the microscope with a micrometer.

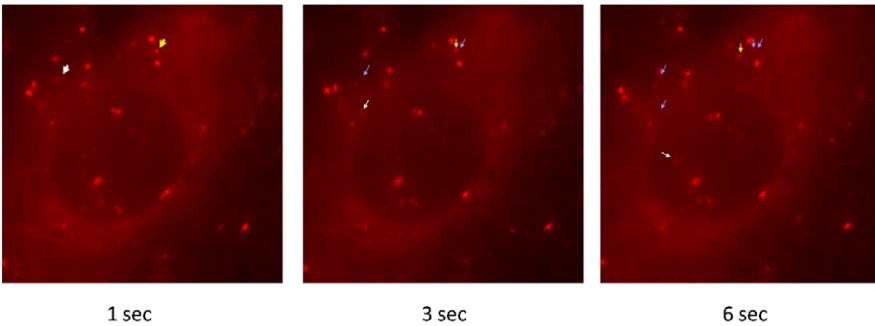


Figure 7: The arrows indicate the position of the vesicles at the times indicated. The blue arrows indicate the vesicle's position in the previous images. A line drawn between these points is used to determine the area graphed. The computer tracks the movements in this area and the Kymograph is produced, as is shown in the screen snapshot show in Figure 3.

Time	Line	Kymo Area	Kymo Distance	Distance Area	Distance	Angle	TRUE Distance	Time	Velocity	Video	Kymo	Motor	Comments
11:9 min	4	243	275.338	1.133078189	69.9714	149.323	5.597712	100	1.3485884	200910144	line 1	k	
13:8 min					39.3673	26.5661	3.148684	100	1.1986697	200910144	line 2	d	
13:9 min					25.2862	16.9075	2.023866	100	2.628674	200910144	line 3	d	
14:12 min	1	55	55.0010	1.001487273	17.4642	159.199	1.397136	100	2.0000415	200910141	line 1	k	very faint
15:15 min	1	146	164.95	1.125884932	30.0852	14.0362	2.409255	100	-3.20001	200910141	line 1	d	
15:15 min					13.6015	14.0362	1.08912	100	-2.00001	200910141	line 2	d	
17:15 min					16.8114	15.9454	1.264912	100	-2.79999	200910141	line 3	d	
18:15 min					26.9615	14.0362	2.07692	100	-3.20001	200910141	line 4	d	
19:15 min					25.0799	22.249	2.008392	100	-1.99999	200910141	line 5	d	
20:15 min	2	43	44.643	1.038209302	26.9615	14.0362	2.07692	100	-3.20001	200910142	line 1	d	
21:15 min	3	119	119.621	1.03869916	36.1389	13.2496	2.891096	100	-3.41109	200910143	line 1	d	
22:10 min	1	113	113.635	1.005619459	62.5551	169.30	6.655200	100	4.2655249	200910141	line 1	k	hop, skip??
23:10 min	2	81	81.3019	1.00372710	26.9250	20.555	2.154064	100	-2.13330	200910142	line 1	d	
24:10 min	3	129	124.78	1.014471545	14.7848	26.5661	1.181184	100	-1.59997	200910142	line 2	d	
25:10 min					39.7131	189.696	2.777046	100	4.99993	200910143	line 1	k	jump??
26:10 min					26.2480	163.74	2.099904	100	2.7428936	200910143	line 2	k	
27:22 min	1	95	101.951	1.073168421	29.1204	14.5345	2.32632	100	-3.005704	200910141	line 1	d	
28:22 min					21.867	11.9099	1.72698	100	-4.00012	200910141	line 2	d	
29:22 min	2	80	84.822	1.077033333	37.3363	160.56	2.986804	100	2.2866711	200910142	line 1	k	
30:22 min	3	54	65.7953	1.033061111	23.0217	33.6901	1.841736	100	-1.19999	200910143	line 1	d	
31:22 min	4	79	89.3238	1.037494615	30.6497	26.5661	2.611976	100	-1.59997	200910144	line 1	d	
32:22 min					13.4164	24.4444	1.073312	100	-1.75999	200910144	line 2	d	
33:22 min	5	49	62.948	1.080671429	38.6264	169.624	3.081112	100	2.1638863	200910145	line 1	k	
34:22 min	6	76	77.1038	1.014503884	18.2788	7.66644	1.302504	100	-6.11111	200910146	line 1	d	weird
35:22 min					18.4391	10.000	1.475120	100	-4.53334	200910146	line 2	d	weird
36:25 min	1	52	71.7978	1.158020072	31.0644	32.8197	2.485157	100	-1.95000	200910141	line 1	d	
37:25 min					146	101.019	1.038438747	100	1.69494	200910147	line 1	k	
38:29 min	2	84	94.3963	1.125483333	26	14.6389	2	100	-3.66661	200910147	line 1	d	
39:29 min					16.4924	11.2099	1.319392	100	-4.00012	200910142	line 2	d	
40:29 min					22.4722	160.71	2.789776	100	2.2897200	200910142	line 3	d	
41:35 min	1	84	89.1964	1.061861905	49.4773	13.1726	3.958184	200	-1.705095	200910141	line 1	d	
42:36 min	2	74	83.1996	1.124141892	19.6469	167.471	1.671762	200	1.7989716	200910142	line 1	d	
43:35 min	3	76	82.0553	1.090281316	19.3132	160.56	1.545056	200	1.333255	200910143	line 1	d	
44:36 min					17.2627	7.12502	1.381016	200	-3.19999	200910143	line 2	d	
45:35 min					17.72	165.964	1.4176	200	1.6000289	200910143	line 3	k	
46:36 min					17.72	144.062	1.4176	200	-1.00109	200910145	line 4	d	
47:47 min	1	60	79.925	1.175367647	39.5601	15.124	3.164000	200	-1.40001	200910141	line 1	d	
48:47 min					17.4642	21.8014	1.397136	200	-1	200910141	line 2	d	
49:47 min	2	47	59.203	1.259362938	16.6433	31.8075	1.331464	200	-0.65	200910142	line 1	d	too low??
50													
51													
52	5	14751.28	100	-4.53334	200910146	line 2	d	0	0	0	0	0	
53	2	2.485152	100	-1.250002	200910141	line 1	d	0	0	0	0	0	
54	1	6.124576	100	1.0399619	200910141	line 1	k	0	0	0	0	0	
55	1	2	100	3.056851	200910142	line 1	d	0	0	0	0	0	
56	9	1.319392	100	-4.000012	200910142	line 2	d	0	0	0	0	0	
57													
58													

Figure 9 (Bottom, Left): From the distance and angle of the line on the kymograph, we can account for the calibration of the microscope and calculate the distance and angle moved.

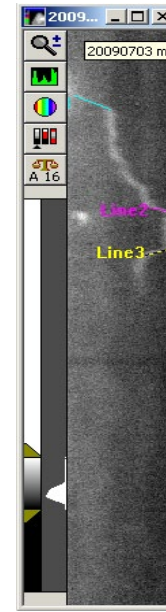


Figure 8: The angle of these lines is used to determine the velocity at which the vesicles moved and the length is used to determine the distance moved.

Results:

After the cells were transfected with the plasmid containing the RNAi and the BFP, I compared distance and velocity of dynein and kinesin-based movements as well as the percentages for each. A summary of this analysis can be seen in Table 1. This shows that while the distance and velocity remained comparable, the percentage of movements was significantly altered. An example of this decrease in percentage of movements can be seen in the supporting.

Cargo Manipulation	GFP-Rab6	BOPDIPY-Ceramide	BODIPY-Ceramide UTR2-BFP
% cells with moves	100	100	48
% moving vesicles	96	64	8
Kinesin Velocity	1.9 +/- 0.7	2.7 +/- 1.2*	2.0 +/- 0.9*
Kinesin distance	2.7 +/- 1.6	3.0 +/- 1.9	2.4 +/- 1.3
n	313	314	403
Dynein velocity	2.1 +/- 0.9	2.7 +/- 1.2	2.1 +/- 1.0
Dynein distance	2.5 +/- 1.4	2.8 +/- 1.6	2.3 +/- 1.1
n	176	315	448

Table 1: A comparison of the distance and velocity for Dynein and Kinesin and the percentage of movements in each experiment. * = $P < 0.01$ Student's t-test

While the velocity of kinesin in the BFP-UTR2 cells was shown to be significantly different between two cell populations, the distance for kinesin and both the velocity and distance of dynein were quite similar. This indicates that while there is a visual difference between cells that have the RNAi and WT cells, it is not the velocity and distance of the movements that is changed. Thus we looked at the percentages of movements, that is, how many of the vesicles in a cell actually move. In the cells with the BFP-UTR2, there is a drastic reduction in the percentage of movements when compared to WT cells.

What was most conspicuous was the fact that some cells had the plasmid in them, as seen by the expression of BFP, but behaved like WT cells. We thus concluded that in the blue cells, some were displaying the mutant phenotype, while some were displaying a WT phenotype. We concluded that the RNAi targeting the untranslated region of p150 was not being consistently effective. The plasmid was clearly in the cells, but the RNAi did not seem to be causing a phenotype, even though it is on

the same plasmid. We expect the RNAi was made, but the level may not have been high enough to remove all cellular p150 RNAs.

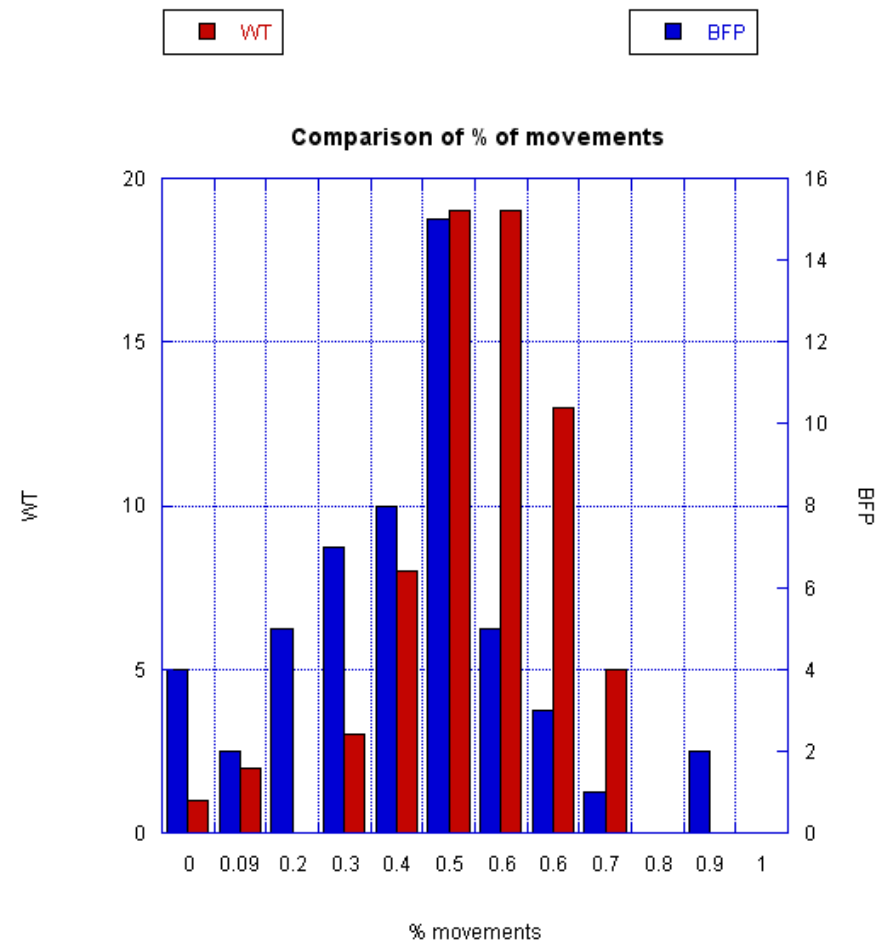


Figure 10: Graph showing the difference in percentage of movements between WT and BFP-UTR2 cells. The WT percentages are shown in red and are on the left y-axis. The BFP percentages are shown in blue and are on the right y-axis.

Conclusions:

The RNAi used did indeed affect the global function of dynein-based transport. However, the distance and velocity of individual movements, when they occurred, were not affected. The effect of the RNAi was a decrease in the number of movements. This indicates that *when* a vesicle moves in a mutant cell, it moves similarly to a vesicle in a WT cell. Also, the number of vesicles was decreased in the mutant cells. Since p150 is only known to be involved in the binding of vesicles to microtubules, it is not immediately apparent if a mutation in p150 would affect vesicle formation or only its transport. Likewise, the decrease in the number of kinesin-based movements as a result of the p150 mutation indicates that any mutation in the cell can affect processes other than that with which it is directly related.

An RNAi to a different region of p150, such as in the coding region, may have different results. Experiments using the same techniques with a new RNAi may have a more consistent effect on p150. If mutations in the coding region of p150 have consistent similar results to the blue cells with a mutant phenotype seen in these experiments, it may indicate that this is the best approach to take in future studies. This can also be examined by introducing the RNAi into live nerve cells and seeing if they cause similar affects to those seen in ALS patients. If this is the case, RNAi may also be a means of reversing ALS by eliminating the mutant p150 and replacing it with the WT p150.

Supplemental Images:

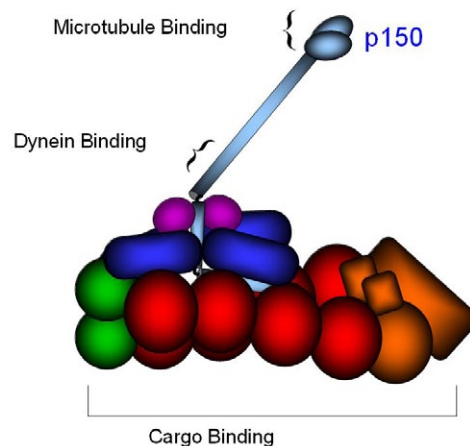


Figure 11: A representation of the structure of dynactin. The microtubule binding domain is what mutations in p150 are affecting.

Notes

1. A microtubule-binding domain in dynactin increases dynein processivity by skating along microtubules. Culver-Hanlon TL, Lex SA, Stephens AD, Quintyne NJ, King SJ. *Nat Cell Biol.* 2006 Mar;8(3):264-70. Epub 2006 Feb 12. PMID: 16474384
2. Dynactin, a conserved, ubiquitously expressed component of an activator of vesicle motility mediated by cytoplasmic dynein. Gill SR, Schroer TA, Szilak I, Steuer ER, Sheetz MP, Cleveland DW. *J Cell Biol.* 1991 Dec;115(6):1639-50. PMID: 1836789
3. MetaMorph version 6.1. Universal Imaging Corp.
4. Dynactin, a conserved, ubiquitously expressed component of an activator of vesicle motility mediated by cytoplasmic dynein. Gill SR, Schroer TA, Szilak I, Steuer ER, Sheetz MP, Cleveland DW. *J Cell Biol.* 1991 Dec;115(6):1639-50. PMID: 1836789
5. Molecular Probes, Inc. NBD- and BODIPY Dye-Labeled Sphingolipids (2003)
6. Constructed by Dr. Margaret Kincaid

Elaina Newton

Power and Rhetoric's Role in the Rwandan Genocide

“The question is, how can forms of identity and identification of such scope—ethnic labels that are abstract containers for the identities of thousands, often millions, of persons—become transformed into instruments of the most brutally intimate forms of violence?”

-Arjun Appadurai

One of the most significant questions of our time, brought to light by the revered ideologist Arjun Appadurai in his essay, *Dead Certainty: Ethnic Violence in the Era of Globalization*, implores contemplation of the process wherein a mere social categorization transcends its origin as an intangible concept, giving rise to massive, fatal consequences. To an American, genocide is an abstract concept foreign to the life lived in pursuit and service of the American Dream. Americans miss the big picture. Distant from and unaware to the facts of pre-colonial, colonial and post-colonial African history, many Americans still assume Africa is filled with underdeveloped, warring tribal cultures. This perspective succeeds in turning many a blind eye to the structuralized social hierarchies pre-existing within these cultures and more relevantly the cultural wounds inflicted by Western imperialist powers like Germany, Belgium and France. In their gamble with power and pursuit of self-benefaction, these nations irreversibly altered the greater political paradigm once inherent to Africa, imposing a new collective consciousness—one bound by the constraints of social categorization—for the many people across this continent.

In Rwanda, two opposing tribal groups, the Hutus and the Tutsis, struggle violently for conquest, for empowerment, and to imbue their collective self with distinct identity. Fostered during the 19th-century

European conquest, these mounting struggles have nurtured explicit definitions of Hutu and Tutsi. Born from insecurity and uncertainty stemming from favoritism during imperialistic rule, these ethnic labels create a desire for certainty attainable only through acceptance of severely categorical identities. Using Appadurai's observations—on how the powerful voices in Rwanda's traditionally oral society successfully used communication channels for spreading rhetoric bent upon creating specific identities dependent on nativeness—as a hypothetical anchor, the complex conditions that conceivably nurtured explosive racial violence in our globalized era are easier to grasp. Further, by exploring theories from anthropologist Liisa Malkki's studies on exiled Hutu refugees in *Purity and Exile* and European colonizers' role in shaping social categories and instilling antagonism through favoritism in Philip Gourevitch's *We wish to inform you that tomorrow we will be killed with our families: Stories from Rwanda*, foreigners, living within utterly different social constructs themselves, can more deeply understand how and why these ethnic labels may have converted to motives for merciless violence in Rwanda.

In April 1994, an estimated 800,000 Rwandan Tutsis died within a 100-day period, slaughtered by their Hutu neighbors and relatives. This is not an isolated, reactionary incident. This kind of wide-scale operation does not simply happen overnight. It stems from highly orchestrated politics involving “propaganda, rumor, prejudice and memory”, bent on obtaining and controlling power (Appadurai 305). As Appadurai discussed in his work on identity, “forms of knowledge [are]...associated with heightened conviction...capable of producing inhumane degrees of violence”, thus this gruesome event grew from a developing certainty (305). Using the aforementioned rhetorical tactics centered on alleviating all painful uncertainty by defining the self through rejecting and eliminating the “other”, those pulling the strings fostered and enforced a conviction based in purity and autochthony—as the theorist Peter Geschiere defined it, “to be born from the soil”—to justify murder while keeping their hands relatively clean (2). Looking for certainty, belonging, success and protection, normal folk butchered their neighbors in villages and towns all across their homeland. This methodical population control

owes its success to Rwanda's long-term integration of social constructs organized by necessary relationships to the land into everyday hegemonic identities. Thus, it seems the genocide arose neither from Rwanda's mid-20th-century independence nor from European colonialism in the late-19th century.

Instead, as anthropologist Liisa Malkki and her research sources argue, "a castelike hierarchy of categories...formed" that "centered around cattle clientship" in ancient times when Central Africa's inhabitants first organized cultural groups and interacted with one another socially ("Historical Contexts" 25). Though most scholars agree that the quantitatively reliable historical evidence pertaining to central Africa's development proves meager—thereby challenging accurate study—most call the area's first inhabitants the Twa. Known as forest dwellers and hunters, these people lived simply until the Hutu, an agriculturalist group, filtered into the land to co-exist among them. Since the Twa lived nomadically and represented only a minority within the population, they posed no threat to the Hutus' agrarian subsistence, allowing the two groups to exist peacefully, while some oral traditions suggest the Hutu "constituted relatively decentralized, 'minor polities'" controlled by kings (Malkki, "Historical Contexts" 21). The Hutus later adopted this historical perspective, suggesting that they helped to build Rwanda as a civilized, social community through its institution of early politics that promoted peaceful interaction with the indigenous Twa, to support arguments that they had natural rights to the country because they birthed it. Over time, a third group called the pastoral Tutsi migrated into the territory, which then primarily bore Hutus. This "large-scale movement of persons" brought with it a different social and economic structure, so the Hutus initially tolerated and adapted to the Tutsi methods for existence because they needed the same land and natural resources to prosper (Appadurai 308). Adopting the Hutus' historical view as a reference point, Malkki draws from the comparative study of Burundi and Rwanda by Lemarchand, which discusses cattle clientship's development in Rwanda. On questioning how a minority group like the Tutsi so easily attained dominance in the region,

Lemarchand adopts the "more widely accepted explanation...that the Tutsi used their cattle as a lever of economic power...[in] a special form of cattle clientship, or cattle contract...[to acquire] sovereign political rights over their Hutu clients" (qtd. in Malkki, "Historical Contexts" 25). To Lemarchand it seems the contract began as a more fluid and symbiotic relationship centered on "mutual dependence" involving "the exchange of cattle for agricultural products"; however, the cattle's substantial value and importance far outweighed crops, eventually tipping the scales to favor the Tutsi pastoralists (qtd. in Malkki, "Historical Contexts" 26).

Whether or not this relationship was purposefully intended is practically untraceable, as Philip Gourevitch points out in his journalistic account of the Rwandan genocide and its aftermath, *We wish to inform you that tomorrow we will be killed with our families: Stories from Rwanda*. To him, the theories on original settlers are solely traditional legends passed down as what Malkki deemed "*mythico-history*", developments of historical lineage with a moralistic emphasis ("The Mythico" 54). Each group wove their own tale explaining their origins and why they were the favored race: the Hutu claimed moral privilege to autochthony because they first settled and brought civilization to the Twa in Rwanda, while the Tutsi believed they were the chosen people, given cattle as a valuable gift by a heavenly power in order to prosper (Gourevitch 47-48). These mythico-histories became important later in the 20th century when the Hutus overthrew the Tutsi rulers and the new politicians emphasized their authentic origins rooted in the land, creating, as Appadurai discussed in his discourse on identity, an "uncertainty...about whether...[the Tutsis] really [were] what they claim[ed] or appear[ed] to be or have historically been" (308). Yet, despite their differing originations, Gourevitch noticed the Hutu and Tutsi groups' intermingling in circumstances relating to marriage, religion and politics, for they shared the same language and land. Nevertheless, because these cultural labels connected directly with their life's work, Hutus were associated with farming and Tutsis with the cattle they shepherded. Unfortunately, "this was the original inequality: cattle [were] a more valuable asset than produce...so the word Tutsi became

synonymous with a political and economic elite” (48).

From that point forward, stemming from necessity and convenience, these two groups remained tied together by “*buhake*”, a mutually dependent “cattle contract” relationship—the Hutus reliant on the Tutsis for providing precious cows and the Tutsis dependent on the Hutus for tending land so that both groups might mutually prosper from its harvest (Malkki, “Historical Contexts” 26). Yet, the Tutsis’ economically superior position, based on cattle control, granted them ample social advantage. Associating them with the cream of the crop because of their privileged political and financial existence, thus separating themselves from the rest of the commoners, the Hutu majority considered the Tutsis excessive outsiders that needed removal. Using Appadurai’s ideas on the conditions for uncertainty as a reference for Rwanda’s partisanship, as long as the favored Tutsis persisted in Rwanda, the working class Hutus would always harbor “uncertainty creat[ing] intolerable anxiety about [their] relationship...to state-provided goods” since these “entitlements [were] frequently directly tied to who ‘you’ [were] and thus to who ‘they’ [were]” (308). In spite of this social imbalance, the class separation eventually expanded into a tiered hierarchy centered on a single Tutsi king, called the “*Mwami*” (Gourevitch 49).

The first colonial invasion by the Germans in the late-19th century confirmed this political structure; however, history predating these events is completely unknown and therefore “dangerous” because history inherently centers on groups vying for power, and as Gourevitch states, “power consists in the ability to make others inhabit your story of their reality” (48). Essentially, from within a society shaped around oral traditions, the victors automatically procure a monumental advantage. Whether achieved through extermination, banishment or surrender, the conqueror survives as the only source left to narrate the tale. In Rwanda’s case, the ruling Tutsi, laxly managed by the Germans and Belgians, controlled the information flow; therefore, they held the creative and economic power to emphasize their own overriding narrative. Yet, when Rwanda secured independence and the Hutus took over, the new political rulers—savvy to the vast populace’s habits and desires—relied on oral

methods, specifically through radio transmission and printed articles, to espouse purist Hutu beliefs and slowly normalize subversive, violent views for the Rwanda audience. Reaching its height in the year before the genocide occurred, 1993, national radio stations like the Radio Télévision Libre des Mille Collines (RTLM) and Radio Rwanda began spouting radical Hutu ideals, taking propaganda straight from the extremist newspaper *Kangura* while also functioning as a hip, entertaining radio outlet for Rwandans, especially the youth population (Gourevitch 99). Mixing doses of racist propaganda with popular music caused the listeners to inadvertently absorb and incorporate the ideas into their own personal schemas (Gourevitch 100).

This clever political tactic is vitally important, but when analyzing the exact motivation for the genocide and questioning what could spur a whole population to zealously murder, one must consider two things: the Hutu power’s constant labor to remain in control and the subversive rhetoric they employed to condition the masses to do their dirty work. Maintaining their power necessitated sustaining high violence and opposition levels to prevent the population from co-existing neutrally, lest that lead to benevolence and independence. To achieve this situation, the Hutu elite bombarded the public with rhetorical messages via newsprint and radio that maligned the Tutsis. Yet when questioning, as Appadurai stated in *Dead Certainty: Ethnic Violence in the Era of Globalization*, “the transformation of neighbours and friends into monsters” (316), it’s essential to note that in Rwanda’s case “verbal propaganda and mass-mediated images...literally turn[ed] ordinary faces into abominations that must be destroyed” (316). Through the repeated emphasis on Tutsis as “the other” in relation to the heavily emphasized true and pure ethnic aspects inherent in Hutus, the radio broadcasters and newspaper writers associated Tutsi with non-human qualities, comparing them to cockroaches needing squashing. By dehumanizing their enemy, while supporting a collective self-identity rooted in autochthony, the Hutu power figures and pawns justified the Tutsi slaughter by convincing the masses to “let me kill you before you kill me”, thereby acting preemptively in self-defense (322). Additionally,

as Gourevitch pointed out, the authoritarian government rationalized the violence using an ideology explaining, “the logic’...of genocide was promoted as a way not to create suffering but to alleviate it” (95). This was already a main concern held by the Hutu individuals who endured serfdom under Tutsi rule, as well as the poorer individuals who resented the Tutsis’ prevalent prosperity.

In recollecting the events leading up to the genocide, both Malkki and Gourevitch, as well as their peers, sought to gain understanding and to clarify the underlying motives of genocide and its effects upon identity. Both ran up against entirely fallible human accounts with notably lacking physical evidence. Delving to understand these central African people, both authors felt exposed to the whim of their interviewees. As Malkki describes in *Purity and Exile*, she relied on the varying stories from the Burundian refugees in Tanzanian camps who actively defined themselves through the “ordering and reordering of social and political categories...[,]historical events, processes, and relationships..., reinterpret[ing] them within a deeply moral scheme of good and evil” (“Historical Contexts” 56). During Gourevitch’s visits to Rwanda, only a year after the ‘94 genocide, he interviewed a mix of victims, perpetrators and key political figures. In recalling the fresh circumstances, these subjects struggled to analyze the situation themselves, just mechanically responding to topics hoping to grasp some shallow “understandings, ways of thinking about the defiant human condition at the end of this century of unforeseen extremity” (183). Aspiring to cope with trauma, the Burundian refugees actively participated in recreating their own history to benefit and bolster their self-identity as Hutus. Within their present condition, isolated and displaced from the land connected to their history, the refugees “emphasized the boundaries between self and other” essentially defining themselves “as that which ‘The Tutsi’ [was] not” (Malkki, “The Mythico” 54). The Rwandans, on the other hand, did not have that luxury. The situation trapped those left alive on the same homeland soil where the mass murdering occurred, which by then bore no resemblance, physically or socially, to its formerly peaceful existence. Taking a different approach, Appadurai sought to understand

precise ethnic violence, carried out by “ordinary persons against other persons with whom they may have—or could have—previously lived in relative amity” by discussing the effect that globalization had in fostering uncertainty amongst people who experienced an influx of diversity within their formerly sheltered cultures (307). Trying to conquer these social ambivalences, villagers found certainty in “ethnic labels and categories...produc[ed] by...state policies and techniques” like purist rhetoric “to generate large-scale identities, which [became] significant imagined affiliations for large numbers of people” (306). Comforted by a community that shared origins, these people blindly absorbed the violent discourse enunciated by their leaders, which drew the foreigners as “ethnic enemies” (312).

Looking at all three theorists’ studies, though, it seems that Malkki’s and Gourevitch’s approaches were somewhat similar in their specificity, while Appadurai’s study analyzed the more global situation, drawing from several regional examples and sources for support. Malkki studied idealized identities and their effect upon people’s actions and upbringing, and Gourevitch focused on Rwandan stories about persisting after the bloodbath and conflict narratives from the genocide, combined with an overriding assumption that foreign powers’ role in supporting the genocide was vast and purposeful. Appadurai, on the other hand, attempted to answer his own question regarding the phenomenon of personal and brutal ethnic violence occurring all over the African continent by looking at the larger social picture instead of at an isolated event. Nevertheless, the link that connects all the diverse incidents discussed by the theorists is the prevalence of globalization, which brought major changes to the societies it invaded, thus inciting a theme common in all the areas: uncertainty of the self in regards to a foreign threat. More specifically, Appadurai points out that dangerous certainty—what he deems “dead certainty”—often occurs through the adoption of radical, violent propaganda dispensed by those in power, who convince people to kill other designated races in order to affirm their own identity (322). Despite Malkki’s and Gourevitch’s difficulty at gaining insight from the current generations—who either work hard to repress and

change their collective narrative or remain jaded from bearing utter social upheaval—and Appadurai’s conjecture that a rising globalized economy caused foreign infiltration, displacement and incertitude, it’s pertinent to discuss what impact the colonial powers played in situating Rwanda for disaster.

Upon entering Rwanda after the 1884 Berlin Conference, the Germans discovered a powerfully exclusive feudal system that paid them no mind. Yet, a year later the influential Mwami Rwabugiri, by far the most ambitious and sectarian Rwandan king, died, and the Germans observed Rwanda’s social structure crumble in a politically turbulent climate as the remaining royal Tutsi clans fought over power (Gourevitch 54). The formerly neutral foreigners set up camp and commenced direct rule by the Germans. Akin to the Hutus’ reliance on Tutsis for cattle, the ruling Tutsi—desperate to remain in power over the Hutu majority—cooperated with the Germans to receive assistance. Gourevitch describes this relationship as a “dual colonialism”...whereby the “Tutsi elites exploited the protection and license extended by the Germans to...further their hegemony over the Hutus” (54). Infatuated with the Tutsi minority’s rule over the majority population, as well as their more European features, the Germans furthered the distinctions between the two races so that once Belgium took over after World War I, the divisions were clear-cut (54).

Similarly fascinated with the natives’ politics and physique, the Belgians applied systematic tests to categorize people based on physical features like hair, bone structure and height. Favoring the Tutsis’ appearance, which they deemed fitter for ruling than laboring, the Belgians issued ethnicity cards to organize all citizens into either racial category. Dealing with insecurities and confusion themselves, European colonizers could not differentiate between the highly diversified, pluralist tribes, so they categorized people by shallow, physical traits that to them were more manageable. Yet, in doing this they transferred their contempt for variety onto the people by forcing them to mold to certain ethnic definitions, which with the absence of their former social fluctuation, made conforming obligatory (Gourevitch 55-56). Drawing from Malkki’s

study, Appadurai discusses her observation that these “earl[y] colonial efforts to reduce the complex social differences among local ethnic groups to simple taxonomy of racial-physical signs” dramatically favored the Tutsi population by giving them powerful and lucrative positions within society (309). This favoritism eliminated the more fluid and equalized cattle clientship relationship in which the two groups coexisted somewhat peacefully, sharing the same land. Instead, it developed into a racial caste structure whereby the Hutu, resembling feudal slaves, were required to work the land. The Hutu resented their suppressed position, so a “theme of secrecy and trickery pervaded Hutu ideas about the Tutsi elite” and as victims, they viewed their rulers as “thieves who stole the country” (313).

Over time, as the Tutsis became increasingly comfortable in their lush lifestyles, they feared losing their privilege. To avoid incurring the hatred they heaped upon the Hutus, the Tutsis followed Belgian orders to oversee Hutu “forced labor, which required armies of Hutus to toil en masse as plantation chattel” (Gourevitch 57). By the time the Belgians left in the mid-20th century, the identity cards and supreme Tutsi reign admonished all chance for Hutus to advance in social class or attain any local control. This racially divided indoctrination, supposedly supported by scientific and logical data, abolished the previously dynamic social hierarchy resonant within Rwandan culture (57). In result, Gourevitch argues, “on either side of the Hutu-Tutsi divide there developed mutually exclusive discourses based on the competing claims of entitlement and injury” (58). In this orally focused society, as the cattle clientship relationship diminished, newer generations grew up with racial divisions that influenced their self-identity. Tutsis enjoyed what they understood as genetic privilege and Hutus felt subjugated, having experienced the “large labels” of racial heritage “[become] unstable, indeterminate, and socially volatile”, so they rallied together under historical “origin” stories that defined the Tutsis as outsiders, thereby granting them the autochthony and authentic self-identity they deserved (Appadurai 322). After undergoing racism and classism for so many decades, Hutus rebelled and took power after Belgium withdrew, giving Rwanda its

independence. Both sides endured much upheaval and violence in the process, but once the Hutu president Juvénal Habyarimana took office in 1973, he implemented an extreme systematic cultivation centered on rediscovering Hutu identity (Gourevitch 69).

Under his rule, Habyarimana favored and protected his race thereby letting the Hutu political power assert its rhetorical dominance over the masses. This idealist discourse fully actualized in 1990 when the president's wife, Madame Agathe, gathered Rwandan covert extremists, known as the "*akazu*", to brainstorm developing a newspaper filled with Hutu propaganda (Gourevitch 85). Initially created to mock a rival newspaper, *Kangura* eventually expanded into a forum for rhetorical discussion centered on vilifying the Tutsi-led Rwandan Patriotic Front (RPF) (Gourevitch 86). Additionally, the newspaper printed articles like "The Ten Hutu Commandments" that served to "articulate a doctrine of militant Hutu purity" by defining the essential and good ethnic qualities (Gourevitch 87-88). Most striking amongst these rules is the eighth commandment that states every Hutu's duty is to "stop having mercy on the Tutsis" (Gourevitch 88). Building upon the logic that all Tutsis were "innately skilled in the arts of deception" the Hutu power erased the Tutsis' humanity, framing them as latent Rwandan spies apt to use manipulation and bent on bringing about the common people's failure (Appadurai 313). In a zealous desire for power, acceptance and retribution, Hutus soaked up this immensely popular propaganda and rhetoric because it solidified their right to flourish unrestrained, enjoying life without foreign interference and control. Throughout this time the Hutu extremists, fondly called Hutu Power, commissioned jobless youths for military "civil defense", calling them the "*interahamwe*—'those who attack together'" (Gourevitch 93). Rallying the unmotivated boys around acceptance, while using incentives like offering free beer and teaching inclusive tactics that spun military drills as popular acts, Hutu power built their military base by brainwashing youth into believing that Hutu purity and aggression was necessary and acceptable (Gourevitch 93).

As both Malkki and Gourevitch attempted, one can only try to study the complex situation through the people who experienced it.

Nevertheless, ascertaining the facts from a culture with an oral tradition dominated by power, desire, and rhetoric mars the effort and muddles the details of the truth. Even Appadurai, who only looked at a minute aspect of violence concerning people who lived in intimate proximity to one another, found difficulty in clearly defining and explaining genocidal acts, only claiming that "these actions indicate a deep and dramatic uncertainty about the ethnic self" (322). Adding to the trouble of gathering answers for the heavy questions relating to genocide is the "epidemic of shame...collusion of silence, and [the] violent need for forgetting" that occurs after the fact (322). Without the support and rationalization provided by propaganda pushers who used radio and newspaper communication as tools to instigate violence, the initial adrenaline rush and supposedly "cathartic" feeling disappeared and only the gross aftereffects remained. In this sobering state, left with hard reality and deadly consequences, the individuals who previously conformed to attain certainty experience a resurgence of uncertainty that only "add[s] underground fuel for new episodes of violence" as they try again to find themselves at any risk (322).

Yet, there are no easy answers for a chain of violence perpetuated and complicated with each new generation reacting to the brutal past. Looking at former times, this cycle is a cornerstone to the history of central Africa, but there is no specific side to blame. Using an "us versus them" dichotomy, all competing groups strive to empower themselves by justifying their actions and defending against the "other". Struggling for this power, both sides condone malice and reinvent the details of morality in order to improve their chance to prosper. In an ambiguous history with no clear-cut facts, physical features or inherent essence cannot define people—only their actions. Morality is a conception of humanity, relative to the society in which it functions. If the labels "good" and "bad" don't apply in these tempestuous realms then there are no innocents, just the ruthless and the helpless.

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Paige Snyder

Occupied Kultur: Cold War Competition and Musical Renaissance in Post-World War II Germany

When Soviet occupiers marched into Berlin in May 1945, they found the once vibrant city decimated by the reality of defeat. Streets, neighborhoods, and businesses were replaced by heaps of rubble. The scene was the same all across the country. But more damaging to Germans than their ruined cities was their tattered identity. Germans had understood themselves as the bearers of high culture, a notion that existed long before Hitler reinforced it with his assertions of German superiority.¹ But after years of war and a crushing loss, cultural life in Germany had all but disappeared. Music halls, sets, costumes, and instruments had all been destroyed in bombings. Additionally, after Nazi Propaganda Minister Joseph Goebbels announced "total war" in August of 1944, most opera and orchestral productions ceased and musicians were no longer playing music.² After the war, the Allied occupiers, understanding that art and specifically music was a critical component of Germans' self-awareness, went to great lengths to revitalize German music culture. In doing this, the Allies hoped to not only eliminate any lingering effects of Nazism in music, but to promote their own cultural traditions as well. Ideological differences, especially between the United States and the Soviet Union, put the Allies at odds over denazification and reeducation procedures. However, it was specifically this Cold War animosity and competitiveness that inspired each side to push its cultural agenda in its respective sector, opening the door for innovative art and sparking a musical rebirth in Germany.

¹ Michael H. Kater, "Introduction" in *Music and Nazism: Art Under Tyranny, 1933-1945* (Laaber, Germany: Laaber-Verlag, 2003), 9.

² David Monod, *Settling Scores: German Music, Denazification, and the Americans, 1945-1953*. (Chapel Hill, NC: The University of North Carolina Press, 2005), 24.

Music had been used as a political tool in Germany long before the Cold War. Nazi influence on music was considerable, perhaps most obviously in the persecution of Jewish composers and musicians. The Nazis banned their music and forced them out of Germany, either into concentration camps or into exile, often in America. Those non-Jewish musicians who remained enjoyed great public acclaim, state support, and career success.³ The Nazis also used music as a manipulative military technique, conditioning Germans from the time they were children to think of themselves as a part of a strong nationalist movement. Constantly hearing Hitler Youth songs had the subconscious effect of making adolescents act, as historian Michael H. Kater explained, “uniformly for the regime: sing in unison, march in unison, and ultimately man the trenches, shoot, and kill as a united army.”⁴ But the most important role music played in the Third Reich was fortifying the national identity. The Nazis claimed that the classical titans that Germany produced and their prominence in Western culture was proof of the country’s superiority. Of course, Germans had long thought of their country as more culturally advanced than others, but by appealing to the people’s special relationship with German music and by venerating renowned German composers, the Nazis managed to place their Reich neatly in sync with the nation’s cultural glories.

This was a considerable problem for the occupiers, who were left with the thorny task of eradicating National Socialism, not merely in government but in the hearts and minds of Germans also. This was a difficult chore: the Allies had to purge Nazism but not appear as authoritarian as the Nazis, all while pushing their own political agendas and still preserving the spirit of the German people. There were drastic reforms to all aspects of German life that had been tainted by the Nazis, from the administrative bureaucracy to the military. But the occupiers, realizing that *Kultur* was such a vital aspect of national identification, also targeted classical music as part of their reeducation programs.⁵

³ Christopher Fox, “Music After Zero Hour,” *Contemporary Music Review* 26.1 (2007): 7.

⁴ Kater 10.

⁵ Monod, *Settling Scores* 4.

The Soviets wasted no time in resurrecting Berlin’s music scene, allowing the Berlin Philharmonic Orchestra (BPO) to organize only five days after the Germans surrendered and rehearse eight days after that.⁶ In authorizing the recuperation of the BPO, the Soviets sought to earn the support of the musicians and intellectuals of Berlin by “cast[ing] themselves as the champions of German cultural tradition.”⁷ As despicable as their actions were towards the general German public, the Soviets were well liked by the musicians and intellectuals because they fraternized with the Germans and revered German music. Indeed, the Soviets and Germans had similar musical traditions. Both believed it was the state’s responsibility to “sponsor, guide, and protect the arts” and both “viewed the arts as an integral aspect of society and were well versed in the European canon of high culture.”⁸ Because the Soviets had the same attitude towards the importance of music in society and the centralized coordination of music as the Nazis, they failed to truly transform music culture in Germany. This laxity extended to Soviet policies of denazification as well. Theirs was a “the show must go on” policy, and instead of trying to rid musical culture of the effects of Nazism, they overlooked musicians’ ties to the Nazis if they were especially talented or cooperated with the Communist military government. To be sure, the Soviets tried to influence musical culture by situating exiled German Communists at top positions in arts departments⁹, but overall their jockeying for the loyalty of the German people, their admiration of German classical music, and their belief that the state ought to subsidize and promote the arts hindered any real attempt at Soviet denazification and reform in music culture.

By the time the Americans arrived in Berlin, the Soviets had already established cultural institutions and American officers were not happy with those arrangements. Whereas the Soviets were willing to excuse musicians’ affiliations with the Nazis, the Americans were

⁶ Amy C. Beal, “Reorchestrating Germany’s Culture: Music after World War II,” *Humanities* 27.6 (2006): 46.

⁷ Elizabeth Janik, “The Golden Hunger Years: Music and Superpower Rivalry in Occupied Berlin,” *German History* 22.1 (2004): 81.

⁸ Janik 82-83.

⁹ Janik 84.

determined to eliminate all traces of National Socialism in German music and life. Their harsh policies of denazification stemmed from their general opinions of Germans as inherently nationalistic, chauvinistic, and militaristic, with Nazism being simply the “latest and most vile manifestation of the German cultural and social character.”¹⁰ In order to ensure that the Third Reich would be the last of such manifestations, Americans barred anyone they associated with National Socialism from holding positions of authority. In the case of performers and composers, this meant that anyone who was a member of the Nazi Party, corroborated with Nazi policies, profited from Hitler’s cultural policies, was a nationalist, or believed in the superiority of German music could no longer work as a musician. In other words, most performers and composers were out of a job.¹¹ In order to comprehend this strict policy, it is important to suspend our contemporary understanding of culpability in regards to the crimes of the Third Reich. In the minds of the American occupiers, all Germans had an inclination towards aggression and hate; the only way to change that was to prevent the worst offenders from further influencing the rest of society.

What emerged from this was the systematic vetting and blacklisting of German musicians. In order to secure work as a musician, Germans had to fill out a series of forms and sit through a number of interviews concerning their role in the Reich. Americans used the lists to determine who was employable and in what field: “persons on the ‘black’ and ‘grey unacceptable’ lists were denied any work above manual labor (these were the ‘mandatory removals’); those on the ‘grey acceptable’ list were to be allowed to work at their profession but not hold ‘policy-making or executive positions’; and those on the ‘white’ list were free to take any job that was offered.” By mid-1946, those lists bore the names of approximately 10,000 Germans in the media and arts.¹²

The American program of denazification was baffling to Germans, who believed only the “xenophobic anti-Semites” could be justly

¹⁰ David Monod, “*Verklarte Nacht*: Denazifying musicians under American control” in *Music and Nazism: Art Under Tyranny, 1933-1945* (Laaber, Germany: Laaber-Verlag, 2003), 297.

¹¹ Monod, *Verklarte Nacht* 299.

¹² Monod, *Settling Scores* 47.

considered Nazis.¹³ Despite their distress over being universally dubbed National Socialists and criminals, musicians devised ways to skirt punishment. Many professed to have had good relationships with Jews and that they did everything they could safely have done to protect their Jewish friends. Some claimed to be unaware of the severity of the Nazis’ racial and social policies, that they had been too immersed in their work and compositions to notice the changes in the country. A common excuse was that they were forced to join but they were not ideologically committed to the Nazi cause. Others asserted that the fascists really did not like them, highlighting every bad review received or negative comment made about them during the Third Reich. Interestingly, the composer Wilhelm Furtwängler, whose close ties to the Nazi regime were well known, insisted that his performances were “gestures of defiance that the Nazis could not comprehend.”¹⁴ Still, it was obvious that the performers and composers who worked during Hitler’s reign prospered from his banishment of Jewish and non-German musicians and most continued to believe in German musical superiority. Thus, the Americans considered most of them guilty Nazis and eliminated them from German cultural life. Their purpose was not to rehabilitate individuals—to turn fascists into republicans—but to rehabilitate German society as a whole.

Beyond just removing musicians with National Socialist affiliations from prominent positions in musical life, American occupiers were also concerned with undoing the Nazis’ discriminatory cultural policies and establishing in their place new democratic values. But this was a delicate situation. Hitler had banned the performance of works by Jews or other so-called degenerate musicians. In order to reverse that policy, the Americans had to promote those forbidden works. But it was difficult to do so without legitimizing the Nazis’ racial myth. Further, they were concerned that authorizing the performances of Hitler-approved German classics would affirm Nazi values. Ultimately, they took the risk. The classics were approved, but not necessarily vigorously promoted by the Americans; they did, however, push the performances of formerly

¹³ Monod, *Settling Scores* 56.

¹⁴ Monod, *Settling Scores* 54.

banned music while hiding the fact that they were promoted primarily because they had been suppressed during Hitler's reign.¹⁵

Americans also had to assess the role of government in music. In the United States the arts were funded by private patrons; in Germany, it had been traditionally supported by public subsidies. But because Germany now lacked wealthy patrons, the Americans knew some kind of government subsidy was necessary to revitalize the music world. But a large, centralized government was "perceived by the Americans in 1945 as one of their former enemy's hereditary ailments." Therefore, the occupiers had to somehow meld the traditions of both America and Germany where "the power of the state in the arts would have to be held in check by the rights of the public and the freedom of the artists."¹⁶ In addressing the key to Germans' national identity—music—the Americans hoped that they would be able to reeducate, denazify, and democratize the rest of the population.

Unfortunately, the Allies' conflicting philosophies on denazification made it more difficult for the Americans to enforce their policies. Not all of the Allies shared the same beliefs about eradicating Nazism and the guilt of ordinary Germans and thus did not enforce the same restrictions as the Americans. Musicians that were barred from performing in the American sector were allowed to work in other sectors. For example, Wilhelm Furtwängler was blacklisted by the Americans and forbidden from occupying a prominent position in the American sector. The Soviets, however, ardently supported his return to conducting and let him perform in the Eastern sector. Americans had to consent to his return, which "pav[ed] the way for other musical celebrities of the Third Reich."¹⁷ The inconsistency regarding denazification among the Allies ultimately weakened American standards. Since they could not enforce their policies everywhere, they were forced to adapt them and accept what they considered to be unsubstantial programs for denazification.

The disharmony between the American and Soviet sectors was certainly not unusual in the years following World War II and its

¹⁵ Monod, *Settling Scores* 31-32, 99, 124.

¹⁶ Monod, *Settling Scores* 27.

¹⁷ Janik 92.

results were often disastrous. But in the case of German musical culture, the competition for loyalty and prestige turned the country, and particularly Berlin, into a vivacious center for the arts. Contending for local cultural prestige, the occupying powers organized art exhibitions, reopened theatres, and issued newspaper licenses.¹⁸ Of course, both sides also encouraged the growth of the music society. But while the Soviets promoted German works considerably more than Russian pieces, Americans promoted their own music as well as more innovative works that had been frowned upon by the Nazis.¹⁹ They saw American culture as the "vanguard of democratization" and promoted it whenever possible.²⁰ For instance, American musical celebrities were brought to Germany to perform not only for the military's occupying force but for local musicians as well. Jewish-American composer Leonard Bernstein was scheduled to conduct the Bavarian State Orchestra in Munich and, as one officer noted, he made quite an impression on Germany's musical elite: "As news of Bernstein's talent spread in the music community critics and conductors in the vicinity began to gather for the last two rehearsals. The surprise expressed all too frequently was that an American could come and teach Germans how to play." The success of this visit "paved the way for other American musicians, conductors, ensembles, and orchestras who toured Germany during the years of military occupation and after."²¹ More important than giving them a new stage on which to perform, the tours of American musicians opened Germans' eyes to the high standards of American music and helped them realize that fantastic talent existed outside of their country. They understood that their musical culture was not altogether superior to that of any other nation.

In promoting modern music, Americans hoped to show the Germans what they were missing during the Reich. In 1946, the heavily subsidized *Internationale Ferienkurse für Neue Musik* (IFNM) in Darmstadt

which "worked in tandem with radio stations to commission, record, and

¹⁸ Amy Beal, *New Music, New Allies* (Berkeley, CA: University of California Press, 2006), 20.

¹⁹ Janik 77.

²⁰ Monod, *Settling Scores* 118.

²¹ Beal, *New Music, New Allies* 22-23.

promote new repertoire” was established, opening doors for musicians wanting to experiment with music.²² It should be noted that the Americans perhaps naïvely thought that modern music was unavailable in Germany under Hitler. In truth, while the Nazis certainly did not like modern music, it was still available for German consumption and those who were already interested in contemporary music were far more knowledgeable than the Americans. Still, the promotion of modernism—albeit more accessible modernism that featured polytonal, polymodal, and polyrhythmic effects without “casting away from the traditional tonal moorings”²³ challenged audiences and pushed Germans’ musical boundaries, all while providing a sharp contrast to Soviet policies of music reform.

By 1948, the currency reform in the western sector sent Germany’s economy into a tailspin and led to the official division of Germany. The political crises that immediately followed in Cold War Germany—the Berlin blockade and airlift—both hold a pivotal place in history. But the musical culture of Germany was damaged by the introduction of the Deutsche Mark as well. Germans’ savings were wiped out and the prices of goods soared even higher than the black market prices immediately after the war. One consequence of all of this was that there was a return to a conservative trend in music. Because seeing a performance was now considered a luxury, Germans typically only went to productions of well-named stars.²⁴ Yet for those few years between the end of World War II and the beginning of the Cold War, Germany was once again a cultural jewel of the world. Attempting to win the support of Germans and revolutionize the country, the Americans and Soviets initiated cultural policies that enabled Germans to not only embrace their own classics, but also experiment and broaden the definition of what is high German culture.

²² Joy H. Calico, “Schoenberg’s Symbolic Remigration: A *Survivor from Warsaw* in Postwar Germany,” *Journal of Musicology* 26.1 (2009): 18.

²³ Monod, *Settling Scores* 125.

²⁴ Monod, *Settling Scores* 182, 193.

Nicholas Ball

Getting to the Root of the Problem: An Introduction to Fibonacci’s Method of Finding Square Roots of Integers

x

Introduction

Leonardo of Pisa, famously known as Fibonacci, provided extensive works to the mathematical community in the early 1200’s, many of which still influence modern mathematics. He experienced arithmetical studies in northern Africa and the Mediterranean, and later exposed his knowledge to larger portions of the world [3, 336]. Fibonacci provided numerous works on the practical applications of mathematics, many of which are explored in his *De Practica Geometrie*. Included in this book are his methods of finding square roots and cube roots, along with how to perform operations with such, which he demonstrated has useful practical applications in geometrical calculations.

One may find Fibonacci’s method of finding the square roots of integers to be interesting, considering most people nowadays depend on a calculator to find such values for them. However, it first must be noted that this mathematician was not the first to explore this topic. The Rhind Papyrus suggests the ancient Egyptians explored this topic earlier than 1650 BCE [1, 30]. Square roots were also studied in ancient India, among many other places. As discussed in the commentary of *De Practica Geometrie* [2, 37], a technique for approximating square roots long before Fibonacci entailed the following: if N is the integer you wish to square root, let $N = a^2 + r$, where a^2 is the largest integer value squared which is less than N , and r is the difference between a^2 and N (for example, 107 would be represented as $10^2 + 7$). A close approximation of the square root of N is $\sqrt{N} = a + r/(2a + 1)$. Traveling to different parts of the world,

Fibonacci acquired knowledge such as this and applied it to his method of finding roots.

Precursors for Fibonacci’s Calculation of Square Roots of Integers

Fibonacci aspired to find simple and relatively far less time-consuming methods of deriving the square roots of quantities. Most astonishing is the fact that he accomplished what he did without the use of symbols, relying only on explanation via words. However, the lack of symbols, along with the lack of explanation in Fibonacci’s works limits the clarity with which a reader can interpret his methods. Modern notation allows us to tackle the task of calculating roots by hand in a much clearer fashion.

To begin root calculations by hand for Fibonacci’s method, it was important to know some simple but essential facts about the roots of numbers. Not surprisingly, it was emphasized that the first ten squares be memorized, for aid in simple calculation: that $1^2 = 1$, $2^2 = 4$, $3^2 = 9$, ..., $10^2 = 100$. Furthermore, it was of utmost importance that a certain property about the relation between an integer and its square root be acknowledged: that the number of digits that represent an integer will determine the number of digits that will represent its root. The following table demonstrates this [2, 38]:

Table

# of digits in integer number	1	2	3	4	5	6	7	8	...
# of digits in integer part of root	1	1	2	2	3	3	4	4	...

Also, it is important to understand Fibonacci’s notation. When he states that the root of an integer is arr , he means that the original integer must be in the form a^2+r , where a and r are both positive integers (and “r” means “root”). In the example below of 864, the root of 864 is found to be $29r23$, meaning $864 = 29^2 + 23$. Considering these facts about numbers and their roots, along with Fibonacci’s notation, one can commence the calculating process.

Simple Cases

Fortunately for modern mathematicians, where Fibonacci lacked in clarity he exhausted in demonstration. It is important to consider a few particular cases of calculation Fibonacci provided, along with his means of verbalizing techniques used, to fully grasp the nature of these hand calculations.

As a first example, Fibonacci demonstrated how to find the (square) root of 864 [2, 40]. Below is the image of what the hand calculation would look like as provided in *De Practica Geometrie*: [My comments are in square brackets and smaller font.]

(23 [23 is the remainder r])

```

1
4 0
8 6 4
  2 9 [29 is the integer part of root]
    4

```

The following is the explanation taken directly out his book [2, 40] on how to complete this hand calculation (as so much of Fibonacci’s work was written in words rather than symbols), and following that will be a more modern interpretation.

If you wish to find the root of 864, put 2 under the 6 because 2 is the whole root of 8 [that is, 2 is the largest integer so that its square is less than or equal to 8]. Put the remainder 4 above the 8. Then double 2 to get 4 placing it under the 2. Form 46 from the 4 above the 8 and the 6 in the second place. Now divide the new number 46 by 4 to get 11. From this division we get an idea of the following first digit which must be multiplied by twice the digit you already found. Afterwards, square it. The digit is a little less or exactly as much as what comes from the

division. Practice with this procedure will perfect you. So we choose 9 since it is less than 11, and put it under the first digit [Fibonacci used a practice of “guessing” what this number would be, as appropriate for the problem. For this problem, he guessed 9, because only a one digit number can fit in the one digit space under 4 in this case, and 9 is the largest one digit number. Unfortunately, Fibonacci did not demonstrate much of an explanation or justification for procedures such as this, as will be reflected further in later examples]. Multiply 9 by 4 (twice the second term) and subtract the product from 46. The remainder is 10. Put 0 over the 6 and 1 above the 4. Join 10 with 4 in the first place to make 104. Subtract the square of 9 from it to get 23. This is less than 29 the root that has been found [Furthermore, Fibonacci knew that $r \leq 2a$ where N is represented as $N = a^2+r$ for the least misleading representation of the root. For example, the root of 107 could be represented as 9r26, meaning $9^2 + 26 = 107$, but since $26 > 9*2$, we know a better representation of the root of 107 must exist, namely 10r7.].

Interpreting this method verbalized in words can be very tricky, especially considering the differences in terminology and notation which we use today. For any number, what we would refer to as the last digit he would refer to as the first, which is based off the right-to-left Arabic writing style [2, 35]. For example, the digit 8 in 864 would be considered the last digit of the number. Additionally, the method itself should seem alien in its nature to most modern readers, as it is “essentially the tremendously tedious technique of the Hindus”, as referred to in the commentary of the textbook [2, 35].

In my modern interpretation of the root-finding method, I

will provide subscript notation to the numbers to indicate the order in which they are derived in the method, along with keeping the digits of the original number to be rooted in boldface type, in this case **864**, to avoid any confusion. Below is the image of the step-by-step handwritten process:

2_1 is placed below **6** because 2_1 is the greatest number whose square is less than or equal to **8** (because $2_1^2 = 4 < \mathbf{8}$). Notice that in this method the 2_1 is being placed below **6**, so that as **864** is a three digit number, its root will be a two digit number (refer to Table p. 54) This follows the aforementioned observation that Fibonacci made in terms of the relation between the number of digits of a number and its root, and this is applied to the technique of finding roots in all of Fibonacci’s examples.

$$\begin{array}{r} \mathbf{8\ 6\ 4} \\ 2_1 \end{array}$$

Moving along, $4_2 = \mathbf{8} - 2_1^2$, the calculation of the difference between **8** and the greatest square less than it.

$$\begin{array}{r} 4_2 \\ \mathbf{8\ 6\ 4} \\ 2_1 \end{array}$$

$$4_3 = 2_1 * 2.$$

$$\begin{array}{r} 4_2 \\ \mathbf{8\ 6\ 4} \\ 2_1 \\ 4_3 \end{array}$$

9_4 is derived in a more complicated manner. On the diagonal in the handwritten calculation, 4_2 and **6** make the value 46. $46/4_3 = 11 + b$ (b being a remainder). Hypothetically, if the value 11 was represented as a one digit number, at this point 11 would simply go in the one’s digit place on the right alongside 2_1 , which would yield 211 as the

integer part of the answer for the root of **864**. However, since this is not the case, further calculation is necessary to find the integer part of the root. Since 9 is the largest single digit number less than 11, 9_4 is placed to the right of 2_1 .

$$\begin{array}{r} 4_2 \\ \mathbf{8\ 6\ 4} \\ 2_1\ 9_4 \\ 4_3 \end{array}$$

Then $46 - 9_4 * 4_3 = 10$ (recall 46 is from the diagonal of 4_2 and **6**), yielding the 1_5 and 0_5 which, with **4**, make 104 on the diagonal.

$$\begin{array}{r} 1_5 \\ 4_2\ 0_5 \\ \mathbf{8\ 6\ 4} \\ 2_1\ 9_4 \\ 4_3 \end{array}$$

$104 - 9_4^2 = 23$, which is the remainder of the root. So the root of **864** is 29r23.

The method functions similarly when working with other numbers. For example, below is my modified version demonstrating the steps to finding the square root of 1234 [2, 41]: To begin, note that 3_1 is placed in the ten's digit place under **3**, as since **1234** is a four digit number, its root must be a two digit number (again, refer to Table p. 54) One can see how the process is similar: 3_1 is the largest number so that its square is less than or equal to **12**,

$$\begin{array}{r} \mathbf{1\ 2\ 3\ 4} \\ 3_1 \end{array}$$

3_2 is $12 - 3_1^2$,

$$\begin{array}{r} 3_2 \\ \mathbf{1\ 2\ 3\ 4} \\ 3_1 \end{array}$$

6_3 is $3_1 * 2$,

$$\begin{array}{r} 3_2 \\ \mathbf{1\ 2\ 3\ 4} \\ 3_1 \\ 6_3 \end{array}$$

and 5_4 is derived from $33/6_3$ (minus remainder $b = 3$), where 33 is composed of 3_2 and **3** on the diagonal.

$$\begin{array}{r} 3_2 \\ \mathbf{1\ 2\ 3\ 4} \\ 3_1\ 5_4 \\ 6_3 \end{array}$$

However, since 5_4 is a one digit number (as opposed to the two digit 11 replaced by 9_4 in the case of 864), the calculation following is a little bit simpler than for finding the root of 864 (for 1234, no second diagonal will need to be formed, unlike the 104 for the case of 864; an analogy can be made to adding large digit numbers by hand: when two numbers added yield a one digit number, it can be left as is, but if the sum yields a two digit number, the extra step of carrying the one must be made. This seems worth noting as Fibonacci's method of hand calculation seems to resemble the nature of hand calculations for basic arithmetic. Unfortunately, Fibonacci's demonstration is devoid of an explanation of why this works.). So it is already known that the integer part of the value of the root of 1234 is 35, all that is left is to find the remainder. To do this, recall the remainder of $33/6_3$ is $b = 3$. This 3 joined with **4** makes 34, and $34 - 5_4^2 = 9$. Thus the root of **1234** is 35r9.

Complications in Subtleties in Calculations

It is important to note the differences in calculation when the first diagonal divided by some one digit value x_3 equals a two digit number versus when it equals a one digit number. Furthermore, there are other small differences in calculation steps when other similar situations arise. Unfortunately, Fibonacci's methods are exceptionally vague for some specific cases.

Such an example is for finding the root of 153 [2, 39]. Unlike

the previously discussed root finding methods for 864 and 1234, for 153 Fibonacci finds both digits of the integer part of the root in a single step: “You will find the root of 1 in the third place to be 1. Place it under the 5 and put 2 before it under the 3.” Fibonacci spends the rest of the demonstration calculating the remainder. He does not explain how he was able to find the one’s place digit of the root, 2, in the same step as finding the ten’s place digit, 1. Perhaps his reasoning lay in the fact that the square root of 1 is 1 as well, so the 2 in the one’s place of the root can be found in the simple method that all first digits of roots can be found: 2 being the largest integer in which its square is less than or equal to the middle digit 5 of the number 153 ($2^2 = 4 \leq 5$).

$$\begin{array}{r} 1 \quad (9 \\ 1 \ 5 \ 3 \\ 1 \ 2 \end{array}$$

Although Fibonacci’s choice to skip the steps in demonstration which he did not ignore for 864 and 1234 may be misleading, one can find the root of 153 by the same method as demonstrated with these two already explored numbers. Again, the boldface and subscript notation will be used in my demonstration: 1_1 is the largest number whose square is less than or equal to 1 .

$$\begin{array}{r} \mathbf{1 \ 5 \ 3} \\ 1_1 \end{array}$$

O_2 is $1^2 - 1_1^2$.

$$\begin{array}{r} O_2 \\ \mathbf{1 \ 5 \ 3} \\ 1_1 \end{array}$$

2_3 is $1_1 * 2$.

$$\begin{array}{r} O_2 \\ \mathbf{1 \ 5 \ 3} \\ 1_1 \\ 2_3 \end{array}$$

2_4 is derived from $5/2_3$ (minus remainder $b = 1_5$), where 5 is composed of O_2 and 5 on the diagonal.

$$\begin{array}{r} O_2 \\ \mathbf{1 \ 5 \ 3} \\ 1_1 \ 2_4 \\ 2_3 \end{array}$$

$$\begin{array}{r} O_2 \ 1_5 \\ \mathbf{1 \ 5 \ 3} \\ 1_1 \ 2_4 \\ 2_3 \end{array}$$

To find the remainder, as demonstrated in the method before, 1_5 composed with 3 makes 13. $13 - 2_4^2 = 9$. So the root of 153 is $12r9$. This result matches the result Fibonacci achieved while “skipping steps” in solving for this root. From this, it can be concluded that at least in the specific case of 153, and perhaps in the cases of all the numbers whose largest digit’s place is 1, the “skipping step” method of finding more than one digit of the root in a single step is possible. However, for the modern student of mathematics, how to make calculations only in very specific cases is not very useful; it is better to have an overall general algorithm which can be applied to all cases.

In finding the root of 960 [2, 40], it can be found that attempting to formulate a general algorithm for Fibonacci’s method will reach complications. As with 153, steps that would aid in clarification for demonstration are omitted by Fibonacci for 960.

$$\begin{array}{r} \text{(60)} \\ 9\ 6\ 0 \\ 3\ 0 \\ 6 \end{array}$$

As with the case of 153, one may attempt to calculate the root of 960 without skipping steps, to assure that the method continues to work for this case:

Following the usual process, 3₁ is the largest integer so that its square is less than or equal to 9.

$$\begin{array}{r} 9\ 6\ 0 \\ 3_1 \end{array}$$

o₂ is 9² - 3₁².

$$\begin{array}{r} o_2 \\ 9\ 6\ 0 \\ 3_1 \end{array}$$

6₃ = 3₁ * 2.

$$\begin{array}{r} o_2 \\ 9\ 6\ 0 \\ 3_1 \\ 6_3 \end{array}$$

To find the one's place digit of the root, o₂ is composed with 6, yielding 6. This 6 is divided by 6₃, with the quotient equaling 1₄ (with remainder b = o₅).

$$\begin{array}{r} o_2 \\ 9\ 6\ 0 \\ 3_1\ 1_4 \\ 6_3 \end{array}$$

$$\begin{array}{r} o_2\ o_5 \\ 9\ 6\ 0 \\ 3_1\ 1_4 \\ 6_3 \end{array}$$

However, this would mean that the integer part of the root of 960 would be 31, not 30 as Fibonacci showed. Additionally, the process would yield the remainder part of the root $r = -1$ (where o₅ is composed with 0, then $0 - 1_4^2 = -1$), so that the result would be 31r(-1). Although putting this in the form $N = a^2 + r$ works, as $31^2 + (-1) = 960$, this does not follow Fibonacci's simple format for representing square roots, in which negative values were avoided. This comes to show that the method of finding and representing roots as discussed so far in this paper is not general. There are many algebraic subtleties which Fibonacci did not bother to explain in his demonstrations of these calculations. It may lead one to question what can be learned from Fibonacci's demonstrations for finding roots overall, and what precautions must be taken.

In order to find what general observations may be made about Fibonacci's methods for finding roots, first, it seems wise to consider all other concerned examples in *De Practica Geometrie* which demonstrate unique properties and methods worth noting. To begin, consider the finding of the root of 8172 [2, 42].

$$\begin{array}{r} \text{(72)} \\ 8\ 1\ 7\ 2 \\ 9\ 0 \\ 1\ 8 \end{array}$$

As with the case of 1234, the largest digit of the root of 8172 will be in the ten's place, as any four digit number has a two digit root (see Table p. 54) and from the usual method, this digit in the ten's place will be 9. As usual, the number to be placed under the 9 should be simply 9 * 2. However, this is a two digit number, 18. A new special case has arisen. Fibonacci describes:

simple cases should be handled with ease. Here composed is a short list of traits found uniform in Fibonacci's methods which can be considerably useful:

1. Obtaining the "last" (that is, of largest place value) digits of a root is always simple.
2. Obtaining the "first" digits of a root can be a difficult task, depending on the subtleties of the specific case. This is where Fibonacci's demonstrations were significantly obscure. However, in general, the method for finding the "first" digits requires a sort of "guessing" nonetheless, and if all else fails, one can easily check a calculation by simply squaring it (Fibonacci actually includes a demonstration for checking a calculation, but such will be omitted here).
3. For larger numbers (five digits or more), it is necessary to find the root of the "last" digits first in a separate calculation.
4. Obtaining the remainder value r also can be a difficult task, depending on the specific case. However, as a criticism against Fibonacci's method, it seems that actually calculating the remainder in the way that he did was not necessary. Simply, a root $\sqrt{N} = ar + r$ with remainder equaling r means $N = a^2 + r$, so once the integer part of the root is found, no more calculation is necessary.
5. Where N is represented as $N = a^2 + r$, we need $r \leq 2a$ for the best representation of the root.

Relief! A Modern Method; and Conclusion

Quite fortunately, in the modern world humanity is blessed with a square root finding algorithm which is general enough to work in all cases. Here is a useful example [4, 1]:

Find $\sqrt{645}$ to one decimal place. First group the numbers under the root in pairs from right to left, leaving either one or two digits on the left (6 in this case). For each pair of numbers you will get one digit in the square root. To start, find a number whose square is less than or

equal to the first pair or first number, and write it above the square root line (2).

$\begin{array}{r} 2 \\ \sqrt{6.45} \end{array}$		
$\begin{array}{r} 2 \\ \sqrt{6.45} \\ -4 \\ \hline 245 \end{array}$	$\begin{array}{r} 2 \\ \sqrt{6.45} \\ -4 \\ \hline (4 \ _) \ 245 \end{array}$	$\begin{array}{r} 2 \\ \sqrt{6.45} \\ -4 \\ \hline (45) \ 245 \end{array}$

Square the 2, giving 4, write that underneath the 6, and subtract. Bring down the next pair of digits.

Then double the number above the square root symbol line (highlighted), and write it down in parenthesis with an empty line next to it as shown.

Next think what single digit number *something* could go on the empty line so that forty-*something* times *something* would be less than or equal to 245. $45 \times 5 = 225$
 $46 \times 6 = 276$, so 5 works.

$$\begin{array}{r}
 25 \\
 \sqrt{6.45.00} \\
 -4 \\
 (45) 245 \\
 -225 \\
 \hline
 2000
 \end{array}$$

Write 5 on top of line.
Calculate 5 x 45, write that below 245, subtract, bring down the next pair of digits (in this case the decimal digits 00).

$$\begin{array}{r}
 25 \\
 \sqrt{6.45.00} \\
 -4 \\
 (45) 245 \\
 -225 \\
 \hline
 (50)2000
 \end{array}$$

Then double the number above the line (25), and write the doubled number (50) in parenthesis with an empty line next to it as indicated.

$$\begin{array}{r}
 25.3 \\
 \sqrt{6.45.00} \\
 -4 \\
 (45) 245 \\
 -225 \\
 \hline
 (503)2000
 \end{array}$$

Think what single digit number *something* could go on the empty line so that five hundred-*something* times *something* would be less than or equal to 2000.
 $503 \times 3 = 1509$
 $504 \times 4 = 2016$, so 3 works.

$$\begin{array}{r}
 25.3 \\
 \sqrt{6.45.00.00} \\
 -4 \\
 (45) 245 \\
 -225 \\
 \hline
 (503)2000 \\
 -1509 \\
 \hline
 49100
 \end{array}$$

Calculate 3 x 503, write that below 2000, subtract, bring down the next digits.

$$\begin{array}{r}
 25.3 \\
 \sqrt{6.45.00.00} \\
 -4 \\
 (45) 245 \\
 -225 \\
 \hline
 (503)2000 \\
 -1509 \\
 \hline
 (506)49100
 \end{array}$$

Then double the 'number' 253 which is above the line (ignoring the decimal point), and write the doubled number 506 in parenthesis with an empty line next to it as indicated:

$$\begin{array}{r}
 25.39 \\
 \sqrt{6.45.00.00} \\
 -4 \\
 (45) 245 \\
 -225 \\
 \hline
 (503)2000 \\
 -1509 \\
 \hline
 (506)49100
 \end{array}$$

$5068 \times 8 = 40544$
 $5069 \times 9 = 45621$, which is less than 49100, so 9 works.

Thus to one decimal place, $\sqrt{645} = 25.4$.

From this, one can greatly appreciate the centuries of experience today's mathematical community has over the one in which Fibonacci was exposed. However, notice the similarities in some of the techniques between the modern method and Fibonacci's, and the similarities in mathematical properties considered. Indeed, Fibonacci could have very well been on the way to creating a more general method for finding roots, and if nothing more, his methods were at least accurate and usable enough for the community in which he prospered as a mathematician.

For those curious about the more in-depth mechanisms of Fibonacci's methods of finding the square roots of integers, along with finding the square roots of irrationals, finding cube roots, and performing the operations addition, subtraction, multiplication, and division with roots, it is suggested that one refers to *De Practica Geometrie* for further study. One may refer to Euclid's *Elements (II.4)* to understand the old technique of the Hindus [2, 35]. Portions of Fibonacci's *Liber Abaci* can also be found useful. So much can be learned from the old techniques Fibonacci exhibited, and further study can reveal even more intriguing characteristics in all of which the mathematician studied involving roots, including all the interesting and unique practical applications he demonstrated.

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Derek Jenkins

The Effect of the Bologna Process on Select Musical Institutions in Europe

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Due to the ever-increasing globalization and technological advances in recent years, higher education institutions around the world are beginning colossal overhauls on their programs to coincide with the cross-cultural demands of their students and the international workplace. This is particularly evident in the European Union's recently initiated education reforms. Using the United States as its model, the E.U. has begun a process of restructuring that will allow for a greater influx of students crossing international borders for their educational development, both in Europe and quite possibly between Europe and the United States. This education reform is known as the Bologna Process, which is part of the Bologna Declaration, and has affected many aspects of the European academia, ranging from degree curriculum restructuring to government-supported international student exchange programs.

The Bologna Process

Forty-six countries ratified the Bologna Declaration at the University of Bologna in Italy in 1999. Despite the E.U. only having twenty-seven members currently (plus Andorra, Monaco, San Marino, and the Vatican as recognized microstates), the Bologna Process reaches beyond the E.U.'s borders and allows countries to participate that are presently recognized as candidates for E.U. accession (Croatia, Iceland, and Macedonia); that will, due to proximity and location, probably be considered for accession into the E.U. at some point in the future (Albania, Montenegro, and Serbia); and that have a currently undetermined future within the E.U., particularly the countries in the Caucasus region of Eurasia.¹ Even with these differences, the nations

¹ Benelux Bologna Secretariat, "Participating countries and organizations," Bologna Process. <http://www.ond.vlaanderen.be/hogeronderwijs/bologna/pcao/index.htm> (ac-

cessed November 14, 2009).
- facilitate mobility of students, graduates and higher education staff;
- prepare students for their future careers and for life as active citizens in democratic societies, and support their personal development;
- offer broad access to high-quality higher education, based on democratic principles and academic freedom.²

While the Bologna Process is helping to initiate educational reforms in Europe, a fine line has to be traversed. Unlike in the United States where there is a federal government consisting of fifty dependent states, the E.U. is a coalition of individual nations, each with its own laws, cultures, ethnic and moral values, and in most cases, language. The Bologna Process, as with any legislation enacted by the European Commission, needs to uphold "[t]he fundamental principles of autonomy and diversity"³ inherent within each country. While it may look as such to the outsider, the Bologna Process "is not a path towards 'standardization' or 'uniformi[ty]' of European higher education."⁴ It is merely "a commitment freely taken by each signatory country to reform its own higher education system in order to create overall *convergence* at the European level."⁵ In addition, the reforms are designed to create:

- easily readable and comparable degrees organized in a three-cycle structure (e.g., bachelor-master-doctorate): countries are currently setting up national qualifications frameworks that are compatible with the overarching framework of qualifications for the European Higher Education Area and define learning outcomes for each of the three cycles.
- fair recognition of foreign degrees and other higher education qualifications in accordance with the Council of Europe/UNESCO

cessed November 14, 2009).

² Benelux Bologna Secretariat, "About the Bologna Process," Bologna Process. <http://www.ond.vlaanderen.be/hogeronderwijs/bologna/about/index.htm> (accessed November 14, 2009).

³ Walter Schludermann, "Unit 1: Bologna Process as a Stimulator of Academic Mobility," *Тексты для слушания (монологи).doc*, document presented to the author, February 5, 2009.

⁴ Ibid.

⁵ Ibid. Emphasis added by author.

Recognition Convention.⁶

More educational programs promoting the goals established by the EHEA have been instituted by the European Commission through the Bologna Process, like the current Lifelong Learning Program (2007-2013), because of this restructuring in the degree programs and changes made to grading systems. The Lifelong Learning Program was preceded by the Socrates Programs (Socrates: 1994-1999, Socrates II: 2000-2006). The Socrates Programs were implemented prior to the ratification of the Bologna Declaration and are built upon four basic divisions, each bearing the name of one of Europe's greatest thinkers and targeting its own particular type of participants. The four divisions are: Comenius (for primary and secondary schools), Erasmus (for higher education), Leonardo da Vinci (for vocational education and training), and Grunting (for adult education).⁷ There is a fifth division, Jean Monnet (first implemented in 1990), which focuses on "teaching, research and reflection on European integration in higher education institutions throughout the world".⁸ This fifth program has since been incorporated into the Lifelong Learning Program, and "has [now] been turned into a Programme at the same level as Erasmus and Leonardo da Vinci."⁹ Each program targets a specific audience, and they all share four basic aims: "policy co-operation, languages, information and communication technologies, effective dissemination and exploitation of project results."¹⁰

Through Erasmus, Leonardo da Vinci, and Jean Monnet programs, college-level students have been able to study abroad, either

6 Benelux Bologna Secretariat, "About the Bologna Process," Bologna Process. <http://www.ond.vlaanderen.be/hogeronderwijs/bologna/about/index.htm> (accessed November 14, 2009).

7 European Commission Education & Training, "A single umbrella for education and training programmes," European Commission. http://ec.europa.eu/education/lifelong-learning-programme/doc78_en.htm (accessed November 14, 2009).

8 European Commission Education & Training, "The Jean Monnet Programme for understanding European integration," European Commission. http://ec.europa.eu/education/lifelong-learning-programme/doc78_en.htm (accessed November 14, 2009).

9 Ibid.

10 European Commission Education & Training, "A single umbrella for education and training programmes," European Commission. http://ec.europa.eu/education/lifelong-learning-programme/doc78_en.htm (accessed November 14, 2009).

at institutions within the E.U. (via the Erasmus or the Leonardo da Vinci programs) or at organizations worldwide (as in the case of the Jean Monnet program) with government support. Unlike the other two college-level programs, Erasmus (which is a moniker derived from its official name: the *European Region Action Scheme for the Mobility of University Students*) focuses mainly on the educational cooperation and exchange of university-based students within the E.U. Its intent is to support:

- students studying abroad, doing a traineeship abroad, and with linguistic preparation
- university/higher education institute staff teaching abroad and receiving training abroad
- universities/higher education institutes with intensive programs, academic and structural networks, and multilateral projects
- enterprises hosting students' placements, teaching abroad, and participating in university cooperation projects.¹¹

To further promote international education cooperation, "a growing number of joint degree programmes are being developed across Europe"¹² where students spend significant periods of time at partner institutions; periods of study and exams passed at the partner institution[s] are recognized *fully* and *automatically* by all institutions involved; ...[and where] students who have completed the full programme should obtain a degree which is awarded jointly by the participating institutions, and is *fully* recognized in all countries.¹³

In addition to Erasmus, Lifelong Learning, and other such programs, the European Commission mandates that all countries participating in the Bologna Process award credit hours in the form of

11 European Commission Education & Training, "The Erasmus Programme," European Commission. http://ec.europa.eu/education/lifelong-learning-programme/doc80_en.htm (accessed November 14, 2009).

12 Benelux Bologna Secretariat, "The European Higher Education Area," Bologna Process. http://www.ond.vlaanderen.be/hogeronderwijs/bologna/documents/Bologna_leaflet_web.pdf (accessed November 14, 2009).

13 Ibid. Emphasis added by author.

European Credit Transfer and Accumulation System (or ECTS). The ECTS "...makes teaching and learning more transparent and facilitates the recognition of studies (formal, non-formal and informal). The system is used across Europe for credit transfer (student mobility) and credit accumulation (learning paths towards a degree). It also informs curriculum design and quality assurance."¹⁴ Most participating members have essentially shifted completely to ECTS. All of these educational changes in Europe are a decisive political movement for the internal stability of the E.U., and because of these modifications, students in Europe are being given freedom and mobility with their education development that has not yet been replicated anywhere else in the world.

Since 1999, all members have now "committed themselves to elaborating national frameworks for qualifications compatible with the overarching framework for qualifications in the EHEA by 2010, and to having started work on this by 2007."¹⁵ To comprehend the impact this process has had over the past two years, an understanding of current discrepancies in the education tracks within the E.U. is needed. Consider the pre-Bologna Process systems in Spain, Germany, and Croatia.

Degree and Grading Systems Before and After the Bologna Process

Prior to ratification, Spain had a three-degree system in place. The *Diplomado* was earned after three years of study. This was followed by the *Licenciado*, which required a total of five to six years of collegiate-level study (two to three years beyond the *Diplomado*), and was considered the equivalent to an American master's degree. Students could then pursue a *Título de Doctor* with additional study beyond the *Licenciado*.¹⁶ In Germany, there was only a two-cycle track for higher education. The first cycle, lasting normally five years, led to the *Diplom*

(regarded as comparable to a master's degree in the U.S.). This degree was the first and highest non-Ph.D. degree available in the country. The second cycle was for obtaining a Ph.D. (or an equivalent).

By 2010, many of the Bundesländer (or states) in Germany and their counterparts in Spain will have replaced their old systems with that of the Bologna Process.¹⁷ With the new system, a three-cycle track is utilized, and its similarity to the American system is remarkable. During the first cycle, "student work-load ranges from 1,500 to 1,800 hours for an academic year, and one credit corresponds to 25-30 hours of work."¹⁸ Given this, most students take around 60 ECTS per year (approximately 33 to 40 U.S. credits per year), and will receive a baccalaureate degree between 180 to 240 ECTS, or after three to four years. The second cycle is directed at receiving a master's degree. Coursework "typically include[s] 90-120 ECTS credits, with a minimum of 60 credits at the level of the 2nd cycle."¹⁹ (German institutions view the new master's degree as the equivalent to their old *Diplom*). The third cycle has no set number of required credits, but at most institutions a third degree (a Ph.D. or a comparable degree) is earned in about three years of post-master's studies. The same reconstruction of higher education systems is taking place in the majority of the other countries participating in the Bologna Process.

Some other countries, like Croatia, already had separate bachelor's and master's degree programs prior to the Bologna Declaration. For example, the Sveučilište u Zagrebu Muzička Academia (The University of Zagreb Music Academy), currently offers a four-year *Baccalaureus* (bachelor's) in *Kompozicija* (Music Composition) or *Kompozicija u teoriju* (Music Composition with Theory).²⁰ These

14 European Commission Education & Training, "European Credit Transfer and Accumulation System (ECTS)," European Commission. http://ec.europa.eu/education/lifelong-learning-policy/doc48_en.htm (accessed November 14, 2009).

15 Ministry of Education and Research, "The framework of qualifications for the European Higher Education Area," Bergen Communiqué. http://www.bologna-bergen2005.no/EN/BASIC/050520_Framework_qualifications.pdf (accessed November 14, 2009).

16 The European Education Directory, "Structure of Education System in Spain," World Higher Education Database (WHED). <http://www.euroeducation.net/prof/spainco.htm> (accessed November 14, 2009).

17 Ministry of Education and Research, "The framework of qualifications for the European Higher Education Area," Bergen Communiqué. http://www.bologna-bergen2005.no/EN/BASIC/050520_Framework_qualifications.pdf (accessed November 14, 2009).

18 European Commission Education & Training, "European Credit Transfer and Accumulation System (ECTS)," European Commission. http://ec.europa.eu/education/lifelong-learning-policy/doc48_en.htm (accessed November 14, 2009).

19 Ministry of Education and Research, "The framework of qualifications for the European Higher Education Area," Bergen Communiqué. http://www.bologna-bergen2005.no/EN/BASIC/050520_Framework_qualifications.pdf (accessed November 14, 2009).

20 Professor Vjekoslav Nježić of the Sveučilište u Zagrebu Muzička Academia, interview

programs are devised to lead directly into a one-year *Magisterij* (master's) in each of the respected fields, if the student is so inclined.²¹ Under the Bologna reforms, the four-year *Bacclareus* will become a three-year degree allotting its final year to the now expanded two-year *Magisterij*.²² The program will, as a result, still retain the overall five-year structure from post-high school to completion of the *Magisterij*.

While these changes to the degree system seem to be a necessity in our evermore connected world, many questions have been raised that can only be answered once more time has passed between the launch of the reforms and the present day. Such questions include: If the old German *Diplom* is the equivalent of the new master's degree, what is the relationship of the new bachelor's to the old system? If one obtains only a bachelor's degree, what value does it have in a country where no such lower degree existed previously? How does one compare a four-year pre-Bologna bachelor's to a three-year post-Bologna bachelor's, as will be the situation in Croatia?

To further expound upon other differences in education systems, one needs only consider the grading scales that each nation uses. Many countries, like the first two in the previous example, gave grades in the form of numbers (as opposed to the letter-type system in use in the United States). Spain uses a grading scale ranging from 0 to 10 (with 10 denoting the highest or best grade).²³ The grade scale is broken down farther into tenths of a point (e.g., 8.5 and 5.4). A grade of 5.0 or higher is passing.²⁴ German and Austrian institutions utilize only the integers 1 through 5 (with 1 as the highest).²⁵ All grades, with the exception of a 5, are considered to be passing.²⁶

with the author, 15-19 and 23-26 April 2009, Zagreb, Croatia.

²¹ Ibid.

²² Ibid.

²³ The European Education Directory, "Structure of Education System in Spain," World Higher Education Database (WHED). <http://www.euroeducation.net/prof/spainco.htm> (accessed November 14, 2009).

²⁴ Ibid.

²⁵ ISEP, "Country Handbooks: Austria | Education." http://www.isep.org/Students/Placed/handbook_education.asp?country=6 (accessed November 14, 2009).

²⁶ Ibid.

^{Fig. 1} The University of Alberta, "The ECTS grading scale." http://www.univ-ab.pt/servicos/rel_inter/gri/ECTS.htm

(accessed November 14, 2009).

The Bologna Process established the ECTS to unify the differences in grading systems, and the general outline, like the degree system restructuring, bears a striking similarity to the American grading system. Grades are earned on a letter-based system ranging from "A" to "F." A notable difference from the American system is the addition of the "E" and the "FX" grades. By converting grades earned at any institution from the national system into the ECTS, much trouble is alleviated in grade conversion and understanding of credit earned as a student progresses in and out of their native country during their academic formation. Many institutions are giving out grades utilizing both the ECTS and their national system (See Figure 1).

Yet there are some problems that have risen regarding this aspect of the reform. For example, Austria only has five marks for evaluation and ECTS has seven. Questions, like "Does a '4' count as a 'D' or an 'E'?", or in the case of Spain, "How can one denote the difference between an 8.2 and an 8.7?" have had to be considered.

The Austrian government, like their counterparts in Spain and Germany, has essentially restructured their education system to correspond to the reforms, as we shall see below.

An Austrian Institution in the Wake of Reform

Although Austria has implemented much of the Bologna Process's reforms, there remains evidence of holdovers from the older system. For starters, both pre- and post-Bologna grade systems (discussed earlier) are still in use at the Alpen-Adria-Universität Klagenfurt, as Figure 2 demonstrates.

While grades are issued using both the old and new systems, there is no mention of Semesterwochenstunden (literally, Semester Week Hours) of the pre-Bologna system, as the ECTS has completed monopolized credit distribution. Another curious addition to the Zeugnis is the use of English translations. This may, in part, be owed to the fact that the corresponding course was a class marketed to foreign exchange students and that "13% of the E.U. citizens speak English as a mother tongue, and 38% as a foreign language."²⁷ Yet by the sheer use of English, one can

²⁷ Walter Schludermann, "Unit 1: Bologna Process as a Stimulator of Academic Mobility," *Тексты для слушания (монологи).doc*, document presented to the author, February

see the attempt to bridge language boundaries and facilitate the mobility of students by using a language understood by at least half of the E.U. populace.

To see the attempts taken to create an international education system and its similarities with higher education in the States, let us compare the curriculum of the master's program in Musicology at the University of Missouri-Kansas City (UMKC) and the corresponding master's program (Angewandte Musikwissenschaft) at the Alpen-Adria-Universität Klagenfurt in Klagenfurt, Austria. A couple of quick disclaimers are need first. In Klagenfurt, the degree offered is a Master of Arts while at UMKC it is a Master of Music. Also at UMKC, the Musicology Department is part of the Conservatory of Music and Dance but the Angewandte Musikwissenschaft program is integrated into the Kulturwissenschaften (Cultural Studies Department), as the Alpen-Adria-Universität has no music department of its own but maintains a standing relationship with the Kärntner Landeskonservatorium (Carinthian Conservatory, also in Klagenfurt, Austria).²⁸

Required Courses ^a	U.S. Credits
Applied Music (Instrument or Voice Lessons)	2 credits
Music History	12 credits
Music Theory	3 credits
Pedagogy of Music History	3 credits
Introduction to Research and Bibliography in Music	3 credits
Advanced Research and Bibliography in Music	3 credits
Research Problems	2 credits
Thesis	6 credits
Electives	1-3 credits

The Master of Music in Musicology program at UMKC requires students to complete a minimum of 35 credits dispersed as follows:

A full-time master's student at UMKC takes at least nine credits each semester and generally graduates after two years of coursework. The Music History requirement consists of four courses and is subdivided into two periods (e.g., Music of the Classical Era, Music Since 1900:

5, 2009.

²⁸ Simone Heilgendorff, ed., "Angewandte Musikwissenschaft," Alpen-Adria-Universität Klagenfurt. http://www.uni-klu.ac.at/main/downloads/MusikWissFoldero7_NEU.pdf (accessed November 14, 2009).

1945 to the Present) and two of choice (e.g., Nineteenth-Century Nationalism in Music or Special Topics: Minimalism).²⁹ The Applied Music prerequisite is only required if entering students are not at the level deemed necessary by the applied faculty.³⁰ If the student is already performing at the appropriate level, then the two allotted credits are moved into the electives category.³¹ Due to institutions like NASM regulating the curriculum, this program is a good representation of an American Masters in Musicology degree program.

While some may claim that there are differences, miniscule as they may be, between an "of Music" degree and an "of Arts," for our purposes they will be considered as similar enough to be compared as equals in this study. The Master of Arts program in Angewandte Musikwissenschaft offered at the Alpen-Adria-Universität Klagenfurt has the following requirements:

Masterstudium (Course of Study) ^b	SWS ^c	ECTS	U.S. credits
Musikwissenschaft II (General Musicology) ^d	6	12	6 to 8 credits
Gebundene Wahlfächer IV: Musikwissenschaft III (Musicology Electives)	6	12	6 to 8 credits
Gebundene Wahlfächer V: Angewandte Komponenten III (Applied Component Electives)	6	12	6 to 8 credits
Angewandte Komponenten IV (Applied Occupational Field/Pedagogy)	6	12	6 to 8 credits
Partiturspiel/-lesen, Tonsatz, Musikalische Analyse, Musikalisches Hauptfach (Score Playing/Reading, Composition, Music Analysis, Major Subject)	9	18	10 to 12 credits
Freie Wahlfächer (Free Electives)	6	12	6 to 8 credits
Praktikum (Practical Training)	NA	6	3 to 4 credits
Kommissionelle Prüfung (Comprehensive Test)	NA	6	3 to 4 credits
Masterarbeit (Thesis)	NA	30	16 to 20 credits

Given these requirements, students must complete 120 ECTS (somewhere between 62 and 80 U.S. credits) for their master's degree, which coincides with the regulations mentioned earlier. This

²⁹ Conservatory of Music and Dance, "Master of Music in Musicology Required Courses," University of Missouri - Kansas City. http://web2.umkc.edu/catalog/Master_of_Music_in_Musicology_Required_Courses.html (accessed November 14, 2009).

³⁰ Ibid.

³¹ Ibid. Adapted from: Conservatory of Music and Dance, "Master of Music in Musicology Required Courses," University of Missouri - Kansas City. http://web2.umkc.edu/catalog/Master_of_Music_in_Musicology_Required_Courses.html (accessed November 14, 2009).

program is designed to usually take four semesters of coursework. The Musikwissenschaft component consists of art music divided into eras of four ECTS each: Music to 1600, Music to 1800, Music of the Nineteenth Century, and Music of the Twentieth/Twenty-First Centuries.³² The Gebundene Wahlfächer categories cover certain topics in a more in-depth scope (e.g., Music and Gender, Jazz Music, Music Aesthetics, Pedagogy, and Media/Music Competency).³³ While the number of required credits is nearly twice that of the UMKC program, a few things must be mentioned:

- The Bachelor of Arts program in Angewandte Musikwissenschaft at the Alpen-Adria-Universität Klagenfurt is a three-year degree,³⁴ whereas most U.S. undergraduate programs last four years. Additionally, UMKC does not offer a bachelor's in Musicology, only a master's.

- The Bachelor of Arts program in Klagenfurt consists of 180 ECTS (roughly between 90 and 110 U.S. credits),³⁵ but most undergraduate programs in the U.S. require around 130 credits.

- Students at the Alpen-Adria-Universität Klagenfurt take about the same number of ECTS each semester, regardless if they are working on a bachelor's or a master's.

So while it seems that there is more involved with the program in Klagenfurt, the two are essentially analogous. The main point in this comparison is to show that despite the fact that the total years needed for completion of the bachelor's/master's degree at the Alpen-Adria-Universität Klagenfurt is one less than the equivalent in the U.S., the breakdown of the basic curriculum between the two programs is quite similar. Both require "era"-focused courses, a pedagogical component,

³² Fakultät für Kulturwissenschaften. 2007. "Curriculum: Master of Arts Angewandte Musikwissenschaft," Alpen-Adria-Universität Klagenfurt, document presented to the author. Adapted from: Fakultät für Kulturwissenschaften. 2007. "Curriculum: Master of Arts Angewandte Musikwissenschaft," Alpen-Adria-Universität Klagenfurt, document presented to the author. SWS stands for *Semesterwochenstunden* (literally, Semester Week Hours). Translations provided by the author.

³³ Fakultät für Kulturwissenschaften. 2007. "Curriculum: Master of Arts Angewandte Musikwissenschaft," Alpen-Adria-Universität Klagenfurt, document presented to the author.

³⁴ Ibid.

³⁵ Fakultät für Kulturwissenschaften. 2007. "Curriculum: Bachelor of Arts Angewandte Musikwissenschaft," Alpen-Adria-Universität Klagenfurt, document presented to the author.

and theory-based courses, yet each student in both programs is given the chance to mold their respective program to fit their individual interests. Students can adapt their programs through a variety of choices, including general musicological classes, musicological electives, or general (music) electives.

Reactions to the Reforms

The Bologna Process has been receiving mixed reviews, especially in Spain, as its policies begin to take the place of the national systems. "In Spain, angry students have stepped up their protests by occupying university buildings, blocking train lines and interrupting senate meetings."³⁶ Most of the problems have resulted from the "recognition" or "value" of the new degrees. Many see the "formula... opted for will devalue first degrees. It will force students to complete an often expensive masters degree...to obtain the same recognition and job prospects they would formerly have earned with a first degree."³⁷ Yet despite the overtly negative response in Spain, most of the ratifying nations have seen comparatively little protest.

To the outsider, these changes seem rather simple. The reevaluating of courses from the previous credit systems to the new Bologna-imposed ECTS and the execution of the new degree hierarchy has essentially been completed in most of the participating countries. But problems are still being encountered in countries that developed after the fall of Communism like the Czech Republic and Croatia.

Unifying Education

One common misconception in regards to higher education is that there is only one way to educate. While in practice, there is a little truth to that statement, in education there tends to be a teacher or "someone with a certain degree of knowledge" who tries to impart a certain percentage of that knowledge onto his or her students or "those who are seeking knowledge." But it does not mean that the approaches to the idea of teaching or imparting knowledge are uniformly consistent

³⁶ Rebecca Warden, "SPAIN: Protests against Bologna begin to spread," *University World News* (2008), <http://www.universityworldnews.com/article.php?story=2008120509191347> (accessed November 14, 2009).

³⁷ Ibid.

or that all higher education institutions (or every teacher within a certain institution) utilize the same traditional lecture style method that many tend to associate with collegiate academic settings.

A great example of this deviation from the “norm” comes from the U.S. in the first half of the twentieth-century. Black Mountain College was situated in Black Mountain, North Carolina, and was operational from 1933-1956. “It was never accredited (although its students were routinely accepted at Harvard and other prestigious institutions),”³⁸ and many progressive thinkers and “greatly talented people [were] associated with the school [like]...artists Willem de Kooning, Franz Kline...composer John Cage, dancer-choreographers Merce Cunningham and Agnes de Mille.”³⁹ This institution essentially put the students in charge of their own education, as the students “in consultation with the faculty [would]...[continue] in the lower or Junior Division until they felt they had experienced various disciplines widely enough to move on to the Senior Division, where specialization began, tailored to...[each] individual student.”⁴⁰

Yet as a direct result of the world becoming more connected, educational differences, like those between Black Mountain College and the rest of the American higher education system, are disappearing in favor of a more unified way to educate people and regulate education standards. Across the U.S., educational standards are, for the most part, consistent from institution to institution, due to accreditation organizations, like NASM (National Association of Schools of Music). Yet, there are still discernable differences that can be noticed when comparing education practices between countries like Croatia with their equivalents in the rest of Europe and the U.S.

38 Warren Bennis and Patricia Ward Biederman, “Experiment at Black Mountain,” In *Organizing Genius* (New York: Basic Books, 1997), 142-70.

39 Ibid.

40 Ibid.

Croatia: Changes in Education *

One such central higher education institution in Croatia resides in its capital city, Zagreb. At the Sveučilište u Zagrebu Muzička Academia (The University of Zagreb Music Academy), many of the same degrees are offered as at its Western counterparts; part of this could be attributed to the influence of the Austro-Hungarian Empire up until the onset of the Great War. Students at the Muzička Academia can focus on many of the same topics offered at music schools across the globe, ranging from composition and theory to performance and music history. Let’s consider the composition program for a moment.

Composition students in Zagreb are paired individually with a professor for the duration of their residency at the university. Each composition professor has only one composition student and meets with this student between two and four hours each week. This means, at any given time, there can only be as many composition students as composition professors.

This strict one-to-one ratio of composition professors to composition students is rarely found in Western institutions, both in the U.S. and in Europe. The capitalist ideals held in the Western world would find the system in place in Zagreb extremely inefficient. From a purely administrative point of view, it would seem to be a rather ineffective way to utilize teachers. Professors are being paid full-time salaries to teach one student, privately, for four to five years at which time the student would graduate and one new student would then fill the vacancy. Beyond financial issues, questions are raised concerning the artistic development of the pupils. Many Westerners could see the lack of different perspectives from other professors and students as detrimental to a composer’s development. In the context of large composition programs at other universities, students have the chance to interact with many students (both older and younger), as well as additional professors.

They can bounce ideas off of one another, and learn from each other’s

*All of the factual information used throughout this section is derived from two sources: Professor Vjekoslav Nježić of the Sveučilište u Zagrebu Muzička Academia, interview with the author, 15-19 and 23-26 April 2009, Zagreb, Croatia and Muzička Academia, “Akademija,” Sveučilište u Zagrebu <http://www.muza.hr/hr/akademija/znacajke/> (accessed November 14, 2009).

successes and mistakes, ergo the more students, the more opportunities there are to learn. Without a wide array of perspectives, would not a student end up writing music just like his or her professor?

On the other side, however, there are several benefits to a system like the one in Zagreb. For example, composition students have a teacher who knows and understands them as people and as artists in addition to understanding their music to a much greater extent than a professor who only has a student for a semester or a year in the classroom environment. A program with many students makes it more difficult for students to develop their own personal style. With such a small number of composition majors at any given time, students have access to many more opportunities with much less competition than students in larger programs. Another benefit to the system in Zagreb is the effect it can have on professional life after schooling. According to the Sveučilište u Zagrebu Muzička Academia online faculty roster, there are currently six professors of Kompozicija (composition). Given the data from before, one can deduce that every five years six new composers will have graduated from the Muzička Academia. In a country of about 4,500,000 people (roughly the same size as South Carolina), having only one new composer enter the professional world per year gives each composer a chance to establish him or herself individually without the hindrance of being associated with a large graduating class of composers.

One could argue though that many colleges and universities throughout the U.S. and Western Europe have relatively small programs, and therefore have about the same ratio of composition students to composition professors as the Zagreb Academy. So is it merely a discussion of size? Do larger or smaller programs offer more opportunities for individual development? Or does the fact that the Zagreb Academy deliberately upholds its strict one-to-one ratio negate its inclusion as a “smaller” program? This is not the main point to be addressed here.

The central argument is that, due to the Bologna Process, more composition students will be accepted into the Zagreb program than before, and the effects of such a change are unknown. Will the

composition professors have to give less time than the currently mandated two to four hours per week to their students? How will this impact the students’ output? Are credits for composition lessons allotted in the same way despite dissimilarity between the amount of time given to each student? What happens if, or rather when, Croatia’s market for new composers becomes too saturated, and the ratio of the number of opportunities to the number of composers decreases?

The composition department at the Muzička Academia is not the only program impacted by the Bologna reforms. Another example comes from the Theory Department. Prior instruction in polyphony was slated for four hours a week. With the impending changes, the administration needed to reduce the lessons from four to two hours with little impact on the quality and quantity of materials covered. In order to compensate for the loss of time, Professor Nježić was going to remove the material covering three-part polyphony from his lesson plans so he could still cover two- and four-part polyphony in as much detail as he had previously done. This idea was discarded by the administration as they still wanted Professor Nježić to include all the topics in as much detail as he had been doing before the Bologna Reforms. Being essentially impossible, the administration has since altered this to give three hours to polyphony. But questions do remain pertaining to what material gets removed, what stays, and what rationale governs these decisions because it is impossible to reduce classroom instruction time without limiting material covered.

The Future of the Bologna Process

While it is impossible to tell at this point what the long-term consequences of the Bologna Process will be, a system like the one that the European Commission is trying to establish is definitely needed in our evermore connected world. The E.U., a federated body of nations, needed to construct a way to promote cross-cultural education in order to forge stronger links between countries. Whether the plans are viewed positively or negatively does not negate the fact that something needed to be implemented like this to help hold the E.U. together. Imagine if there were no accreditation agencies in the U.S. How could one possibly move

from one state to another (or, for that matter, one school to another) without the hassle of converting grades and evaluating each credit (or course) taken on a case-by-case basis? This is not to say that it cannot be done, but rather it shows that in order to easily “facilitate mobility of students”⁴² –especially in large numbers–the government(s) must be willing to institute reforms to unify education systems within their jurisdiction.

As Europe is unifying its education system through the Bologna Process and using the American structure as a basis, it requires no stretch of the imagination to foresee a future transatlantic system aiding student movement between the United States and Europe. The Bergen Communiqué (a conference of European higher education ministers that took place in Bergen, Norway in 2005) has already stated that they “see the European Higher Education Area [and therefore, the Bologna Reforms] as a partner of higher education systems in other regions of the world, stimulating balanced student and staff exchange and cooperation between higher education institutions.”⁴³ It remains to be seen whether international exchange between Europe and the rest of the world becomes solidified in a formal agreement, like the Bologna Process, or simply will be a bi-product of these reforms. But one thing is for certain, mono-location education is becoming a thing of the past.


Figure 1
ECTS Grading System

ECTS Grade	% of successful students normally achieving the grade	Comment
A	10	The use of words like “excellent” or “good” is no longer recommended as they do not fit with percentage based ranking of the ECTS Grade Transfer Scale
B	25	
C	30	
D	25	
E	10	
FX	--	Fail – some work required to pass
F	--	FAIL – considerable further work required

42 Benelux Bologna Secretariat, “About the Bologna Process,” Bologna Process. <http://www.ond.vlaanderen.be/hogeronderwijs/bologna/about/index.htm> (accessed November 14, 2009).

43 Pavel Zagaga, introduction to *Looking out: The Bologna Process in a Global Setting* (Oslo: Norwegian Ministry of Education and Research, 2006), http://www.ond.vlaanderen.be/hogeronderwijs/bologna/documents/WGR2007/Bologna_Process_in_global_setting_finalreport.pdf (accessed November 14, 2009). 1-4.

Figure 2



Universitätslehrgang "Deutsch als Fremd- und Zweitsprache"
University Course "German as a Foreign and Second Language"

ZEUGNIS CERTIFICATE

Herr | Mr. DEREK JENKINS
Vorname | First Name Familienname | Last Name

Geburtsdatum 08.09.1986 Matrikelnummer 0861291 Studienkennzahl L 992 815
Date of Birth Registration Number Reference Number

LV Nr. 521.007 Kurs Sprachkurs 7
Course no. Course

Ausmaß 6 Semesterstunden 09S Stufe Mittelstufe I B1/b
for Hours per Week Winter/Sommer- Semester Winter/Summer Semester Level

BEURTEILUNG | GRADES

Sprechen <u>1</u>	Schreiben <u>2</u>	ECTS - Punkte <u>9</u>
Speaking	Writing	ECTS - Credits
Hören <u>1</u>	Lesen <u>2</u>	
Listening	Reading	
Gesamt-Beurteilung <u>sehr gut</u>	ECTS - Beurteilung <u>A</u>	
Overall Grade	ECTS - Grade	

Prüfungsdatum | Examination Date 17.06.2009

Mag. Waltraud Bone
Kursleiter/in - Prüfer/in
Instructor / Examiner

[Signature]
Lehrgangsleitung
Director

Grundstufe I (Breakthrough Level)	A1	Mittelstufe I (Threshold Level)	B1	Oberstufe I (Proficiency Level)	C1
Grundstufe II (Waystage Level)	A2	Mittelstufe II (Vantage Level)	B2	Oberstufe II (Mastery Level)	C2

Notenskala | Scale of Grades
1 = sehr gut (excellent) 2 = gut (good) 3 = befriedigend (satisfactory) 4 = genügend (sufficient) 5 = nicht genügend (failed)
ECTS-Beurteilung (Grade): sehr gut (A) | gut (B) | befriedigend (C) | genügend (D) | mangelhaft (E) | nicht genügend (F)

Kathryn Hembree

The Nuremberg Trials: A Postmodern Justification of Natural Law

✧

To understand the magnitude of the Nuremberg Trials it is necessary to provide a brief background of the Holocaust and crimes that took place. By 1933, when Hitler gained power, Jews were encouraged to leave Germany and by 1938 many of the larger Jewish communities were no more. The Jews who had chosen to stay were ridiculed and abused – only to become targets for Nazi propaganda. The declaration of war in 1939 resulted in the annexation of Poland whereupon Polish Jews were forced to live in ghettos with little access to food and other necessities. Those who were fit enough to survive the meager conditions were forced to work in labor camps. Nearly 30,000 Jews had perished in 1941 from street massacres and work camps, while another 20,000 died from starvation in the ghettos (Chippendale 35).

A new policy was enacted in June of 1941 with the invasion of Russia to destroy entire communities of Jews. An elite military unit known as the Waffen SS created special groups of soldiers, *Einsatzgruppen*, or “special killing forces” whose job was to “eliminate as many Jews as possible in the hundreds of small towns and villages throughout the conquered territories on the Eastern Front” (Chippendale 35). Their plan of attack was to line up and shoot as many Jews as they could, but this soon proved to be inefficient. Second to Hitler in the Nazi hierarchy was Hermann Göring, who commissioned the SS to “submit [...] promptly an overall plan showing the preliminary organizational, substantive and financial measures for the execution of the intended final solution of the Jewish question” (Chippendale 37). In 1942, a new system of transporting Jews in trucks and pumping poisonous gas into the trucks proved more efficient. Of those who were not gassed in trucks, many suffered the same fateful end via the gas chamber upon arriving at various concentration camps. Those who were fit to work

were not killed immediately but sentenced to work grueling jobs under horrific conditions. By the end of World War II more than one third of the worldwide Jewish population, nearly six million men, women, and children, had been murdered by the Nazis.

“The enormity of the crimes committed by the Germans in their attempt to render Europe *Judenfrei* (cleansed of Jews) is beyond the ability or the willingness of ethical people to accept” (Rice 10). Consequently, the results of the Holocaust left victims desperate for justice. The Nazis, under Hitler’s rule, had committed mass killings and torturous experiments, had enslaved and forced labor upon individuals, ultimately leaving Europe in a state of complete disarray. Representatives of the United States, Great Britain, France, and the Soviet Union decided to bring to trial the most notable Nazi war criminals. The charges ranged from conspiracy to crimes against peace, to war crimes, and perhaps most well known – crimes against humanity. The trial began on November 20, 1945, and lasted ten months. On the second day of the trial, Justice Robert H. Jackson of the United States opened for the prosecution saying, “[...] That four great nations, flushed with victory and stung with injury, stay the hand of vengeance and voluntarily submit their captive enemies to the judgment of the law is one of the most significant tributes that Power has ever paid to Reason” (Chippendale 42). Throughout the trial, evidence was never hard to pinpoint and the revealed crimes against humanity as noted were the “murder, extermination, enslavement, deportation, and other inhumane acts committed against civilian populations, before or during the war; or persecutions on political, racial or religious grounds in execution of or in connection with any crime within the jurisdiction of the Tribunal, whether or not in violation of the domestic law of the country where perpetrated” (Peress 107). Furthermore, it was maintained that crimes against humanity “fell within the province of international law if they were committed in preparation for or in connection with international war such as aggressive war and War Crimes. This restriction was so as to not infringe in the domestic affairs of a sovereign state merely on the grounds that it was offending against humanitarian principles”

(Calvocoressi 57-8).

The defense's claim was to emphasize that they were only following orders and should therefore not be charged with the associated crimes. More specifically, three claims were laid out for the defense: "1. Hitler and others were to blame for everything. 2. The men on trial had no knowledge of the crimes that were committed. 3. The laws by which they were being tried were *ex post facto*, or established after the fact. (In other words, the Germans had broken no laws because the laws did not exist until after their actions came to light.)" (Chippendale 45). Yet based upon the court's ultimate decision, the defense was unable to win their case. Thus it was decided that there exists a moral obligation to reject orders that constitute a crime against humanity (Chippendale 62). Additionally, it was deemed "neither manly nor true" that one person, Hitler, was responsible for the acts committed. Thousands of men laid witness who had access to Hitler and often had the ability to control the information on which he based his policy and orders. While many Nazis escaped trial, ten of the defendants were sentenced to hanging, seven were given prison sentences, and three were acquitted. Prosecutor Whitney R. Harris said of the trials, "For the first time in history, the judicial process was brought to bear against those who had offended the conscience of humanity by committing the acts of military aggression and related crimes." "[...] Crimes against humanity and initiating and waging of aggressive war are now judicial concepts" (Chippendale 46). The Nuremberg Trials represented the first time that crimes against humanity were established in positive international law. Since the Nuremberg trials aimed at attaining justice for crimes against humanity, I will show that they were justified in their hearings. Because there is a higher order of law that all nations should adhere to, the trials were legitimate secondary to a defiance of natural law.

It is necessary to provide an outline for the basis of natural law as divine law in addition to international law before correlating the application of the Nuremberg Trials. While it need not always be the case, natural law is often grounded in religious beliefs. It is the law of the universe, the overarching backdrop to every action made in the

cosmos, and the standard against which all national laws are judged. The universality of natural law provides the basis for something that is "right" or "wrong" regardless of country or legal system. There exist three types of law: *jus naturale*, *jus gentium*, and *jus civile*. *Jus naturale*, as has been explained, is the natural law – existing by nature to all animals. *Jus gentium* is the law applied to strangers, and *jus civile* is the law applied to citizens of a particular place. It is necessary to declare a distinction between *jus gentium* and *jus civile* because not all laws apply to citizens everywhere in the same fashion. Because of this, laws must be enacted to keep the peace between strangers and citizens. Natural law ultimately applies to all men. *Jus naturale* is something God himself cannot change once it has been established. For philosophers who don't feel comfortable with founding legal theory in God, they may contest that reason is an innate faculty like our physical senses. In other words, the foundation for *jus naturale* could reside in a sense of reason existing within humans instead of through God. Theists would argue that natural law is promulgated in our consciences by God, while atheists would argue that we identify natural law through reason.

To demonstrate an understanding of natural law practice, let us examine the traditions and theory of St. Thomas Aquinas. Allow us to assume that Aquinas is correct in his notion that God grants within us a conscience with which we are to promulgate the law. Aquinas holds that a law is an ordering of reason. This makes sense within his framework because reason comes from God, who established the divine or natural law. Therefore, we are to align ourselves according to the divine law by using our God-given conscience to order God's law into applicable rules for our lives. Laws must be for the common good because they are for the entire community. Reason would not have us make a law that only benefited certain groups just as God did not make the world only hospitable to certain humans, animals, plants, etc. The "end" of a law is to bring a "good" to the community in its entirety whether it be peace, order, etc. The law must be made public by the caretakers. This follows from Aquinas's proclamation that God, the caretaker of the universe, promulgated his law to humans through conscience. Without such

announcement, a law cannot be a law, for its purpose is to bring good to a community. How can it bring good if it is not known? Aquinas would say that it could not. (Bubacz)

An abhorrent of divine-natural law theory is Grotius, who founded a law superior to all nations – thus establishing a communal standard outside of a religious belief. Grotius defined natural law as stemming from reason, which cannot be changed by God himself, rather than from divine order. The overarching principles of Grotius’s ideas present themselves in the order of international relations. His ideas aim to bring nations together, uniting everyone with the same responsibilities for behavior. Even if one is hesitant to associate God as the deliverer of natural law, s/he can still see the Nuremberg Trials as just in that natural law was disobeyed. (Bubacz)

Those who would tend to reject the justification of the Nuremberg Trials would likely ground their reasoning in a rejection of natural law. Why might one reject natural law theory? One of the central difficulties with natural law is that it surrounds the question “who is the law giver?” This of course would have to be God, the only being that supersedes all else. A problem automatically arises if one does not feel comfortable rooting a legal theory in God. Another problem of natural law is “how” (assuming its existence) it is to be identified. If there is no God, seeking an answer to this question becomes very difficult.

One philosopher who does not believe in God is Thomas Hobbes. Hobbes’s theory is rooted in long-term self-preservation. He would argue that the Nazis were aiming to preserve themselves; they were the sovereigns, the power. Because they have no concept of “wrong” or “humanitarian laws,” Hobbes would argue that there is no point to a trial. A trial is senseless because there is no law, no “right,” no “wrong.” If the sovereign ultimately wants the Nazi war criminals dead, then the sovereign should kill them. If the sovereign wants to have a trial, a trial can be enacted for appealing purposes, but there is no basis for this. A Hobbesian would argue that the Nazis didn’t violate any laws in the first place because no laws exist other than the laws dictated by the sovereign who is incapable of committing any crime. Because the Nazis lost their

role as sovereign by losing the war, a new sovereign is introduced who then provides the standard for a new set of “laws” (Kemerling 1).

Utilitarians like John Stuart Mill and Jeremy Bentham are also opponents to natural law theory. These philosophers assume a consequentialist viewpoint, which places stress on the importance of weighing the consequences of actions based on the utility of those actions, utility here is related to some conception of what makes those actions useful and/or valuable to undertake. Essentially nothing is intrinsically right or wrong (right or wrong simply because of the intentions behind the act); rightness and wrongness must be based on the sum effect of actions. Also, the foundation of morality, therefore, is utility: actions are right that tend to promote happiness (pleasure and absence of pain), wrong if they tend toward the opposite (unhappiness – pain and the privation of pleasure). Pleasure and freedom of pain are the only things desirable as ends; they are intrinsically good. In regards to the assessment of overall well-being, Bentham argues that utilitarianism deals with quantitative assessment of pain and pleasure. We need to employ a “hedonistic calculus” when making ethical assessments of well-being. Mill, on the other hand notes that there exists qualitative differences of which we ought to take account when making ethical assessments of well-being. To say that Mill and Bentham would be in support of the crimes committed in the Holocaust is unfair; however, the creed they are suggesting we follow would justify the actions of the Nazis. (Bubacz)

All of these opponents, Hobbes, Mill, and Bentham, are relativists. They believe in ends, which ultimately define their morality and which lead to immorality because there is nothing intrinsically good or evil; it begs the question, how does this meet my personal end? If no act is good in and of itself, if it is only good as an instrument to a means, then the act has no intrinsic value. This way of thought leads to relativism because it is impossible to predict the future or accurately define the good for another person or oneself; human beings are not omniscient. This leads to a picking and choosing of potential outcomes one wishes to examine. A morally valid act for one person has the ability to become a morally

invalid act for another person, yet both cannot be correct. Because there is no standard by which to judge these acts, the examination and the moral validity or invalidity becomes relative. The problem with moral relativism is that relativists can't accuse others of wrongdoing, just as they can't complain about evil. They can't demand justice and fairness and they cannot promote the obligation of tolerance (Relativism para. 5).

In response to these rejections, it seems odd that positivists (those most likely to object to natural law) do in fact object to overriding moral principles. Generally speaking, positivists claim to found their morality in scientific observations of human behavior. Morality is just a convention – we say things are right and wrong based upon the ends. It seems strange that they would fail to notice that all of nature is governed by superseding laws that place restrictions on all activity in the universe. Why should human behavior be any different?

Despite the existence of alternative theories to natural law, as presented by Hobbes, Mill, and Bentham, such theories do not override the elements presented in natural law theory. As natural law pertains to the Nuremberg Trials, its theory commits an international basis of moral law. Natural law is objective in that it provides a standard to work with – the ends don't justify the means. No one is asked to predict the future, read minds, or do anything humanly incapable to determine the moral status of an action. Acts are based on principle, not utility. The Nazis defied these principles, and were thus punished for the crimes they wrongfully committed. Reasons for the existence of punishment are vast – to change people, to express society's dissatisfaction of particular behavior, to set aside wrongdoing individuals from others, etc. The punishment fared by the Nazis was likely a result of all of the above reasons; it was necessary to hold the trials in order to solidify a sense of nationalism and unity. The trials also functioned to display a public, outward sense of discordance by the governments of sundry nations.

The trials were able to give rise to many changes in regards to international law. Crimes against humanity have since been deemed a part of *jus cogens* – “the highest standing in international legal norms [...] [constituting] a non-derogable rule of international law” (Peress

108). This association requires committers of such acts to be subject to universal jurisdiction, in that each state may exercise jurisdiction regardless of where the crime was committed. It is interesting to note that everyone is held to the same expectation – no sovereign is allowed to escape these parameters. Peress writes, “[...] no one is immune from prosecution for such crimes, even a head of state” (108). The definition of a crime against humanity has since been updated since the time of the trials to include forms of torture that have more recently plagued humanity, such as rape and forced pregnancy. New legislation has since been created to identify differences between crimes against humanity, and genocide. Crimes against humanity “do not require an intent to ‘destroy in whole or in part,’ [...] but only target a given group and carry out a policy of ‘widespread or systematic’ violations” (Peress 108). Crimes against humanity are also distinguishable in that they may be committed in times of war or times of peace.

To recapitulate my thesis (as an argument for the justification of the Nuremberg trials in response to actions that defied natural law) the necessary groundwork and interpretations both outlining and opposing the stance have been made. My interpretation of natural law answers the deficiencies found in the other theories presented. Natural law provides condemnation for acts that were lawfully committed. To say that the Nazis' acts were justified because there weren't any prohibitive laws in Germany is not only unacceptable but screams of immorality: an immorality that led to the massacre of nearly an entire population. Such moral justification is deplorable. I must on these principles reject any relative claim to morality. The Nuremberg Trials clearly depict the error in accepting positivist claims about morality and they provide clear foresight into the sanctioned acts of such governments. Unfortunately, it took a grievous, extreme situation like the Holocaust to demonstrate the flawed nature of positivist claims. Their claims naturally lead to a slippery slope situation where the concepts of the right and wrong are continually put at variance with selfish motives. Those motives find justification within the premise of utility. I hope that this occurrence never repeats itself in history; however, our false idea of tolerance leads

to the illusion of distance between ourselves and other human beings. This distance leads to extreme immorality and we as humans have to ask ourselves – is this the type of world in which we want to live? I will choose to accept as my creed beliefs that value life in and of itself.

Are human beings not capable of empathy? When I see the photos of Holocaust victims in pages upon pages of these books I cannot help but feel that there has to be something more than the pursuit of our ends. To ignore this is to strip ourselves of being human. This intuition tells me that there is some commonality amongst human beings. I feel a person's pain when I see these photos and to deny those feelings would be to distance myself from morality. I find it hard to believe that someone could examine these photographs of walking, living, breathing skeletons, of babies piled in heaps and women and children waiting in line for the gas chambers and not be moved to tears. This is how we know that something binds us together as human beings. There is a reason why I feel for these people; an indefinable relationship exists. While the events of the Holocaust occurred long before my lifetime, I still suffer when I see depictions of the horrific event. In his final assessment of the trials, Henry Stimson writes in his essay "Nuremberg: Landmark in Law,"

We must never forget that under modern conditions of life, science and technology, all war has become greatly brutalized, and that no one who joins in it, even in self-defense can escape becoming also in a measure brutalized. [...] A standard has been raised to which Americans, at least, must repair, for it is only as this standard is accepted, supported and enforced that we can move onward to a world of law and peace (Marrus 244-5).

The more I research and come to learn, the less I distance myself from the events that took place. This is beyond convention. I feel that these actions were wrong in and of themselves without regard to their ends, which implies that there is more to morality than strict utility. There are absolute connections that bind us to each other, and with those connections come law(s) that can't be violated.

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Brodie Barnard

Exercise and Cortisol Stress Levels: How Does Exercise Decrease Cortisol Stress Levels?

The purpose of this research is to review whether or not exercise can be used as a successful coping mechanism for stress. The way stress will be measured is by the bodily chemical cortisol. Low levels of cortisol are associated with low stress levels. In some instances, low levels of the chemical cortisol are also associated with high levels of exercise. However, on the opposite end of the spectrum high levels of exercise are not always correlated with a low stress level. Exercise does not always result in lowered levels of the chemical cortisol. Excess exercise can be unhealthy and may cause health problems; however, optimal amounts of exercise for a college age person have been shown to decrease cortisol stress levels (West, Otte, Geher, Johnson, & Mohr, 2004).

Stress is a condition that every person encounters in some way, shape, or form throughout their lives. Although stress can be an unavoidable aspect of life, there are many useful ways to cope and manage it. Stress can be defined as a person's state of mind that is influenced by stressors, any external or internal force that triggers or causes stress. A person's homeostasis is threatened under stress. When changes to homeostasis occur, they can be both behavioral and physical. This is the beginning of the stress response system. Exercise can also be considered a stressful situation for the body (Mastorakos, Pavlatou, Diamanti-Kandarkis, & Chrousos, 2005). Stress is positively correlated with contributing to or exacerbating many psychological disorders, especially depression. Exercise has been shown to have positive effects on depression and is often used as a treatment (Nabkasorn et al., 2005).

Cortisol is a chemical that is released during the human stress response, regulated by the hypothalamic-pituitary-adrenal (HPA) axis (Harbach et al., 1999). The stress model is important in understanding how hormones relating to stress are released into the bloodstream.

When a stressor is encountered, cortisol is released from the brain and is regulated by the HPA axis (de Vries, Bernards, de Rooij, & Koppeschaar, 2000).

According to Harbach et al (1999) exercise can be defined as any type of physical activity outside of a person's normal daily activities. For the purpose of this paper, exercise includes treadmill running, playing sports, hiking, yoga, and walking. Exercise and cortisol are directly related. During physical activity cortisol is released; however, the amount and time of the cortisol release depend on the situation, type of physical activity, and the duration of physical activity (de Vries et al., 2000).

Although exercise has shown to be an effective way to decrease stress, this is not always true. Too much exercise can be problematic, so it is important for an individual to find their optimal level of exercise. This can be done by monitoring their activity and heart rate, as well as frequency and duration of vigorous activity. Over-exercising has been shown to create more stress on the body, causing fatigue and exhaustion. This is especially true for professional athletes who exercise everyday at maximum output (Gonzalez, Moya, Martinez, & Salvador, 2002).

The current healthcare system is mainly focused on simply managing acute medical and mental conditions. The medical model is insufficient against the increasing prevalence of chronic diseases, primarily as a result of poor lifestyle choices. Although it is important to manage stress in regard to chronic disease, stress is not the only contributing factor. It is important to note that susceptibility to chronic diseases can be caused by biological (genetic predisposition), psychological (effective coping mechanisms), and social factors (stress) (West et al., 2004).

Implications of Exercise and Cortisol Stress Levels

Healthcare professionals could utilize exercise as an effective mechanism for coping with stress, and for preventing and treating both psychological and physical disorders. Depression, for example, is a very common psychological disorder of which stress is a contributing factor. Research has shown that a decrease in psychological stress of depressed patients could be attributed to exercise and physical activity. On average,

exercise lowers cortisol stress levels in people with depression. Regular exercise has been shown to have anti-depressant effects on depression (Nabkasorn et al., 2005).

Chronic disease is a growing problem in America and has many stress-related difficulties. Primary, secondary or public health approaches have not always been the best approach to dealing with these stress-related difficulties. These approaches were built around the bio-medical model. They focus mainly on biological treatments for disease, such as medication and surgery. According to West and his colleagues (2004), the increasing number of people who are now using alternative medicine and complementary medicine can be attributed to the need for care that is developed from modern life stress. Some of these alternative and complementary forms include exercise such as yoga or dance, meditation, and herbal remedies. These complementary and alternative approaches have been proven to be successful at lowering stress levels, treating depression, increasing positive moods, and helping cancer patients cope. Although it is true these approaches are gaining popularity within society, they are typically not used alone. People are using them in combination with primary health approaches for the best possible outcome.

Exercise and Cortisol Stress Levels

Exercise may increase stress levels

In regard to the negative effects of exercise, too much can be unhealthy. There is a point in which training and exercise become a risk. Exercise is physically a stress situation for the body. During exercise the body must adapt with the equilibrium. This process requires adaptive responses of the hormonal systems such as the HPA axis. When looking to control stress through exercise, it is important for people to regulate and find the right amount of exercise for them personally (Mastorakos et al. 2005).

A study conducted by Gonzalez et al. (2002) was designed to examine a four-month training period of two different male basketball teams. They examined the effects of training on the salivary testosterone (Tsal), salivary cortisol (Csal) responses, and differences in the salivary

testosterone/cortisol ratio (Tsal/Csal ratio) after acute physical training. Tsal and Csal were measured by collecting saliva samples. The professional athletes were chosen from the National Spanish Basketball League. The participants were drug free and healthy.

The baseline levels of Tsal and Csal were measured before the basketball season had started, and the participants had not engaged in training for at least 6 weeks. Participants took part in an incremental graded exercise (GXT). This GXT consisted of riding an exercise bicycle in three phases. The first phase was a warm up with light cycling. The second phase was the test phase. The test phase started out at 30 watts of cycling and increased 30 watts until exhaustion. This was followed by a recovery phase of light cycling. Tsal and Csal levels were measured 20 minutes after cycling. This same test was performed 4 months later after the season had started and participants were engaging in normal training. Team 1 engaged in the highest amount of training during the season, and team 2 engaged in a lower amount of training (Gonzalez et al., 2002).

The results show that neither team had differences among Tsal levels from the pre-test to the post-test. The Csal levels of team 1 did not show any changes; however, team 2 did show an increase in Csal. For team 2, training caused an increase of cortisol instead of a reduction. This could reflect that team 1 adapted better to the training than team 2 due to the possibility of over-training. At the end of this study, Gonzalez et al. (2002) ultimately concluded that exercise did not work as a successful stress coping mechanism for team 2.

The correct amount of exercise is needed to reduce stress

A person's response to stressors is typically a reaction of the organism trying to compensate for the stress. This reaction activates the HPA axis, which releases the chemical cortisol into the blood stream. De Vries et al. (2000) investigated if incremental exercise could be used as a model stressor to disclose a pattern of activation in the HPA axis. Eight healthy men (ages 19-26 years old) fasted overnight and then cycled at 40, 60, 80, and 100% of power output. For the purpose of this study,

power output relates to the amount of energy exerted during exercise (de Vries et al., 2000). This was done in successive time increments of 10 minutes each up to exhaustion. Blood was drawn before the exercise, at the end of each time increment, and during the exhaustion state 5 and 30 minutes after the exercise in order to measure cortisol, endorphin, and prolactin levels. These were markers of workload-related responses.

This study concluded that cortisol was a delayed response to the stressor. This may be the result of a drop in blood glucose levels. Cortisol increased for a short time period only during or after intense exercise. It could be considered to be the body's way of preparing muscles and protecting against muscle damage. The researchers concluded that the activation of these stress hormones occurred at different time points. It seems that these hormones play different roles in preparing for physical activity and recovery. This shows that exercise can actually be a stressor on the body rather than decreasing the stress of a person (de Vries et al. 2000).

Exercise affecting stress levels varies from individual to individual

In a study done by Harbach et al. (1999) cortisol levels were not the same for every individual after exercise. Fourteen male volunteers participated in a study in which cortisol levels were measured. All participants were drug free including alcohol and medication. Three of the men smoked, but less than 10 cigarettes a day. They had no history of disease or psychological disorders. All of the volunteers participated in 2 to 6 hours a week of physical activity.

For the study, participants ran 3 km outdoors at their own comfort level. After this task was completed participants ran up 8 floors of a building. The exercise lasted roughly 20 minutes. Blood samples were collected from the participants before and after the workout. Cortisol levels were measured from the plasma samples. The findings indicate that cortisol levels were different for individuals undergoing the same workout. After the workout cortisol levels increased slightly or decreased in some participants. This study shows that there is individual variation in how exercise can impact cortisol levels. Stress is not strictly a

biological concept including hormones. It encompasses a person's unique psychological makeup (Harbach et al., 1999).

Exercise can reduce cortisol stress levels

A study by West et al. (2004) found positive effects of exercise on stress. In this study participants were healthy college students who were enrolled in classes of Hatha yoga, introductory biology, and African dance. A total of 69 participants were divided into three groups: 21 were enrolled in African dance, 30 from biology, and 18 from Hatha yoga. The student's age range was from 17 to 24 years of age, ($M = 19$). All classes were promptly 2 hours in length. At the beginning and end of each class, salivary cortisol levels were measured. Students were also asked to fill out the Perceived Stress Scale (PSS). The findings of this study confirmed that participants in the African dance and Hatha yoga class reported decreased perceived stress compared to participants in the biology class. Cortisol levels increased in African dance, decreased in Hatha yoga, and did not change in biology class (West et al., 2004).

West et al. (2004) concluded that the incongruence between cortisol levels and the PSS results could be attributed to changes in physiological arousal and its different effects on cortisol. Both the Hatha yoga and African dance groups showed lowered perceived stress; however, there was not a significant relationship between perceived stress and cortisol levels. Both Hatha yoga and African dance reduced perceived stress, even though they are different physiologically. Cortisol is a steroid that is a regulation of physical arousal. This could be why African dance produced higher levels of cortisol, yet a lowered perceived stress level. Over time, however, both Hatha yoga and African dance showed reductions in baseline cortisol levels that contributed to the students' overall health. The results of this research are consistent with findings that have shown exercise as a way to decrease stress levels (West et al., 2004).

Exercise and depression

Nabkasorn et al. (2005) investigated exercise as a coping

mechanism for stress in patients with depression. The participants for this study included 266 female volunteers whose ages ranged from 18 to 20 years old. All participants were recruited from the Chronburi, Thailand university nursing program. Participants were screened for depression using the Center for Epidemiologic Studies Depression (CES-D) rating scale. Out of 266 participants, 152 did not meet the criteria for clinical depression, leaving an eligible sample size of 114 participants with depression. Participants were excluded from the study if they had ever taken anti-depressant medication, had health problems that interfered with physical activity, or had participated in strenuous physical activity in the prior 6 months. Only 59 of the 114 participants agreed to the study and provided informed consent.

Participants were divided into two groups. The treatment group took part in an 8-week physical exercise program. The control group continued with their daily routines. All participants were asked to complete the CES-D every four weeks in order to measure depression levels. Urinary secretions of cortisol were measured every 24 hours in order to measure psychological stress levels. Of the 59 original participants, five failed to complete the exercise program. Three dropped out because of lack of motivation, and two participants attended less than three sessions per week. The results were based on the remaining 49 participants (Nabkasorn et al., 2005).

The treatment group, who completed the exercise regime, was able to lower their levels of cortisol. They also had lower CES-D scores compared with the control group. In contrast, the control group showed no change in cortisol levels and no significant change in CES-D scores. Researchers concluded that exercise was beneficial to lowering stress and decreasing depressive symptoms. These findings directly support the idea that exercise can decrease the stress cortisol levels of college age students (Nabkasorn et al., 2005).

Conclusions

Research has shown that exercise can be successful in decreasing the cortisol stress levels of college age people. The research by West et al. (2004) suggests that in some cases cortisol stress levels are lowered as

a result of exercise. The research conducted by Nabkasorn et al. (2005) also showed that cortisol can be decreased as a result of exercise in patients with depression. After completing an exercise regime, patients demonstrated lower levels of depressive symptoms in addition to lowered levels of cortisol. Harbach et al. (1999) found the effects of exercise on cortisol stress levels can vary from individual to individual. Stress not only encompasses the biological components such as cortisol levels, but also a person's psychological make up.

Although appropriate exercise has positive effects on stress levels, the health benefits of exercise are mediated by an individual's temperament for an optimal level of exercise. De Vries et al. (2000) concluded that exercise can actually be a stressor on the body. Cortisol stress levels could also be related to the amount of physical exercise being performed. Gonzalez et al. (2002) concluded that cortisol levels of basketball players differed at baseline depending on how much training the players were undergoing at a certain time.

Implications

These findings show many implications for using exercise as a means of stress management. It is important for people to understand both the positive and negative effects of exercise. Exercise is certainly healthy for individuals; however, finding the appropriate exercise regime is important. Every person is unique and needs to find an exercise regime that works best for them as an individual. Stress can cause many different health problems, and it is important to find an appropriate way to cope with stressful situations, including psychological health problems as well as physical health problems. This is why it is important to learn the right strategy for coping with stress. Too much exercise is not good for a person's stress level. With this being stated, too little exercise is not good for a person's stress level either. The correct amount is needed to successfully reduce stress, and finding the correct moderation between the two can be useful for reducing stress levels (de Vries et al., 2000).

Limitations and Future Directions

Limitations to this area of research include the limited age range of participants and baseline activity levels. Age could be a factor that

could cause problems generalizing these studies to the general population as the studies reviewed in this literature were conducted using college age people. College age people might have a higher base level of cortisol than other age groups because of their lifestyles. College can be stressful, creating higher stress levels compared to people who are older, or not in college. This could affect the measurement of baseline cortisol. Different baseline levels of cortisol would make it very difficult to generalize this information to the general public (West et al., 2004).

The amount of physical activity people perform on an everyday basis may also change their level of cortisol. For example, a person with a very physically strenuous job might have higher levels of cortisol making it harder to generalize to the larger population as well. The strenuous workout of African dance increased cortisol levels, so it could also be possible for a physically strenuous job to affect the amount of cortisol in a person's body (West et al., 2004).

Areas of future study might include the effects of exercise on stress in an older adult population. Being able to replicate these results with multiple populations would support the hypothesis of exercise as a stress moderator. Knowledge of these results could possibly educate people better about the importance of exercise as a coping mechanism for stress. People should be encouraged to find an exercise regime that works best for them individually. It not only reduces acute stress, but also long-term stress as well (de Vries et al., 2000). The knowledge of exercise and stress levels could also be applied more often as a treatment for depression and other psychological disorders, decreasing dependence on medication. Exercise has been shown to be a powerful protective factor against depression, with people who exercise regularly being at a reduced risk for developing depression. Research on the correlation between exercise and depression could also be expanded to other psychological disorders as well. In the future, exercise could be used as a prevention and treatment mechanism (Nabkasorn et al., 2005).

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A B O U T
T H E
A U T H O R S

Nick Ball is a senior at UMKC majoring in mathematics and statistics. The paper that Nick submitted for this volume also earned him recognition as a finalist in the annual HOMSIGMAA (History of Mathematics Special Interest Group of the Mathematical Association of America) nationwide contest for papers written in History of Mathematics courses. Nick wishes to thank Prof. Richard Delaware.

Brodie Barnard graduated from UMKC in May 2010 with a degree in psychology. She chose UMKC because of the smaller class size and friendly atmosphere. She is very interested in the correlation between exercise and stress levels because she grew up playing sports; exercise has always been a part of her life. Her hobbies include reading, playing volleyball, and yoga. Brodie plans on attending graduate school at UMKC for clinical psychology and becoming a college professor. Brodie wishes to thank Prof. Linda Garavalia.

Jennifer Garnett graduated from UMKC in May 2010 with degrees in both Art History and English Literature. She chose UMKC because of the close interaction between the Nelson-Atkins Museum of Art and the Art Department at UMKC, as well as references to teachers from fellow classmates. She also chose UMKC because it is well known in the Kansas City area, where she is from. She loves art of all forms and mediums, the history of it and how it evolved. Jennifer is an artist, writer, and musician. She hopes to begin working on her Masters soon, and aspires to work in the Art History field. She would like to thank her friends and family for their support in everything she does; if it weren't for them, she wouldn't have gotten so far. Jennifer wishes to thank Prof. Burton Dunbar.

Kathryn Hembree graduated with honors from UMKC in May 2009 with degrees in both chemistry and philosophy. She chose to attend UMKC for the opportunities available in undergraduate research, and the vast selection of curriculum in the sciences. Since June 2009, Kathryn has been working as an investment banker at Goldman Sachs in New York City. She enjoys reading, organic living, international travel, viticulture, yoga, and speaking French. Kathryn wishes to thank Prof. James Sheppard.

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Elaina Newton is a senior majoring in creative writing with a minor in manuscript, print culture, and editing. She chose UMKC because the English Program is excellent and the professors are phenomenal. Elaina enjoys reading, writing, watching films, cooking, and philosophizing. After graduation, she plans to pursue a career in the publishing field while writing creatively on the side. Elaina hopes that her essay will raise awareness of African conflict and incite critical thinking in relation to global issues. Elaina wishes to thank Prof. Stephen Dilks.

Thomas Nienaber graduated in May 2010 with a biology major, with an emphasis on the Cellular and Molecular Basis of Health and Disease. He chose UMKC as it was close to home, after studying abroad for several years, and because of its reputation as a research institution. Thomas currently works as a network operator, maintaining computer networks and websites for companies. He is very grateful to his family and the faculty at UMKC, especially those who aided and encouraged him during his time there. Thomas also wishes to thank SEARCH for helping to fund his research. Thomas wishes to thank Prof. Stephen King.

Paige Snyder is a history major with a minor in German Studies. She has studied many different types of history focusing on many different peoples, but has always been most interested in the political and social/ everyday life history of East Germany. With this paper she wanted to explore how those two worlds interacted: how two countries with opposing political systems used the same social and cultural tool (music) to legitimize their rule in post-WWII Germany. She intends to graduate in December and then go on to graduate school and earn a Ph.D. in order to dedicate her life to researching and teaching German history. Paige wishes to thank Prof. Larson Powell.