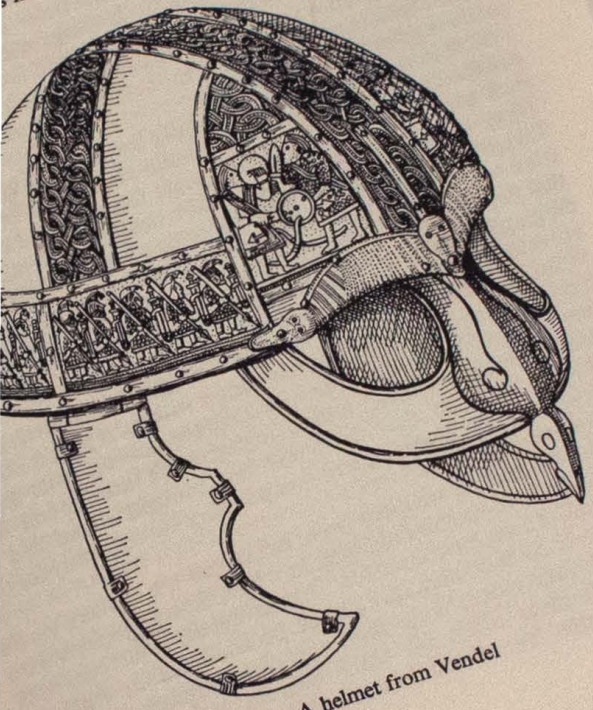


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76 A helmet from Vendel
123

LONGWOOD UNIVERSITY

INCITE

Journal of Undergraduate Scholarship
Cook-Cole College of Arts & Sciences

INCITE

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Longwood University

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Journal of Undergraduate Scholarship
Cook-Cole College of Arts & Sciences

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From the Dean

Dr. Roger A. Byrne, Dean,
Cook-Cole College of Arts & Sciences

Longwood University prides itself on producing citizen leaders, and one of the ways in which this leadership is produced and honed is through the individual and small-group efforts of students in forming their own scholarly and creative works. The process instills development of critical thought and enhancement of skills. But more than this, it also cultivates persistence through overcoming initial failures and challenges while striving to attain a goal, a sense of shared purpose through working collaboratively with faculty and peer mentors, and it results in a great sense of accomplishment when the act of creation is complete. This happens in many ways and at many times throughout a Longwood student's progress through his or her educational program in the Cook-Cole College. What is included here in this slim volume is a carefully selected set of examples of the works of Longwood students that demonstrate the best of what can be achieved. It serves as a model and a testament to the efforts of the students involved and their faculty mentors and collaborators.

I would like to acknowledge and thank the students who permitted their work to be included, and the faculty mentors who guided the students in the creation of these works. I would also like to thank the faculty board, the editors, and the students of the Design Lab for all their efforts in producing this fine volume.

I hope you take some time to review the works included in this volume of *Incite* and you will come away with a greater appreciation for the achievements of our students.

From the Editor

Dr. Larissa “Kat” Tracy

Department of English & Modern Languages

Back in 2007, the then-Dean of the Cook-Cole College of Arts and Sciences, Chuck Ross, started an initiative to elevate the standards of undergraduate research among the disciplines within the College. Part of that project was the inception of *Incite*, a journal dedicated to publishing the best undergraduate research in the humanities, arts, and sciences. Over the years, *Incite* has built upon that tradition, showcasing the work and dedication of students, the faculty who mentor them, and those involved in the production of the journal. Last year, *Incite* editor Gordon Van Ness retired, turning over the reins of this journal to me. It is my great honor to edit this journal, and to work with the faculty and students across the disciplines to produce it.

This year is an exciting one for *Incite*. Students under the direction of Chris Register and Wade Lough in Design Lab have executed a beautiful and professional redesign of the journal, bringing it in-line with other national academic publications. The new Faculty Advisory Board, comprised of volunteers within the various departments of CCCAS, has worked diligently to refashion the submission guidelines in order to offer publishing opportunities to a larger body of students. These Board members also worked tirelessly to review and comment on the student submissions, ensuring that each article is of the highest caliber. The student contributors were a pleasure to work with; they met deadlines and they worked in the spirit of cooperation to get their pieces in publishing form. Our student proofreading intern, Karyn Keane, an English major on the Rhetoric and Professional Writing track, was indispensable. She proofed every submission, checked all the references, and cross-checked the citation formats before each piece came to me for editing. It would not have been possible to produce this journal without her and the rest of the *Incite* faculty and student volunteers.

This journal is truly a team effort. From the students who submitted their work, to the individual faculty advisors who spent the time outside of class to help them revise and professionalize their submissions, to the Faculty Board members who vetted them, to our student-intern, to the Design Lab team who did the redesign and produced the finished volume under the direction of Wade Lough, to the Printing Office that met our deadlines and delivered this amazing volume, and to the CCCAS Dean Roger Byrne who has given this endeavor his full support, we could not have done it without you. We rely on the dedication of faculty, students, and staff to promote the best of undergraduate research in the Cook-Cole College of Arts and Sciences so that this journal, *Incite*, can continue. Thank you very much for all your hard work in making this possible.

From the Designers

Rachel English
Rachel Hanson
Longwood University
Graphic Design, 2019

Welcome to the redesigned *Incite*. The changes we made were intended to give this academic journal a new design voice. As designers, our intention was to create a journal that would communicate its purpose as an academic publication, but also please its audience visually. There is an established format that journals and scholarly articles tend to fall into, but we have learned in our design study at Longwood to bring a fresh perspective to established design. Without the guidance and assistance of our professors none of this would have been possible. We are thankful to everyone who helped make this journal possible, and grateful for the opportunity to help craft the eleventh edition of the undergraduate academic journal. We hope you enjoy it.

Synthesis of 3,5-substituted Parabens and their Antimicrobial Properties

Jacob Carney and Ryan White
Faculty Advisor: Dr. Andrew Yeagley,
Department of Chemistry & Physics
Awarded first place Natural Sciences paper

Abstract

*Parabens, ester derivatives of para-hydroxybenzoic acid, are commonly used in cosmetic items as antimicrobial and antifungal agents. Recent studies have discovered a correlation between paraben use and breast cancer due to the xenoestrogenic properties of parabens. This experiment was designed to synthesize a paraben that does not activate estrogen receptors but is still antimicrobial in nature. By substituting bromine atoms onto the aromatic ring of the paraben, its capability of activating the estrogen receptor is nullified. The antimicrobial properties of the substituted paraben were then confirmed by comparing its ability to kill Streptococcus salivarius to various traditional parabens in a serial dilution assay on a 96-well plate. The substituted butylparaben created had a minimum inhibitory concentration (MIC) of 128 micrograms per milliliter ($\mu\text{g/mL}$) for *S. salivarius*. Butylparaben, the traditional paraben counterpart, has been determined to have a MIC of 128 $\mu\text{g/mL}$ for *S. salivarius*. Thus, the brominated paraben we synthesized killed *S. salivarius* as well as its traditional paraben counterpart, confirming that bromination does not inhibit its ability to kill bacteria. This study in conjunction with past studies illustrating substituted parabens are weaker xenoestrogens supports the possibility that they are safer commercial alternatives.*

Introduction

Parabens are ester derivatives of para-hydroxybenzoic acid and are used for antimicrobial and antifungal purposes in cosmetics as well as an array of other products (Darbre et al., 2004). The effectiveness of parabens as antimicrobial agents increases with the length of the alkyl chain of the ester (Darbre et al., 2004). However, as the length of the chain increases, the water solubility of the paraben decreases and thus negatively impacts the number of applications (Darbre et al., 2004). Five of the most commonly used parabens (methylparaben, ethylparaben, n-propylparaben, n-butylparaben, and isobutylparaben) have been shown both *in vitro* and *in vivo* to display xenoestrogenic properties (Pugazhendhi et al., 2005).

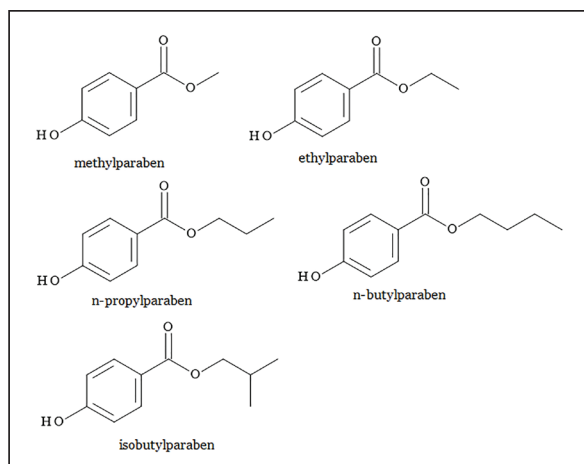


Figure 1: The five most commonly used parabens. Source: Jacob Carney.

Long-term exposure of 20 weeks to methylparaben, n-propylparaben or n-butylparaben can increase the migratory and invasive properties of human breast cancer cells *in vitro* (Khan-na et al., 2014). This is thought to be associated with the parabens' ability to bind to estrogen receptors, such as human MCF7 breast cancer cells, and cause them to grow (Darbre et al., 2004). It has been shown that the removal of the ester group in parabens does not nullify its xenoestrogenic activity towards human breast cancer cells *in vitro* (Pugazhendhi et al., 2005). However, it has been shown that shortening the alkyl group from n-butylparaben to methylparaben does reduce the xenoestrogenic activity (Pugazhendhi et al., 2005). Studies of these xenoestrogenic activities have shown that mimicking the phenolic function of estrogen is most important for estrogen receptor binding (Bergquist et al., 2018).

Due to the number of products that employ parabens as preservative agents, a safer alternative must be designed. Parabens work as preservative agents through nonspecific insertion into bacterial cell membranes, which will make the membrane more fluid and decrease its integrity. The phenolic function then disrupts the cation gradient (Campos et al., 2009). While the phenol is also responsible for the pre-cancerous properties, previous studies by Bergquist et al. have demonstrated that substitution of the paraben's ring decreases its affinity for estrogen receptors. Specifically, substitution near the phenolic function of the paraben greatly weakens association to the estrogen receptor in most cases. Adding one bromine atom, one iodine atom, or two hydroxide groups demonstrated weaker bonding as well, but to a lesser extent. All of the paraben derivatives created demonstrated an improvement in antimicrobial properties without the xenoestrogenic properties associated with tumor cell production. This has shown that it is possible to dissociate the paraben activities and keep the antimicrobial properties while removing the precancerous activity. This was shown through the synthesis of 3,5-substitutions to a butylparaben derivative, which were equivalent if not improved antimicrobial compounds that lack the competitive estrogen receptor binding (Bergquist et al., 2018).

The estrogen binding capability of brominated parabens has been tested and found to displace 50 percent of a fluorescent labeled estrogen derivative (IC₅₀) at a concentration of 39400 nM. When compared to the traditional paraben IC₅₀ value of 1490, it is clear that the substitution reduces the dangers associated with the estrogen receptor. This project thus assumes the synthesized paraben is safer than the commonly used parabens. However, more information is still required to determine the antimicrobial property of the brominated paraben. Parabens with two bromine atoms surrounding the phenol have been tested to have a minimum inhibitory concentration (MIC) of 32 µg/mL and parabens with only one bromine around the phenol have been tested to have a MIC of 64 µg/mL when tested against *S. aureus*, while penicillin G, the control compound, had a MIC of 0.25 µg/mL (Bergquist et al., 2018). The goal of this experiment is to further test the antimicrobial properties as they relate to the ester chain length of the brominated paraben on *S. salivarius* through a serial dilution assay.

Results and Discussion

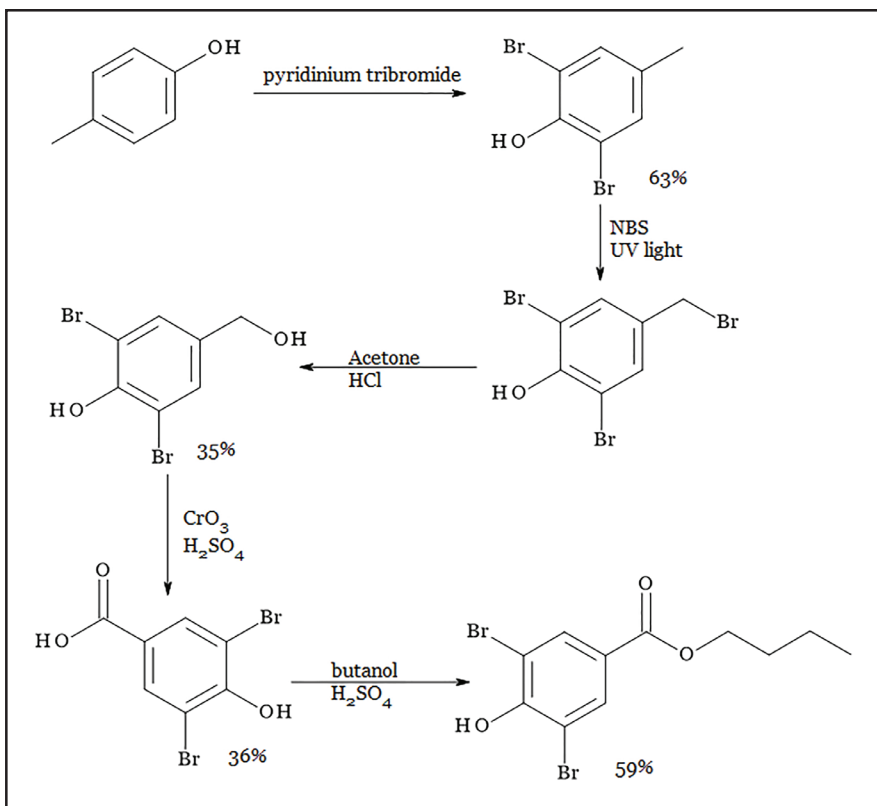
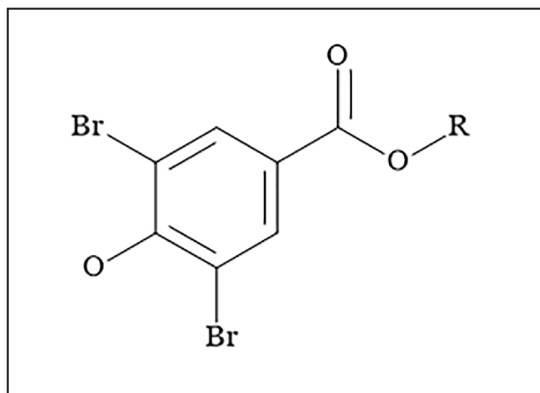


Figure 2: Scheme for synthesizing 3,5-substituted butylparaben. Source: Jacob Carney.

The synthesis of the substituted butylparaben produced an overall 4.6% yield from the starting *p*-cresol. The combination of the benzylic bromination and benzylic substitution reactions (reactions 2 and 3) produced the lowest yield. The synthesis started with 3g of *p*-cresol and we created 0.211g of the substituted butylparaben. Reaction intermediates were identified using various spectrometric techniques while the structure of the benzylic bromination reaction was not verified due to its tendency to polymerize. This is likely the cause of the lowered yields through these combined steps. Since the bromide intermediate could not be isolated, the percent yield for this reaction was calculated over two steps. The benzylic substitution (reaction 3), which was purified by flash chromatography, had a 35 percent yield.

Table 1: The MIC values for the various synthesized parabens. MIC values are in $\mu\text{g/mL}$ and are based on at least three trials unless noted.



Brominated Paraben (R)	MIC (<i>S. salivarius</i>)
Methyl	>256
Ethyl	>256
Propyl	>256 ^a
Butyl	128
Pentyl	64 ^a
Hexyl	16
Heptyl	4
Octyl	8 ^b
<i>Iso</i> -butyl	128
<i>Sec</i> -butyl	128
<i>Iso</i> -pentyl	64

^a - Based on two trials.; ^b - No reportable mode, maximum value reported. Source: Jacob Carney.

Table 2: The MIC values for the positive controls used. MIC values are in $\mu\text{g}/\text{mL}$ and are based on at least three trials unless noted.

Control Compound	MIC (<i>S. salivarius</i>)
Methylparaben	>256
Ethylparaben	>256
Propylparaben	256 ^a
Butylparaben	128 ^a
Erythromycin	1
Amphicillin	1

^a - Based on two trials. Source: Jacob Carney.

The results obtained from the 96-well serial dilution are listed in Tables 1 and 2. Table 1 displays the MIC values for the substituted parabens the class synthesized. Table 2 displays the MIC values for the control compounds that the synthesized compounds were compared against. The listed values are the modes of the collected data based on at least three trials, with a few exceptions. Several of the parabens, traditional and substituted, displayed MIC values higher than we tested. The substituted heptylparaben had the lowest observable MIC at $4\mu\text{g}/\text{mL}$. After six trials on octylparaben, there was not an observable mode for the MIC value. The results show a trend that, in the case of straight-chain substituted parabens, antimicrobial activity increases with the length. Similarly, the three branched parabens displayed comparable activities as their straight-chain counterpart. The substituted butylparaben, iso-butylparaben, and sec-butylparaben all had the same MIC values; however, iso-butylparaben and sec-butylparaben have shorter carbon chains than butylparaben. These branched derivatives indicate that antimicrobial activity is likely associated with the number of carbons or hydrophobicity rather than the exact length of the carbon chain.

Conclusion

The results show that brominated parabens with at least a four-carbon ester chain retained their antimicrobial properties. However, the different chain lengths of brominated parabens were not evenly tested. Propylparaben and Pentylparaben were tested fewer

times than other lengths. Additionally, octylparaben displayed no observable MIC value and requires more testing. These brominated parabens could serve as a safer replacement for the commonly used parabens in pharmaceutical and cosmetic products. However, the substituted parabens have only been tested against *S. salivarius* in this study. In order to better understand their antimicrobial ability, it should be tested against other types of bacteria, particularly those commonly found growing on the surface of cosmetics. They should also be tested more rigorously for their ability to bind to the oestrogen receptor.

Experimental

2,6-dibromo-4-methylphenol

In a round-bottom flask, 3g of *p*-cresol was dissolved in glacial acetic acid (5 mL) and 2.1 mole equivalents of pyridinium tribromide was added. This reaction formed a white solid precipitate that was vacuum-filtered from the solvents (4.615g, 63%). From the crude product, 50mg was taken to be verified through GC-MS. GC-MS: 105, 193, 207, 266. Expected exact mass for molecule is 265.89 amu.

2,6-dibromo-4-(bromomethyl)phenol

The remainder of the crude 2,6-dibromo-4-methylphenol was dissolved in 50mL of chloroform. 1.05 mole equivalents of NBS were added and allowed to react under a UV light for seven days. No measures were taken to verify the structure of this molecule since it is prone to polymerization. (5.442 g).

2,6-dibromo-4-(hydroxymethyl)phenol

The 2,6-dibromo-4-(bromomethyl)phenol was washed three times in a 125 mL separatory funnel with 1 M hydrochloric acid and once more with brine. The remaining water was dried with magnesium sulfate and vacuum filtered out of the crude product. The solvent was removed by a rotary evaporator and a 2:1 mixture of acetone and 1 M HCl was added and allowed to react with the crude 2,6-dibromo-4-(bromomethyl)phenol for seven days. The 2,6-dibromo-4-(hydroxymethyl)phenol was separated by column using ethyl acetate and hexanes to produce a white solid (1.57g, 35%). $R_f = 0.2$, $^1\text{H NMR}$: 9.7 (s 1H), 7.5 (s 1H), 5.2 (s 1H), 4.4 (s 2H), 3.4 (s 2H).

3,5-dibromo-4-hydroxybenzoic acid

In an Erlenmeyer flask, 1.57 g of 2,6-dibromo-4-(hydroxymethyl)phenol was dissolved in acetone until it was a 0.1 M solution. A 1.5 equivalent of 2 M Jones reagent was added drop-

wise and allowed to stir for 1 hour. The product was diluted in a 250 mL separatory funnel with 75 mL of ethyl acetate and then that organic layer was washed three times with DI water, dried with magnesium sulfate, and then vacuum filtered out into a 250 mL round bottom flask. (0.5933g, 36%). MP: 268-273 °C (literature mp was 269-271 °C)

Butyl 3,5-dibromo-4-hydroxybenzoate

In a round bottom flask, 300 mg of 3,5-dibromo-4-hydroxybenzoic acid, 1 mL of 1-butanol, and 4 drops of sulfuric acid were added and allowed to reflux for 1 hour. The product was purified by column with ethyl acetate and hexanes. The final substituted paraben product was dried in a rotary evaporator. (0.211g, 59%)., ¹H NMR: 8.9 (s 2H), 7.2 (s 1H), 5.0 (t 2H), 2.4 (m 4H), 1.75 (d 3H), IR: 3298, 2959, 2925, 2871, 1699, 1588, 1555, 1479, 1463, 1392, 1369, 1297, 1258, 1224, 1206, 1121, 1055, 1020 942, 904, 896, 836, R_f = 0.5.

Biological

Brain heart infusion broth was inoculated with *S. salivarius* which would be added to the 96 well plate. In an Eppendorf, 12 mg of the substituted paraben were dissolved to 16mg/mL in DMSO. The paraben stock, which was then diluted to 256µg/mL, was added to the first well on the plate. Rows 1-12 were filled with 100µL of the inoculant. Row 1 was aliquoted with 100µL of the substituted paraben. Rows 2-12 were then serially diluted with 100µL from the previous row. The plate was sealed with GLAD Press n' Seal® and allowed to incubate for 16 hours. Minimum inhibitory concentration (MIC) values were recorded from the lowest concentration well that exhibited no bacterial growth.

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Chernobyl: Putting *Perestroika* and *Glasnost* to the Test

Joseph Hyman

Faculty Advisor: Dr. Yulia Uryadova,

Department of History, Political Science, & Philosophy

Awarded first place Humanities paper

Abstract

The 1986 Chernobyl Nuclear accident was the first major test of General Secretary Gorbachev's 1985 perestroika and glasnost reforms that were meant to promote political openness and greater transparency from the Soviet government. The Soviet government's initially false and ever-changing narrative of events surrounding the nuclear disaster directly conflicted with Gorbachev's perestroika and glasnost platforms, casting a shadow over the legitimacy of the Soviet state in international affairs and exposing deep flaws in the Soviet system that spanned decades. It took years for the facts about the handling of nuclear power plants in the Soviet Union to emerge, and it is clear from the information available today, that the Soviets fell short in safe management of these plants, particularly Chernobyl.

In February of 1985, then-General Secretary of the Communist Party of the Soviet Union, Mikhail Gorbachev, in a report given to the 27th Communist Party of the Soviet Union (CPSU) Congress, advocated for political, economic, diplomatic, and social reform in the Soviet Union. The concept, known as “glasnost,” aimed at reforming the Soviet system in a manner that would establish greater trust and openness with the state, while “perestroika” referred to economic reforms of the communist system. Shortly thereafter, on April 25 and 26, 1986, the nuclear catastrophe at Chernobyl took place. The core of reactor number four at the V.I. Lenin Nuclear Chernobyl RMBK-1000 Nuclear Power Station exploded, resulting in the release of radioactive material into the atmosphere and across the globe, particularly in Europe and the Soviet Union. The Soviet state did not immediately report the Chernobyl accident. Details surrounding the incident were not internationally released, and, even after years passed, little else was disclosed regarding the explosion. The Soviet government’s initially false and ever-changing narrative of events surrounding the nuclear disaster conflicted with Gorbachev’s *perestroika* and *glasnost* platforms, resulting in a shadow being cast over the legitimacy of the Soviet state in international affairs.

Prior to 1985, the Soviet Union functioned under a system of total state control over media and the dissemination of information. From its inception, the Soviet government ruled on the principle that free media was inherently western in nature. V.I. Lenin was fully “aware of western concepts of free speech and press but considered them bourgeoisie notions to be debunked.”¹ In 1917, Lenin stated, “What kind of freedom do these [bourgeoisie] newspapers want [...]. Isn’t freedom to buy rolls of newsprint and hire crowds of pen pushers? We must escape from the freedom of press dependent on capital. This is a matter of principle.”² This attitude toward the press became Soviet government policy over the next sixty-five years and remained largely unchanged under the leadership of later Soviet rulers Joseph Stalin, Georgy Malenkov, Nikita Khrushchev, Leonid Brezhnev, Yuri Andropov, and Konstantin Chernenko. Particularly under Stalin, there was systematic repression and falsification of information, as well as an increase in the dissemination of propaganda. Stalin had individuals airbrushed and removed from photos after they had been purged from the Soviet government. His tendency to falsify photographs is a powerful example of the kind of repression and disinformation typical of the Soviet government under his leadership.

In 1865, during the Tsarist Russian period, an agency focused on censorship named Glavlit was founded. It died out but was later resurrected under Bolshevik rule. The agency

¹ Joseph Gibbs, *Gorbachev’s Glasnost: The Soviet Media in the First Phase of Perestroika* (College Station: Texas A&M University Press, 1999), 4.

² Gibbs, *Gorbachev’s Glasnost*, 4, 5.

worked in accordance with secret police on both the national and local levels.³ People caught violating the rules set by Glavlit were “quickly silenced,” often in a violent manner.⁴ It was not until 1985, when Mikhail Gorbachev rose to power, that this mentality regarding a free press appeared to change. Glavlit, in Gorbachev’s words, was a kind of “ideological KGB” that kept “close supervision of the periodical press, especially, libraries and archives.” In addition, Glavlit was the chief classification organization (i.e. the organization in charge of determining whether something was classified).⁵ Gorbachev saw the abolition of this practice of ideological monitoring in 1988 as a “victory” for *glasnost*, although it took three years for Glavlit to be fully abolished under his rule.⁶ *Glasnost* was heavily integrated into the Soviet system of government. Events such as the Chernobyl disaster led Gorbachev and those around him to examine and eliminate programs/organizations like Glavlit because they prevented accessibility to information and resulted in serious consequences for the Soviet state in foreign and domestic affairs.

Gorbachev saw these as serious flaws in the Soviet system, particularly with regard to limits on free speech, rampant corruption, and failure of the government to properly serve its functions. When it came to free speech and the media, the Communist Party-run press was responsible for disseminating information only deemed acceptable by the Communist Party. In an interview years after he left office, Gorbachev remarked on the Soviet system prior to his reforms, stating, “Our society, which was a very well-educated society, one of the best-educated societies, already rejected the system of total control, of suppressing dissidents and such like. The lack of freedoms was being rejected at the cultural level. The people had outgrown the system.”⁷ The unfolding of the Chernobyl disaster sparked further rejection of the Soviet system of state control, making it clear that the state was incapable of maintaining public safety even when it came to something as dangerous as nuclear fission reactors. In February 1986, Gorbachev spoke to the 27th CPSU Congress. In his speech, he asserted, “For a number of years, the deeds and actions of party and government bodies tailed behind the needs of the times and life [...]. The problems in the country’s development built up more

³ Gibbs, *Gorbachev’s Glasnost*, 5.

⁴ Veronica Ma, “Propaganda and Censorship: Adapting to the Modern Age,” *Harvard International Review* (April 28, 2016): <http://hir.harvard.edu/article/?a=13083>. Accessed Feb. 1, 2019

⁵ Mikhail Gorbachev, *Memoirs* (New York: Doubleday), 208.

⁶ Gorbachev, *Memoirs*, 208.

⁷ “The Impetus for Change in the Soviet Union,” Public Broadcasting Service, Interview conducted April 23, 2001, http://www.pbs.org/wgbh/commandingheights/shared/minitext/int_mikhailgorbachev.html. Accessed Feb. 1 2019.

rapidly than they were being solved.”⁸ For these reasons, Gorbachev sought to move away from the established practices of censorship in favor of implementing *glasnost* and *perestroika*. These programs were designed to establish more liberal, western traditions in the Soviet system, which would allow for increased economic competitiveness and for greater domestic political freedom.

In December 1985, Alexander Yakovlev, the Chief Ideologue, Second Secretary of the CPSU (1982-1990) and the Head of the Propaganda Department of the CPSU (1985-1986), wrote to Mikhail Gorbachev in a memorandum titled, *The Priority of Political Development*. Here, he argued, “[There should be] organizational forms of practicing the right to hold rallies, freedom of speech, religion, press, assembly, and the right to free travel. We want everybody to have great civic responsibilities, but that is only possible if there are great civil rights.”⁹ This attitude had previously been met with staunch opposition by many who saw these kinds of reforms as anti-Leninist and anti-communist. For example, in 1969, F. B. Sadykov, the head of philosophy at the Stavropol Agricultural Institute, criticized the Soviet system in *Unity of the People and Contradictions of Socialism*, for which he was “severely reprimanded.”¹⁰ Gorbachev referred to the treatment of Sadykov and others like him as “cruel and undeserved.” He credited the experiences of Sadykov and others for changing him as a person and leading him to promote concepts such as *glasnost* and *perestroika*.

There are many critics who say that Gorbachev’s efforts fell short. For example, Russian agronomist Zhores Medvedev argues that *glasnost* was “ambiguous” and rather selective in terms of where, when, and what information was made public. Medvedev stated, “the publication of selective reports from the weekly politburo meetings is an example of *glasnost*, but the very fact that the reports are selective and brief show the limits of the meaning [of *glasnost*] and how far it is from open government.”¹¹ *Glasnost*, as a principle, promised openness and reform for the Soviet people; however, in its initial phases, it fell short of the expectations that accompanied its implementation. A significant disparity between the introduction of *glasnost* and *perestroika* as concepts and their actual implementation was clear. As Piers Paul Read

⁸ United Press International, “Highlights of Gorbachev Talk to 27th Congress,” *Los Angeles Times* (February 26, 1986): http://articles.latimes.com/1986-02-26/news/mn-47_1_27th-congress. Accessed Feb.1 2019.

⁹ Alexander Yakovlev, trans. Svetlana Savranskaya, “Memorandum to Mikhail Gorbachev: *The Imperative of Political Development*,” The National Security Archive, December 25, 1985, <https://nsarchive2.gwu.edu/NSAEBB/NSAEBB168/yakovlev02.pdf>. Accessed Feb.1 2019.

¹⁰ Philip Boobbyer, *Conscience, Dissent and Reform in Soviet Russia* (New York: Routledge Taylor and Francis Group, 2005), 174.

¹¹ Gibbs, *Gorbachev’s Glasnost*, 11.

remarked, "It was one thing to endorse reform and another to achieve it."¹² The disaster at Chernobyl and the manner in which the Soviet government handled the situation made glaringly obvious the difference between the intended outcome of promoting transparency and the actual handling of controversial events by the government and, consequently, the media. Years of repression and the fear of consequences at the hands of the Soviet state for any type of perceived dissent resulted in the absence of the most basic communications regarding the catastrophic explosion.

In the United States, there were mixed perceptions about whether or not Gorbachev would truly bring change to the Soviet system. The April 1986 CIA Intelligence Assessment on the 27th CPSU Congress, in large part, expressed skepticism about Gorbachev's posturing towards reform. While the report acknowledges the closing of the door on the Brezhnev era of Soviet politics, which it refers to as "*laissez-faire*," it also recognizes the lack of a "decisive break" from past Soviet politics as some in the West had hypothesized.¹³ The report assessed the implications of and made predictions about what was to come of Gorbachev's new social policy:

Outcome: ... On Culture, took an ambiguous line but pushed forward more pragmatic officials into ideological apparatus.

Implications: ... Culture issues may be a source of continuing tension between those worries about ideological contamination and those who view freer flow of information necessary abject to economic modernization.

Further Steps for Second Year: Gorbachev needs to push forward with revamping propaganda machinery under the tutelage of his protégé Yakolev. May need to confront intellectuals' growing expectations for change.¹⁴

The report also stated that "Gorbachev needs to give more substance to his call for 'radical reform' if he intends to change the system in more than just cosmetic ways."¹⁵ This assessment of Gorbachev's posturing for change at the 27th CPSU Congress brought attention to elements of his new policy that could become problematic for the Soviet government,

¹² Piers Paul Read, *Ablaze: The Story of the Heroes and Victims of Chernobyl* (Great Britain: Mandarin Paperbacks, 1993), 68.

¹³ "The 27th CPSU Congress: Gorbachev's Unfinished Business," Central Intelligence Agency, April 1986, 1, <https://www.cia.gov/library/readingroom/docs/CIA-RDP87T00787R000200230004-6.pdf>. Accessed Feb.1 2019.

¹⁴ "The 27th CPSU Congress: Gorbachev's Unfinished Business."

¹⁵ Ibid.

which is precisely what happened following the Chernobyl disaster. Abroad, there was hope that Gorbachev's reforms would be successful. In December 1984, British Prime Minister Margaret Thatcher met with then-politburo member Gorbachev in London. Following the meeting, Thatcher said, "I like Mr. Gorbachev, we can do business together."¹⁶ Then-chancellor of West Germany, Helmut Kohl, had a more positive and optimistic view of Gorbachev than many in the US. Kohl stated that "if Moscow and Washington reach an agreement on medium-range missiles" he would dismantle certain German missiles.¹⁷ This move bothered American leaders who viewed these sentiments as too trusting of Gorbachev's reforms. Thus, in some foreign nations, there was a true sense of hope that Gorbachev would bring about real change in Soviet policy, particularly with regard to honesty and openness. The Chernobyl disaster proved that these foreign leaders' hopes for change were overly-optimistic and that there was still much work to be done to reform the Soviet Union.

During the latter half of the twentieth century, the Cold War was raging, while societies worldwide modernized at a previously unseen pace. Modern technology desperately needed expanded access to energy and electricity, especially in the vast and largely rural Soviet Union. In response, the Soviet government decided to pursue nuclear power as a means of satisfying this demand for energy, and, by the early- to mid-1960s, there was a race across the Soviet Union to build the biggest, most efficient, and most powerful nuclear power stations possible.¹⁸ Viktor Brukhnov, a thirty-five-year old nuclear engineer, was selected to lead construction of the V.I. Lenin Nuclear Power Station at Chernobyl, along with Nikolai Fomin, who had a background in electrical power stations (not nuclear power stations). Brukhnov was put under immense pressure to complete the power station by 1975; however, from the beginning, the project was behind schedule. Lacking proper parts and rushing through construction, the station was practically destined for failure. Brukhnov was forced to improvise parts on-site in order to complete the construction, rather than using mass-produced and purpose-built parts.¹⁹ This kind of corner cutting and haphazard management by the two young men, who had no real experience with nuclear reactors,

¹⁶ Rupert Cornwall, "Margaret Thatcher was Both Trailblazer and Sounding Board," *The Independent* (April 8, 2013): <https://www.independent.co.uk/voices/comment/margaret-thatcher-was-both-trailblazer-and-sounding-board-8564859.html>. Accessed Feb.1 2019.

¹⁷ R. W. Apple Jr., "A President And Glasnost; His Speech on Soviet Reflects a Skepticism," *The New York Times* (August 27, 1987): <https://www.nytimes.com/1987/08/27/world/a-president-and-glasnost-his-speech-on-soviet-reflects-a-skepticism.html>. Accessed Feb.1 2019.

¹⁸ Read, *Ablaze*, 35.

¹⁹ *Ibid.*, 40.

soon proved a huge oversight. The rushed, shoddy construction, and inadequately planned maintenance of the power station illuminated Soviet economic shortcomings. The power station was not fully operational until 1977, two years after the scheduled completion date.

One year after completion of the Chernobyl Power Station, an accident occurred at the Leningrad RMBK-1000 Nuclear Power Station, which was the same design as the Chernobyl Power Station, involving the “rupture of large diameter pipes, which represent major reactor accident.”²⁰ This accident was completely obscured by the Soviet government, which kept it out of the media; other power stations were oblivious to the incident and were completely unaware of specific problem areas that could lead to similar issues. The lack of disclosure regarding the accident prohibited engineers from making improvements based on documented past mistakes.²¹ The Soviet public and the rest of the international community were ignorant of the possibility and the implications of nuclear accidents.

The accident at the Leningrad RMBK-1000 Nuclear Power Station was not the only nuclear accident kept out of the public eye. In 1980, the Kursk RMBK-1000 Power Station experienced a “total blackout” which sparked serious concern for a runaway meltdown due to a power shortage to the cooling system.²² Fortunately, the built-in safety systems performed as they should, preventing a total meltdown.²³ In 1986, Chernobyl operators were simulating a similar “black-out” situation to test safety systems when the disaster took place. It was several years before any information about the Kursk accident surfaced. The information surrounding the accident at Kursk would have been important in preventing the Chernobyl disaster; however, because it was suppressed, other operators made decisions without information that would have allowed them to perform their jobs safely and more effectively. Following both the Leningrad and Kursk accidents, scientific papers were published in the Soviet Union on safety and nuclear power. Unfortunately, these papers only focused on safety for the rest of the world, not the Soviet Union. The lack of transparency surrounding previous accidents shows two very important things. First, it reveals a track record for how Soviets dealt with nuclear accidents: withholding information; keeping all mishaps, like those at Leningrad and Kursk, shrouded in secrecy; showing a disregard for public safety; and in general, treating the accidents as if they never happened. Second, this secrecy illustrates a greater concern for the Soviet Union’s image on the world stage above anything else, like public safety. The Soviet Union wanted and needed to compete with the United States and, in order to do so, cut corners to promote a better, surface-level image.

²⁰ Zhores A. Medvedev, *The Legacy of Chernobyl* (New York: W. W. Norton & Company, 1990), 268.

²¹ Read, *Ablaze*, 53.

²² Medvedev, *The Legacy of Chernobyl*, 269.

²³ *Ibid.*

In the late hours of April 25, 1986, roughly 130 kilometers from the Ukrainian capital Kiev, a safety test began at reactor No. 4 of the V.I. Lenin Chernobyl RMBK-1000 Power Station. This test was meant to simulate what would happen in the event of a loss of power, much like the blackout at the Kursk Power Station. The former leading nuclear physicist of Chernobyl, who was also commissioned as the chief investigator of the disaster, wrote that the test was “poorly prepared and its safety related measures were drawn up as a pure formality.”²⁴ Operators decided that alterations would be made to the MPA button—an essential safety feature—thus making it ineffective in the context of the test. This decision, according to Grigori Medvedev, was made chiefly by Anatoly Dyatlov, the vice chief-engineer at Chernobyl; however, the decision was not authorized by any higher authority.²⁵ This decision—though only one of many other poor decisions—was crucial because it restricted safety features which may have prevented the accident.

At 01:23 am April 26, 1986, the power to the primary turbine was turned off and the test began, despite a scheduled shutdown of the power station just hours prior, which created a hotspot within the core. This set a chain of events in motion that led to the eventual meltdown and explosion at Chernobyl. Steam built up in the reactor core, creating a massive amount of pressure. The operators then decided to insert temperature control rods tipped with graphite meant to cool the reactor; however, things did not go as planned, resulting in an unfortunate and “unforeseen consequence.”²⁶ Inserting graphite-tipped control rods massively increases the power within the reactor for a brief moment before it begins to cool the reactor. In the case of Chernobyl, this spike in power directly contributed to the massive amount of heat that had already built up.

At 01:24 am, the core of the reactor exploded, and a subsequent hydrogen explosion launched radioactive material and red-hot graphite into the air, which landed in the surrounding area.²⁷ The explosion sent 50 tons of nuclear fuel and 700 tons of radioactive graphite into the atmosphere.²⁸ Chernobyl had officially become the worst nuclear disaster known to man. The Soviet handling of the situation, however, would prove to be a disaster as well. The health and lives of citizens, the reputation of the Soviet government nationally and internationally, and Gorbachev’s newly implemented *perestroika* and *glasnost* initiatives were adversely affected.

On the morning of April 26, KGB officials began investigating, filming, and reporting the catastrophe. Not until the following morning did the news reach the town of Pripyat, only a

²⁴ Grigori Medvedev, *The Truth About Chernobyl* (Paris: Basic Books Harper Collins Publishers, 1991), 35.

²⁵ Medvedev, *The Truth About Chernobyl*, 39.

²⁶ *Zero Hour: Disaster at Chernobyl*, directed by Renny Bartlett (2004); United Kingdom: Discovery Networks Europe, 2004, Online Stream, (31:01).

²⁷ Medvedev, *The Legacy of Chernobyl*, 33.

²⁸ *Zero Hour* (33:30).

few kilometers from the power station. The announcement could be heard coming from loudspeakers throughout the town: "Attention Comrades, an unsatisfactory radioactive situation has occurred at the Chernobyl power plant. As a temporary precaution, it has been decided to evacuate people from the neighborhood of Pripyat, from 2pm today 27th of April."²⁹ This announcement was vague and minimized the danger, failing to capture the true gravity of the situation. By the time the people of Pripyat received the message, they had already been exposed to massive amounts of radiation due to their proximity to the reactor. Soviet authorities were well aware of the damage already done, and the danger of remaining in the nuclear disaster zone where radiation levels were 600,000 times greater than normal.³⁰ On April 27, the Soviet News Channel Vremya reported, "An accident has occurred at the Chernobyl Nuclear Power Station, and one of the reactors has been damaged, steps are being taken to deal with the situation and aid is being given to those affected. The government has formed a commission of inquiry."³¹ This report was brief, lacked details and, much like the announcement to the town's people of Pripyat, used vague language to hid the true extent of what had occurred. On May 15, Gorbachev made a speech on Soviet Television:

"Good evening, comrades. As you all know, a misfortune has befallen us – the accident at the Chernobyl nuclear power plant [...]. As specialist report, the reactor's capacity suddenly increased during a scheduled shutdown of the fourth unit. The considerable emission of steam and subsequent reaction resulted in the formation of hydrogen, its explosion caused damage to the reactor and the associated radioactive release."³²

It took nearly twenty days for Gorbachev to openly disclose what occurred at the reactor, even though KGB officials were on site the morning of April 26 gathering information. In the same televised speech, Gorbachev said that the people of Pripyat had been evacuated in "a matter of hours," which was blatantly false: it took nearly 12 hours for the first medical experts to arrive in Pripyat, and it was decided on the morning of April 26 that only those suffering

²⁹ *Zero Hour*, (39:10).

³⁰ *Battle of Chernobyl*, directed by Thomas Johnson, (Paris: M Way Films, 2006), <https://www.youtube.com/watch?v=p5GTvaW34O0>, (09:48). Accessed Feb.1 2019.

³¹ *First coverage of Chernobyl disaster on Soviet TV*, (Moscow: Вре́мя [Vremya], 1986), <https://www.youtube.com/watch?v=4PytcgdPuTI>. Accessed Feb.1 2019.

³² Mikhail Gorbachev, trans. Soviet Press Agency, "Excerpts from Gorbachev's Speech on Chernobyl Accident," *New York Times* (May 15, 1986): <https://www.nytimes.com/1986/05/15/world/excerpts-from-gorbachev-s-speech-on-chernobyl-accident.html>. Accessed Feb.1 2019.

from third and fourth degree burns were to be evacuated.³³ The same day, the First Deputy Minister of Energy and Electrification of the USSR, A.N. Makukhin said in his official report of events, "It is the opinion of the Third Main Directorate of the Ministry of Health that special measures, including the evacuation of the city, are not necessary."³⁴ It was not until 15:00 on April 26 that the deputy chairman of Pripyat was ordered to evacuate the entire town.³⁵ The evacuation took days to complete, not hours, as Gorbachev had said on TV more than two weeks after the event. Even in his own memoirs, Gorbachev admits that it was not until "the first few days of May" that the evacuation of those affected was to be completed.³⁶ Gorbachev, the very man promoting openness, transparency, and reform, could not get his story straight on something as simple as the time it took to evacuate the people of Pripyat. He also never mentioned the initial report made by the Ministry of Health which declared that an evacuation was unnecessary.

In early May 1986, American President Ronald Reagan was briefed by the CIA on the Chernobyl situation. In the briefing, the CIA, using satellite imagery, reported that the evacuation had not been completed until May 7, 1986, confirming that Gorbachev's initial television statement was false. It is unlikely that Gorbachev did not know the facts and timeline, when even those outside the Soviet Union did.³⁷

Both in interviews and in his memoirs, Gorbachev said that he received vague information, lacking details regarding the accident. In an interview, Gorbachev claimed he was not informed, that he heard "not a word about an explosion, at first I was told there had not been an explosion. The consequences of such false information was particularly dramatic [...] information we got was that everything was sound including the reactor [...] that the reactor could be set up in Red Square."³⁸ Yet, Gorbachev states in his memoirs "I absolutely reject the accusation that Soviet Leadership intentionally held back the truth about Chernobyl. We simply did not know the whole truth yet."³⁹ This declaration fails to acknowledge that there were KGB

³³ Medvedev, *The Legacy of Chernobyl*, 136.

³⁴ A.N. Makukhin, trans. Anna Melyakova, "First Deputy Minister of Energy and Electrification of the USSR Regarding the accident at Reactor No. 4 of the Chernobyl Nuclear Power Plant," April 26, 1986, <https://nsarchive2.gwu.edu/NSAEBB/NSAEBB504/docs/1986.04.26%20Report%20on%20Chernobyl%20Accident.pdf>. Accessed Feb. 1, 2019

³⁵ Medvedev, *The Legacy of Chernobyl*, 137.

³⁶ Gorbachev, *Memoirs*, 189.

³⁷ *Chernobyl Accident* (Washington, DC, Central Intelligence Agency Directorate of Intelligence, 1986): <https://www.youtube.com/watch?v=sFevQANQjOI>. Accessed Feb. 1 2019.

³⁸ *Battle of Chernobyl* (07:00).

³⁹ Gorbachev, *Memoirs*, 189.

and Ministry of Health officials, along with others, on-site recording videos and making notes about the situation. At some level, Soviet leadership withheld information and yet, supposedly none of this reached Gorbachev. The handling and subsequent reporting of this situation clearly demonstrates a lack of consistency with regard to what was actually happening, what was being reported to the people, what was being reported to Gorbachev, and what Gorbachev was reporting to the world. The layers of nebulosity and contradiction directly contrasted the internal openness that Gorbachev was promoting in *perestroika* and *glasnost*.

Internationally, the Chernobyl disaster only reaffirmed what many nations and world leaders had come to expect from the Soviet state: lowered safety standards, the dilution or complete falsification of facts, and attempts to save face on the international stage, even at the cost of human life. While Gorbachev claimed that he and other members of the Politburo thought that "information should be released completely,"⁴⁰ from the day of the disaster, it was clear the Soviet Union was going to attempt to obfuscate the truth, omit information, and mislead the international community.

The first international reports of the disaster came from Sweden, not the Soviet Union. At the Swedish Forsmark Nuclear Power Station, workers began showing up presenting higher-than-normal levels of radiation on their clothing and shoes. In an interview, Swedish nuclear engineer Cliff Robinson stated, "It was a frightening experience and of course we could not rule out that something had happened at Forsmark [...] my first thought was that a war had broken out and that somebody had blown up a nuclear bomb," and yet, several days passed before Moscow made any official international announcement of the event.⁴¹ On May 4, President Reagan stated in a speech that "the Soviets owe the world an explanation." Reagan also declared that "a full accounting of what happened at Chernobyl and what is happening now is the least the world community has a right to expect."⁴² Based on the information being delivered to President Reagan, he clearly understood the gravity of the situation and the degree to which the Soviet Union was obfuscating, falsifying, and/or omitting information. The same frustration regarding the situation was felt around the world, since the incident affected the entire global community. Norway was particularly afflicted, stating in a 1994 report, the Norwegian Radiation Protection Authority: "Countries outside

⁴⁰ Gibbs, *Gorbachev's Glasnost*, 40.

⁴¹ "Chernobyl haunts engineer who alerted world," *Cable News Network* (April 26, 1996): <http://www.cnn.com/WORLD/9604/26/chernobyl/230pm/index2.html>. Accessed Feb.1 2019.

⁴² Jack Nelson, "Reagan Criticizes Disaster Secrecy: Soviets 'Owe World an Explanation' for Chernobyl Blast, President Says," *The Los Angeles Times* (May 4, 1986): http://articles.latimes.com/1986-05-04/news/mn-3685_1_soviet-union. Accessed Feb.1 2019.

the former USSR, particular Norway and Sweden received considerable amounts of fallout from the release during the first days following the accident."⁴³ The fact that the first international knowledge of a disaster within the Soviet Union came from other nations pointed to one of two possibilities: that the Soviet Union was purposefully covering up the disaster and attempting to keep it hidden from the global eye for as long as possible, or that the Soviet system was so inept and disorganized that other nations were more aware of Soviet internal affairs than they were. Whether it was the former, the latter, or some combination of the two, the deep political flaws in both scenarios completely contradicted Gorbachev's *perestroika*.

On April 28, 1986, ABC News featured a report detailing the Chernobyl events up to that point. The report lasted roughly five minutes and consisted of photos, on-site journalistic reports, and more general information.⁴⁴ The ABC report was clearly more informative than what had been disclosed by the Soviet government. Overall, reporting from the international community was more accurate and detailed than that coming out of the Soviet Union. In addition, these reports were apparently more factual and reliable than the intelligence that Gorbachev was receiving from his own investigatory commission. Compared to the initial television broadcast from *Vremya*, there was no question that those outside the Soviet Union were receiving far more extensive and comprehensive information than the Soviet people.

In the years following the disaster, more information surfaced regarding the event. Accounts differed depending on which country was reporting on the issue. For the first few years, those in the western world had no choice but to rely on information provided by the Soviets. In 1992, *The Washington Post* reported, "Western experts were at first inclined to accept the Soviet explanation that operator error was chiefly responsible for the Chernobyl disaster. But a recent report by the International Atomic Energy Agency in Vienna pinned most of the blame on a series of fundamental flaws in reactor design."⁴⁵ Gorbachev even admitted that, "the accident at Chernobyl nuclear power station was graphic evidence, not only of how obsolete our technology was but also of the failure of the old system."⁴⁶

⁴³ *Radioactive Fallout in Norway from the Chernobyl Accident*, Norwegian Radiation Protection Authority, (1994): http://www.iaea.org/inis/collection/NCLCollectionStore/_Public/25/049/25049596.pdf. Accessed Feb.1 2019.

⁴⁴ *Chernobyl Nuclear Disaster ABC News Report From April 28, 1986* (New York: American Broadcasting Company, 1986): <https://www.youtube.com/watch?v=hF5995Z1S-I>. Accessed Feb.1 2019.

⁴⁵ Michael Dobbs, "Chernobyl's Shameless Lies," *The Washington Post* (April 27, 1992): https://www.washingtonpost.com/archive/politics/1992/04/27/chernobyls-shameless-lies/96230408-084a-48dd-9236-e3e61cbe41da/?noredirect=on&utm_term=.25a0eea396cc. Accessed Feb.1 2019.

⁴⁶ Gorbachev, *Memoirs*, 189.

The Chernobyl disaster was a major test for Gorbachev's newly implemented *perestroika* and *glasnost* initiatives. Soviet nuclear power stations, particularly the Chernobyl Power Station, were constructed and managed in the classic Soviet style of cutting corners, concealing information, and in general, mismanaging highly critical matters such as critical nuclear tests and accidents. On April 25 and 26 of 1986, the combination of mismanagement, the absence of pertinent information, and a facility with subpar safety conditions resulted in the worst nuclear disaster in history. During an interview later in life, after being sentenced to more than ten years in prison, Dyatlov, one of the chief engineers, stated that "the real blame lies with the [Soviet] atomic energy authorities not having the correct documentation when and where it was needed [and] made the explosion of the reactor inevitable. The reactor marched straight to its doom."⁴⁷ The Soviet handling of the disaster was just as much of a catastrophe. It took years for the facts about what happened that fateful night to come to light. The mismanagement of the power station and aftermath of the accident resulted in thousands of cancer cases and various other medical issues for victims both inside and outside of the Soviet Union. The handling of the disaster was the first real test of the *perestroika* and *glasnost* reforms, and did not pass muster, showing that the Soviet system was inherently flawed. In the years following the Chernobyl disaster, no true reform had taken place with regard to transparency of information in the Soviet Union.

⁴⁷ *Battle of Chernobyl* (09:48).

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Awarded first place in Visual Arts

Artist's Statement

The materials I work with are cast bronze, copper, resin, and clay. I am especially excited about my recent material explorations with casting bronze around bisque fired clay. With these materials, I create imagery related to the human body. The metal, clay, and other materials work together to represent the human body by representing bone, flesh, and other organs. I particularly appreciate the relationship that clay and metal can have, one being strong and the other more fragile. This has become the basis of my three-dimensional work. The jewelry I create is more sculptural because it is non-functional jewelry. My initial interpretation of jewelry was that it is supposed to be pretty, but that does not appeal to me either aesthetically or conceptually. What I want to convey is a slight uneasiness or an unsettling feeling when viewing my work. My artworks deal with a sense of discomfort.



Work Details: Pulled Teeth Part #1 and Pulled Teeth Part #2, fabricated brooches (top); Finger-Vertebrae Ring, fabricated ring (bottom)

Watering Down Accessibility: The Issue with Public Access to Alaska's Federal Waterways

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Awarded first place Environmental Science paper

Abstract

Federal land management is a major issue throughout the United States, but especially within Alaska. The land and waterways managed by the federal government also include the facilities and accessibility points within them. Through Longwood University's Arctic Circle trip to Alaska, I discovered that many of these accessibility points are poorly maintained, with some even closed completely. As the majority of Alaskans use federal waterways, it is important to maintain these docks and boat ramps for the safety of residents. This paper proposes four potential solutions to this issue and explains the impact of each on the stakeholders involved. Through this research, I have found the best options and have provided a proposal for action for the parties involved.

Introduction

Longwood University's citizen leader curriculum provides many opportunities for students to explore world issues. One of the programs available for students is the Brock Experience in the Arctic Circle. This program allows students to explore Alaska from Fairbanks to Prudhoe Bay with the main goal of studying the Trans-Alaska pipeline. Although this issue was the central focus of the excursion, students in this program were encouraged to observe and reflect upon other problems that the Alaskan people may face, provided potential solutions to these issues, and applied these measures to a much broader perspective.

Throughout the Arctic Circle Excursion, Longwood's participants grasped the importance of federal lands and waterways in the lives of Alaskans. The federal waterways, typically managed by the National Park Service or Bureau of Land Management, grant residents access to prime fishing areas and recreation grounds. Yet, after conversations with stakeholders throughout the state, the students found that many of the rivers and streams residents depend on have become nearly inaccessible in recent years. Many docks and ramps along federal waterways have become dangerous and many have been closed to public access. Those not closed to the public remain imminent safety hazards for those who choose to use them. Without a solution to this issue, Alaska residents risk physical harm in their attempts to gain access to public waters or will have no access whatsoever. Although the issue is extremely dynamic, there are four main solutions for resolving such a multifaceted problem. Through these solutions, it is possible to decipher the impacts on stakeholders and provide information on each option available. With these four possible solutions, I offer unique perspectives on the issue in order to come to a conclusion that will both resolve the current issue and reduce the potential for future recurrence.

The reader will be afforded a detailed description of the issue, including information from various sources. In this section, photographic evidence will be used to display the safety and accessibility issues involved. Next, the research introduces the four options for solutions to the issue. Each solution defines the stakeholders it impacts, as well as those that would prefer this particular solution. Following the solutions, the paper concludes with recommendations for the viable solutions and potential steps that can be taken towards implementing the proposed option.

Issue Description

For decades, the state of Alaska and the federal government have battled over the jurisdiction of waterways within the state. The United States is the largest landholder in Alaska, with ownership of just over 60 percent of the total area of the state (Alaska Department of

Natural Resources, 2000). Nearly half of these federal lands have been set aside for public use with eighty million of the total two-hundred and twenty-two million acres. The U.S. National Park Service and the U.S. Fish and Wildlife Service manages just over half of all federal lands in Alaska, while the Forest Service and the U.S. Bureau of Land Management manages the remaining public areas (ADoNR, 2000). The nation's control over more than half of the state blurs many lines concerning regulations and access to the state's waterways. Throughout the years, federal jurisdiction has changed significantly, leaving many areas undefined in the process. The most prominent law related to this issue is the Alaska National Interest Lands Conservation Act of 1980 or ANILCA. Passed during the Carter administration, this act protects federal ownership of lands within the state, but also stipulates that areas within federal lands are not subject to many federal regulations (Tobias, 2015).

Unfortunately for many Alaska residents, including John Sturgeon of the recent U.S. Supreme Court case *Sturgeon v. Frost*, federal regulations still apply to the banks of these waterways. Thus, any accessibility point, boat ramp, or dock placed along federal waterways is under federal agency, unless it has been granted to the state by the Bureau of Land Management through a Recordable Disclaimer of Interest or RDI (Gullufsen, 2018).

The issue lies in the management of countless access points to waterways within the United States' eighty-eight million acres of public lands. Alaska itself is home to more than three million lakes, 12,000 rivers, and thousands of streams and creeks, and 60 percent of these are within the federal government's jurisdiction (ADoNR, 2018). With so many waterways to manage, many access points have become degraded by years of weather damage and wear (see Appendix A). According to Barbara, a 32-year Fairbanks resident and employee at the local sweets shop, Fudge Pot, many of these facilities are left unrepaired. The local dock that she and many other Fairbanks residents use for fishing has been derelict for nearly two years now. When Barbara complained to local officials, they informed her that the dock was under federal agency, as it is on federal land. When federal officials were informed of the accessibility point's condition, they closed the dock instead of repairing it. Barbara explained that she was devastated by the outcome, as she relies on her fishing trips as a food source.

The main stakeholders in this issue are residents of Alaska, just like Barbara. These people comprise the public that has "a constitutional right to access on and use of navigable and public waters regardless of who owns the underlying bed" (Ryland, 2010). Next, there is the federal government, whose funds and resources are needed to maintain accessibility points, unless granted to another agency. The state is also a major stakeholder in this issue, as it is responsible for the well-being of its residents and has the option of applying for jurisdiction over many of the accessibility points owned by the federal government. Finally, there are

private agencies, many of whom have an interest in such accessibility points, as they may be hired for maintenance of facilities. Each of these four primary stakeholders has a special interest in federal waterways and accessibility points which impacts their views on primary options for resolution to this issue.

Options for a Solution

By researching Alaska's waterways and the many factors related to the dynamic issue, I have provided four solutions to the problem of accessibility point maintenance. Although the points are controlled by the federal government and its agencies, there are countless accessibility points involved in this issue. Because of this, maintaining the condition of all docks and boating ramps is both time-consuming and costly. In recent years, the federal government has suggested that it may not have the resources to deal with such a large issue while taking into account the needs of Alaska residents. Thus, the four solutions described represent the key potential solutions to the issue, while the Conclusion and Recommendations portion of the research explains which option would suit the most stakeholders best.

Option 1: Completely Federal

Currently, the federal government has exclusive jurisdiction over federal lands, including the docks, boating ramps, and other accessibility points involved. This option allows the federal government to maintain complete control over all federal waterways and accessibility points. With this option, the federal government will be in charge of maintaining all accessibility points through specified agency funding provided by the National Park Service or the Bureau of Land Management. The federal agencies involved would facilitate the repair of all accessibility points. Yet, this option allows the federal government to continue to do so at their discretion. Because of this, many private individuals may not have their desires acknowledged by the federal agencies, thus many Alaska residents would continue to use unsafe accessibility points or go without access entirely. Although the option may not be best for private individuals, the state of Alaska would not be required to fund such maintenance programs. Thus, the state may prefer this option.

This option is subject to change, as the U.S. Supreme Court is currently reviewing it in *Sturgeon v. Frost*. In this case, though not directly related to the issue of accessibility points, the Court is examining federal regulatory control over waterways within the National Park System (*Fairbanks Daily News-Miner*, 2018). In 2016, the Supreme Court decided in favor of *Sturgeon* in a unanimous decision, but it did not completely resolve regulatory issues (Oyez, 2018). Once the Court hears the issue again, it may release the issue of accessibility to state regulation and agency.

Option 2: Private Contractors

The second option is closely related to the first. Under this option, the federal government would remain in exclusive control of waterways within their lands. Rather than completing maintenance projects themselves, each federal agency would hire private contractors to complete routine maintenance on accessibility points within their jurisdiction. This option is slightly more complex, as it requires that the ownership of these facilities remain with the federal government, as regulatory policies would prevent this occurrence otherwise.

Through Option 2, the federal government would enter into contracts with private construction companies to ensure the upkeep and maintenance of waterway access points, including docks and boating ramps. This method is preferable to the federal government rather than Option 1, as it saves on labor, maintenance, and completion oversight costs; however, it may be just as expensive to enter into such contracts, depending on the companies involved. Private individuals may also prefer this option, as the incentive of a federal contract may ensure that projects are completed effectively. The state government would also prefer this option, as they will not be responsible for ensuring such projects be completed. Finally, private companies would much prefer this option, as federal contracts are valuable and often provide necessary business to small construction agencies.

Option 3: Private Individuals

Next, there is the option of completely privatizing accessibility points for federal waterways. Through this option, the federal government would allow private individuals, likely Alaskan residents, to construct their own accessibility points for private use along waterways. Unfortunately, this issue openly displays the economic phenomenon titled “the free-rider problem.” As privately constructed docks and boating ramps would not be on private land, they would be open to all of the public for use, despite being built by individuals. Because of this, few individuals would participate in constructing accessibility points, while others would simply “free-ride” and use those constructed by others. Eventually, this could lead to more potential issues, including poorly-maintained structures and lawsuits.

Because of the issues involved, few stakeholders would choose this option. Some private individuals may prefer this option as it would grant them free reign to construct accessibility points where they see fit, within federal regulations. Yet, the federal government would still risk lawsuits if accidents were to occur and private individuals would be forced to invest their own resources in maintaining such structures. Private companies would not receive the same business they would with Option 2 either. The state government may also deal with potential lawsuits arising from this option. Thus, few would say this is the best of the four solutions.

Option 4: State Maintenance

The final option of the four requires that the federal government grant waterway jurisdiction to the state. With this solution, the state would be granted agency over federal waterways, thus they would be subjected solely to state regulation and maintenance. Through this option, the state government would be responsible for the construction and maintenance of accessibility points along the now-federal waterways. Over the past few decades, the state government has been fighting to gain control of federal waterways and submit them to state regulatory policies (Gullufsen, 2018). Under this option, the state would finally have the ability to completely regulate their own waterways. This option may become the primary option if the U.S. Supreme Court rules in Sturgeon's favor in *Sturgeon v. Frost* during the second hearing.

The federal government may not prefer this option as they would lose jurisdiction over all waterways within 88 million acres of land; however, it would save the financial resources of federal agencies through reduced labor and maintenance costs. Private individuals may not like this issue as Alaska is the least economically-stable state in the United States and renowned for budgetary issues (*U.S. News*, 2018). Conversely, both private companies and the state of Alaska would be satisfied with this option, as the state already employs private companies to maintain its accessibility points. The state would have to pay much more in recreational maintenance but, under this option, would have sole control over its own waterways.

Conclusions and Recommendations

There are many facets of the dynamic issue of accessibility point maintenance along Alaska's federal waterways, as evidenced by the research provided. For centuries, residents of Alaska relied upon the waterways' resources for survival. Yet, many accessibility points have been demolished in recent years and the federal government has not responded to citizens' calls for help. Without a solution to this issue, private individuals are at risk for physical harm or even death due to poorly maintained and unsafe waterway structures. The current solution being employed is simply the closure of unsafe structures. Unfortunately, this leaves citizens without access to waterways that they have a constitutional right to enter. The waterways and the resources within belong to the citizens of Alaska, and it is their right to access them freely and safely.

By researching these options, there is only one solution that will please all four primary stakeholders involved: Option 2: Private Contractors. Although this option assumes that the federal government maintains exclusive jurisdiction over federal waterways, which is subject to change in the coming months, it creates the proper economic incentives for the best quality accessibility points. With this option, the federal government would privatize the mainte-

nance of public access points, which would ensure through contracts that such points are in proper condition. This would allow private individuals to safely enter waterways, without risk of physical harm. The state, although not in control of the waterways, would not have to pay the heavy costs of maintenance and regulation involved. Alaska would also receive some economic benefits through the consistent employment opportunities in the private sector created by the contracts.

Thus, with the selection of Option 2, the first step is for the federal agencies within Alaska, specifically the National Park Service and Bureau of Land Management, to create a list of all public accessibility points within their jurisdiction. The agencies must then auction off contracts for groups of or even individual accessibility points, docks, and boating ramps. The auction ensures that the federal agencies receive the best price available. Next, contracts must be formed that establish maintenance requirements, in compliance with federal regulations. Finally, the contracts must be made and overseen by the distributing agency to ensure maintenance is proper and all accessibility points remain safe.

Through this solution, stakeholders, such as Barbara, would be able to access their public waterways both safely and freely. The federal government would be relieved of the burden of maintaining so many accessibility points, while providing business for numerous construction agencies within the state. This would contribute to Alaska's economy as well, providing consistent construction jobs. Overall, this option, though complex, would please the most stakeholders involved while maintaining the safety of Alaska residents.

Although the issues discussed largely focus on the impact in Alaska, the potential solutions may apply in other instances. Within the United States, many localities feel the animosity between the public and private sector, especially in areas where the federal government owns much of the land area. Particularly in western states, this conflict has been a major part of citizens' lives. If researched farther, much of the tension between public and private sectors may be avoided through the application of the solutions I have provided. Through collaborative efforts with private agencies, the federal government will be able to provide for its citizens across the United States.

Appendix A



Damaged Boat Ramp (Canfield, 2014)

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Why Has the Democratic Republic of the Congo Outsourced its Responsibility to Educate its Citizens?

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Awarded second place Humanities paper

The Congolese State has been struggling to achieve most of its Millennium Development Goals (MDGs) and has failed to control many areas of public life. This has led to a disengagement of the state which has yielded its responsibility to educate its own people. We have seen several actors engaging in what can be coined as a “negotiated” or “hybrid” system. The first part of this research will try to uncover the failures of the civil service and its responsibility in the hindrance of the state capacity. Given the extractive and predatory nature of the Congolese bureaucracy uncovered in the literature on the topic, we will focus on how it has continuously contributed to the state’s inability to control its education system. The second part will deliberate of different approaches to solve this issue, namely their advantages and shortcomings, and assess the most feasible solution in the context of the DRC.

Introduction

The Democratic Republic of the Congo (DRC) is experiencing a strong decentralization of its national education system, giving rise to a hybridization of the education process between state and non-state actors. This phenomenon has been further exacerbated by repeated crises in the country and has led to a very slow evolution of the country's schooling in contrast with strong demands, mostly among younger generations, for a dynamic education system. Thus, the Congolese State has disengaged from its responsibility to educate its citizens. The complexity of its education system is exposed by the multitude of actors engaging in the education sector. Like most systems, the DRC has a public and private sector; however, within the public sector, there is the government-controlled system ("unconventionized") and another controlled by religious group ("conventionized"). What also sets them apart from other systems is the influence of external actors. Religious groups (Catholic, Protestant, Kimbanguist, and Islamic), parent associations, and non-governmental organizations (NGOs) all take active roles in the DRC's education system at the local level, which ultimately lessens the state's authority in this domain of public life. But why has the Democratic Republic of Congo (DRC) outsourced its responsibility to educate its people?

This question derives from the current context of reconstruction in the country. Having suffered losses from repeated military and economic crises, the DRC cannot handle many of its internal crises, particularly their national education system. The many repercussions of these crises have undercut the country's reconstruction efforts at the educational level. The literacy rate has remained low, albeit with some recent improvements.¹ Despite this alarming situation, the international community has tried implementing societal reforms to find parity between the state and various local actors. However, the state still takes a backseat when it comes to education in the DRC. Explaining this situation is the main focus of this paper. While many factors may play a role, such as the history of violent conflict in the DRC, the focal point of this study is on the Congolese civil service. Specifically, it is argued that the state bureaucracy has failed in its job to maintain control of the education system.

This hypothesis will be developed further in a comprehensive essay starting with a brief contextual presentation of the problem. The academic literature on the topic will then be analyzed. Finally, a thorough exploration of the thesis, with data analysis, will lead us to an evaluation of the accuracy of the hypothesis.

¹ World Bank, *Monthly Revenue by Level of Education for the Education Sector and other Sectors in the DRC (USD)* figure 65 (2015). <http://documents.worldbank.org/curated/en/469851468186549157/pdf/ACS14542-WP-P147553-Box394836B-PUBLIC-ENGLISH-DRC-Education-PER-FRE.pdf>. Accessed Jan. 31, 2019.

Outlining the Problem

The DRC has faced several problems over the course of its existence, and there are several factors responsible for the failure of the reconstruction process in the country. Among those problems is a particular focus on the struggles of the national education system, mainly the state's inability to control and properly govern it. This failure is partly due to the inefficiency of the civil service in carrying out the directions of the central government for the entirety of the territory. This has been the case for several years now, and the source of these issues traces back to the colonial period, and the fragmented governance inherited thereafter. Therefore, before presenting and analyzing the literature on the topic, a bit of historical context is necessary.

Understanding the uniqueness of the Congolese school system involves analyzing its origins and its socio-historical construction. Doing so requires briefly highlighting the strategies established by the colonial rulers after Belgium's King Leopold II, who considered this area to be his personal property, ceded Congo's territory to the Belgium government in 1908. Missionaries worked closely with the colonial government and education quickly became part of their focus. Thus, religious figures were considered teachers by the state and assumed all school expenses. Literacy, evangelization, and colonization became one. Until the late 1940s, Catholic schools grew in autonomy; they managed and inspected their own schools. No academic degree or specific qualifications were required for missionaries to teach.² At the dawn of World War II, the Catholic Church managed nearly 18,000 schools, with 4,600 subsidized by the government. However, this Church hegemony contrasted with other actors in the education system, namely the state which wanted higher literacy rates. In the late 1950s, moreover, Belgium experienced a domestic crisis as Catholics and secular (anticlerical) forces fought for control of the education system: *La Guerre scolaire* [The School War] (1950–59). This crisis shattered relations between Catholics and the colonial administration and resulted in a division of authority over the school system between the public sector, controlled by the state administration, and the *libre* sector, which included Catholic and other private groups.³

Another crisis in the post-colonial period also affected the education system. In 1971, a revolutionary movement—the MPR—decreed the complete nationalization of education in Zaire (the previous name of the DRC). This movement emanated from frustration over the ineffectiveness of the current education system. State secularism and authenticity were proclaimed and implemented. Yet, faced with the pressure of religious networks, the Mobutu regime caved and

² M. D. Markowitz, *Cross and Sword: The Political Role of Christian Missions in the Belgian Congo, 1908–1960* (Stanford University Press, 1973), 223.

³ République Démocratique Du Congo—Constitution Du 1er Août 1964. <http://mjp.univ-perp.fr/constit/cd1964.htm>. Accessed January 31, 2019.

agreed to give schools back to churches under a vague supervision of the state called the "1+ 4 government." The public sector was now divided into five "networks." The state manages one of these networks. The other four "conventionized" networks have a religious origin and were managed by four religious groups (Catholic, Protestant, Kimbanguist, and Islamic). The ambiguity of the terms and the lack of proper sanctions resulted in the signing of a new deal in 1986 which further opened the door to the private sector without fixing the real problem: the inexistence of a well-administered and uniform system. Worse, in 1992, the *Association nationale des parents d'élèves* (ANAPE) undertook the payment of teachers by parents in the Catholic network in the form of a "motivation bonus." This model was later institutionalized in most of the networks and still exists today (SECOPE). By the early 2000s, funding for education was virtually nonexistent, and "donors" entered into the DRC education system. Their entrance further diminished the national government's power over schooling. This decentralized system is under the direction of the *Ministère de l'Enseignement Primaire, Secondaire et Professionnelle* (MEPSP), which consists of thirty *provinces éducatives* (PROVED) and 258 *Sous-provinces éducatives* (Sous-PROVED).

Literature Review

Problems with the DRC's education system started long ago; several actors influenced a part of the education system without being fully capable nor willing to control it exclusively. M. Poncelet, G. André, and T. De Herdt point out how the "historic hybridization of the education system in the DRC" is the core explanation of the deficiency of schools in the DRC.⁴ They also argue that foreign aid is futile since it does not fully tackle the complexity of the system already in place. Marenin similarly suggests that donors should "learn how to play local politics."⁵

Similarly, K. Titeca and T. de Herdt assert that the lack of national authority in this system undercuts any administrative policies since there is no effective enforcement mechanism nor any proper inspection.⁶ However, there are some instances that refute the complete absence of state governance in education since it retains "the symbolic power," particularly in the negotiation arena. This case is also corroborated by Boas and Jennings' claim that what categorizes so-called "failed states" is not the absence of the state but rather the blurring of boundaries and responsibilities.⁷

⁴ M. Poncelet, G. André, and T. de Herdt, "La survie de l'école primaire congolaise (RDC): héritage colonial, hybridité et résilience," *Autrepart* 54 (2010/2): 23-41.

⁵ O. Marenin, "Styles of Policing and Economic Development in African States," *Public Adm Dev*, 34 (2014): 149-61, at 59.

⁶ T. de Herdt and K. Titeca, "Governance with Empty Pockets: The Education Sector in the Democratic Republic of Congo," *Development and Change* (2016).

⁷ M. Boas and K. Jennings, "Insecurity and Development: The Rhetoric of the 'Failed State.'" *European*

After noticing recent improvements of the Congolese school system,⁸ K. Titeca and T. de Herdt observe a functioning and somewhat working education system “with empty pockets.”⁹ Far from collapsing along with the budget, the school administration continues to operate. Such a paradox leads them to conclude that both state failure and persistence exist. In a system they describe as “mystification,” the authors present the Congolese state as sustaining authority by trading its financial involvement for the maintenance of the education system, thus reducing the burden from the national budget.

While the DRC has suffered from several wars, K. Titeca, I. Wagemakers, and T. de Herdt refuse to blame the country’s instability.¹⁰ They first highlight a large gap between the population’s demand for public school education and the state’s inability to fulfill it. They then conclude that the social contract between the people and the state has eroded, a process that began before its civil conflicts, when the state largely withdrew from the budgetary area. Finally, they assert that there is a paralyzed system of checks and balances within the state in addition to problems with donors who have failed to organize effectively at the local level.

K. Titeca, T. De Herdt, and I. Wagemakers argue that given the *de facto* decentralization of the education system, schools run on a supply and demand basis conditioned by parents’ purchasing power matching teachers’ salaries.¹¹ This arrangement extends beyond the reach of national government and is instead driven by local-level realities. More troubling, local governance and public services are not produced by the state, but by a large network of actors. Therefore, depending on the local reality and the main regional actor, the state’s negotiating power may vary, which makes even the “negotiated stateness” more complex. A similar study from Niamh Gaynor shows the challenges of decentralization as a peacebuilding strategy in fragile states like the DRC.¹² She shows that the “complex and negotiated” structure of the Congolese administration is rooted in an elite political settlement to the detriment marginalized factions and groups at the provincial level.

Similarly, V. Boege, A. Brown, K. Clements, and A. Nolan posit that the complex institutional makeup of “failed states” differs from the mainstream Western concepts of what constitutes

Journal of Development Research (2005): 385-95.

⁸ World Bank, *Monthly Revenue in the Education Sector in the DRC* (2015).

⁹ Herdt and Titeca, “Governance with Empty Pockets,” 472-94.

¹⁰ T. de Herdt, T. K. Titeca, and I. Wagemakers, “Make Schools, Not War? Donors’ Rewriting of the Social Contract in the DRC,” *Development Policy Review* 30:6 (2012): 681-701.

¹¹ K. Titeca, T. De Herdt, and I. Wagemakers, “God and Caesar in the Democratic Republic of Congo: Negotiating Church-state Relations Through the Management of School Fees in Kinshasa’s Catholic Schools,” *Review of African Political Economy* 40:135 (2013): 115-130.

¹² N. Gaynor, “Challenges to Decentralization in the Democratic Republic of the Congo: Beyond the Political Settlement,” *Journal of International Development* 28:2 (2016): 193-213.

a state.¹³ They claim that such states have transformed their institutional powers into a “hybrid political order.” By acknowledging the strength of local institutions, the state gains authority by not imposing its supremacy over them. Thus, they see this lack of centralization not as inherently problematic, but as one that can be dealt with through a “coordinating and harmonizing framework.” Similarly, Shahar Hameiri dismisses the idea of understanding state failure through a simple assessment of capabilities.¹⁴ He argues for the possibility of “real governance” at play in a particular sector within the institutional identity of a particular state. This relativist theory matches the DRC school system where the administrative framework has recreated itself based on its context to survive.

However, the investigations conducted by T. De Herdt and E. Kasongo refute this argument.¹⁵ About eighteen months after the enactment of a policy that provided for free primary education (2010–11), the Congolese administration struggled to enforce this directive due to its inability to match the costs. However, this effort was also stifled by the state’s inability to enforce the directives uniformly since each locality had its own specific particularities that needed to be handled separately. These findings show the inefficiency of this multi-faced system with little to no central authority.

For M. Larmer, A. Laudati, and J. F. Clark, the complexity of the education system in the DRC emanates from the creative response of communities and ordinary citizens that has allowed public sectors like education to survive in a war-torn state.¹⁶ However, they warn against the persistence of this originally temporary “coping” system since it has been embedded in social relations that will be hard to overcome given the social division in the country. Conversely, J. Gouzou reveals that after looking at civil society organizations (CSOs) in eastern DRC, civil societies are also incapable of assisting the state as it seeks to improve governance.¹⁷ He also points out some of their insufficiencies ranging from financial capacities to general incompetence.

The academic literature portrays a problematic situation in the Democratic Republic of the Congo’s education system. The next section of this paper will examine the role played by the

¹³ K.P. Clements, V. Boege, A. Brown, W. Foley, and A. Nolan, “State Building Reconsidered: The Role of Hybridity in the Formation of Political Order,” *Political Science* 59:1 (2007): 45–56.

¹⁴ Shahar Hameiri, “Failed States or a Tailed Paradigm? State Capacity and the Limits of Institutionalism,” *Journal of International Relations and Development* 10 (2007): 122–149.

¹⁵ T. De Herdt and E. Kasongo Mungongo, “La gratuité de l’enseignement primaire en RDC: attentes et revers de la médaille,” *Conjonctures Congolaises: chroniques et analyses de la RD Congo en 2011* (2013): 215–38.

¹⁶ M. Larmer, A. Laudati, and J.F. Clark, “Neither War nor Peace in the Democratic Republic of Congo (DRC): Profiting and Coping amid Violence and Disorder,” *Review of African Political Economy* 40:135 (2013): 5

¹⁷ J. Gouzou, *Study on the Role of Civil Society in Governance Processes in the Democratic Republic of Congo (DRC)* (ISaC, CARE International, & PSO, 2012).

civil service in order to explain this situation. This section will focus on the educational responsibilities of the civil service, which has been largely dysfunctional since 1991.

Data Analysis

Recent reports show net improvements in the DRC's education sector between 2005 and 2012. In particular, access to education as measured by Gross Enrollment Rate (GER) has increased at all levels.¹⁸ This results from coordinated reforms between the state and foreign donors to increase public spending in education.¹⁹ However, as noted earlier, there are several governance issues that have slowed down improvements and control of the national education system on the part of the state. Despite the gradual reassertion of authority by the Congolese government, most notably with the 2006 and 2011 elections and the civil service reforms of 2005 and 2011, the country is ranked 176th in the Human Development Index (2014), which partly measures education levels. Thus, the DRC remains on the list of "failed states."²⁰ In addition, the DRC is 47th out of 52 African countries in the Mo Ibrahim Index of African Governance.²¹ The International Monetary Fund (IMF), furthermore, characterizes the country as possessing "strong macroeconomic performance, but high vulnerabilities."²²

In the context of education, only 47 percent of Congolese students are considered literate, relative to 59 percent for comparable countries in the region. Only 77 percent of the country's adult population is literate.²³ Additionally, despite improvements in access to education, the country has failed to achieve its UN Millennium Development Goals—now called Sustainable Development Goals—in the education sector.²⁴ These realities highlight a certain failure of the system directed by the MESPS, the state agency in charge of education. This study suggests that the Congolese civil service is partly to blame for the inability of the state to control its education system.

¹⁸ World Bank Group-Education, *Democratic Republic of Congo: Education Sector Public Expenditure, Review (PER)*, rapport final (2015).

¹⁹ The education budget represented 12.8 percent of government expenditures in 2015 relative to 6.7 percent in 2005; an increase of 120 percent. T. Herdt, W. Marivoet, and F. Muhigirwa, *Vers la réalisation du droit à une éducation de qualité pour tous*, UNICEF Rapport_ SITAN_ DRC (2015).

²⁰ World Bank, Worldwide Governance Indicators Project 2015: <http://info.worldbank.org/governance/wgi/index.aspx#home>. Accessed Jan. 31, 2019.

²¹ Mo Ibrahim Foundation, *Democratic Republic of Congo Insights (2006-2015)*: <http://s.mo.ibrahim.foundation/u/2017/03/08200132/Democratic-Republic-of-Congo-Insights-2016-IIAG.pdf>. Accessed Jan. 31, 2019.

²² Internal Monetary Fund, "Democratic Republic of the Congo," Country Report (2015) No. 15/280: <https://www.imf.org/external/pubs/ft/scr/2015/cr15280.pdf>. Accessed Feb. 1, 2019.

²³ World Bank, *Monthly Revenue in the Education Sector in the DRC* (2015).

²⁴ Ibid.

The failures of the civil service in the education sector are noticeable in terms of inefficiencies linked to personnel management. The two parallel education systems in the DRC (conventionized and unconventionized) severely complicate the organization of this sector. Over the years, the state has revealed that it is unable to manage the growth of its population with regard to education. There is an average of 40 students per teacher in primary schools, which is far higher than the optimal maximum of 25.²⁵ Thus, there is a shortage of teachers at the primary level. Moreover, with 2,504,639 additional students in 2017, this ratio is likely to worsen since the state cannot match it.²⁶

Additionally, the government poorly allocates their already-scarce resources. The administrative apparatus absorbs the improper allocation of funds received primarily by donors instead of flowing towards service delivery.²⁷ Further, the enormous disparities of funds allocated between provinces are not rationally based on population. For instance, Kinshasa accounts for 4 percent of enrolled students and Katanga has 14 percent; however, Kinshasa receives 5,036 francs per student while Katanga receives 1,513 francs.²⁸

Even worse, teacher salaries are not managed entirely by the state. Parent contributions fund many teachers' income, yet they claim to be under the management of the state. In addition, while publicly financed institutions enroll 88 percent of students, only 24 percent of these are managed directly by the state, with the remaining cost born by parents and various partners.²⁹ This dichotomy of funding by one entity and management by another undermines the effective evaluation of the performance of the civil servants and hinders any inspection. SECOPE, a parent association agency that oversees teacher pay, also creates a loss of resources at the administrative level. Government administrators in charge of education receive an estimated \$0.76 million per month plus additional benefits of \$0.87 million, which are only available to officers in Kinshasa.³⁰ This affects teachers' salaries, and qualified teachers have incentives to enter the private sector since "at all levels of education, the private sector pays its teachers better than the public sector."³¹

²⁵ Ibid.

²⁶ UNESCO Institute for Statistics, *The Official Annual Number of Children Entering Primary School*.

²⁷ S. Moshonas, T. de Herdt, and K. Titeca, "DR Congo: The Case for Taking the Administration Seriously," *Africa at LSE*. <http://blogs.lse.ac.uk/africaatlse/2017/12/20/dr-congo-the-case-for-taking-the-administration-seriously/>. Accessed Jan. 31, 2019.

²⁸ Herdt, Marivoet, and Muhigirwa, *Vers la réalisation*, UNICEF (2015).

²⁹ The state participated only \$513 million to the \$2,184 million spent on education in 2013 (World Bank/ USAID).

³⁰ UNICEF, UNESCO, "Rapport d'État du Système Educatif National (RESEN) de la République Démocratique du Congo 2014" (2014).

³¹ World Bank, *Monthly Revenue in the Education Sector in the DRC* (2015).

In addition to this lack of financial coordination, there is also a lack of coordination between the provincial ministries, which manage the school system in their provinces, and the National Coordinating Committees, which are in charge of verifying the compliance of schools within the framework of guidelines from the MESPS. There has been a blurring of responsibility and accountability between government agencies. For example, the official census of teachers resulted in only an estimate because of "disagreements regarding methodology and the sharing of responsibility" between the Ministry of Public Service and the MESPS.³² This results in a situation where some schools escape the state's administrative radar, such as in the case of two Kivu provinces where up to 20 percent of public schools are non-registered.³³

An uncoordinated bureaucracy, coupled with the aforementioned failures, undermines the execution of national directives. In short, human resource management represents a big problem for the DRC. On top of the loss of state control over its personnel and payroll, other problems arise from their lack of logistical means. One other example is the retirement problem. The government lacks the funds to pay for retirement plans, resulting in roughly 323,189 teachers past retirement age remaining at their posts.³⁴ Additional problems like "ghost employees" and malpractice continue to plague sectors.³⁵

Another civil service impediment relates to predation, or administrative "dishonesties." The DRC has long suffered from public officials considering the country their own private property, from Leopold II to Mobutu to the present day. This predation is visible in its most popular form through corruption and the lack of transparency and accountability in the public sector. In 2017, the DRC ranked 161 out of 180 countries in a corruption index.³⁶ A study by Williams and Ghonda confirms these numbers, finding that only 77 percent of "expenses announced" for the education sector in 2014 were actually realized.³⁷ On a similar note, Englebert observed an under-reporting of fiscal revenues mobilized, notably

³² The World Bank, *Resilience of an African Giant Boosting Growth and Development in the Democratic Republic of Congo* (2012), 50.

³³ T. de Herdt and K. Titeca, "The United Nations Set an Ambitious Education Goal. Why Did It Fail in Congo?" *The Washington Post* (June 08, 2016).

³⁴ Herdt, Marivoet, and Muhigirwa, *Vers la réalisation*, UNICEF (2015), 67

³⁵ M. Tshiyoyo, "Civil Service in the Democratic Republic of the Congo," *African Journal of Public Affairs* (2011).

³⁶ Transparency International, "Corruption Perceptions Index: 0=high to 100=low (Transparency)," <https://www.transparency.org/research>. Accessed Jan. 31, 2019.

³⁷ Updated calculation based on the work of Williams and Ghonda: G. Williams and E. Ghonda, *The Political Economy of Public Financial Management in the DRC* (2012), unpublished.

in the mining sector where the leakage is estimated at \$2 billion USD.³⁸ He also advanced the hypothesis that there is about as much tax revenue as parafiscal revenue. Parafiscal revenue, while not entirely illegal, completely escapes the treasury's nets and questions the autonomy and the capacity of the state to act; hence, the public accounting problem. Consequently, parafiscal revenue allows non-state actors in the system to appropriate the already-meager resources of the state. For example, local coordination groups, including parent associations, account for 71 percent of operating costs for the Equateur province.³⁹ For many people, the most rational strategy is to participate in the continuation of this predation rather than being its victim. As a result, the average Congolese seeks entry into the civil service by patronage or corruption rather than qualifications.

Furthermore, several investigations have shown a rather cynical approach to the problems in the civil service. Indeed, when observing the expenses and the irrational allocation of funds, we wonder if they may be willful attempts at curtailing some institutions to attract more donors. With some of the abovementioned examples, like functioning costs and disproportionate expenditure across provinces, we also note the existence of "zombie institutions" which are legally alive but fiscally dead institutions.⁴⁰ These behaviors reflect a universal aid dependency of the Congolese (the administration and the population) and is corroborated by Stanford who describes aid dependency as a damage of hasty donations.⁴¹

Conclusion

The failures of the civil service help explain the state's lack of control over its education system. The fragility of the country has weakened its institutional framework, but not to the point of extinction. Because the basic infrastructure persisted, the education system survived at the expense of isolated and rural communities that the government permitted itself to ignore. However, the perverse aspects of the public bureaucracy help us understand them as a rational response to their historical structure geared towards resource extraction and administrative predation that dates from its inception in the 1880s.⁴² Presently, the civil service is broken, weak, and quasi-nonexistent. Thus, as long as the challenges which hinder a proper functioning of the civil service are not addressed holistically,

³⁸ P. Englebert, *DRC: Growth for All? Challenges and Opportunities for a New Economic Future*, The Brenthurst Foundation (2014).

³⁹ Herdt, Marivoet, and Muhigirwa, *Vers la réalisation*, UNICEF (2015), 69.

⁴⁰ Englebert, *DRC* (2014).

⁴¹ V. Stanford, *Aid Dependency: The Damage of Donation*. <https://www.twigh.org/twigh-blog-archives/2015/7/31/aid-dependency-the-damage-of-donation>. Accessed Jan. 31, 2019.

⁴² Moshonas, et al., "DR Congo," (2018).

even the best policies drafted for the reconstruction of the country will not bear positive results in their implementation phase.⁴³ In this context, a “retooling” of the administrative structure is a prerequisite.⁴⁴

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⁴³ Tshiyoyo, “Civil Service,” (2011).

⁴⁴ T. Trefon, *Administrative Obstacles to Reform in the Democratic Republic of Congo*, International Review of Administrative Sciences (2010).

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Artist:

Summer Meinhard

Faculty Advisor: Kerri Cushman

Awarded second place Visual Arts

Artist's Statement

My papermaking research led me to work with a new material called kozo, the inner bark of a mulberry tree, and also to explore the sustainable properties of recycled cotton fabric. The main focus of my work was experimenting with paper pulp casting. Kozo is a resilient, strong material that can be manipulated around a collapsible armature to achieve various hollow shapes. These spherical forms were installed in the Bedford Building atrium. Since my artistic concentration focuses on a BFA in Design in Craft, my goal was to incorporate architectural elements into my work.





A Computational Study of Single Molecule Diodes

Lauren Johnson

Faculty Advisor: Dr. Benjamin Topham,

Department of Chemistry & Physics

Awarded second place Natural Sciences paper

Abstract

The field of molecular electronics uses single molecules as individual electronic components, such as diodes. The electrical current through various single molecule diodes was calculated. The use of different asymmetric components in the diodes was examined as well as the effects of chemical modification. Diode performance is related to molecular orbitals of the molecules in the junctions. The connection between components in the diode and from the molecule to the gold electrodes on either side are found to play pivotal roles in the diodes' performance. By accounting for these effects, the most effective diode was designed with a calculated rectification ratio of 14.10.

Introduction

Electronic devices are made from a combination of components such as transistors, resistors, and diodes that are connected into circuits that perform specific functions. Advancement in electronics has led to smaller and more powerful devices over the years. As size limits are reached, there will be a need for new technology. A leading candidate for development is the field of single molecule electronics, where the goal is to replace an individual component like a transistor or diode with a single molecule. This reduction in size of individual components has the potential to make electronic devices smaller, more efficient, and to open the door to new device functions and products.

The field of molecular electronics^{1, 2, 3, 4} is not a new area of study but much research is still needed. The original idea was proposed in the 1970s¹ and the first experimental results of current measured through a single molecule were published in the 1990s.⁵ A major goal in this field is to understand how to control the electrical current through a single molecule using chemical modification. There are many ways to accomplish this, including modification of the functional groups,^{6,7} the length of the molecule,^{8,9} or the connecting groups to the electrodes.^{10,11,12} These ideas and others can be used to design device components with specific functions such as transistors, resistors, and diodes.

For current (or electrons) to travel through a molecule, the electrons flow from a metal electrode, through the molecule, and then back to a metal electrode on the other side. Considering energy, electrons flow from the Fermi level of the metal through the molecular orbitals (MOs) of the molecule. In order to understand how this occurs, it is important to understand the MOs of the molecule and how the molecule interacts with the electrodes. In this study, the relationship between the MOs and the performance of single molecule diodes was investigated.

Experimental

All molecular calculations have been performed with QChem 4.2 software.^{13,14} Molecular geometry is optimized with one gold atom at each end to facilitate comparison to systems attached to gold electrodes. MOs are calculated for these thiol-terminated molecules. Density functional theory is used with the B3LYP functional^{15,16} and the LACVP basis set. The LACVP basis set uses the 6-31G¹⁷ basis set for atoms H-Ar and the LANL2DZ¹⁸ basis set for heavier atoms. For electron transmission calculations, gold electrodes are modeled with a single gold atom bonded to the molecule, followed by a layer of three gold atoms, followed by repeating layers of six gold atoms. A typical example of a molecule bonded to gold electrodes is shown in Figure 1. Electron transmission is calculated near the Fermi energy with a scattering-based picture of molecular conductance based on the Landauer approximation.¹⁹

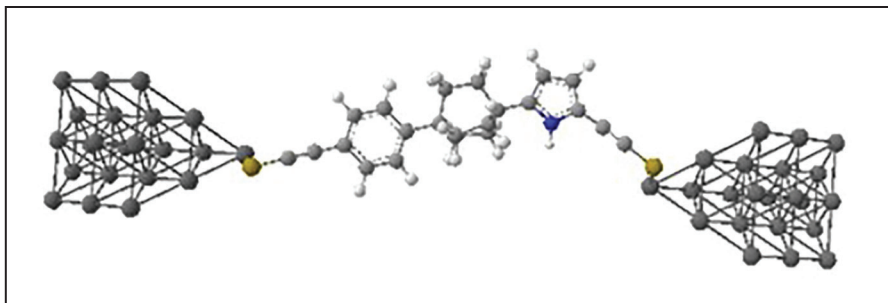


Figure 1. A typical single molecule junction showing a molecule connected to two gold electrodes.
Source: Lauren Johnson.

Results

A diode is an electronic device component that allows for more current in one direction than the reverse. To create a single molecule diode, a molecule with asymmetric components is needed. As shown in Figure 2, two distinct parts are combined (represented by the squares) to form the asymmetry and the components are linked with a connecting group (represented by the circle). These molecules were selected by evaluating various chemical and physical properties, in particular the energy of their MOs.

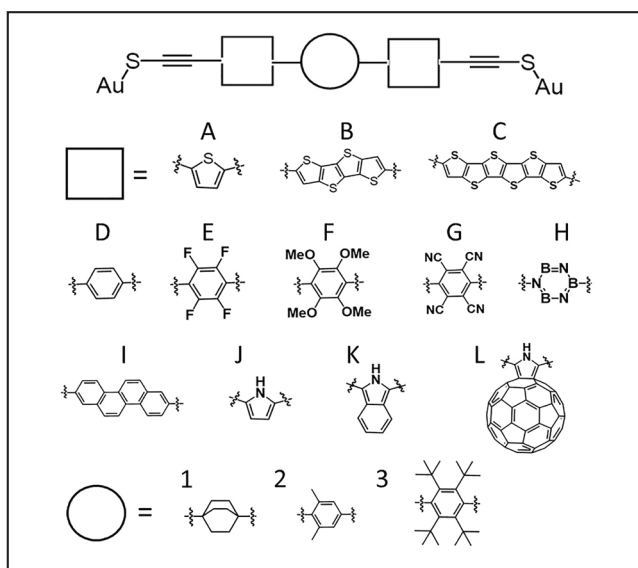


Figure 2. Schematic for forming and naming molecular diodes. Source: Lauren Johnson.

Figure 3 depicts the calculated MOs of diode B1D (see Figure 2) as well as the MOs of the B and D components. A direct correlation can be found between the MOs of the individual B and D components with the molecular diode. The connecting group keeps the sides electronically separate by disrupting the conjugation. All individual components of the diodes were evaluated separately, and similar trends were found with all of them.

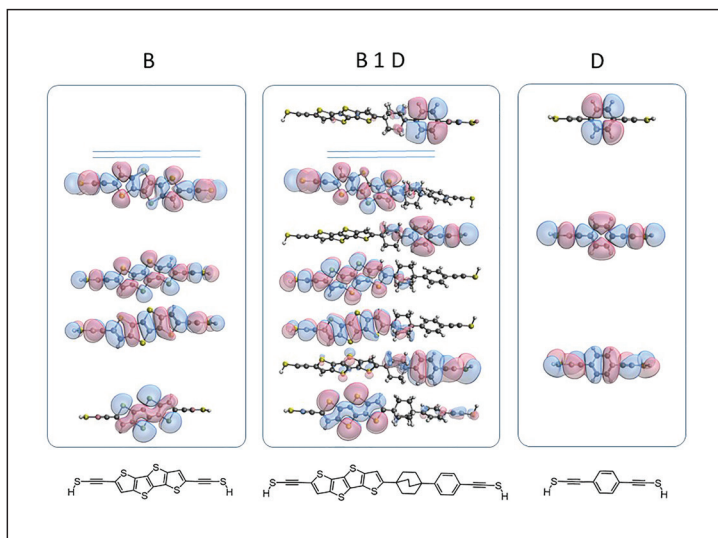


Figure 3. Calculated MOs of component B, diode B1D and component D are shown. The MOs of the diode are directly correlated to the MOs of the individual pieces. The diode MOs are isolated on one side or the other by the middle connection piece. Horizontal lines in the diagram represent additional MOs that are not pictured. Source: Lauren Johnson.

The forward and reverse currents were calculated for the diodes listed in Table 1 using the naming scheme in Figure 2. The rectification ratio (RR) is calculated as the ratio of the forward and reverse currents, with a higher RR corresponding to a more effective diode. In Table 1 the RR at 0 V and at 1 V were shown, listed in order of increasing RR at 0 V (least to most effective). A molecule with RR = 1 has no rectifying properties because the forward and reverse currents do not differ. Figure 4 is a plot of RR values in chronological order of testing. There is an increasing trend over time to verify improved diode design. The highest RR calculated was 5.56 for diode K3E at 0V.

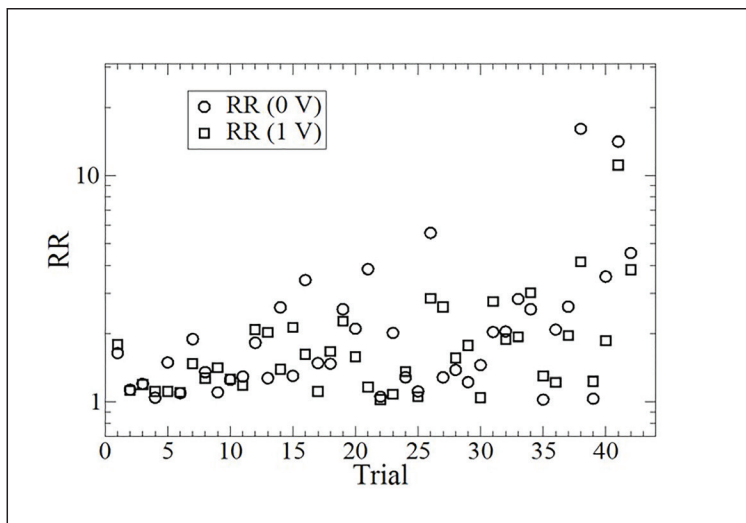


Figure 4. Chronological graph of the RR of the diodes. The trend shows the increase in effectiveness of diode design over time. Source: Lauren Johnson.

Some of the effects of chemical modifications are shown in Figure 5. Molecular orbital energy levels for B1F, B1D, B1E, and B1G are displayed on the left. Selected MOs are labeled and can be found in each of the B1x molecular diodes. Similar MOs are connected with dotted lines. The changes in the substituents on the benzene (right side of the molecule) directly affect the energies of the MOs, whereas the MOs that are found on the thiophene (left side of the molecule) are not affected. For instance, the energy of MO II and III remain consistent due to the MO favoring the left side. MOs I, IV, and VI have more density on the right side of the molecule, so their energies are affected more dramatically. Interestingly, although the MOs show a systematic trend, the RRs do not follow in an obvious way. Figure 6 shows the same set of molecules from Figure 5 that were modified by changing the carbon-carbon triple bond to a CH_2 group. This has a negligible effect on the MOs, but drastically changes the rectification ratios.

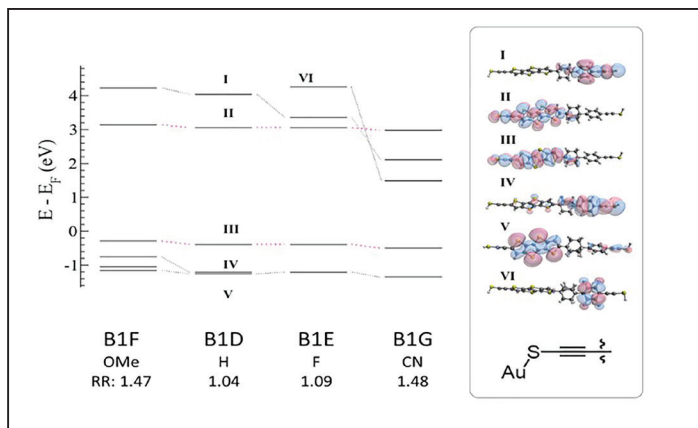


Figure 5. Molecular orbital diagram for B1F, B1D, B1E, and B1G, arranged in order from least to most electron-withdrawing substituents on the benzene ring. Similar MOs are connected with dotted lines. Selected MOs are displayed on the right. RR values at 0 V are shown. Source: Lauren Johnson.

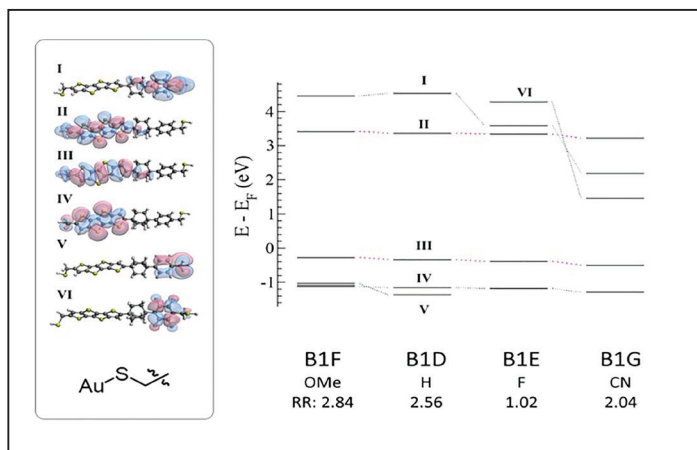


Figure 6. Molecular orbital diagram with the same molecules as in Figure 5 but the connections to the electrodes change from the carbon-carbon triple bond to a CH group. Source: Lauren Johnson.

The differences in diode performance between the two end connections can be understood by an effect called pinning.²⁰ This can be seen by the total density of states (TDOS) (Figure 7) near the Fermi energy level and the transmission (Figure 8). Molecules that have carbon-carbon triple bonds (black, open) have their peaks “pinned” near the Fermi level. The same set of molecules that have a CH_2 group (red, filled) disable the pinning effect by decoupling

the molecule from the electrodes. These peaks are found further away from the Fermi level. The same effect can be seen in both the TDOS and the transmission. Since transmission occurs near the Fermi level, this suggests that the electrode connections play a significant role in the current and, therefore, the rectification ratio of single molecule diodes.

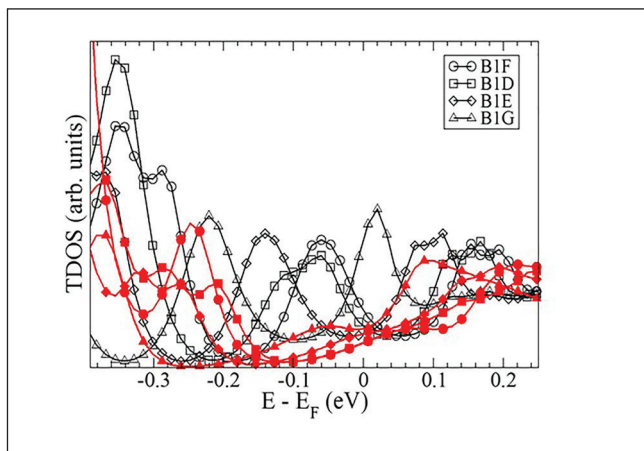


Figure 7. The total density of states near the Fermi level for molecules indicated. Open black symbols are for the carbon-carbon triple bond connections, filled red symbols are for CH_2 connections. Source: Lauren Johnson.

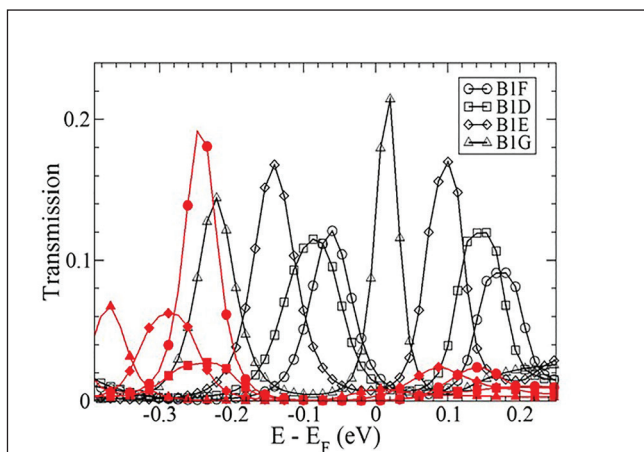


Figure 8. Transmission of the molecules for carbon-carbon triple bond connections (open, black) and CH_2 (filled, red). The transmission is the probability that the electron will pass through the junction at the given energy. Source: Lauren Johnson.

Additional calculations were performed to confirm the effects of the connecting group between components in a diode and the connections to the electrodes. Figure 9 displays diodes created using two different naturally occurring molecules in each diode, connected to the electrodes with a CH_2 group. These molecules are found in fruits (banana, mango, and raspberry) and chocolate. Though the combinations are arbitrary, the RRs show the importance of middle connections that provide electronically separated components. The molecules in Figure 9 have different connecting groups. Starting from the left, the molecule has a connecting chain of two CH_2 groups, then a single CH_2 group, then a direct connection between the two components. The orientation of the molecules also plays a role. The RRs confirm that there is a significant jump in the performance of the diode with larger separation and a less planar orientation between components. The highest RR calculated was 14.10 at 0 V.

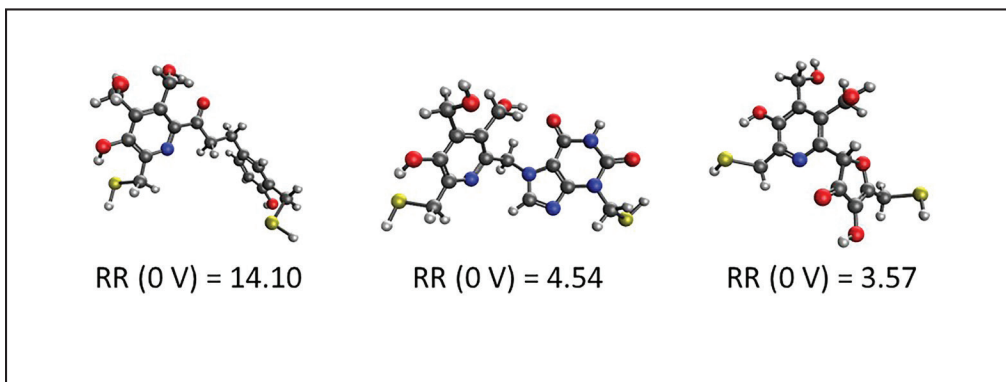


Figure 9. Diodes designed from naturally occurring molecules connected together using different lengths of connection pieces and different orientations. Source: Lauren Johnson.

Conclusion

A number of diodes were tested to further our understanding of diode function. Different combinations were used to create the necessary asymmetry; however, it was found that if they are not electronically separated, then the diode performance suffers. Separation can be created by adding a connecting group or by manipulating the orientation of the two asymmetric pieces. The effects of chemical modification were examined and resulted in predictable trends in MOs but not in diode performance. Electrode-connecting groups also played a significant role in determining diode performance, according to the pinning effect. Additional testing has confirmed these effects using arbitrary components.

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Tables

Table 1. Diodes tested and ranked from least effective to most effective according to the RR at 0 V. See Figure 2 for naming. Parenthetical comments describe small changes to diode structures. (CH) describes the diode connection to electrodes by substituting the triple bond with a methyl group. Source: Lauren Johnson.

Diode	RR (0 V)	RR (1 V)
B1E(CH)	1.02	1.3
B1D	1.04	1.11
B1E	1.09	1.1
B(S=O)1E	1.1	1.41
B1H	1.11	1.05
I(2Me)2	1.13	1.12
I3E	1.22	1.77
B(1Me)E(2CF)	1.25	1.26
A1E	1.27	2.02
B(S=O)1E(adj)	1.28	1.36
K3D	1.28	2.62
A1D	1.29	1.18
I(2Me)2E	1.3	2.13
BH(rev)	1.35	1.27
B3E	1.38	1.56
J3D	1.45	1.04
B1F	1.47	1.67
B1G	1.48	1.11
B(S=O)1D	1.49	1.11
B(1Me)2	1.64	1.79
C1D	1.82	2.08
BH	1.89	1.47
K1I	2.03	2.77
B1G(CH)	2.04	1.89
L1D(CH)	2.08	1.22
L1D	2.1	1.58
J1D	2.56	2.27
B1D(CH)	2.56	3.03
C1E	2.61	1.39
K1G(CH)	2.63	1.96
B1F(CH)	2.84	1.93
I(2Me)2D	3.45	1.62
L1E	3.85	1.16
K3E	5.56	2.86

Satire of the State through Discourse: Applying Althusser and Bakhtin to William Dean Howells "Editha"

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Abstract

This paper discusses Howells' take on what was wrong with America both as a government and society at large and its moral faults due to its desire for war. By applying Althusser's thoughts on the ideological state apparatus and Bakhtin's ideas on dialogism and heteroglossia Howells' satire is illuminated and his biting remarks land far harder than a first reading suggests. Through the use of dialogism, it becomes clear that Howells does not think anyone in America is free from fault and are all influenced negatively through ISAs. With both of those forces present within Howells work it becomes clear that he sees America, while championing itself as a warrior of freedom, as no better than the enemies it fights against.

William Dean Howells wrote a scathing satire against American imperialism when he penned the short story "Editha." The titular character, a romantic young woman, is swept up in the propaganda of the Spanish American War. Even after her fiancé dies in battle, Editha remains in thrall to the discourse of a nationalistic "ideal" in which she lives (Howells 8). The ideal can be approached using Louis Althusser's Ideological State Apparatus [hereafter the ISA]. Jingoism, the discourse of pro-war imperialism, plays a large role within the story Howells tells. Indeed, at times, Editha directly parrots this discourse, including when she pressures George to fight in a war he opposes. Howells makes no overt political statements and shows no allegiance to any particular party. In fact, the politics discussed within "Editha" are largely indirect and done through his characters' political vocabulary, their quotation of poetry, and their invocation of abstract moral values. Howells dramatizes the actions of the ISA through the various discourses employed by his characters and the many-voicedness that Mikhail Bakhtin described as *heteroglossia*. Attending to these discourses clarifies Howells's satire, which suggests that what Editha rather naively calls "the Ideal" is a perverse view that only furthers the agenda of the State, and any attempt to go against this ideology is either squashed or cast out of the mainstream.

Scholarly discussion of "Editha" is not as robust as that about Howells's novels. Scholars tend to focus on his larger texts, but the themes and tones tend to appear consistently throughout his work, large portions of which focus on the plight of the average American citizen and how their interests do not line up with those in power. "Editha" criticizes the government but, to a larger extent, condemns the society that stands by and lets the government dictate what they believe, allowing unethical practices to become the norm. One controversial topic in discussions of "Editha" is the extent to which Howells criticizes the State, and how much blame falls back from the government onto the average citizen. Some critics, such as Jacob Gretzels, argue that Howells's writings have strong socialist undertones that dominate the message of the work in question. Others, such as George Arms, view Howells as a pacifist, motivated by a desire to avoid imperial wars as well as socialist revolution. For instance, Arms argues that Howells hoped to strengthen workers' rights without redistributing property. Specifically, Arms cites a letter Howells wrote to another American socialist named Gronlund about a man named Henry George, a working class socialist leader and contemporary of both men. Arms writes, "He condemns George's doctrine because the expropriation of land alone 'would not constitute a social revolution, but downright robbery'" (247). Arms states that Howells and Gronlund agreed that if a socialist revolution were to take place, it would only succeed by slow collectivization of telecommunications and the railroad industry lead by the intellectual class (247). By applying Bakhtin's thoughts on discourse and Althusser's theory

of the ISA, Howells's satire becomes a clear case against runaway chauvinism that makes war into a matter of taste instead of an event to be discussed with gravitas.

Althusser's thoughts on the ISA boil down to the idea that any institution, such as church, school, or, as in "Editha" a newspaper, exists to promote and insure the domination of a certain ideology. They are not violent institutions, but instead lead those they influence to believe the dominant ideology and create a cultural hegemony. Althusser and Howells, who were both socialists, would be fine with an ISA controlled and dominated by the working class; however, the bourgeois controls the ISA found within "Editha" and it does not act within the best interests of the working class.

Bakhtin's thoughts on heteroglossia and dialogism are also effective ways of analyzing Howells's "Editha." These ideas are complementary because both have to do with the concept of multi-voicedness within a novel. While "Editha" is only a short story, these ideas still apply as Bakhtin formed these concepts in response to epic poetry and the unique position novels inhabit as a way of providing multiple opinions on the same subject. In the case of "Editha," Howells pits two distinct outlooks against one another: pacifism and obedience to the State, or complacency within the State and how it chooses to exploit its citizens. Bakhtin does not say that the author must necessarily agree with any point raised through the use of heteroglossia, but instead that as long as heteroglossia exists in the work, the work benefits from it.

Howells's analysis of American society is as poignant in the twenty-first century as it was in the twentieth, due largely to the complacency of the majority of the populace regarding the State and a war effort that sees either continued blind support or apathy towards any resistance to the industrial war complex. Howells's writing relies on the idea that the populace blindly believes whatever the State deems appropriate. In "Editha," the titular character believes whatever the State claims, and the narrative follows her particular ideological journey regarding the Spanish-American war and her fiancé George who initially finds himself at the opposite end of the ideological spectrum. Editha is a stand-in for the everyday American. She believes what the majority believe and is a staunch patriot, but her patriotism borders on nationalism. Editha is patriotic insofar as she loves her nation, but she also dances around and across the line to the point where she believes that America, or at least the government, is superior and therefore can do no wrong. As Minxin Pei points out in "The Paradoxes of American Nationalism," "equating patriotism with allegiance to one's country and defining nationalism as sentiments of ethno-national superiority" (32). Editha's opinions are clear when she states, "'That ignoble peace! It was no peace at all, with that crime and shame at our very gates.' She was conscious of parroting the current phrases of the newspapers, but it was no time to pick and choose her words." (Howells 1). Editha's mimicry of the newspapers is

an example of Althusser's ISA, and gives insight into Howells's use of the device to devalue Editha's argument. Howells emphasizes individuals thinking for themselves and, repeatedly throughout the story, he makes Editha the image of stupidity. The use of quotations by characters specifically shows that they no longer think for themselves and are, therefore, dumb. George and Editha both quote either the newspaper or famous pieces of literature once they have been interpellated by the State, while other characters, especially Mrs. Gearson (who has the most important role after George and Editha), never quote anything, showcasing their ability to form original thoughts and, thus, a higher level of intelligence within context of the story. Here, Editha parrots the teachings and ideology of the State and is not a free thinker. The very next line confirms Editha's interpellation of the ideology of the American empire: "She must sacrifice anything to the high ideal she had for [George]" (Howells 1). Editha's high ideal is not her own original thought but instead echoes the discourse of yellow journalism that drummed up support for the war. John Offner explains that "the 'yellow' press carried many stories that exaggerated Spanish atrocities and Cuban suffering" (54), but film, which was a brand-new medium, also influenced American opinion. While film was not used to drive support before the official declaration of the war, it kept support high throughout. Amy Kaplan notes that films made during the height of the conflict that re-enacted naval battles and engagements by the rough riders "were so popular that they were repeated every hour around the clock" (1069). This increase of support for the war, and continued support for the nation throughout the war, allows the State to make peace an ugly thing, instead turning war into a beautiful aesthetic ideal. The state promotes this ideal through the perversion of art and poetry, turning rational citizens into irrational but highly enthusiastic proponents of war, continuously feeding the American imperial machine.

Editha's unthinking enthusiasm for war is not an accident nor solely the product of reading too many newspapers. Rather, it is a product of Bakhtin's heteroglossia, the process of recognizing the many voices crying for war that echo in Editha's ears. She starts as an individual in society but is quickly acted upon by the ISA, which promotes one ideology, and by other ideologies that agree with or oppose the one she consumes from the State. Howells uses her enthusiasm to drive home the point that war during this time was what was considered right and was so pervasive that anything other than enthusiasm for war met challenge. In "Editha," when George presents opposing ideals, Editha calls off their engagement in a letter unless he enlists. Bakhtin defines modern prose fiction as "a diversity of social speech types and a diversity of individual voices, artistically organized" (1002). While there are only seven characters in the story, each becomes a mouthpiece for a particular discourse, ranging from jingoism to indecision to pacifism. Ultimately, however, all of these discourses paint Editha

and her enthusiasm for war as evidence of the harm inflicted by seemingly benign ideological State apparatuses including the news, poetry, and art. The seemingly benign aspect is crucial to Howells' arguments because those ISAs, especially poetry and art, are not normally considered tools for promoting war, but instead are ways of disagreeing with and demonstrating against the government.

Editha is a staunch supporter of what she reads in the newspapers and this indicates her inability to think critically for herself. However, the interpellation by the State does not stop at the newspaper but permeates all aspects of discourse. In fact, her ability to deem what is moral and ideal is twisted to the point where she believes that war, which results only in death, to be part of the ideal state of being. She writes to George, trying to convince him to go fight: "I could not love thee, dear, so much, Loved I not honor more" (Howells 3), which itself is a quote from a Richard Lovelace poem entitled "To Lucasta, Going to the Wars." Howells criticizes the inability of others to think for themselves through Editha's continuous quotation of others rather than formulating her own unique thoughts. Howells argues that everyone should be free to formulate their own ideas and asserts that the ISA is supported through art. While art can be a tool for positive social change, Howells chillingly reminds his audience that art may also leave an impression promoting ideals that a just society would not normally support but which, through the discourse of the ISA, becomes a critical part of what "good" in society means.

George, who is first convinced that war in any capacity does no good, is persuaded otherwise by Editha and eventually goes on to lead the local regiment. After succumbing to the same way of thinking, he tells Editha of his enlistment: "'Cry havoc, and let slip the dogs of war.' That was the style. Now that it had come to the fight, there were no two parties; there was one country" (Howells 4). Here, George quotes Shakespeare's play *Julius Caesar* out of context. In the original play, Marc Antony points out how horrible war truly is—a fitting quotation for the scenario in the original context. As both a call to arms and an ironic statement on war itself, this quotation fits Howells' satire well, serving as a rallying cry for those who have been interpellated by the State to showcase how facts can be twisted to suit the needs of the State, but also as scathing remark upon the intelligence of those succumb to that way of thinking. This quotation also reflects upon how the chaos of war even though those who have fallen into the ISA think of it as an ideal position to occupy within the world. Through these discourses, Howells demonstrates how easy it is to get swept up in propaganda and succumb to the worst aspects of civilized society. George experiences the complete conversion from a dove to a war hawk once he goes to the town meeting and succumbs to peer pressure. Howells only allows those who have accepted the ISA to quote poetry, arguing

that art is used as a discourse to support war and that no medium is above being used for purposes outside of its intended meaning.

Discourse within "Editha" is all about the clear divides between succumbing to the State's ideology and questioning the ISA. This is evident in an exchange between Editha and her mother. Editha's mother says, "'Well, I hope *he* won't go.' To which Editha replies, 'And I hope he *will*'" (Howells 3) [emphasis mine]. This exchange explains that Editha, true to form, cares less about the man and more about the action of falling in line with the State. She does not love her fiancé as she claims, but loves the idea of what she believes a perfect man to be. She says several times within the text that George is so close to being her idea of the perfect man, and that if he would to only live up to what she considers the ideal, then he would be perfect. The ISA creates a dominant cultural idea that when met with opposition rejects that opposition and turns proponents of different ideals into social nobodies. With her mother, the emphasis is on the man. In this exchange, Howells presents Editha's mother as the moral superior, focusing more on the man than the State, but he undercuts this moment of superiority by ending the argument between the two women there. Editha's mother never responds to the idea that it would be better to have a fiancé that went to war, and even died for the cause, than to have one living and breathing next to her. Editha, however, is concerned primarily with complying with the ISA and is better off being part of the herd rather than staying with the one she loves.

Howells clearly asserts that Editha should care more about the man than complying with the ISA so that she can remain in good social graces. The conversation between Mrs. Gearson and Editha is the climax of the story and provides the most overt discourse in the text. Howells clarifies his position that American culture is fixated on the "good" war when Mrs. Gearson come out on top as the clear moral victor in this conversation. Mrs. Gearson states, "'I suppose you would have been glad to die, such a brave person as you! I don't believe *he* was glad to die'" (Howells, 7) [emphasis mine]. Here again, the emphasis is on the individual instead of the ISA. However, Mrs. Gearson says that the cost of war is never fully realized by those who support it. Those who desire for their hometown heroes to go kill and return victorious and full of vigor and life for their nation never consider the enemies in the other trenches who also have mothers and fiances to return to. Mrs. Gearson fully understands the cost of war and is distraught, not just over the death of her son, but the potential death of the enemy as well. She is so vehemently opposed to war and its effects on a person that she says she is happy that George died before he had a chance to kill anyone so he would not have to live with blood on his hands. This discourse is powerful and takes a remarkable stand against the ISA, which exists to perpetuate the state ideology and coerce the populace into a specific way of conducting things. Mrs. Gearson opposes this because she disagrees with the ISA's opinion.

As mentioned in conversation by George, her opinions on war changed over time because his father lost an arm in the Civil War. The evolution of Mrs. Gearson from a supporter of the State to a contrarian of the State is an important part of Howells' overall discourse, indicating that it is possible to overcome the ISA. There is light at the end of the tunnel for serious and meaningful reform to live in a more ethical society, as Howells sees it.

When George Gearson consents to lead a regiment for the town, he appears torn between his pacifism and the community's militarism, as evidenced by his use of two distinct discourses. On the one hand, his interpellation within the ISA is apparent in the anecdote he tells about his fellow soldiers demanding that he lead the regiment: "There was a lot of speaking, and then some of the fools set up a shout for me" (Howells 4). George responds to the popular clamor of militaristic discourse by echoing it and adding to his authority through his invocation of Shakespeare: "The first thing I knew I was sprinkling hell-fire on them. 'Cry havoc, and let slip the dogs of war.' That was the style" (Howells 4). While George might personally disagree with what the State is doing, he is caught up in the ISA and the monologism of propaganda. Indeed, George never comes across as confident until he agrees with the State. Once he agrees with the State, he becomes this second version of himself. His discourse is vastly different to the point that Editha notices it: "They strained each other in embraces that seemed as ineffective as their words, and he kissed her face with quick, hot breaths that were so unlike him, that made her feel as if she had lost her old lover and found a stranger in his place" (Howells 4). Before being acted upon by the ISA, George is a cool, educated, and level-headed man, but once he has agreed to go off to war there is an unspoken shakiness about his character, exemplified by his body language.

George's commitment to the ISA is nuanced. While he primarily disagrees with how the State presents war and even opposes the idea of war outright, there are times when he is swept up in the nationalistic fervor which ultimately leads to him volunteering and leading the local regiment despite his personal reservations. However, while George falls fully in line with the ISA way of thinking, he proclaims, "'It's all for the country! What a thing it is to have a country that can't be wrong, but if it is, is right, anyway!'" (Howells 4). The ISA has taken full control over him. Having been stoked by nationalism, George now becomes its puppet, even if only for a moment, and he believes that the only thing that matters is unity and cohesiveness in action towards the State's goal, the morality of the actions and their consequences be damned. Even though Editha is the most constant supporter of the State, she is always portrayed as dumb and ill-suited to think her actions through to their fullest extent. However, George is depicted as calm, caring, and intelligent. For Editha, he would be perfect to her if only he would fight for his nation. When George is full of nationalistic fever, he stops thinking

clearly and begins instead to participate in groupthink, which in turn blindly agrees with the State. The discourse surrounding him changes from the man of peace first described in the story to an ambivalent and passive member of the State's way of thinking. George even recognizes this, saying, "I never thought I should like to kill a man, but now I shouldn't care, and the smokeless powder lets you see the man drop that you kill" (Howells 4). The nationalistic entrapment turns a peaceful man into one convinced that war, while wrong, is a necessary action. Once a peaceful man is convinced that one war is necessary, it becomes much easier to justify the next war, starting a vicious cycle in which people may claim to be peaceful and truly believe that they are, but will accept any reason as justification for war.

George is ensnared by nationalistic language, which Howells criticizes by making it seem like anyone who is interpellated by the State is idiotic. Editha, as the protagonist of the short story, is the greatest proof of Howells' disgust with those who seem to agree with the State either blindly (as Editha does), or against their better judgment (as George does). Howells describes Editha several times throughout as feeble-minded: "She hardly knew whether he was mocking or not, in the ironical way he always had with her plainer mind" (Howells 2). Howells makes Editha a less credible and less likable individual. The discourse that surrounds her from the narrator discourages his readers from emulating similar aspects of Editha. Howells writes, "Whether his sophistries satisfied him or not, they satisfied her" (Howells 6). As the character most enthralled by the ISA, Editha is willing to believe anything especially if it keeps her in the ideal. Editha recognizes what was George's argument for going to war, so that he may help bring about a quicker end to it, as fallacious but accepts it anyway.

Howells was aware that his ideas were controversial, and so he ends the story on a down note, writing:

A light broke upon Editha in the darkness which she felt had been without a gleam of brightness for weeks and months. The mystery that had bewildered her was solved by the word, and from that moment she rose from groveling in shame and self-pity, and began to live again in the ideal. (Howells 8)

Howells writes this at the end, right after she relays the events of the story to a traveling artist who paints Editha at her family home. The painter finds Mrs. Gearson's reaction reprehensible. Even though her conversation with Mrs. Gearson challenges Editha's views on the State, this painter sends Editha right back to the beginning. The painter ironically calls Mrs. Gearson "vulgar," which convinces Editha that she is not wrong but Mrs. Gearson is. As both Editha and George say several times when he is wrapped up in the patriotic fever, it is fine if the country is wrong, because even if it is wrong, it is still right. Howells refutes this type of thinking but

also makes it clear that changing the minds of those who truly believe this is an impossible task. Thus, while Howells advocates for peace and clear-headedness, this satire also remarks on the dangers that art and poetry can pose towards a peace-loving society. However, he also seemingly concludes that people's minds cannot change once they have succumbed to the ISA unless the ISA itself is changed. Therefore, it might suffice to say that Howells argues for peace but admits that it is unattainable when the State holds just a few people under its spell. As with Editha and George's relationship, once one believes in "the cause" or the ideal, it causes doubt in the non-believer, if not full-on conversion.

Howells presents the discourse of a monologic ideology as a coercive element of the Ideological State Apparatus that, even in the absence of conscription, persuades us that war is a beautiful ideal. By approaching Howells's satire through Althusser and Bakhtin, Howells' opinions of American society leave no one free of fault. While he mostly mocks those who openly and unapologetically support the ideal of war, he also criticizes those who sit by passively and do not make any attempt to dissuade their fellow citizens of this misguided state of thought.

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Designer:

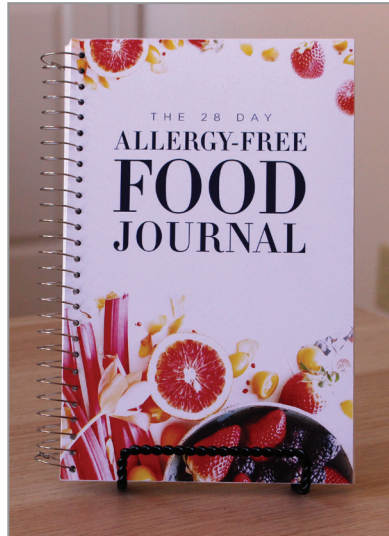
Laura Gottschalk

Faculty Advisors: Wade Lough, Chris Register

Awarded third place Visual Arts

Designer's Statement

Current and prospective college students, with common and uncommon food allergies, struggle to find allergy-free food options on a university meal plan. Addressing this problem was clear due to my personal struggles with common and uncommon food allergies. Knowing first-hand how difficult it was to manage an allergy-free diet, I wanted to know if others struggled the same way. By conducting a self-report survey I found that 50 percent of students reported having food allergies. Of that 50 percent, 39 percent experienced difficulty avoiding allergens on campus. The reasons fell into four categories: terminating a meal plan is undesirable, it is difficult for students to locate allergen information, learning to live allergy-free is daunting and discouraging, and specialized diets make meal plans complicated. A comparative analysis of Longwood University Dining Services with those of other universities was performed to evaluate accommodations available for students with food allergies. With the determination to help university students with allergies find better ways to manage them on a meal plan, three deliverables were created. My research conclusively showed there are practical measures that can be taken to help students with allergies remain on a university meal plan, enjoy the conveniences offered, and remain allergy-free.



Why Did the United Kingdom Vote to Leave the European Union?

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Abstract

This research-driven study seeks to explain why the British people voted by referendum to exit the European Union (EU) on June 23, 2016. While there are certainly many factors that led to Brexit, this essay asserts that the British voters who opted to Leave the European Union did so because of economic concerns. After a brief introduction, a consideration of other scholars' work follows in the literature review. The data analysis provides qualitative and quantitative findings which affirm the thesis that: The British were concerned that their economic prosperity was being diminished as a result of their continued membership in the EU.

Introduction

The current European Union (EU) evolved out of the European Coal and Steel Community and the European Economic Community (EEC), both established following World War II. The EU has certainly succeeded in establishing a peaceful and cohesive Europe since its inception; yet, in the last decade, the alliance has weakened. The United Kingdom (UK), one of the EU's strongest member states, voted to exit the European Union in a referendum on June 23, 2016. This action has become known as "Brexit." Why did the UK vote to Leave the EU? While many factors influenced this decision, this study explores the economic dimensions of Brexit. This paper contends that the vote to Leave the EU resulted from economic anxiety. Specifically, the British were concerned that their economic prosperity was diminishing as a result of their continued membership in the European Union. Before analyzing this thesis, the next section of this paper considers what other scholars have said about Brexit.

Literature Review

Upon examining the literature of recent scholarship concerning Brexit, it is evident that economic issues are among the most prominent. For instance, Chris Bickerton explains that the incompatibility of the UK's growth model and the EU's Single Market system "helped push the UK out of the EU."¹ Bickerton argues that the EU's open labor market "is associated with low productivity and low wage growth."² The only way for the EU model to increase net productivity is through an expansion of the labor market, and, according to Bickerton, "the only way the labor market can grow" in the UK "is through high levels of net immigration."³ Britain is unwilling to permit increasing levels of immigration and sacrifice their original citizen's ability to secure employment in exchange for better productivity. Thus, Bickerton asserts that the EU's Single Market system works contrary to the British people's desire for greater autonomy over their own economy. He contends that the EU system, most significantly, limits the UK's ability to establish employment preference for natural-born Britons.⁴

In the *Routledge Handbook of the Politics of Brexit*, Andrew Baker and Scott Lavery assert that Brexit was a reaction to "low and stagnating wages; rising inequality" and "austerity-induced falling living standards."⁵ In "The Great European Unraveling?," Alina Polyakova points to the

¹ Chris Bickerton, *Brexit and Beyond: Rethinking the Futures of Europe*, ed. Benjamin Martill and Uta Staiger (London: UCL Press, 2018), <http://www.jstor.org.proxy.longwood.edu/stable/j.ctt20krxf8>, 134. Accessed November 19, 2018.

² Bickerton, *Brexit and Beyond*, 134.

³ Ibid.

⁴ Ibid.

⁵ Andrew Baker and Scott Lavery, "Brexit and the Future Model of British Capitalism," in *The Routledge*

plight of the Greek economy following the 2009 international recession as the cause for widespread resentment among northern members of the EU. Polyakova states that Greece's "economy contracted by a quarter from 2008 to 2014... [and] Athens nearly defaulted on its debts."⁶ Only a bailout from the EU saved the Greek economy. Polyakova suggests that the bailout was a key factor leading to British voters supporting Brexit.⁷ Furthermore, Richard Roberts writes that the British Bankers Association (BBA) criticized the EU's response to the crisis. The BBA noted that "the plethora of post-crisis regulatory reforms at multiple levels [...]" contributed to "a 12 percent decline in assets [...] falling returns on equity [...]" and a "business downturn in capital formation activity that was blighting investment business banking."⁸ Since the BBA represents one of the UK's vital economic institutions, it follows that some major figures in government, the media, and a good portion of the public would push towards a separation from the EU.⁹

In *Labour, Finance and Inequality: The Insecurity Cycle in British Public Policy's*, Suzanne J. Konzelmann notes that while "EU law provided the legal framework within which large scale migration took place after 2003," it "provided only the background conditions to growing labour migration into the UK. The British government could have chosen to defer the free movement rights of citizens of the EU-8 from 2004, as did almost all other member states," but it did not.¹⁰ Konzelmann states that "what is clear is that organised migration involving cross-border supply chains had a major impact on certain towns and regions"; however, "regions experiencing a high level of EU migration were not, in general, those which recorded a high Leave vote [...]" The opposite was the case—there is a correlation between voting patterns and downwards pressure on wages and employment conditions in the northeast Midlands, and the agricultural towns of Boston and Wisbech."¹¹ Basically, Konzelmann's analysis shows that those who opted to Leave on June 23, 2016 did so partial-

Handbook of the Politics of Brexit, ed. Patrick Diamond, Peter Nedergaard, and Ben Rosamond, (New York: Routledge, 2018), 67.

⁶ Alina Polyakova, "The Great European Unraveling?," *World Policy Journal* 33:4 (2016), 68-72, doi:10.1215/07402775-3813051.

⁷ Polyakova, "The Great European Unraveling?," 68-72.

⁸ Richard Roberts, "London: Downturn, Recovery and New Challenges—But Still Pre-eminent," in *International Financial Centres After the Global Financial Crisis and Brexit*, ed. Youssef Cassis and Dariusz Wójcik (Oxford: Oxford University Press, 2018), 44.

⁹ Roberts, "London," 43-45.

¹⁰ Suzanne J. Konzelmann, Simon F. Deakin, and Marc Fovargue-Davies, *Labour, Finance and Inequality the Insecurity Cycle in British Public Policy* (New York: Routledge, 2018), 252-253,

¹¹ Konzelmann, et al, *Labour, Finance and Inequality*, 251.

ly in response to EU migration policies, but also to the British government's failure to protect its own labor force's employment security. Interestingly, regions affected less by increases in migration, yet still suffering continual economic downturn, voted to exit the EU in higher numbers. This phenomenon can probably be explained by a general sentiment that the EU worsened Britain's collective economic wellbeing. In any case, Konzelmann regards the factor of mass, employment-based migration as one "which probably tilted the outcome of the vote in favour of Leave."¹²

In "Voting to Leave: Economic Insecurity and the Brexit Vote," Daphne Halikiopoulou and Tim Vlandas confirm Konzelmann's findings. They state that "the economically insecure are more likely to see themselves as the 'losers' of European integration—as well as of modernisation more broadly."¹³ Moreover, Halikiopoulou and Vlandas' assertions align with those of Baker, Lavery, and Polyakova, as they all believe there was "a clear link between Brexit and austerity measures" that increased in the UK.¹⁴ Chris Gifford and Ben Wellings also support the notion that "the Eurozone crisis provided new ammunition for Eurosceptics, and further proof of the rightness of their cause. As the EU began to formulate proposals for further monetary and economic union [...] the Eurosceptic argument was that the UK was going to be drawn into a new wave of integration."¹⁵

In her work, "The Political Mantra: Brexit, Control and the Transformation of the European Order," Kalypso Nicolaïdis argues that by the mid-2010's, the balance between "control" and "cooperation" of European interdependence, reaffirmed by the Maastricht Treaty of 1992, had been "stretched to its limits." She further states that "the adoption of the 2012 Treaty on Stability Coordination and Governance [...]" led to "British opposition [...] to the idea of granting new powers to Brussels over national economic policy," although "new powers were nevertheless conferred on EU institutions through a veto override."¹⁶ Nicolaïdis supports the common suggestion that the ever-tightening economic constraints of the EU on the UK led to Brexit. As she notes in her introduction, the slogan of the Leave campaign, "Take Back Control,"

¹² Ibid.

¹³ Daphne Halikiopoulou and Tim Vlandas, "Voting to Leave: Economic Insecurity and the Brexit Vote," in *The Routledge Handbook of Euroscepticism*, ed. Benjamin Leruth, Nicholas Startin, and Simon McDougall Usherwood (New York: Routledge, 2018), 447.

¹⁴ Halikiopoulou and Vlandas, "Voting to Leave," 452.

¹⁵ Chris Gifford and Ben Wellings, "Referendums and European Integration," in *The Routledge Handbook of Euroscepticism*, ed. Benjamin Leruth, Nicholas Startin, and Simon McDougall Usherwood (New York: Routledge, 2018), 277.

¹⁶ Kalypso Nicolaïdis, "The Political Mantra: Brexit, Control and the Transformation of the European Order," in *The Law & Politics of Brexit*, ed. Federico Fabbrini (Oxford: Oxford University Press, 2017), 34.

was a powerful populist message. While it meant something different for every group in favor of Brexit, the number one factor that led to the event was an increasingly uncomfortable level of EU control over purely British economic matters.¹⁷

In an essay representative of the economic approach to Brexit, Abby Innes advances the thesis that “the Brexit vote represented, in the most part, a public reaction against radically increased material insecurity, frustration with political elites seen to collude with international business at the public expense, despair of public services wreathed in regulatory red-tape and perverse decisions and, finally, austerity.”¹⁸ Similar to the implications of some of Konzelmann’s findings, Innes also places greater blame on the UK government for the backlash of Brexit. She argues that a failure to do so “should be understood as a tragic exercise in misdirected blame.”¹⁹

In their research, Harold D. Clarke, Matthew Goodwin, and Paul Whiteley attest that while economic factors were an influential reason for Brexit, they were not the primary driver. Contrary to the previously mentioned contentions, they note that, according to the data, more “respondents were inclined to think that if Britain left the EU then it would be worse off regarding the economy,” yet they had greater concerns about the EU’s negative effects on security and immigration and voted to Leave in turn.²⁰ Richard Bellamy promulgates a view akin to that of Clarke, Goodwin, and Whiteley. He notes that “had the referendum on Britain’s membership of the EU been decided on the economic case alone, then in all likelihood the UK would have voted to stay in.”²¹ Bellamy’s study suggests that the economic case for the UK leaving the EU was weak, and that the Remain campaign covered their bases in this regard; however, he concludes that “the debate ended up turning as much on politics as economics, and on that issue in particular the Remain campaign” faltered, “barely mentioning the political risks and costs of Brexit.”²² Bellamy supplements his argument with “a YouGov poll [that] found 60 percent of Brexit voters still believed the political gains of Brexit would justify any potential economic costs.”²³

¹⁷ Nicolaïdis, “The Political Mantra,” 34.

¹⁸ Abby Innes, “The New Crisis of Ungovernability,” in *Brexit and Beyond: Rethinking the Futures of Europe*, ed. Benjamin Martill and Uta Staiger (London: UCL Press, 2018), 138–46.

¹⁹ Innes, “The New Crisis of Ungovernability,” 138–46.

²⁰ Harold D. Clarke, Matthew Goodwin, and Paul Whiteley, “Why Britain Voted for Brexit: An Individual-Level Analysis of the 2016 Referendum Vote,” *Parliamentary Affairs* 70:3 (2017): 439–464.

²¹ Richard Bellamy, “Losing Control: Brexit and the Demoi-cratic Disconnect,” in *Brexit and Beyond: Rethinking the Futures of Europe*, ed. Benjamin Martill and Uta Staiger (London: UCL Press, 2018), 222–28.

²² Bellamy, “Losing Control,” 222–28.

²³ *Ibid.*

Data Analysis

In a poll by the Pew Research Center, 64 percent of Britons said that “the EU is inefficient,” 64 percent agreed that the “EU does not understand needs of its citizens,” and 55 percent “disapprove of the EU’s handling of European economic issues.”²⁴ The main issue that led to Brexit was a perception of the EU as economically unfavorable for the UK, and this data supports that claim.²⁵ Another opinion study by Pew gauged the stances on the issues by party affiliation. This study found that 44 percent of Labour Party members surveyed reported to “disapprove of the way the EU is dealing with European economic issues.”²⁶ Similarly, 54 percent of the Conservative Party and 84 percent of the UK Independence Party (UKIP) responded the same. This data, while varying among parties, again suggests that economics played a role in the Brexit vote. While UKIP backers reported a dissatisfaction with the EU’s economic policies at an expectedly high level, Labour Party members responded with less skepticism. However, the pro-EU Labour Party’s reporting of a 44 percent disapproval rating of the EU’s economic competence suggests that widespread uneasiness about the economy was a primary factor that led to the Brexit vote.²⁷

Backing for Brexit based on an economic rationale stretches back to 2014, when the *Daily Express* published the views of Boris Johnson, a prominent member of the Conservative Party and then-mayor of London. Johnson stated that “the weight of employment regulation is now back-breaking: the collective redundancies directive, the atypical workers directive, the working time directive and a thousand more.”²⁸ He also noted that rolling back relations with the “Eurozone could boost trade with the rest of the world and add 1.1 per cent to GDP.”²⁹ On June 20, 2016, several days before the Brexit referendum, UKIP founder and Member of the European Parliament Nigel Farage published an editorial in the *Independent* titled “Why You should Vote for Brexit This Thursday.” In his article, Farage stated that “so many who now insist

²⁴ Bruce Stokes, “Brexit Vote Highlighted Discontent with EU in UK, Other Countries,” *Pew Research Center* (June 24, 2016): <http://www.pewresearch.org/fact-tank/2016/06/24/brexit-vote-highlighted-uk-discontent-with-eu-but-other-european-countries-are-grumbling-too/#>. Accessed November 20, 2018.

²⁵ Stokes, “Brexit Vote Highlighted Discontent.”

²⁶ *Ibid.*

²⁷ Dorothy Manevich, “British Crave More Autonomy from EU as Brexit Vote Nears,” *Pew Research Center* (June 08, 2016): <http://www.pewresearch.org/fact-tank/2016/06/08/british-crave-more-autonomy-from-eu-as-brexit-vote-nears/>. Accessed November 20, 2018.

²⁸ Owen Bennett, “Boris Johnson Blasts EU and Says Future OUTSIDE of It Is ‘attractive,’” *Express* (August 06, 2014): <https://www.express.co.uk/news/politics/495970/Boris-Johnson-says-Britain-could-have-good-future-outside-European-Union>. Accessed November 20, 2018.

²⁹ Bennett, “Boris Johnson Blasts EU.”

that we would be diminished as a nation if we Leave the EU said that our economy would suffer if we did not join the euro. They were wrong then and they are wrong now.”³⁰ Farage and Johnson’s arguments suggest that the Leave Campaign paid more attention to the economic perspective. Obviously, this was the winning approach and represented the primary interest of a slim majority (52 percent–48 percent) of UK voters.³¹

The Vote Leave website outlined several of its beliefs about the benefits of Brexit, most of them economically driven. One position read: “The EU stops us signing our own trade deals with key [...] growing economies like India, China, or Brazil” and that if the UK votes Leave “we’ll be free to seize more opportunities which means more jobs.”³² While the Vote Leave campaign struck at the heart of the matter, the Remain campaign failed to demonstrate how staying with the EU would benefit the UK. In a *New Yorker* article, “Why the Remain Campaign Lost the Brexit Vote,” John Cassidy states that “economic anxieties and resentments underpinned the political anger that fueled the Leave vote.”³³ While Cassidy concedes that “demagogues such as Nigel Farage [...] were able to exploit these economic worries, directing them against immigrants and other easy targets,” he still says the primary issue was economics. Even though the more social aspect of immigration control comes into the equation as a useful emotional motivator for Farage’s cause, this does not negate the importance of the economic argument.³⁴

One aspect that may prove beneficial to the UK economically, if the terms of Brexit are reached in their best favor, would be Britain’s ability to escape the higher consumer costs of EU tariffs. Johnson, Farage, and others argued in favor of leaving the EU, stating that the average Briton would essentially see a rise in their Purchasing Power Parity (PPP). Statistics from Matthew Ward’s July 2018 House of Commons Briefing Paper suggest that this is a possibility. Ward notes that animal products carry a 15.7 percent tariff when imported to any member-state from outside the EU, dairy products carry a significant 35.4 percent tariff, sugars and confectionery at 23.6 percent, and beverages and tobacco at 19.6 percent. These tariffs may

³⁰ Nigel Farage, “Why You Should Vote for Brexit—According to Nigel Farage,” *The Independent* (June 20, 2016): <https://www.independent.co.uk/voices/eu-referendum-brexit-nigel-farage-on-why-you-should-vote-to-leave-a7091021.html>. Accessed November 20, 2018.

³¹ Farage, “Why You Should Vote for Brexit.”

³² “Why Vote Leave,” Vote Leave, http://www.voteleavetakecontrol.org/why_vote_leave.html. Accessed November 20, 2018.

³³ John Cassidy, “Why the Remain Campaign Lost the Brexit Vote,” *The New Yorker* (June 19, 2017): https://www.newyorker.com/news/john-cassidy/why-the-remain-campaign-lost-the-brexit-vote_ Accessed November 20, 2018.

³⁴ Cassidy, “Why the Remain Campaign Lost the Brexit Vote.”

be devised as part of an incentive for EU members to trade amongst each other, and thereby strengthen their alliances, the definition of interdependence itself; however, if the whole EU is beginning to falter, or simply cannot produce enough of the listed imports necessary, then it ceases to make practical sense for the UK or any member-state to continue to accept these terms, according to one of the Leave arguments. The UK is particularly dependent on agricultural products, like the dairy imports mentioned above, so this move could certainly help them if all goes right.³⁵

In a study by Gallup, "Before Brexit Vote, 37% of Britons Approve of EU Leadership," Sofi Kluch and Linda Lyons conclude that "those likely voting to Leave the EU believe it would free Britain from EU regulations and stimulate economic expansion."³⁶ This conclusion neatly sums up several of the above-mentioned data points and corroborates the findings of this paper.

According to the BBC, the ward with the second highest percentage of Leave votes "was 80.3% in Waterlees Village, a poor locality within Wisbech, Cambridgeshire. This area has seen a major influx of East European migrants who have been doing low-paid work in nearby food processing factories and farms, with tensions between them and British residents."³⁷ This data suggests that those in the poorest regions were inclined to vote Leave because they felt it would improve the economic standing of native Britons and the country as a whole, as migrants damagingly flooded the job market. However, the BBC mentions the clashing culture of the migrant and British populations in Waterlees Village, suggesting that there are some social factors at play. Ultimately, in this case, many who voted Leave likely believed that it would help the economy, in addition to restricting immigration.³⁸

The study "Why Britain Voted for Brexit: An Individual Level Analysis of the 2016 Brexit Referendum Vote" presents data that agrees with Richard Bellamy's assertions. One piece of important data reveals that 30 percent of those surveyed responded that they felt that by leaving their personal finances would be worse off, while 12 percent thought they would improve, and 58 percent believed they would not be affected.³⁹ This survey revealed that 39

³⁵ Matthew Ward and Dominic Webb, "Statistics on UK-EU Trade," Commons Library Briefing—UK Parliament (July 31, 2018): <https://researchbriefings.parliament.uk/ResearchBriefing/Summary/CBP-7851#fullreport>. Accessed November 20, 2018.

³⁶ Gallup, Inc., "Before Brexit Vote, 37% of Britons Approve of EU Leadership," (June 22, 2016): <https://news.gallup.com/poll/193049/brexit-vote-britons-approve-leadership.aspx>. Accessed November 20, 2018.

³⁷ Martin Rosenbaum, "Local Voting Figures Shed New Light on EU Referendum," *BBC News* (February 06, 2017): <https://www.bbc.com/news/uk-politics-38762034>. Accessed November 02, 2018.

³⁸ Rosenbaum, "Local Voting Figures."

³⁹ Clarke, et al., "Why Britain Voted for Brexit," 439-446.

percent said the economy would be worse off from Brexit, 24 percent said better off, and 37 percent said there would be no difference. The same survey found that 51 percent believed that Brexit would lead to less immigration, while 3 percent felt it would lead to an increase, and 46 thought it would bring no change.⁴⁰ Since a majority voted Leave, this data can be interpreted to mean that while citizens of the UK do not fully disregard economic factors in their value judgements of the EU, they also emphasize immigration-related issues such as security and culture. While this paper's thesis is certainly not disproven by these statistics alone, they do require a greater analysis of the contribution of social factors to the Leave majority of the 2016 referendum. Further research should be conducted to determine the wider accuracy of these polls which would help to more fully explain the outcome of the Brexit vote.⁴¹

Conclusion

Only time will tell how Brexit will affect the economic future of the United Kingdom. In today's global economy, factors beyond the EU, such as the rise of China, will determine Britain's fate. Regardless of how the UK fares outside the mold of European interdependence, it is still worth studying why Brexit occurred, especially since Euroskepticism is spreading throughout the EU. A study by the Pew Research Center, "Euroskepticism Beyond Brexit," states that "a median of just 51% across 10 EU countries surveyed have a favorable view of the European Union."⁴² Future studies could help EU officials understand how to reform its institutions and operations to prevent other countries from seeking to Leave the organization.

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⁴⁰ Ibid.

⁴¹ Ibid.

⁴² Bruce Stokes, "How European Countries View Brexit," Last modified August 28, 2017, <http://www.pewglobal.org/2016/06/07/euroskepticism-beyond-brexit/>.

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Artist:

Pink Powell

Faculty Advisor: Kerri Cushman

Artist's Statement

My "crash" book was inspired by the Grimm's Fairy Tale classic, "The Devil with the Three Golden Hairs," and a contemporary New York Times article under the category heading of food, "The Family Run Store that Sold New York's Best Lox Since 1914." Taking these two concepts, I combined text and image into a handmade, cut paper graphic novella without words. The end result was creating a modern day classic.



Artist:

Natasha Woodmancy

Faculty Advisor: Kerri Cushman

Artist's Statement

This is a modern recreation of a medieval girdle book. Girdle books were popular between the 13th and 16th centuries. They were small portable books typically containing religious texts. Generally worn by monks, clergymen and nobles, they were attached to either one's girdle or belt by an extended leather tail often with a large knot at the end. The leather extends from the binding to create the tail and often on either edge to get folded in and protect the pages from day to day use. My rendition of the girdle book was made using leather from a car wash sham. The leather was dyed using Rit Evening Blue for 72 hours. A template was used to cut the correct shape. The book itself is 4 ¼ by 7 inches with six sections of six folios. I learned how to sew on cords to create this book. It is a medieval stitch which creates soft ridges on the spine. The covers are book board covered in a green pastel paper to match the dye of the leather. All components were assembled together using PVA glue. Finally, the tail was gathered and tied using remaining leather.



Method for the Detection of PFOA in Water Samples

Katharine Colley

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Abstract

Perfluorooctanoic acid (PFOA), a common perfluorochemical, has contaminated aqueous environments for years due to its frequent use in manufacturing facilities. The unwanted distribution of PFOA in drinking and surface water has prompted researchers to develop several detection and removal methods. For this project, GC-MS was used as the detection method for PFOA in three water samples. One sample was collected from the Ni River Reservoir in Spotsylvania County, VA. The next sample was collected from a kitchen faucet that received its water from the Ni River Reservoir Water Treatment Facility. The last sample was generated in the laboratory. Prior to GC analysis, a derivatization procedure was necessary to transform PFOA into a more volatile compound (isobutyl ester). PFOA isobutyl ester was not detected in the Ni River reservoir sample or the tap water sample, but it was detected at a concentration of 3.024mg/L in the contaminated water sample generated in the laboratory.

Introduction

In the last decade, perfluorochemicals (PFCs) have become a serious environmental concern, particularly in drinking water. These chemicals, along with their derivatives, have been industrially and commercially used as chemical agents to produce non-stick cookware, stain-resistant carpets and furniture, coatings on fast food packaging, and fire-fighting foam.¹ One of the most common PFCs is perfluorooctanoic acid (PFOA), an emerging organic pollutant comprised of a carboxylic acid and long fluorinated carbon chain.¹ PFOA's structural characteristics contribute to its high water-solubility and high resistance to degradation, both of which have led to its abundance in aqueous environments for long periods of time.¹ PFOA has become more prominent in sediment, sludge, municipal wastewater, coastal water, and tap water.² For these reasons, researchers have been studying the toxicity effects, detection methods, and removal methods of PFOA in aqueous environments.

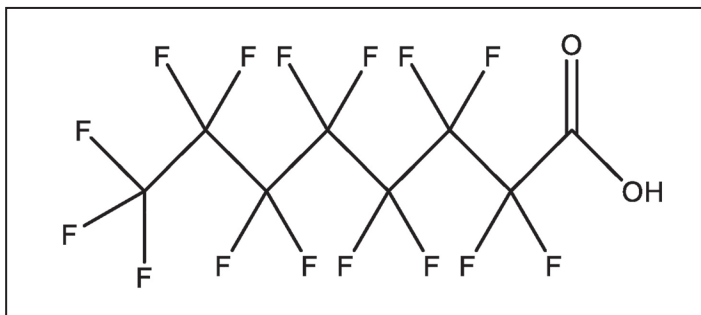


Figure 1. Perfluorooctanoic acid (PFOA). Source: Katharine Colley.

PFOA exposure in humans and animals through drinking and surface water is a developing problem worldwide, specifically in industrialized areas.¹ In a review paper written by Suja, several common direct and non-direct point sources of this pollutant were listed as industrial and sewage treatment plants, surface runoff areas, atmospheric discharge, and bioaccumulation (accumulation of substances or chemicals in an organism).¹ A mechanism that connected the contamination flow of PFOA into peoples' homes was introduced by Boulanger in an additional study.³ In summary, PFOA is produced and released from manufacturing companies, traveling unaffected through wastewater treatment plants, several aqueous environments, and water purification plants, until it emerges in tap water.³ Exposure to perfluorochemicals potentially raises the following health risks: liver damage, the formation of noncancerous

tumors in the liver, and the formation of noncancerous tumors in the thyroid tissues.⁴ Many countries have been questioning the safety levels of PFOA in drinking water, but in 2007, the Minnesota Department of Health recommended a safety level of 0.5 µg/L for PFOA.⁵ As of 2016, however, the EPA has taken steps toward regulating and maintaining this exposure by establishing a health advisory for PFOA of 0.07 µg/L in drinking water systems.⁶

The detection of PFOA, as well as many other PFC derivatives, in drinking and surface water is critical in researchers' efforts to reduce contamination in aqueous environments. A commonly used PFOA detection method is high-performance liquid chromatography (HPLC), which is typically coupled with mass spectrometry.² In an article published in 2002, Moody and colleagues discussed the use of HPLC/MS/MS as a primary analytical tool for the detection of PFOA (and other derivatives) in the investigation of the release of fire-fighting foam into the Etobicoke Creek.² In another article published twelve years later in 2015, Castiglioni and colleagues discussed the use of HPLC/MS/MS, coupled with solid-phase extraction, as a primary analytical tool for the detection of PFOA (and other derivatives) in the investigation of the source of perfluorinated compounds in drinking water in industrialized areas in Italy.⁷ HPLC has continued to be and will continue to be an effective detection method for PFOA and PFC's worldwide.

An additional method, used less often than HPLC, is gas-chromatography (GC).⁸ This method has proved to be successful when conditions are optimized, but the sensitivity and effectiveness of GC decreases as molecular weight increases.⁸ An article written by Dufková in 2009 addressed this molecular weight issue by investigating the fast derivatization procedure for gas chromatographic analysis of perfluorinated organic acids.⁹ The study used HPLC-ESI-MS, GC-EI-MS, and GC-ECD in the determination of PFCA isobutyl esters.⁹ GC was considered the principal analytical technique, while HPLC was primarily used for comparison. Prior to sample preparation, a derivatization procedure was completed to transform PFOA, along with additional PFC derivatives, into an isobutyl ester for gas chromatography.⁹ This transformation was needed to increase the volatility of PFOA, subsequently making the compound more suitable and responsive for GC analysis.⁹ The reaction yield of the derivatization procedure was >99%.⁹ The study was not only successful in obtaining LOD (limit of detection) values for HPLC-ESI-MS, GC-EI-MS, and GC-ECD, but it was also successful in determining a PFOA concentration of 3.4 ng/mL in a Vltava River (Czech Republic) water sample (GC-EI-MS).⁹

Developing a better understanding of the transportation of PFOA in aqueous environments allows researchers to cultivate more effective removal methods for the compound. For

example, a study conducted by Wang investigated the environmental impact of the adsorption of PFOA on alumina.¹⁰ The article discussed the influence that the hydrophobic chain and hydrophilic functional groups of PFOA had on the adsorption to different solid matrices.¹⁰ Alumina was utilized as one of the solid matrices because of its protonated surface and likely presence in aqueous environments.¹⁰ Since alumina has a protonated surface and PFOA has an anionic surface, PFOA should adsorb to alumina; however, the study proved that as the pH and ionic strength increased, the adsorption of PFOA onto alumina surfaces decreased.¹⁰ These findings suggest that the adsorption capabilities could be manipulated in order to develop removal methods for PFOA from aqueous environments.

A common and fairly successful method for drinking water treatment is conventional and enhanced coagulation.¹¹ Coagulation can be described as using metal salts, such as alum and ferric chloride, to promote the clumping of contaminants, which can then be filtrated and removed.¹¹ Both types of coagulation methods were used in a study conducted by Xiao and his colleagues that investigated the removal of PFOA from drinking water.¹¹ Variables such as solution pH, type of coagulant, flocculation (the clumping of particles) time, and coagulant dosage were taken into account and varied throughout the study.¹¹ Concentrations of PFOA were quantified by using HPLC coupled with ESI-MS.¹¹ They found that enhanced coagulation was most successful and that the removal of PFOA was greater at lower pH values and alum (coagulant) dosages that were greater than 60mg/L.¹¹ These results indicate that electrostatic and hydrophobic effects control coagulation.¹¹ Although this study proves that coagulation can be optimized under certain conditions, many other published journal articles differ in their responses to this removal method of PFOA.

A more successful method for the removal of PFOA from drinking water is granulated activated carbon (GAC) filtration.¹² This method is commonly used to reduce the concentrations of synthetic organic compounds, taste and odor compounds, and natural organic matter in drinking water treatment plants.¹² In order to enhance organic absorption onto a GAC, a sample must have a low pH, relative molecular weight (because low molecular weight will not be removed by GAC), and solubility.¹³ Studies conducted at several different treatment plants in Osaka, Japan found that these filters are capable of removing 69-100% of ng/L levels of PFOA.¹² This method was also used to investigate high concentrations of PFOA in the Little Hocking community in Washington, West Virginia and in the Sauerland area in Arnsberg-Neheim, Germany.¹² In the Little Hocking community, studies detected an average PFOA concentration of 4800 ng/L in distribution systems and an average PFOA concentration of 200 ng/L in private well drinking water.¹² In the Sauerland area in Arnsberg-Neheim, Germany, studies detected average PFOA concentrations in drinking water to be 500-640

ng/L, which directly correlated to the increasingly higher levels of PFOA in inhabitant's blood plasma.¹² In both cases, the use of GAC filtration was successful in decreasing the concentration of PFOA in drinking water to below its limit of detection (LOD), as well as lowering blood serum levels by as much as 28%.¹² GAC filtration has proved to be successful in these studies, as well as many others, but its ability to remove contaminants is reduced if it is not regenerated 2-3 times per year.¹²

The aim of the present study is to continue the investigation of the detection of PFOA in water samples. HPLC and GC will be used as detection methods. A derivatization procedure will be used prior to GC analysis to transform PFOA into a more volatile compound (isobutyl ester). Results will be quantified and used to determine unknown PFOA concentrations in three water samples. One sample will be collected from the Ni River Reservoir in Spotsylvania County, VA. The next sample will be collected from a kitchen faucet that received its water from the Ni River Reservoir Water Treatment Facility. The last sample will be generated in the laboratory. Studying the detection of PFOA in these water samples will help determine the effectiveness of PFOA removal in the Ni River Reservoir Water Treatment Facility.

Experimental

Perfluorooctanoic acid (PFOA) 95% (5g: \$29.30) was purchased from Alfa Aesar. Additional reagents and/or catalysts necessary for this experiment were HPLC grade acetonitrile (ACN), iso-butanol, pyridine, iso-butyl chloroformate (IBCF), hexane, and sulfuric acid (catalyst). Seven standards were created through fast derivatization procedures. The first derivatization procedure generated one standard through acyl chloride esterification. The second derivatization procedure generated six standards through Fischer esterification. Both derivatization procedures were necessary to transform PFOA into an isobutyl ester.

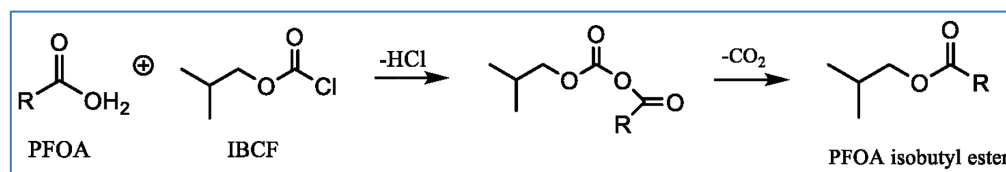


Figure 2. Reaction scheme for the acyl chloride esterification. The R group represents PFOA's long fluorinated carbon chain. Source: Katharine Colley.

Figure 2 displays the reaction scheme for the acyl chloride esterification. To begin this derivatization procedure, a 700ppm PFOA stock solution was created in a 100mL volumetric

flask with 0.0706g PFOA and 100mL HPLC grade ACN. The reaction mixture was created in a 25mL volumetric flask with 20 μ L of PFOA stock solution, 158 μ L of ACN, 8 μ L of iso-butanol, 4 μ L of pyridine, and 10 μ L of isobutyl chloroformate (IBCF).⁹ The mixture was placed in an ultrasonic bath for 20s and then 200 μ L of hexane was added.⁹ The hexane layer (top layer), which contained the isobutyl ester, was extracted after lightly shaking the reaction mixture for 1-2 min. GC-MS analysis was performed using a Shimadzu GCMS-QP2010 instrument. A splitless-mode injection at 250°C was selected. The oven temperature was held at 40°C for 3 minutes, ramped to 170°C, and then held for 3 minutes.⁹ The total run time was 19 minutes.

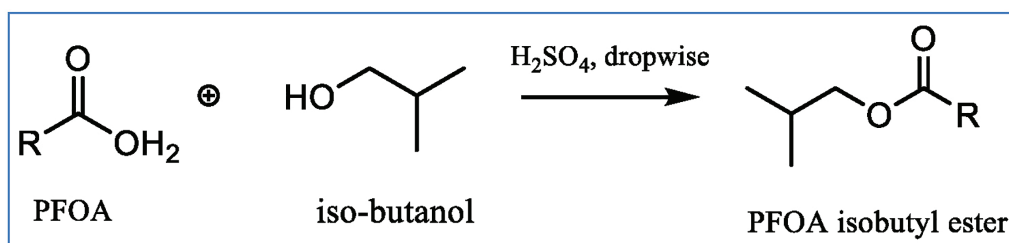


Figure 3. Reaction scheme for the Fischer esterification. The R group represents PFOA's long fluorinated carbon chain. Source: Katharine Colley.

Figure 3 displays the reaction scheme for the Fischer esterification, or second derivatization procedure. Figure 3's reaction scheme differs from Figure 2's reaction scheme in that it transforms a carboxylic acid (PFOA) into an ester by heating it with an alcohol and strong acid catalyst.¹⁴ In this experiment, PFOA was used as the carboxylic acid, iso-butanol was used as the alcohol, and H₂SO₄ was used as the strong acid catalyst.

Standards were created for the second derivatization procedure by using two different methods. The first method required mixing 0.0127g PFOA, 1mL iso-butanol, and 1 drop of H₂SO₄ in a 25 mL volumetric flask. The reaction mixture was heated on low with a stir bar for 1 hour and then remained on the stir plate for 2 days. The hexane layer (top layer) was extracted from the reaction mixture after the addition of 1mL of hexane. The hexane extract was diluted through a serial dilution to generate 4 standards: 356mg/L, 35.6mg/L, 3.56mg/L, and 0.356mg/L. The original GC-MS method was used on these standards.

The second method used for the second derivatization procedure required mixing 1.003g PFOA, 10mL iso-butanol, and 10 drops of H₂SO₄ in a 25mL volumetric flask. The reaction mixture was heated on low with a stir bar for 2 hours and then remained on the stir plate for 5 days. The hexane layer was extracted from the reaction mixture after the addition of 10mL of hexane. The hexane extract was diluted through a serial dilution to generate 6 standards:

28mg/L, 14mg/L, 7mg/L 3.5mg/L, 0.35mg/L, and 0.035mg/L. Note that the original hexane extract concentration was 28,000mg/L. Figure 4 illustrates the original hexane extraction and 6 standards. The original GC-MS method was used on these standards.



Figure 4. Six standards created through a serial dilution. The original hexane extract (far left vial) was created through the Fischer esterification procedure. Source: Katharine Colley.

The second method for the Fischer esterification derivatization procedure was most successful in producing results for the standards, therefore, it was used to test water samples. The first water sample, also known as the “contaminated” water sample, was generated in the lab by mixing 0.0734g PFOA and 100mL DI H₂O in a 100mL volumetric flask. The second water sample was collected from the Ni River Reservoir in Spotsylvania County, VA. The third water sample was collected from a kitchen faucet that received its water from the Ni River Reservoir Water Treatment Facility. The Fischer esterification derivatization procedure was modified for the water samples because PFOA was dissolved in water. (Note that PFOA was not dissolved in water for the standards.) This was a concern because water is a byproduct of the Fischer esterification, meaning that the Fischer esterification derivatization procedure would most likely not go to completion. To avoid this problem, the following modified derivatization procedure was performed on all three water samples: Five, 1mL hexane extractions with 5mL of water sample, dry hexane extraction, reconstitute dried hexane with 100µL iso-butanol and 10µL H₂SO₄, and place reaction mixture on stir plate with no heat for 4-5 days. The original GC-MS method was used for analysis.

Results & Discussion

The acyl derivatization procedure for this experiment was identical to the one performed by Dufková and colleagues.⁹ Unlike Dufková, this experiment was not successful in detecting the PFOA isobutyl ester. The lack of detection in this experiment could have been the result of several factors such as the composition of the mixture, the purity of the chemicals, the reaction temperature, and duration of the reaction.⁹ According to Dufková, the reaction temperature can be optimized at 20 to 60°C, the duration of the reaction can be optimized at 8 min, and the composition of the reaction mixture can be optimized when the volume of pyridine ranges from 0 to 20µL.⁹ The acyl chloride esterification in this experiment could likely be a successful detection method if it were tested again using the suggested optimization conditions.

The PFOA isobutyl ester was detected in all six standards created through the Fischer esterification procedure. Standards were run in both scan mode and SIM mode on the GC-MS. SIM mode is used for detecting specific ions, while scan mode is used in most other cases to detect all ions. Figure 5 displays a general representation of what each standard's mass spectrum resembled in scan mode. The SIM mode mass spectrum would differ from the scan mode mass spectrum in that it would only display the specific ions selected.

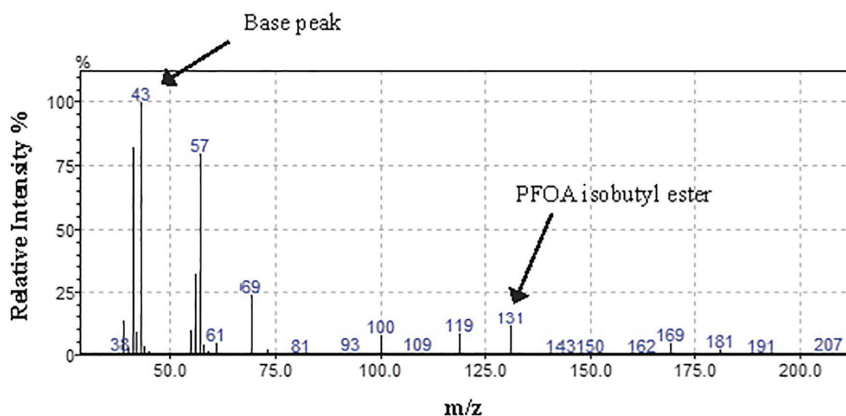


Figure 5. Mass spectrum for a Fischer esterification standard. Source: Katharine Colley.

As Figure 5 displays, the base peak (tallest peak) is represented by a m/z value of 43. The PFOA isobutyl ester is represented by a m/z value of 131. An additional GC analysis tool that helped verify the detection of the PFOA isobutyl ester in the standards was a similarity search. This search explores a mass spectrum database and identifies molecules that are a

likely match. In this case, the similarity search for Figure 5 indicated that the mass spectrum was pentadecafluorooctanoic acid (PFOA), isobutyl ester.

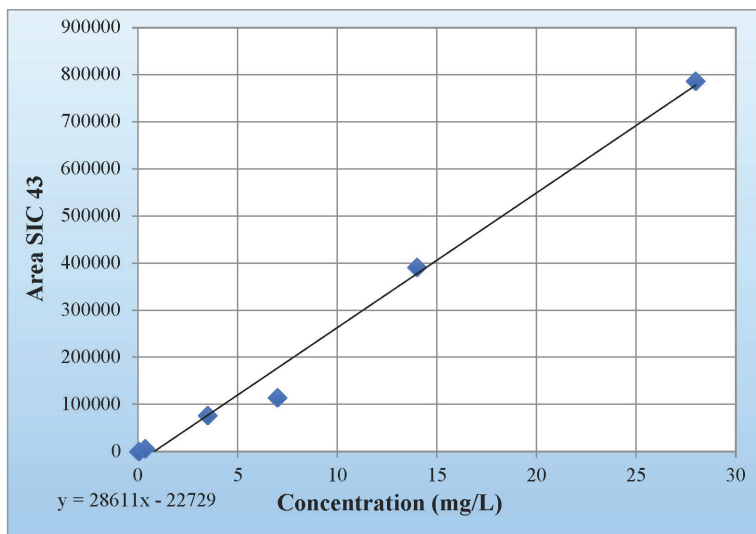


Figure 6. Standard curve for the Fischer esterification standards. Source: Katharine Colley.

Figure 6 displays the standard curve created from the Fischer esterification standards. The standards' concentrations are on the x-axis and their corresponding peak areas are on the y-axis. Peak areas were integrated computationally by selecting a peak on the standard's chromatogram. Each standard displayed a PFOA isobutyl ester peak around 7.0–7.1 min.

Water samples with unknown PFOA concentrations were evaluated next. The laboratory generated contaminated water samples, the Ni River Reservoir water sample, and the tap water sample were all analyzed in scan mode and SIM mode. In this case, SIM mode was more useful in the detection of PFOA isobutyl ester. The PFOA isobutyl ester was not detected in the Ni River Reservoir water samples or the tap water sample. Both samples were run through GC-MS twice, and the PFOA isobutyl ester was not detected in any of the trials. Although this suggests that there was little to no PFOA in the water samples, additional procedures could be performed to verify results.

The PFOA isobutyl ester was detected in the contaminated water sample. Figure 7 and Figure 8 below display the GC-MS chromatogram (169 ion) of the laboratory generated contaminated water sample. The GC-MS was set up to select for the 43 ion, 131 ion, 169 ion, and 181 ion. Figure 7 and Figure 8 only display the 169 ion. Note that a SIM mode

chromatogram slightly differs from a scan mode chromatogram in that the chromatogram only displays selected ions.

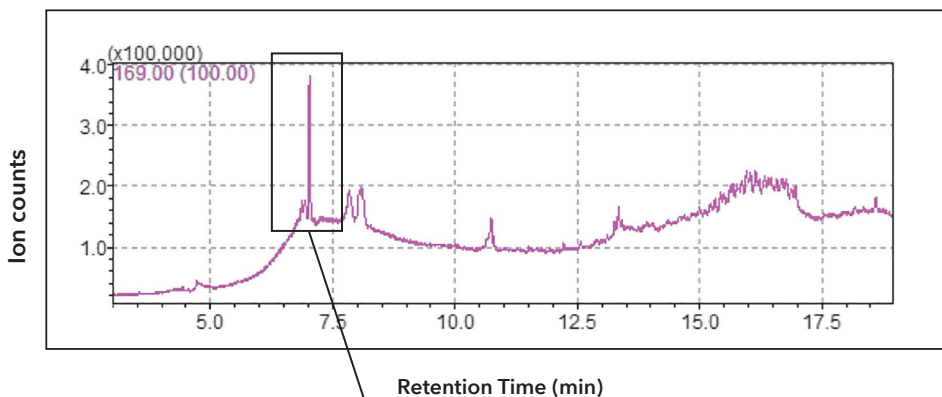


Figure 7. GC-MS chromatogram for contaminated water hexane extract (SIC169). Source: Katharine Colley.

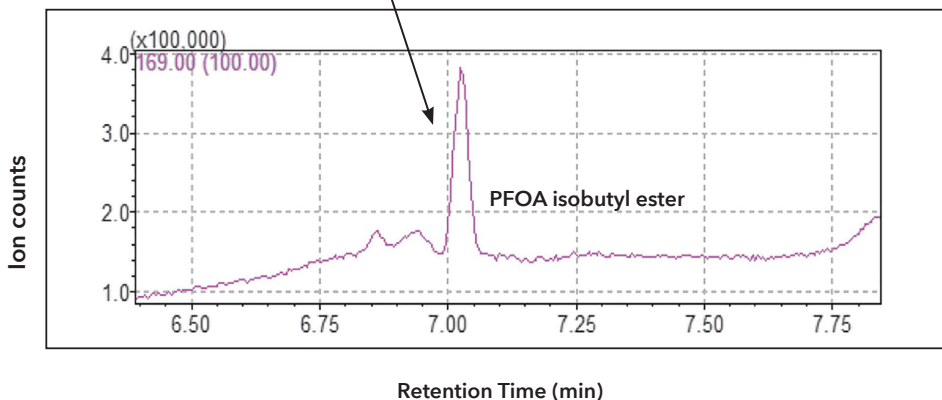


Figure 8. Zoomed in image of the PFOA isobutyl ester peak from Figure 7. Retention time was 7.0-7.1 min for contaminated water sample and standards. Source: Katharine Colley.

Figure 7 and 8 indicate that the retention time of the PFOA isobutyl ester peak was around 7.0 minutes. This is relatively close to the retention time of the standards. The PFOA isobutyl ester peak in Figure 7 and Figure 8 was integrated to calculate a peak area. The results are displayed in Table 1 below. An additional value that was also calculated and displayed in Table 1 was concentration (mg/L). This was calculated by using the linear line equation, $y = 28611x - 22729$, from Figure 6.

Table 1. Peak area and concentration values for water samples. Source: Katharine Colley

Unknown	Peak area	Calculated concentration (mg/L)
Contaminated water sample	63798	3.024
Ni River Reservoir water sample	PFOA not detected	PFOA not detected
Tap water sample	PFOA not detected	PFOA not detected

Conclusion

In conclusion, perfluorooctanoic acid (PFOA) has contaminated aqueous environments for years. Its frequent use in manufacturing facilities has led to its distribution in surface and drinking water systems. Gas chromatography, liquid chromatography, and granulated activated carbon filtration are common detection and removal methods. GC-MS was used as the detection method in this experiment. Prior to GC analysis, a derivatization procedure was used to transform PFOA into a more volatile compound (isobutyl ester). PFOA isobutyl ester was not detected in the Ni River reservoir sample or the tap water sample, but was detected at a concentration of 3.024mg/L in the contaminated water sample generated in the laboratory. For future work, granulated activated carbon filtration will be used as a PFOA removal method.

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Artist:

Abbey Mays

Faculty Advisor: Kerri Cushman

Artist's Statement

Flash floods can happen fast and be unexpected. This piece is designed to reflect the detrimental floods and natural disasters that have been happening all over the world in the past year. These events are increasingly becoming stronger and more unpredictable. This is because greenhouse gases have been accumulating for many years causing the climate patterns to change. These increasing temperatures are leading to the ice caps melting, which in turn, makes the ocean levels rise. This is also the reason for much of the flooding all over the world. The wrath of mother nature is powerful, and she can destroy homes, vehicles, and bridges. All in all, after a flood you may only be left with the umbrella you grabbed before trying to seek shelter.



The Rhetorical Construction of eSports' Legitimacy

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Abstract

Technology changes quickly, and with it so has the concept of traditional athletic sports. The growth of electronic Sports or eSports has created a debate about whether it is an actual athletic sport or if it should be considered a separate entity. This rhetorical analysis uses a variety of articles to defend eSports as a legitimate athletic sport, explaining how it has become a large financial industry by using Aristotle's three rhetorical appeals along with the modern rhetorical concepts from Jay Heinrich's Thank You For Arguing. This paper also focuses on how increasing eSports viewership and financial success has led to sponsorship from well-known, credible companies, helping to bring eSports into the mainstream of television, allowing players to find financial success, and surpassing large traditional sporting events, such as the World Series and the Super Bowl.

From running around a track to catching a ball, playing a sport has long been considered a real-time, physical activity. However, the evolution of technology and society now allows for performing sports in an entirely new way, leading to the multimillion-dollar industry of eSports: an organized competition in which professional video gamers play top games for millions of spectators in a specialized arena setup. Since the 1970s, video games evolved from basics like *Mario*, *Pac-Man*, and *Pong* to highly complex games like *Pokémon*, *Overwatch*, *Fortnite*, and *Counter Strike: Global Offensive*. With multiplayer, first-person shooter video games such as *Counter Strike: Global Offensive* and *Overwatch*, or single player games like *Pokémon*, the increasingly popular eSports earned the world of competitive video gaming consideration as a mainstream sport.

Several of these video games turned into some of the largest events in the field of competitive sports, further reinforcing the perception of eSports as a real-time activity. According to an article written by the Syracuse University Online Business Program on their blog, “The 2016 championships of the role-playing game *League of Legends* attracted 43 million unique viewers, who watched a total of 370 million hours of players competing for \$6.7 million in prizes via 23 broadcasts in 18 languages. At its peak, 14.7 million people were watching” (“With Viewership”). The article states that “traditional sports leagues are also paying attention” to this recent phenomenon: “This year [2017], the NBA announced it would be the first professional sports league to form an eSports partnership—the ‘NBA 2K eLeague’ with Take-Two Interactive Software, publisher of the NBA 2K video game” (“With Viewership”). The recognition by such big sports leagues, as reported in the media, brought further legitimacy to video games as eSports.

Indeed, eSports has grown as an athletic event particularly because of the press generated on the topic, which utilized this virtual phenomenon to target audiences and stakeholders on various levels. This has even led to a new generation of athletes, both in the collegiate (e.g., Daniel De Jesus Turgeon) and professional world (e.g., Richard “Ninja” Belvins), and a change in the trends in what games people now play. It has also changed the way many non-gamers view those who do play video games and, for the most successful players, has allowed the stereotype of a gamer to transform into that of a superstar. While a common assumption and stereotype once was that video game players were reclusive, nerdy, stereotypical gamers, gamers are now seen as the next collegiate and professional athletes, changing the idea of sports completely by creating a multitude of careers and transforming the perception of athletes, as well as viewership.

Combing classical, Greco-Roman perspectives on persuasion with contemporary concepts explains how various mediated texts contributed to the expansion of sports (real, phys-

ical) to eSports (virtual reality) and maintained its multimillion-dollar influence on the market, legitimizing eSports. Aristotle (384–322 BCE), commonly known not only as a Greek philosopher but also as the father of rhetoric, provides a model in his three-book treatise. Exploring the rhetoric of sample textual artifacts from the media, including the following news articles on eSports that appear on Syracuse Online: “With Viewership and Revenue Booming, ESports Set to Compete with Traditional Sports,” “College Athletic Departments Go Recruiting for Gamers for eSports Teams,” “ESports Is Quickly Becoming a Big Business for Game-Makers,” “Overwatch League Comes to ESPN, Disney and ABC,” and “With Viewership and Revenue Booming, ESports Set to Compete with Traditional Sports,” suggests that these pieces engage with rhetorical devices like Aristotle’s three appeals: *logos*, *pathos*, and *ethos*. The rhetorical appeals of the short-lived web series *Good Game* compare to the news coverage on eSports, presenting a more emotional approach to eSports while also giving statistical data. *Good Game*, on the other hand, uses pathos to increase audience awareness of eSports as a legitimate sport. Using Aristotle’s three appeals helps these articles make a defensive argument that allows the audience to formulate an educated opinion and see the positive side of eSports.

A Rhetorical Perspective to Analyzing the Media on eSports

In *Thank You for Arguing: What Aristotle, Lincoln, and Homer Simpson Can Teach Us about the Art of Persuasion*, Jay Heinrichs simplifies Aristotle’s “Three Big:” logos, ethos, and pathos (39). Logos is an argument made by using logical information such as statistics, facts, logical reasoning, and evidence, like financial and player data. Ethos is “argument by character,” and it “employs the persuaders personality, reputation, and ability to look trustworthy...” (Heinrichs 40). Ethos also “involves convincing your audience that you are intelligent and *can be trusted*. Writers cannot simply say to their audience ‘I can be trusted because I’m smart and a good person’” (“The Argument’s Best Friends”). Heinrichs notes that, “In rhetoric, a sterling reputation is more than good” (40) and having credible information builds this (in this case, using trustworthy companies like Blizzard and collegiate players). Pathos argues with emotion, using things and the audience’s concern for the topic: “Because your audience has emotions as well as intellect, your argument must seek to engage the audience emotionally” (“The Argument’s Best Friends”). These three rhetorical appeals are useful for examining these mediated texts because understanding how the appeals are employed in the media helps unravel the construction of eSports’s as a real-time phenomenon, legitimizing it in comparison to more physical sports.

Other modern rhetorical concepts useful for understanding the media on eSports include *commonplaces*, or “a viewpoint your audience holds in common” (Heinrichs 112), and *identity strategy*, or making the audience identify with the argument (Heinrichs 250). Finally, these blog articles use *induction*, or “argument by example” (Heinrich 148). An inductive argument starts with specific examples, using them to build up to a general principle. The goal is to describe smaller pieces of a puzzle to create the main idea (Heinrichs 148). The use of these rhetorical arguments in the media texts here portrays eSports as an actual sport and influences audiences’ perception and reception of eSports as a significant phenomenon.

Legitimizing eSports through Rhetoric

eSports involves playing video games at a professional level. The research, such as the data given by the Syracuse Business blog post and information collected by companies such as Newzoo, that goes into the financial portion of this industry uses *induction* to promote eSports as an actual athletic sport. While playing video games for a living sounds less lucrative than other competitive physical sports, it is now a business with the possibility for exponential growth. Mai-Hanh Nguyen points out the financial benefit of eSports to multiple groups (players, event location, companies, etc). Nyugen explains that eSports benefit both the companies and the players by helping to build an industry worth millions of dollars: “Activision Blizzard was seeking \$20 million per team and players are being paid in excess of \$100,000 per year in certain cases.” This allows for a larger focus on the eSports movement and attracts potential financial sponsors of eSports interested in the possibility of monetary success, which also benefits the promotion of eSports as an actual sport. According to Nguyen, using credible company names such as Buffalo Wild Wings and Red Bull (sponsors of eSports events) points to the industry’s growth and its financial success. Nguyen states, “As the growth and success of eSports leagues continue to rise, the execution of tournaments and competitions requires thorough planning and precise detailing.” This includes arenas and convention centers where the games are held, as well as the production and the conceptualization of the competition, such as the screens showing real time play and announcers who call the game. This also leads to more people watching these competitions, with more money and viewership that is in the growing eSports industry and it creates a more captive audience. Using the financial and statistical data and providing information for the audience is an argumentative strategy that falls under Aristotle’s *logos*.

While financial success in sports is important, the necessity of audience is also key. Online viewership and in-person statistics allow for a more realistic idea of the popularity of eSports and uses *logos* to support the debate of eSports as a sport. For example, the article from

Syracuse University Online Business Program's blog, "With Viewership and Revenue Booming, ESports Set to Compete with Traditional Sports," gives statistical information about the viewership, painting a logical picture of the large view count in eSports and defending the idea of eSports as a legitimate sport. Syracuse's article presents statistical analysis from the consulting firm Activate stating, "In 2017, more than 111 million people watched the Super Bowl, traditionally one of the most popular sporting events on television [...] ESports, also known as electronic sports or professional video gaming, has been booming. More than 250 million people follow the competitions, according to the technology consulting firm Activate, and most of those viewers also play" ("With Viewership"). These statistics indicate eSports's ability to beat the viewership of a major American Football event, suggesting that eSports holds more of an audience with its competition than one of the largest viewed athletic events in the United States. Despite what some audience members think about eSports not being a more "traditional" sport, it gains more attention than some of the most popular American sporting events, drawing more viewers and retaining more of its audience.

The statistical analysis given in the Syracuse University blog also estimates that by 2020, eSports will beat viewership of the MLB by close to six million viewers and is expected to be the second most-viewed professional sports league, also beating traditional sports leagues like the NHL and NBA ("With Viewership"). Viewership is an important aspect of any sport, building a fanbase and adding the financial increase of the eSports industry. Nguyen also discusses viewership, explaining how streaming video game play on platforms built for it, such as YouTube and Twitch, has increased over the years. She also provides statistical analysis on viewership of gameplay and competitive matches, writing that "Newzoo projects that figure to grow to 345 million by 2019. As an audience, eSports viewers are highly engaged, so projections indicate that 213 million people will watch competitive gaming this year." All of the statistical data builds the credibility of eSports, suggesting that it will eventually surpass some of the largest sports leagues in the United States; however, with the growth in viewership, there would also have to be an increase in financial backing for the idea of eSports as a real sport. This statistical data once again provides the basis for a logical argument.

Playing video games is not limited to the paid professional playing level. It has even moved to the collegiate level, with universities offering scholarships in exchange for playing. To further add to the legitimacy of eSports through logical appeals, René Guzman's online article, "College Athletic Departments Go Recruiting For Gamers For eSports Teams," uses information from the analytical firm Newzoo to show how eSports is expected to grow financially: "The market research firm Newzoo, which focuses on global games and eSports, expects worldwide eSports market revenue to hit \$906 million for 2018 and nearly \$1.5 billion

by 2020. This is big business, and it's becoming a recruiting tool for colleges." This shows the financial integrity of eSports and how it has grown into a large business. Guzman points out that "Harrisburg University in Pennsylvania is home to around 6,000 students where esports is its only varsity sport." Some universities have eSports as their only sport, which allows other schools that cannot compete with the larger schools to face some of them in non-division-based tournaments on an even playing field.

Guzman's article also uses ethos by having an actual competitive gamer, Daniel De Jesus Turgeon, as a credible source for talking about how eSports and the recruitment of players is slowly transforming it into a college sport as well. This promotes education as well as showing that professional, collegiate athletes can also be non-physical athletes. Turgeon's reputation as a competitive player enhances the credibility of the source and the argument of eSports as an athletic sport and event, especially when he points out the monetary benefit for the players themselves. Turgeon states that he "is cashing in on all those hours of computerized carnage with a four-year, \$40,000 scholarship from Schreiner University, where he'll game on as part of the Kerrville school's new varsity eSports program" (Guzman). While numbers and facts that give solid information are helpful, using ethos helps give further life to eSports, allowing audiences to see eSports as a tangible idea by presenting testimonies and real-life examples of eSports as a legitimate business.

While using an actual player is beneficial to the integrity of the source and topic, the use of credible companies such as Blizzard Entertainment improves the credibility of the industry, with reliable video and computer game companies that serve as a key part of eSports. The use of ethos is important for the promotion of eSports as an athletic sport, as seen from using the character of some of the largest companies in the industry. The use of ethos in the articles indicates that companies are willing to invest in and sponsor these events and promote eSports. For example, Travis Hoium's article "eSports Is Quickly Becoming a Big Business for Game-Makers" uses ethos because it lists a credible company like Blizzard Entertainment which is known for releasing some of the leading competitive games. Hoium points out that such companies "create the games and can, therefore, create the sports leagues as they choose."

Hoium relies on the name of a prestigious gaming company to give credibility to his article and to allow the audience to see who and what supports eSports in its growth. After all, Blizzard Entertainment, created competitive games like *Overwatch* and *StarCraft II*. Hoium ends his article saying, "As the eSports business grows, it could become a meaningful driver of Activision Blizzard and Electronic Arts' businesses long term as it opens up a plethora of

new revenue streams and keeps players engaged.” Hoiium notes that the growth in eSports means trustworthy companies can maintain their own credibility, thereby constructing a reliable character in the eyes of their audiences.

Video game companies are not the only ones using their credible name to encourage the perception of eSports as a legitimate athletic event in the sports world. The Walt Disney Company also uses their reputation to back eSports by airing competitions on their network channels. The Entertainment and Sports Programming Network or ESPN, which published an article stating what channels would feature the Overwatch League, is another artifact that uses ethos in observing its popularity: “We’ve had an interest and have been watching pretty closely...Clearly by the way we’re going to be covering it starting with the playoffs and the finals this year certainly speaks volumes to our excitement and our enthusiasm overall for eSports moving forward” (“Overwatch League”). The fact that a major sports network airs the competition helps retain a steady viewership. In addition, sponsorship by credible companies like Disney helps bring eSports into the mainstream, improving the argument of eSports as a legitimate athletic event and allowing the audience to see it as a functioning industry.

While using credible sources and statistics are all effective means of arguing for the viability and legitimacy of eSports, the media also uses the rhetorical appeal of pathos to persuade audiences to perceive eSports as an athletic event. This allows a variety of audience members to connect at a common emotional level and see the more human side of an argument. The web series, *Good Game* by Dan Harmon makes a pathos-based argument by providing a more comedic or humorous approach of the eSports world. The main premise of the show is an underdog team of misfits preparing to compete in a large eSports competition for a game called *Killcore*, a parody of an actual game, *Defense of the Ancients 2* or *Dota 2*. *Good Game* is a pathos argument because it resonates with competitive sports players who experience certain frustrations similar to the show’s characters, while also demonstrating that eSports is not just playing video games for fun and that becoming a champion in a video game competition is difficult. The show makes a pathos appeal by using the emotions of characters who face personal frustration with the competitive world of video games. The show points out the difficulties with competitive gaming, from not getting along with teammates to the intense training and stress that comes with it. In doing so, the show serves its purpose of legitimizing the eSport world because the show reveals the intense amount of training, time, and pressure competitive gamers face, much like real-time football and baseball athletes. It portrays the process to prepare for a video game competition as frustrating and stressful.

Good Game uses pathos to build empathy with its viewership while they train to become competitive gamers as well as those who were physical athletes and still find it difficult to

believe that eSports should be considered a sport. While it is a fictional account of an eSports team, *Good Game* shows the real-world problems that arise with a competitive team. The emotions the show invokes resonates with the audience, especially those who are familiar with being an athlete, potentially convincing them that eSports is a truly legitimate and respectable athletic event.

The online articles and other mediated texts discussed here enrich their rhetorical appeal by also relying on identity as a rhetorical strategy. For example, Nguyen's article points out that the marketing alone allows for "brands and marketers, there are huge opportunities to build new fan bases and engage with this growing audience [...] As a marketer, assets such as naming rights, branded content, experiential activation, tech integration, jersey branding, and so forth are available for brands willing to invest in the eSports space." These statements are an *identity strategy* because they mention the large group of people and businesses that participate in eSports as an industry. Guzman uses a similar strategy in his article, targeting an audience getting ready to enter higher education or already there. Guzman also focuses on those who are heavily involved in the eSport community and industry, saying, "To date, Tespa has overseen more than 30,000 student competitors and awarded more than \$3 million in scholarships." This allows for a variety of people in the audience to identify with students and competitors, as well as legitimizing the idea of competitive gaming by showing a large number of competitors and the monetary value of scholarships as prizes. This serves as identity strategy because it focuses on the competitor audience and those in higher education.

All of the media texts discussed in this essay constitute small pieces of the puzzle that is the eSports industry. They all show the multiple parts that constitute competitive gaming by using an inductive argument. They show the financial, statistical, and actual active portions of competitive gaming. The articles discussed in this essay explain how the growing eSports empire works through smaller portions, all of which are just small parts of the multi-billion-dollar gaming industry itself which is entering the world of sports. The artifacts also serve as a *commonplace* for the audience. While they all target various audiences, the main audience is those interested in eSports. ESPN uses the interest to their advantage by showing it on the channels of their parent company, Walt Disney, specifically the young adult channels Disney XD, ESPN, and ESPN 2 ("Overwatch League"). These articles also use commonplace to show the similarities of physical athletic sports fans and eSports fans. Dan Harmon's series *Good Game* also uses a commonplace by featuring characters that others can relate to in both the physically athletic and eSport athletic players. Guzman's article also points out another commonplace. With eSports there are currently no collegiate conferences. This has allowed for different types of universities like Schreiner and Harvard, to play against each other ("College

Athletic"). This is commonplace because it tells the audience who want to participate in eSports at a collegiate and professional levels that everyone can play as equals. The articles use commonplace to pull in a very large audience of those interested in eSports.

Conclusion

With the rise of technology and constant production of video games in the new millennium, competitive gaming has gradually gained traction as a sport. Companies like Blizzard Entertainment seek millions for their teams and make the eSports industry worth millions of dollars. The use of rhetoric in the promotion of eSports as a legitimate sport opens a new window for players who were previously not considered athletes at the collegiate level. The rhetoric also portrays eSports as a lucrative field and reaches a larger audience. The media's emphasis on the financial success of eSports, the popularity of its players, and sponsorship of credible companies and businesses influences various types of audiences and their views of eSports.

The media rhetoric allows the multi-million-dollar industry to gain a substantial number of viewers and convince others to perceive eSports as a legitimate athletic activity. Articles such as Guzman's get the attention of the younger generation following eSports as well as higher education institutions interested in diversifying their athletics department. Other articles on the Syracuse University Online Business Program's blog focus on a more business-oriented audience. Such articles allow for a larger audience to consider watching or playing eSports as a part of the larger sporting industry and help legitimize eSports as an athletic event. As a result, eSports allows people to not only play on an even field but also changes their perspective about sports and the growing idea of competitive gaming. Considering the use of ethos, pathos, and logos in the media helps clarify eSports's increasingly widespread consideration as an athletic event comparable to traditional sports.

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75 Helmet with nose-guard

even if they were still sometimes made for kings or wealthy chieftains, they were certainly no part of the ordinary man's equipment.

No actual helmet from the Vendel or the Viking period has horns on it. Indirectly, however, there is some evidence that such may once have existed, for the rich Vendel helmets were decorated with embossed plaques showing human figures, and some of these themselves wear helmets with huge crests shaped like boars or birds of prey (74, 108), or with crescent horns sweeping up from the sides (93, 95). In general, the weapons shown on these plaques (and on the dies for making them) accurately represent types really used in seventh-century Scandinavia; it is therefore quite possible that horned helmets existed too, but it does not follow that they were common objects, or meant for daily use. The plaques in question were almost certainly designed for magical protection as well as ornament, so that figures on them are unlikely to be ordinary warriors; more probably they represent deities of war, or initiates performing a religious ritual (pp. 153, 160).

Vendel and Valsgärde in Sweden. There, helmets from the late seventh century cover the whole head and face with cheek- and neck-guards, and are enriched with much decoration, including eyebrow ridges which give them the aspect of a fearsome mask (76); the well-known helmet from the Anglo-Saxon mound at Sutton Hoo is the same type, and almost certainly comes from Sweden.

It may be that these elaborate helmets were still being produced in Viking times, at least in some areas, for a pair of the characteristic eyebrow ridges were found in Gotland, inlaid with silver in a pattern of Viking style. But, made for kings or wealthy

From the Vikings in horned helmets: Oseberg Tapestry (7) from the figures of Oseberg Tapestry. Birka figurine made best to assume that in the Viking religious power. Probably that many different