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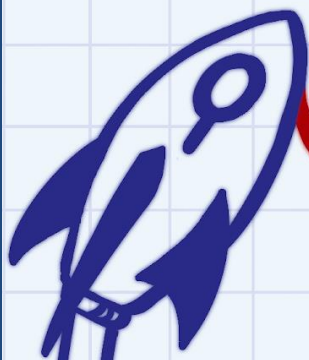
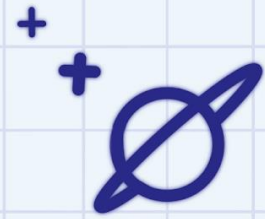
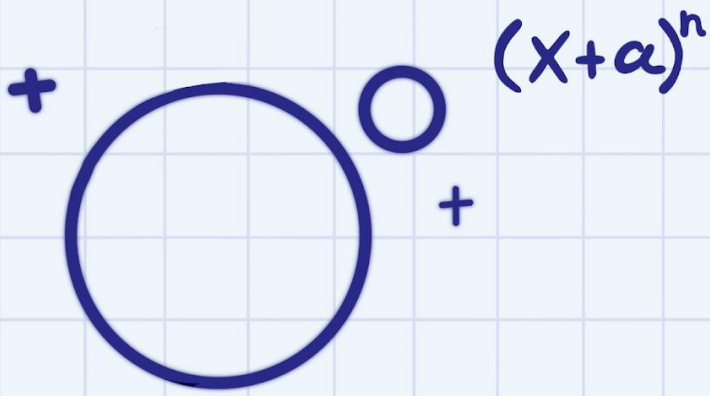
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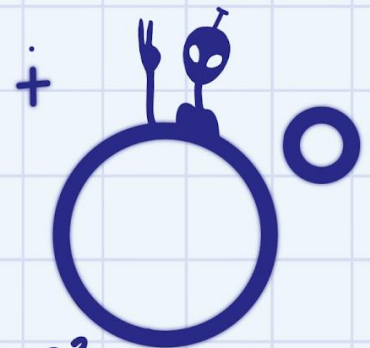


# MOMENTUM

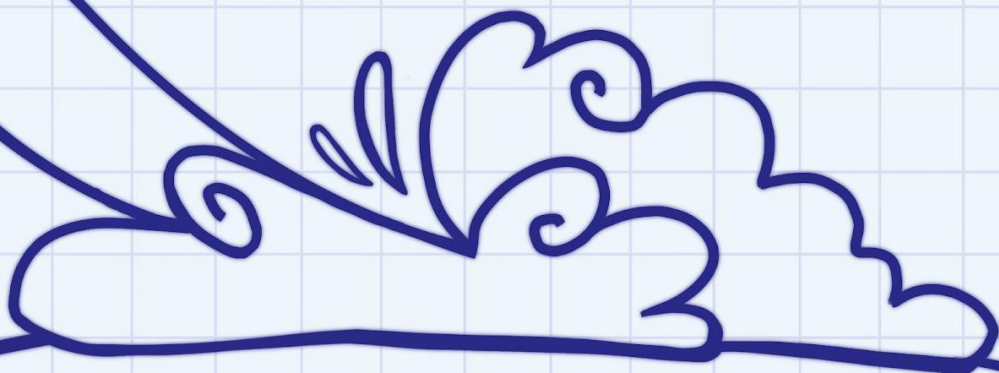
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Columbus State University's  
Undergraduate Research Journal

Volume VII



$$e = mc^2$$



**“Momentum of Success = Your Speed and Direction x Mass of Your Action”  
Dr. Zdeslav Hrepic**

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## Faculty Reviewers

### Monica Frazier

Dr. Frazier is a professor of biology and director of the Southwest Georgia LSAMP Alliance. She earned her PhD in virology from the University of Alabama at Birmingham and completed her post-doctoral studies at Emory University's Winship Cancer Institute where she performed prostate cancer research. After completing her post-doc, Dr. Frazier accepted a position as a research assistant professor at Tuskegee University's Center for Biomedical Research where she eventually became the assistant director of RCMI (Research Center for Minority Institutions). In 2006, she left Tuskegee University to accept a position as an assistant professor in biology at Columbus State University to teach Cell Biology. Since coming to CSU, Dr. Frazier has taught other courses, including Principles of Biology, General Biology I, Cell and Molecular Techniques, Virology, Bioethics, Capstone and other Honors enrichment courses. Dr. Frazier has also led a study abroad course on the history of medicine in Oxford, England. Her primary research interest is in cancer research, primarily in the area of drug discovery.

### Shannon Godlove

Dr. Shannon Godlove is an associate professor of English and co-ordinator of the Certificate Program in Medieval and Renaissance Studies at Columbus State University. She has published several articles in peer-reviewed journals and is the co-editor of *A Companion to Boniface*, a collection of essays on an early medieval English missionary and saint, that will be published in spring 2020.

### Susan Hrach

Dr. Susan Hrach is Professor of English and director of the Faculty Center for the Enhancement of Teaching and Learning. She has been awarded by the University System of Georgia with the Regents' Award in the Scholarship of Teaching and Learning. As an undergraduate at Notre Dame, she studied German at the Universität Innsbruck, Austria, and holds a PhD in English from the University of Washington. Her disciplinary specialties include early modern literature, early world literature, and translation studies.

### Daewoo Lee

Dr. Lee earned his degree in joint Ph.D. in public policy in 2016 from Paul O'Neill School of Public and Environmental Affairs at Indiana University. Dr. Lee is now in his fifth year at CSU and teaches upper-level political science and Master of Public Administration courses. His primary research interests include program evaluation, policy analysis, policy process, comparative politics, and trust in government. His recent research has appeared in the *American Journal of Distance Education*, *Asia-Pacific Journal of Public Administration*, and *Child and Youth Care Forum*

**Ramesh Rao**

Professor Ramesh N. Rao teaches a variety of communication courses at CSU. He has co-authored a book on intercultural communication and has authored a handful of books on Indian society and politics. His opinion pieces and articles have appeared in *The Guardian* (London), *The Washington Post*, *The Pioneer* (India), *Swarajya* (India), and elsewhere. His foray into Indian philosophy and texts is as a generalist, but he has a network of scholar friends who are experts in Indology. Among those friends is Vishal Agarwal, who offered his critical comments on the student paper reviewed by Professor Rao

**Brian Schwartz**

Brian Schwartz is a professor of biology at Columbus State University, where he has taught for 24 years. He earned his Ph.D. in genetics in 1992 from the University of Wisconsin, Madison, and carried out research in plant genetics at Oklahoma State University before coming to CSU in 1996. He currently serves as the assistant chair in the biology department and teaches Genetics, Developmental Biology, and Senior Capstone in Biology.

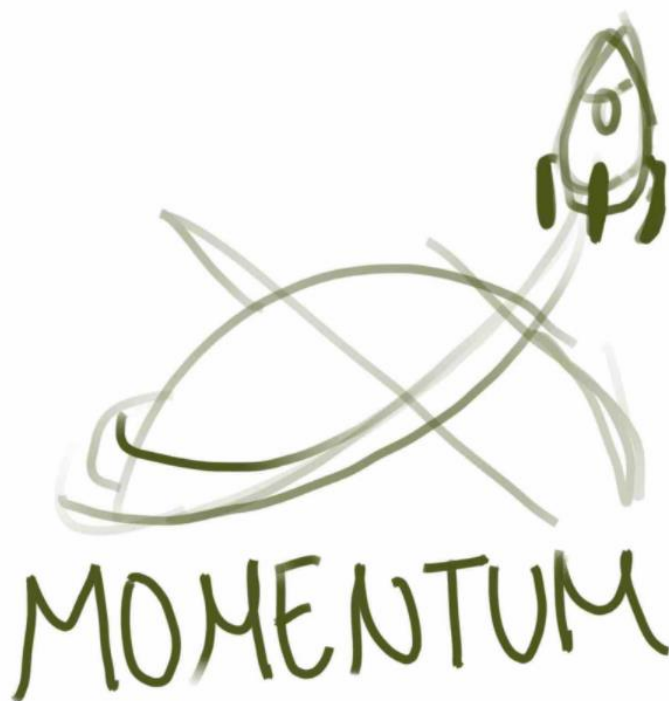


## Editor's Note

Our community has experienced immense change in 2020 with the unprecedented spread of COVID-19. According to the Center for Disease Control and Prevention, the social isolation, sickness, and death plaguing our world today has led to a marked increase in mental health issues. However, despite it all, some motivated students continued to conduct research. The *Momentum* editorial board has curated a selection of pieces from these talented students, including a relevant review of recent literature on COVID-19. We hope you enjoy the contents of this issue as much as we enjoyed reviewing and editing it, and that you stayed safe and healthy over the holidays.

Stephanie D. Clarke

Editor-in-Chief





## Letter from the Provost

Dear Colleagues,

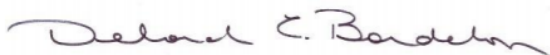
I am very honored to share with you this year's publication of *Momentum*, our innovative journal promoting undergraduate research and critique at Columbus State University. Without a doubt this has been an extraordinary year, but even with the disruptions and challenges of COVID-19, our undergraduates and their faculty mentors have persisted and excelled in their research and scholarly endeavors. This peer-reviewed journal reflects the insightful and high-quality work being done by students in a wide range of disciplines. *Momentum* provides a very important professional academic venue for our undergraduates to share the scholarly work they are engaged in with their peers and their faculty mentors.

The strong commitment on our campus to engaging undergraduates in meaningful research experiences is impressive. Through this research, students are not only gaining knowledge, but creating new knowledge to advance their respective fields and disciplines. By going through the rigorous peer review process, these undergraduate researchers are well-prepared for success in their academic pursuits and future careers.

The *Momentum* editorial staff, comprised of undergraduate students from a variety of academic majors, is strongly committed to providing a broad scope of research with varying levels of complexity and significance. The faculty advisor, Dr. Lauren King, mentors and supports the editorial staff; however, she also empowers these students to expand their horizons and develop as scholars and leaders as they make editorial decisions for this publication.

I think you will find the scholarly articles in this issue thought-provoking and informative. The researchers' vision and dedication to academic inquiry are evident throughout this latest edition. I commend the editorial staff of *Momentum* for a job well done!

Sincerely,



Deborah E. Bordelon, Ph.D.

Provost and Executive Vice President

## **A Mirror Which Makes Beautiful: Giuseppe Mazzini's Love of Romantic Literature and its Effects on the Risorgimento**

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Columbus State University

### **Abstract**

Scholars of 19th century Italy tend to recognize how Romantic literature—through its appeals to the working class emphasis on public activism—impacted individualistic political movements and the desire for republican government. The same scholars often fail to elaborate on Italian revolutionaries' personal connections with Romantic literature. When scholars discuss Giuseppe Mazzini, one of the founding fathers of modern Italy, they usually mention his career as a literary critic. But when they do, these authors only include it as brief, additional context, and fail to explore cover how his career and profound knowledge of Romantic literature impacted the ideals of the Risorgimento. Six volumes of Mazzini's literary and personal essays exist, yet scholars rarely delve into those essays. By reading Mazzini's literary criticisms of Romantic poets, authors, and playwrights, one can see that the Genoan was incredibly well-read in the subject because of his career. Inspired by the Romantics' works, Mazzini saw a need for Italian literature to adopt the same appeals as its European contemporaries. He believed that in order for Italians to break free from their Papal and Austrian influences, Italian literature had to develop its own character, independent from its Graeco-Roman roots. The purpose of this research is to expound upon Mazzini's passion for literature through close examination of a selection of his critical essays. The examination reveals that Romantic literature was more than a hobby for the Genoan, but instead a means of creating an Italian republic, complete with its own cultural identity.

### **Author Biography**

Jessica DeMarco-Jacobson is an Italian-American studying English literature and minoring in history. She currently works as a senior copy editor for The Saber at Columbus State University. Jessica has always held a particular fervor for the literary. At the age of 10, she read her first piece of literary canon, Melville's *Moby Dick*, with the help of a red Merriam Webster. Since then, she has dedicated much time to the canon. Her favourite book is Tolstoy's *War and Peace*, and she has a special fondness for nineteenth-century literature and history. She likes collecting antique books and writes fictional prose and poetry in her spare time, when she has it.

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### **A Mirror Which Makes Beautiful: Giuseppe Mazzini's Love of Romantic Literature and its Effects on the Risorgimento**

The year is 1816. After being under the rule of Napoleon's French Empire for just over a decade, the city of Genoa and the surrounding area were given to the Kingdom of Sardinia after the Congress of Vienna concluded. A young Genoan boy sits at his father's desk, poring over a thick leather tome that he can barely hold in his small hands. Beside him are a glass inkwell and a blank piece of parchment paper. He picks up a quill and begins copying out the poems of William Wordsworth, John Milton, Alexander Pope, and Percy Shelley, the latter of which would define and defend poetry as "a mirror which makes beautiful that which is distorted."<sup>1</sup>

Inspired by the Romantics' individualist attitude, usage of common language, and coverage of contemporary social issues, this boy, Giuseppe Mazzini (1805-1872), lived to become a prolific literary critic who spent his life trying to establish an independent Italian republic. In one of his critical essays, Mazzini wrote that literature is "the true expression of the conditions and aims of modern civilization."<sup>2</sup> In the same essay, he provides a thorough analysis of great Romantic writers, such as Wordsworth, Johann Wolfgang von Goethe, and Robert Burns, further revealing his admiration for European poets.

Although Mazzini is more commonly remembered as a politician and activist for Italian unification, his years of writing literary criticism reveal one of his greatest sources of inspiration: Romantic literature. These essays display Mazzini's desire to create a more unique cultural identity for

Italy. He believed the Italian people could achieve this by reinventing their literature. In one of Mazzini's essays titled "From the Preface to the Second Volume of the Italian Edition of Mazzini's Literary Works," the Genoan revolutionary states that Italian literature lacks identity, and that Italian literature should be less dependent on its Graeco-Roman past. Instead, if Italy is to become a respectable, stable country, its literature must develop its own modern character, and it should address social issues. His critical essays on the works of Victor Hugo and Alphonse de Lamartine reveal his zeal for republicanism and the importance of individualism in literary and political movements. Because of Italy's long history of being controlled by foreign nations, which Mazzini resented, the Genoan saw republicanism and individualism as a means of recreating the Italian identity.

Mazzini's focus on creating a new Italian identity, addressing societal issues, and forming an Italian republic is apparent in his literary criticisms. His expressions in these essays become the very columns of the Risorgimento, which was a sociopolitical movement that aimed to enkindle the Italian national consciousness through education and literature. For Mazzini, Romantic literature was more than just poems in his father's books; it was a way to unite an Italy divided by lingual, dialectal, and cultural barriers as a result of a history of constant political upheaval.

Scholars of the Risorgimento period often note the importance of Romantic culture during nineteenth-century Italy, remarking how Romantic individualism

<sup>1</sup> Percy Shelley, *A Defence of Poetry* (Cambridge, MA: Ginn & Company, 1891), 10.

<sup>2</sup> Giuseppe Mazzini, "Of an European Literature," in *Life and Writings of Joseph Mazzini in Six Volumes:*

*Vol. II-Critical and Literary* (London: Smith, Elder, & Co., 1891), 4.

inspired an optimistic Italian public.<sup>3</sup> Although Italian historians discuss how Romantic individualism inspired nationalism across Europe, scholars fail to examine the personal influence of Romantic literature on Italian revolutionaries. Biographers of Giuseppe Mazzini usually mention his love of Wordsworthian and Byronic poetry and briefly discuss his younger years as a literary critic. However, scholars fail to read Mazzini's many—and often lengthy—essays on the most well-known Romantic writers of his time, thereby failing to realize the tremendous impact these authors had on his political ideology. The reasons for which scholars fail to highlight this important part of Mazzini's life are mostly unclear, but perhaps a focus on the other aspects of his life seemed more relevant to academia. Mazzini's literary criticisms of Goethe, Victor Hugo, and Alphonse de Lamartine, among other Romantic writers, reveal his thoughts on literature's purpose in politics and society, which were to incite public activism and address contemporary issues. Furthermore, he discusses Italian literature's need to re-establish itself. Mazzini believed the Italian nation could be saved if Italian literature promoted a cultural identity less dependent on the Roman legacy and focused more on its own social issues. Many scholars have contributed to the histories of Mazzini and the Risorgimento, and understanding their research is essential for viewing Mazzini in a wholistic sense.

Professor Lucy Riall at the European University Institute in Florence specializes in nineteenth-century Italy and the Risorgimento. She is most famous for her book, *Garibaldi: Invention of a Hero*, which examines Garibaldi as a cultural

phenomenon, but she has published other research in the field. Lucy Riall and her co-editor, Silvana Patriarca, focus on how Euro-Italian Romanticism impacted Risorgimento values in their book, *The Risorgimento Revisited: Nationalism and Culture in Nineteenth-Century Italy*. In the introduction of *The Risorgimento Revisited*, Riall and Patriarca write that Giuseppe Garibaldi and Giuseppe Mazzini, along with their fellow members of the Risorgimento, created a “political strategy to make [a] visible, convincing and more popular sense of Italian cultural identity.”<sup>4</sup> One chapter written by Paul Ginsborg focuses on Romantic literature's instillation of “the importance of individuality,” “passion,” and “optimism” in Risorgimento thought.<sup>5</sup> In one of Riall's earlier books, *The Italian Risorgimento: State, Society, and National Unification*, the historian focuses on the individualistic and nationalistic aspects of the Romantic movement and their effects on the Risorgimento. Although Riall does spend one chapter discussing the Risorgimento and society, she focuses on the aristocracy and bourgeoisie and makes little mention of the impact of Romantic literature on Italian revolutionaries.

While Riall fails to highlight the influence of Romantic literature on Italian revolutionaries, Joseph Luzzi, a professor of comparative literature at Bard College who specializes in Italian Romanticism and other Italian topics. He provides a more cultural and literary view of the Risorgimento in his book *Romantic Europe and the Ghost of Italy*. Luzzi, unlike his contemporaries, not only argues for the existence of Italian Romantic literature—and the features which separate it from European Romantic literature—but also its influence on the

<sup>3</sup> Silvana Patriarca and Lucy Riall, *The Risorgimento Revisited: Nationalism and Culture in Nineteenth-Century Italy*. (Hampshire: Palgrave Macmillan, 2012), 7.

<sup>4</sup> Silvana Patriarca and Lucy Riall. *The Risorgimento Revisited*, 5.

<sup>5</sup> Silvana Patriarca and Lucy Riall. *The Risorgimento Revisited*, 7.

leading members of Risorgimento. Luzzi goes into detail about how Italian Romantic literature has Catholic appeals. For example, Luzzi discusses Alessandro Manzoni, a proto-nationalist Italian poet who attempted to prepare Italian society for nationalism through his poetry. Manzoni incorporated the spiritual in his works, which help made Italian Romantic literature unique.<sup>6</sup>

Meanwhile, scholars such as Andrew Ciccarelli, a professor who specializes in Italian studies and literature, argue for the lack of individualism in Italian Romantic literature. In his journal article "Dante and Italian Culture from the Risorgimento to World War I," Ciccarelli writes that Italian Romantic writers failed to be nationalistic, or individualistic, until the rediscovery of Dante Alighieri's works.<sup>7</sup> Although Ciccarelli stands out from the rest of historians of nineteenth-century Italy by making the point that Dante was a literary symbol of the Risorgimento, he only recognizes non-Dantesque works as influential to the Risorgimento. Luzzi, however, analyzes Ugo Foscolo's "Dei sepolcri"<sup>8</sup> and Mazzini's strive to honour the poet's death because the poem exhibits nationalistic appeals.<sup>9</sup> Although Luzzi recognizes the Italian Romantic impact on the Risorgimento from a broader perspective, he does not realize that individuals of the Risorgimento, especially Mazzini, sought to utilize literature in creating a national identity for Italians.

In Denis Mack Smith's *Mazzini*, the celebrated English academic mentions that

Mazzini copied out the poems of Wordsworth and Byron in his early years and that the Genoan revolutionary wrote a prolific amount of literary criticism. However, like other scholars of Italian history, he does not discuss Mazzini's essays on Romantic writers. These essays reveal that Mazzini believed Italian writers had utterly failed to create a national identity.<sup>10</sup> Although Mazzini explicitly states that Italian literature had to re-link "the intellect of Italy to our national tradition" in order to save Italy, Smith does not mention these opinions, nor how they shaped the aims of the Risorgimento.<sup>11</sup>

Because historians of nineteenth-century Italy do not wholly recognize Mazzini's fervor for Romantic literature or his criticisms of Italian literature, they fail to realize how much the literature he criticized influenced the direction of the Risorgimento. Scholars may have missed the impact of Romantic literature on Mazzini because the Genoan revolutionary's many essays on literary topics were often incredibly long and verbose. Analyzing Mazzini's essays and scouring to find his opinions and how they may be linked to Risorgimento thought can take tremendous effort. This work only examines a few of those essays to get across a general point, but it would take another scholar much work to analyze a greater number of them. But when these scholars only mention Mazzini's years as a literary critic and love of Romantic literature as additional biographical context, they fail to realize the greater impact these years of

<sup>6</sup> Joseph Luzzi. *Romantic Europe and the Ghost of Italy*. (New Haven: Yale University Press, 2008), 35-6.

<sup>7</sup> Andrea Ciccarelli. "Dante and Italian Culture from the Risorgimento to World War I," *Dante Studies, with the Annual Report of the Dante Society*, no. 119 (2001): 126-43.

<sup>8</sup> Meaning "Of the Sepulchres." Part of the poem discusses the funeral rites, monuments, and tombs dedicated to great Italians.

"Ugo Foscolo," Internet Culturale, October 1, 2019. <http://www.internetculturale.it/directories/ViaggiNelTesto/foscolo/eng/b21.html>

<sup>9</sup> Joseph Luzzi. *Romantic Europe*, 26-7.

<sup>10</sup> Giuseppe Mazzini. "European Literature," 16.

<sup>11</sup> Giuseppe Mazzini. "From the Preface to the Second Volume of the Italian Edition of Mazzini's Literary Works," in *Life and Writings of Joseph Mazzini in Six Volumes: Vol. II-Critical and Literary* (London: Smith, Elder, & Co., 1891), 156.



Mazzini's life had on the Risorgimento. It would have broadened their scholarship to at least consider a few of Mazzini's critical works. Additionally, when they only write of European Romantic literature's nationalistic appeals and not how Italian literature lacked these appeals or their Catholic allusions, which differentiated them from European Romanticism, scholars do not recognize the literature's impact on the cultural aims of the Risorgimento.

Even as a young child, Mazzini "resented the humiliation of foreign rule," having grown up in a Napoleonic Genoa.<sup>12</sup> Denis Mack Smith, a renowned historian of Italy and the Risorgimento period, wrote that Mazzini was interested in entering the field of literary criticism as early as fourteen, when he entered university.<sup>13</sup> At the time, the young Genoan revolutionary was fascinated by the English Romantics—especially Burns, Wordsworth, and Byron—considering them the "exemplars of a new liberal romanticism," and he viewed literature as a force "cutting across political barriers... a necessary ingredient in creating the common European conscious he tried to promote" in his lifetime.<sup>14</sup> Despite Romantic literature's influence on Mazzini, Smith spent only one paragraph discussing the Genoan's distinguished career as a literary critic and only scratched at the surface of Mazzini's numerous essays and articles that discussed the most prominent writers of his time and literature's importance in a modern European society.

In the words of the late Roderick Cavaliero, a scholar of English Romanticism at the British School at Rome, Mazzini

believed Romantic literature could "unshackle the mind from the tyranny of classicism."<sup>15</sup> Furthermore, the Genoan revolutionary considered Byron and Foscolo as "the angel voices of a Young Italy," a political movement that Mazzini founded in 1831, hoping to create a united Italian republic.<sup>16</sup> However, the best source of Mazzini's opinions on Romantic literature are his essays, especially "Of an European Literature," where he lauds his favourite Romantic writers. In it, he praises Goethe at length, saying that his works carry a "deep meaning" and that they "establish... the essential difference between ancient and modern literature."<sup>17</sup> Mazzini spends a substantial portion of the essay on Goethe's works, then discusses the general history of European literature, commenting on Italian, Spanish, English, and even Scandinavian authors. Here, Mazzini displays an encyclopedic knowledge of European literature. After examining English authors, he concludes that English literature is generally "entirely positive in its character... [England's] poetry is all made up of feeling and description," referring to Burns's, Crabbe's, and Wordsworth's usage of idyllic imagery and themes of being close to nature.<sup>18</sup> In fact, Mazzini seems to be directly referring to Wordsworth's 1802 preface to *Lyrical Ballads*, where the Romantic poet asserts that "all good poetry is the spontaneous overflow of powerful feelings" and that "poetry is the image of man and nature."<sup>19</sup> Wordsworth three purposes of Romantic literature are perhaps some of the most well-known sentiments spoken in the subject, but Mazzini displays a

<sup>12</sup> Denis Mack Smith. *Mazzini*. (New Haven: Yale University Press, 1996), 2.

<sup>13</sup> Denis Mack Smith. *Mazzini*, 3.

<sup>14</sup> Denis Mack Smith. *Mazzini*, 3.

<sup>15</sup> Roderick Cavaliero. *Italia Romantic: English Romantics and Italian Freedom*. (London: I. B. Tauris, 2005), 44.

<sup>16</sup> Roderick Cavaliero. *Italia Romantic*, 44.

<sup>17</sup> Giuseppe Mazzini. "European Literature," 16.

<sup>18</sup> Giuseppe Mazzini. "European Literature," 15.

<sup>19</sup> William Wordsworth. Preface to *Lyrical Ballads* (Philadelphia: University of Pennsylvania).

deeper knowledge and fervour for Romantic literature as the essay continues. The essay reveals that Romantic literature was a major component of his identity, and it directly influenced the aims of the Risorgimento by establishing an emphasis on the working class. Mazzini appreciated Romantic literature's ability to address contemporary issues such as the influence of the Church and foreign powers in the Italian homeland and inspiring people to participate in public activism.<sup>20</sup>

In "Of an European Literature," Mazzini spends considerable time remarking on the weaknesses of Italian literature, noting its lack of Wordsworthian or Goethean appeals.<sup>21</sup> But compared to other European literature, Mazzini criticizes Italian works for changing dramatically throughout the ages, blaming constant political upheaval for being too "frivolous and effeminate" and unappealing to "the higher faculties of the mind."<sup>22</sup> Finally, he says that Italian literature "has never yet been either useful or national...except the works of some," most likely referring to Foscolo and Dante.<sup>23</sup> Mazzini saw Dante as the shining example of Italian integrity, but he wanted new writers, writers other than Foscolo, to connect to the Italian people.<sup>24</sup> Modern Italian literature did not have its own voice, and even its contemporary writers at the time depended too much on its classical and medieval predecessors.<sup>25</sup> While classical and medieval authors did pertain to nineteenth-century Italians, it was largely unable to address contemporary socio-political issues

due to its age. Thus, Mazzini felt these works were insufficient as rallying points for an Italian national identity. Instead, Italy first had to separate itself from its past and create a new identity that would apply to Italians from all regions.

In another one of his essays, Mazzini provides a scathing critique of Italian literature by claiming it is deprived of "spontaneity and originality," that Italian literature is "mere imitation."<sup>26</sup> Mazzini's criticisms do not stop there, for he writes that Italian literature is "without a spark of true genius or feeling."<sup>27</sup> Mazzini did not just criticize Italian literature, however. He also provided a solution to its downfalls. In order for Italian literature to develop its own character, Mazzini believed that writers of the period needed "to re-link the intellect of Italy to our [Italians'] national tradition."<sup>28</sup> In Mazzini's opinion—and foreign opinion—only a few notable Italian writers existed, but he believes that is due to the presence of Austria in the north and the Pope in central Italy.<sup>29</sup> With the Church living in the heart of Italy and with a foreign imperial power at its Alpine foothills, Italy struggled to develop its own national identity. Writers of Mazzini's time likely experienced suppression—or at least felt suppressed—by the surrounding forces. As the Genoan discusses in his critical essay "On Italian Literature since 1830," Italian intellectuals were unable to occupy themselves with literature when domestic, national, and international crises riddled

<sup>20</sup> Ros Pesman. "Mazzini and/in Love," in *The Risorgimento Revisited: Nationalism and Culture in Nineteenth-Century Italy*, ed. Silvana Patriarca and Lucy Riall. (Hampshire: Palgrave Macmillan, 2012), 99-100.

<sup>21</sup> Giuseppe Mazzini. "European Literature," 16.

<sup>22</sup> Giuseppe Mazzini. "European Literature," 16.

<sup>23</sup> Giuseppe Mazzini. "European Literature," 16; "On Italian Literature Since 1830," in *Life and Writings of*

*Joseph Mazzini in Six Volumes: Vol. II-Critical and Literary* (London: Smith, Elder, & Co., 1891), 182.

<sup>24</sup> Andrea Ciccarelli. "Dante and Italian Culture," 126.

<sup>25</sup> Andrea Ciccarelli. "Dante and Italian Culture," 129.

<sup>26</sup> Giuseppe Mazzini. "On Italian Literature," 164.

<sup>27</sup> Giuseppe Mazzini. "On Italian Literature," 156.

<sup>28</sup> Giuseppe Mazzini. "On Italian Literature," 167.

<sup>29</sup> Giuseppe Mazzini. "On Italian Literature," 171.

Italy in the late 1820s and early 1830s.<sup>30</sup> But if Italian literature needed to develop its own identity in order for unification to be successful, how were Italian writers supposed to accomplish that? Mazzini provided an answer for that: Italian literature needed to discuss contemporary, Italian problems, and it needed to do so in a way that would strike emotion in Italian readers, similar to the European Romantics.

Because Romantic culture forced a confrontation between public activism and private life, Italian literature had to eventually discuss its domestic and national issues.<sup>31</sup> Aside from admiring the works of the English Romantics, Mazzini wrote extensively on Hugo and Lamartine, two of the most prominent and prolific Romantic French authors of the time. Like Hugo and Lamartine, who were both republicans at the time, Mazzini shared the sentiment that a unified Italy would be most successful as a republic. Mazzini and Hugo also believed in abolishing capital punishment, and they both campaigned for social causes. Though he does share some critiques of Hugo's work, Mazzini praises the Frenchman for writing about contemporary issues in his poetry. He lauds Hugo's earlier works, including *Les Feuilles d'Automne*<sup>32</sup> for its "graceful ease, spontaneity, sweet and heartfelt thoughts; inspirations sublime...and charity towards the poor." However, Mazzini remarks that Hugo's later works lack "enthusiastic audacity" perhaps because they tended to focus on other subjects, or because Hugo was less effective in writing in a Romantic style.<sup>33</sup> Later in the essay, it becomes

evident that Mazzini truly cares about literature and its effects on the population: he spends the rest of the essay criticizing Hugo's poetry poem by poem and line by line. He concludes that Hugo succeeded in effecting a literary revolution but advises the writer to involve more religious aspects<sup>34</sup> Mazzini preferred religious sentiments within literature, as he felt it would resonate with Italians, but perhaps Hugo's was lacking in this realm because he was writing in post-revolutionary France. Mazzini then concludes his criticism by saying that Hugo has "broken his promises" as "the head of the Romantic school in France."<sup>35</sup> In total, Mazzini's essay on Hugo spans over forty pages, and for each of Hugo's faults, Mazzini offers a solution, seeing literature as necessary in uniting people. Again, the length and breadth of Mazzini's essays is what likely deterred other historians from taking a closer look at it. But despite anything that Hugo's later poetry lacked in, Mazzini knew Italian literature had to adapt to its modern European contemporaries.

Mazzini also wrote an essay criticizing the work of Alphonse de Lamartine, who was both a writer and one of the founders of the Second French Republic. Other than republicanism, Mazzini and Lamartine shared a variety of progressive ideas, such as abolishment of slavery and capital punishment. Mazzini almost immediately praises Lamartine's work for being "eminently moral and social in aim."<sup>36</sup> Mazzini expounds upon Lamartine's ability to evoke emotion within the reader and writes that Italian literature needs to do the

<sup>30</sup> Giuseppe Mazzini. "On Italian Literature," 172-3.

<sup>31</sup> Silvana Patriaca and Lucy Riall. *The Risorgimento Revisited*, 98.

<sup>32</sup> In English: *The Leaves of Autumn*, or *The Autumn Leaves*.

<sup>33</sup> Giuseppe Mazzini. "On the Poems of Victor Hugo," in *Life and Writings of Joseph Mazzini in Six Volumes: Vol. II-Critical and Literary* (London: Smith, Elder, & Co., 1891), 258, 260.

<sup>34</sup> Giuseppe Mazzini. "On the Poems of Victor Hugo," 281.

<sup>35</sup> Giuseppe Mazzini. "On the Poems of Victor Hugo," 302.

<sup>36</sup> Giuseppe Mazzini. "On the Poems of Lamartine," in *Life and Writings of Joseph Mazzini in Six Volumes: Vol. II-Critical and Literary* (London: Smith, Elder, & Co., 1891), 305.



same for its people. To solve its lack of genius and spark of feeling, as Mazzini put it in “On Italian Literature since 1830,” Italian literature needed to address contemporary issues.<sup>37</sup> Because Italian literature mostly concerned itself with its past, it had little influence on its people. Without sentimental literature, how could the Italian people be unified? If literature did not reflect current issues, how could it strike emotion? Because of his extensive literary knowledge, Mazzini saw the answers to these questions. Ginsborg argues that the Romantic culture forced a confrontation between public activism and private life, and Mazzini’s criticisms of Hugo and Lamartine prove the scholar’s point.<sup>38</sup> Italian literature had to adopt the Romantics’ literary methods in order for Italian unification to succeed.

Unfortunately for Giuseppe Mazzini, his vision of an Italian republic did not quite succeed. On 17 March 1861, the first Italian Parliament proclaimed Vittorio Emanuele II<sup>39</sup> as King of Italy. Though he was discontent with the idea of an Italian monarchy, Mazzini persisted in his arguments for a republic. He joined Garibaldi in freeing Rome in 1862 but refused to join the Italian Chamber of Deputies five years later. After attempting to start a rebellion in Sicily, the Genoan revolutionary was arrested. When he was released, he returned to London, where he had previously spent his youth in exile. In 1872, Mazzini died of pleurisy, the inflammation of a membrane that lines the chest cavity and lungs. Today, Italy is considered a parliamentary republic, but its

unity is questionable, with its leading parties including the far-right populist Lega Nord<sup>40</sup> and the populist new-right party, Movimento 5 Stelle.<sup>41</sup> The current trend in Italian politics conflicts with Mazzini’s ideals because Italian politics have become increasingly regionalist, meaning that politicians and bureaucrats try to appeal to the identities of each state, rather than the national Italian identity. Though Mazzini’s vision for Italy did not succeed, the Italian people consider him one of the “fathers of the fatherland,” and his works inspired other European republican movements.

For Mazzini, literature was more than an interest and temporary career. The writings of his favourite authors, poets, and playwrights—Burns, Wordsworth, Byron, Shelley, Crabbe, Milton, Foscolo, Goethe, and Dante, to name a few—were alive with powerful imagery and emotive writing. Their writings talked about what others did not—ongoing social issues and the working class—and evoked a sense of unity among readers. In contrast, Italian literature failed to compete with the European Romantics, but Mazzini’s years of reading and writing about Romantic literature provided him with answers: one of the Risorgimento’s goals was to reinvent Italian literature, so that Italian unification could succeed. Mazzini believed that Italian literature could adopt the worldviews and approaches of Romanticism because it appealed to the middle and lower classes by refraining from high diction and acknowledging contemporary social issues such as child labour. Romantic literature also evoked a sense of national unity in its readers, which

<sup>37</sup> Giuseppe Mazzini. “On Italian Literature,” 156.

<sup>38</sup> Silvana Patriaca and Lucy Riall. *The Risorgimento Revisited*, 7.

<sup>39</sup> Known in English as Victor Emmanuel II.

<sup>40</sup> In English: Northern League. Their complete party name translates to “Northern League for the Independence of Padania.”

<sup>41</sup> In English: Five Star Movement. The “five stars” refer to their campaign’s five major concerns: public water accessibility, sustainable transport, sustainable development, Internet accessibility, and environmentalism.

Mazzini criticized Italian literature's failure to do. By making nationalistic appeals, Italian literature could help recreate the. Although the Risorgimento failed in creating an Italian republic, Mazzini's fervour for

Italian identity, which was essential in creating a united republic free from the influence of the Church and Austria. Romantic literature shaped the Risorgimento's beliefs.

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## **An Unfortunate Governess Received: Anne and Charlotte Brontë's Portrayals of the Feminine Occupation**

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### **Abstract**

Charlotte and Anne Brontë, while both talented and canonized authors in their own right, display different approaches in their writing style. Both of the Brontë sisters worked as governesses at some point in their lives, then created novels with a plain governess as a main character. Although Anne was the first to do so, she faced difficulties in publishing her book, *Agnes Grey*, due to the candid nature of her writing. Agnes faced criticism from her sister, who maintained that Anne's style was inappropriate for the readers of their century. However, Anne's lengthier career as a governess allowed her better insight into the profession. Unlike her Charlotte's novel, *Jane Eyre*, *Agnes Grey* exhibits what a 19th-century governess would have encountered in her career: loneliness due to her awkward social position, disrespect from her employers, and difficult, unruly children whose behaviour could endanger her career. Aside from Jane's childhood at the Reeds' residence and Lowood School, her career as a governess is one contrary to what governesses at the time recorded. Jane has an employer that sees her as her equal, a loving student, and coworkers that respect her. Agnes experiences the complete opposite during her life, supporting the assertion that Anne's career influenced her to write a more realistic portrayal of the feminine occupation. Letters and books concerning the livelihood of being a governess reveal that most women employed in that profession would have claimed themselves as "an unfortunate governess received," rather than attest to any of Jane's experiences.

### **Author Biography**

Jessica DeMarco-Jacobson is an Italian-American studying English literature and minoring in history. She currently works as a senior copy editor for The Saber at Columbus State University. Jessica has always held a particular fervor for the literary. At the age of 10, she read her first piece of literary canon, Melville's *Moby Dick*, with the help of a red Merriam Webster. Since then, she has dedicated much time to the canon. Her favourite book is Tolstoy's *War and Peace*, and she has a special fondness for nineteenth-century literature and history. She likes collecting antique books and writes fictional prose and poetry in her spare time, when she has it.

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### **An Unfortunate Governess Received: Anne and Charlotte Brontë's Portrayals of the Feminine Occupation**

Like many other middle-class women of their century, Charlotte and Anne Brontë worked as governesses, their only other desirable option being marriage. Although Anne worked as a governess longer than Charlotte did, their years of working with often unruly children inspired them to published works with governesses as the protagonist. Both of their novels were published in the same year, 1847, and include real events from their careers, but scholars consider only *Agnes Grey* a highly autobiographical account. This results in certain differences between the two novels: *Jane Eyre* is a markedly more romanticized and idealized account of what it was like to be a governess, meanwhile *Agnes Grey* expresses the hardships of the profession. Additionally, *Jane Eyre* is much more well known than *Agnes Grey*, perhaps leading to misconceptions concerning the governess profession.

Although Anne had begun writing *Agnes Grey* before Charlotte's *Jane Eyre*, Charlotte found a publisher first, as *Agnes Grey* was initially rejected (Armitage). Alongside publisher's rejections were Charlotte's criticisms; she had always criticized Anne's work. For example, she wrote that Anne's poetry in the sisters' *Poems by Currer, Ellis, and Acton Bell* were too "sweet," and "had a sincere pathos of their own" (C. Brontë, "About Emily"). Charlotte also criticized *Agnes Grey*, calling it "unexaggerated" (C. Brontë and Smith, 94). Later on, she attacked Anne's second novel, *The Tenant of Wildfell Hall*, for its "slightly morbid motives" (C. Brontë, "About Emily"). Whether Charlotte criticized Anne out of jealousy—*Jane Eyre* shared *Agnes Grey*'s plain looks and lack of wealth, though Anne began *Agnes Grey* before Charlotte began *Jane Eyre*—or another reason, Anne wrote a

response to Charlotte's criticisms in the second edition of *Wildfell Hall*, which was published in 1848:

To represent a bad thing in its least offensive light, is doubtless the most agreeable course for a writer of fiction to pursue; but is it the most honest, or the safest?... if there were less of this delicate concealment of facts...there would be less of sin and misery to the young of both sexes who are left to wring their bitter knowledge from experience.

(A. Brontë, *Wildfell Hall* 1)

Anne believed that an author ought to portray life truthfully, even if it made the reader uncomfortable, because she felt that unvarnished realism prepared her readers for life. Anne's preference for gritty realism is apparent in both of her novels. Meanwhile, *Jane Eyre* contains uncomfortable scenes as well, but overall, the novel is decidedly more optimistic in its depiction of a nineteenth-century governess's lifestyle. Because Anne Brontë worked as a governess longer than her sister Charlotte did and refused to conceal the most unpleasant parts of being a governess, *Agnes Grey* presents a more authentic portrayal of the feminine occupation. Because Charlotte prevented the publication of Anne's governess novel, this authentic portrayal of the livelihood of a governess was delayed. Only somewhat recently have scholars begun to revisit *Agnes Grey* and realize its literary potential. But before analyzing either books portrayal of governesses, the circumstances in which the occupation became a common one for middle-class women to have.

After the Napoleonic Wars, the United Kingdom's lack of welfare state left the middle-class devoid of opportunity and wealth (Hughes). As a result of the state of the economy and the rules of social construct, women had few options for an occupation. Being a housemaid, midwife,

seamstress, or spinner labeled one as “working class,” which was not an option for middle-class daughters raised to be ladies (McGeevor and Hughs). Because of these societal notions, many middle class women became governesses, who would live with a family and educate that family’s children. Governesses faced unique difficulties when working in their households. According to the British Library, the governess “didn’t quite fit anywhere” within the household she worked for (Hughs). Her unclear status results from the nature of her work: a governess was a single woman who taught the children of genteel ladies of the upper class but was neither a servant nor a maid. Though the profession was less physically grueling than working in a factory or such, it presented a menagerie of other social and emotional obstacles. For example, Charlotte Brontë recounted that her employers treated her with little respect (Paddock and Rollyson 18). A nineteenth-century book of advice reveals how lonely the occupation often was: “it is not now a separation merely from friends and relations to which you are called; it is a seclusion from society altogether” (Ridout 49). Both *Jane Eyre* and *Agnes Grey* portray loneliness, although the former portrays loneliness before Jane begins working as a governess. Contrary to her own experiences, Charlotte Brontë writes an account where the governess enjoys her occupation, and contrary to what was realistic, has an adoring—although precocious—pupil and eventually marries her employer, a wealthy landowner, at the end of the novel. This ending is of course highly unrealistic, as middle-class women would very rarely marry their richer employers, mainly due to class differences. *Agnes Grey* presents the occupation differently: the protagonist often recounts how unpleasant her students were, or how awfully her employers treated her. Through

her “offensive” realism, Anne Brontë creates a more realistic account of the occupation, while Charlotte seems to have written out her wishful thinking.

*Jane Eyre* certainly has its share of uncomfortable parts, but few of them occur when Jane is a governess; instead, they mainly take place when she lives at the Reed residence or when she attends Lowood. These scenes still contain some of the gritty realism that Anne Brontë would have appreciated. For example, in Jane’s early years at the Reed estate, she experiences both physical and emotional abuse from her mischievous and abusive cousin, John Reed. The scene in which John Reed strikes Jane, first with his hand, then with a book, is one of the more powerful scenes in the novel: “He struck suddenly and strongly. I tottered... the volume was flung...and I fell, striking my head against the door and cutting it. The cut bled, the pain was sharp” (C. Brontë, *Jane Eyre* 12-4). Charlotte Brontë is vivid, even grotesque, here because she wanted to show how awful Jane’s life was at the Reeds’ household. Following Jane’s escape from the Reeds, several instances of abuse occur while Jane is at Lowood: Mr. Brockelhurst humiliates her in front of all the students and teachers, and Ms. Scatcherd beats Helen, Jane’s best friend, at the school (C. Brontë, *Jane Eyre* 98). Jane’s embarrassment during Helen’s humiliation is one of the more profoundly sympathetic scenes, and when Ms. Scatcherd strikes Helen’s neck with a bundle of twigs, the reader can imagine Helen’s pain, despite her great fortitude. Jane quivers at the very sight because she experienced similar trauma, hence the reader knows Helen endures something awful. Charlotte Brontë uses intense realism in Jane’s younger—and more terrible—years rather than her years as a governess at Thornfield, wherein her own words, she “lived in it a full and delightful life” (C. Brontë, *Jane*



*Eyre* 481). Her experiences before becoming a governess are vital to understanding Jane's character, but her future with Mr. Rochester attains all she lost during her childhood.

When Jane reaches the end of her academic career at Lowood, Charlotte Brontë presents the proposition of becoming a governess as a saving grace rather than a continuation of her suffering. Although entering the profession might have been perceived as an economic relief to women of Jane's class, the job potentially entailed more loneliness and physical as well as emotional abuse for the protagonist. Although the profession would have certainly presented "Discontent, Mortification, or mere Sorrow of the heart," Jane's years as a governess are her happiest (Ridout 50). At the Reed household and at Lowood, Jane experiences severe disrespect and abuse, meanwhile at Thornfield Hall, her fellow employees treat her kindly. At Thornfield, Jane is able to assert herself in conversation with Mr. Rochester, though a nineteenth-century governess would have been expected to be "gentle and modest," lest they "forget [their] proper place" (Ridout 54). While most governesses would not have been treated by their employers as much, Jane is able to enjoy respect and equal treatment, even from the gloomy Mr. Rochester. Although Mr. Rochester possesses a questionable behaviour—locking up his mentally ill wife—and at first treats Jane in an "exacting" manner, he eventually treats Jane as an equal and marries her, a completely unrealistic notion for the 19th century (C. Brontë, *Jane Eyre* 253). Also against nineteenth-century expectations, the housekeeper of Thornfield Hall—Mrs. Alice Fairfax—accepts Jane openly when she first enters Thornfield. In fact, Jane describes her as "placid-tempered" and "kind-natured" (C. Brontë, *Jane Eyre* 204). Not accustomed to living in a mansion, Jane is ignorant of certain social

traditions, like changing clothes based on the time of day—the evening requires more formal clothes, for example. Mrs. Fairfax helps Jane learn these customs, without ever ridiculing her for her childhood at Lowood (C. Brontë, *Jane Eyre* 226). Mrs. Fairfax's kind behaviour towards Jane contradicts what would have likely been reality: servants and fellow house employees would have not become companions with a governess, as society considered them members of a different class (Ridout 49). Jane's experience as a governess contradicts advisory essays from the period, the only possible antidote to the loneliness attached to being a governess was being with their pupil (Ridout 52). Jane is never lonely at Thornfield because her employers treat her well, and her pupil becomes a means for Jane to prove herself to Mr. Rochester.

Adele is an unlikely student. Although she exhibits some immature behaviours, the girl becomes kind and intelligent. Once again, Jane's experience with Adele contrasts reality, as shown in the writings of Caroline-Stéphanie-Félicité, Madame de Genlis, who wrote prolifically about children's education in the late 18th and early 19th century. In her *Lessons of a Governess to Her Pupils*, one letter from 1788 reveals the stark realities of a governess' pupils: "All the children yesterday...indulged themselves at dinner in loud laughs and other disagreeable manners... This is a species of disobedience" (Genlis 85). As this letter reveals, a governess' pupils could often prove to be disrespectful and unruly, perhaps because of their privileged upbringing or because of the governess' ambiguous position within the household. Despite that, Mr. Rochester's French ward, Adele, proves to be a good pupil, despite her precociousness. Jane expresses a "conscientious solicitude for Adele's welfare and progress, and a quiet liking for

her little self' (C. Brontë, *Jane Eyre* 205). In one scene, Adele does make it difficult for Jane to teach her, but it later becomes apparent that this was due to Mr. Rochester's avoidance of company (C. Brontë, *Jane Eyre* 223). Whenever Adele is willful, which is rare, Charlotte Brontë provides a just reason; never does Adele act disobediently to antagonize or disrespect Jane. By making Adele a relatively spotless pupil, Charlotte Brontë's work ignores the some of the major difficulties of being a governess. Charlotte's decision to make *Jane Eyre* ignore these difficulties lead to its palatability, just recall how Charlotte criticized *Agnes Grey* for being too grim. But where Charlotte chooses to ignore these difficulties, Anne includes them in *Agnes Grey*.

Anne Brontë's fictional governess experiences a more difficulty than Charlotte's. In the fourth chapter of *Agnes Grey*, the titular character defends her realistic narrative:

I have not enumerated half the vexatious propensities of my pupils, or half the troubles resulting Responsibilities... My design in writing the few last pages was not to amuse, but to benefit those whom it might concern... but if a parent has, therefrom, gathered any useful hint, or an unfortunate governess received thereby the slightest benefit, I am well rewarded for my pains (A. Brontë, *Agnes Grey* 44).

Here, Anne Brontë uses *Agnes* to reflect her own sentiments that she previously wrote in the preface of *The Tenant of Wildfell Hall*. Anne's five years as a governess had a deep effect on her, as shown by *Agnes*'s truthful accounts of her occupation. At first, the titular character is excited to become a governess and become financially independent, inspired by her family history of strong women (A. Brontë, *Agnes Grey*

14). However, *Agnes*'s expectations are soon crushed upon her arrival at Wellwood. *Agnes* remarks that Mrs. Bloomfield, the mistress of the mansion and her first employer, is "chilly in her manner" and speaks to *Agnes* in a "cool, immutable gravity at dinner" (A. Brontë, *Agnes Grey* 22). *Agnes*' employer shows little respect for her, as was common for fellow governesses of the century. One of Anne's other employers, the Murrays, are also disrespectful to *Agnes* and make her feel "like one deaf and dumb, who could neither speak nor be spoken to" (A. Brontë, *Agnes Grey* 166). In her first novel, Anne Brontë also includes the governess's invisibility within the household she worked, the strange displacement she would have experienced, being neither a servant nor a member of the family. After being treated poorly by the Murrays, *Agnes* expresses that she "had ceased to be visible" (A. Brontë, *Agnes Grey* 199). Once again, Anne proves her determination to illustrate the reality of being a governess in the 19<sup>th</sup> century.

In addition to her employers, *Agnes* experiences hardships with her employers' children as well. Both of the families *Agnes* serves as a governess for have children with disciplinary issues. Although *Agnes* attempts to notify her employers of their children's disrespectful behaviour, they fail to do it due to their own pride. For example, Mrs. Bloomfield fails to recognize her children—*Agnes*' pupils—are unruly, though *Agnes* tries to tell her (A. Brontë, *Agnes Grey* 39). Instead, Mrs. Bloomfield dismisses the news of her children's unruliness, leaving *Agnes* to work with their disruptive behaviour. Mrs. Bloomfield also blames *Agnes* for her children's disobedience. In one scene, she asks *Agnes*, "'Don't you observe, my dear, how she [Fanny, one of Mrs. Bloomfield's children,] is altered since she entered the schoolroom?'" (A. Brontë, *Agnes Grey* 41).



With only a few words, Anne Brontë uses Mrs. Bloomfield to illustrate what the relationship between a governess and her employer was really like. “A lack of sympathy between them [governesses] and their employers” was an extremely common experience, according to *The Educator’s Guide*, an mid-nineteenth century text (Mair 105). Feeling as though her children made little progress with Agnes as their governess, Mrs. Bloomfield fires her, undeservedly, in Agnes’ opinion. By analyzing the behaviour of Agnes’ pupils, the truth about governess’ pupils is revealed.

To call Mrs. Bloomfield’s children “unruly” is an understatement. Choosing the worst Bloomfield child is a difficult task, as all of them are difficult in their own right. The scene where Agnes performs a mercy killing on the birds that Tom loves to torture is something Charlotte Brontë would have never included in her novels. Though *Jane Eyre*’s scenes at the Reed estate and Lowood School are certainly uncomfortable for a reader, *Agnes Grey*’s scenes of violence are remarkably more unnerving. Anne describes how Agnes “dropped the stone upon his [Tom’s] intended victims and crushed them flat beneath it” as well as the loud, terrible outcries the birds make upon being crushed (A. Brontë, *Agnes Grey* 59). Though literary critics of the day provided more of their opinions on *Wildfell Hall*, which some considered “profane” and to include “inconceivably coarse language, and revolting scenes and descriptions,” Anne includes similar scenes in *Agnes Grey* through scenes with Bloomfield’s children (Barker 574). It is for these scenes that *Agnes Grey* was remarkably less popular than *Jane Eyre*, along with Charlotte preventing Anne from publishing the novel. Anne portrays violence that would be considered unseemly and morally shocking to a nineteenth-century audience. Aside from their violent behaviour, Anne Brontë

provides candid descriptions of their behaviour throughout the novel. For example, Tom shows off his most prized possessions to Agnes, which consist of animals he’s killed—weasels and moles included. He also physically abuses his own siblings, who are equally disobedient. While Agnes is employed at Wellwood, Tom’s sisters do everything they can to get Agnes in trouble with their mother: they scream, they throw things, and they cry often.

The Murray children are just as ill-mannered as the Bloomfield children, though in a different manner. Agnes is certainly in a better position at the Murray estate than she was at Wellwood, but the Murray girls present plenty of difficulties for the young governess. Matilda, the younger of the sisters, is “reckless, headstrong, violent, and unamenable to reason,” and did not care for “the cultivation of her mind” (A. Brontë, *Agnes Grey* 84-85). Meanwhile, Rosalie’s sole concern is in finding a suitable marriage partner, maintaining a coquettish approach to all of the eligible gentlemen in the region, thereby gaining their affections. Agnes recounts her frustration in teaching the two sisters, as their interests lie elsewhere, and at one point in the novel, Agnes cannot bring herself to decide which of the sisters “was the more reprehensible of the two” (A. Brontë, *Agnes Grey* 112). Though *Jane Eyre*’s pupil presented a few problems for her, Adele is an angel compared to the children that Agnes meets in her profession, and unlike the advisory pamphlets of the day suggested, Agnes’ pupils are not the antidote to her loneliness. If anything, they separate her further from everyone else.

Compared to *Jane Eyre*, *Agnes Grey* is a far more realistic depiction of a nineteenth-century governess’ lifestyle. By creating a character who endures disrespectful employers, disobedient and violent pupils, episodes of haunting loneliness and

isolation, Anne Brontë writes a fictional autobiography of her own time as a governess. Although her sister Charlotte worked as a governess, Anne did so for five years, while Charlotte did for less than a year. Her novel *Jane Eyre* provides a much more romantic portrayal of the feminine occupation. Mr. Rochester respects and loves Jane as an equal and eventually marries her, Mrs. Fairfax treats her kindly, and Adele is a good pupil who shows astounding progress. The most negative experiences Jane has are the ones outside her time at Thornfield as a governess, and Jane considers those instances minor. Although Agnes stands the tests of her occupation, her terrible experiences as a governess shape her character. In *Agnes Grey*, Anne Brontë creates an authentic narrative. Because *Agnes Grey* was largely ignored until recent years, it deserves serious analysis and contemplation, as it could shed light into the social and emotional difficulties of being a governess in the nineteenth century. As revealed by letters and books concerning the occupation, the vast majority of governesses would not have attested to being their employer's equal as the titular character did in *Jane Eyre*, but instead "an unfortunate governess received."

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## The Impact and Potential Treatments of 2019-nCoV and Related Coronaviruses

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### Abstract

Around December of 2019, scientists discovered a novel coronavirus—2019-nCoV or SARS-CoV-2—that is linked to the Huanan Seafood Market in China. SARS-CoV-2 is one of seven human coronaviruses—including MERS-CoV and SARS-CoV—that causes the development of respiratory and gastrointestinal symptoms. The hallmark symptoms of CoV diseases like COVID-19 tend to be fever, dry cough, and dyspnea, and though most cases resemble flu or cold infections, sensitive populations like those over 60 or with underlying health issues may experience worse symptoms, such as pneumonia and ARDS, and even a higher risk of mortality. Identification of CoVs may occur through clinical features, transmission electron microscopy, and RT-PCR. Additionally, identification measures may contribute to early enforcement of treatments and quarantine, which may improve patient outcomes and limit the spread of infection. Although all groups are susceptible to CoV infection, certain individuals have a higher risk of contracting the virus and experiencing more severe disease outcomes. As of now, there are no official antiviral treatments or vaccines for any of the human coronaviruses. Research is examining a variety of candidate drugs, and companies like Sinovac, Moderna, and AstraZeneca are now moving into Phase III testing for their SARS-CoV-2 vaccines. For now, interventions are to offer supportive care and monitoring, treat physical and psychological symptoms as they arise, and impose social distancing and quarantine practices.

*Keywords:* Human coronavirus, 2019-nCoV, SARS-CoV, MERS-CoV, SARS-CoV-2, COVID-19, coronavirus treatments, coronavirus identification, coronavirus symptoms, coronavirus risk factors

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### Definitions of Terms

*Desquamation*: shedding of the uppermost layer of cells (Farlex, 2012)

*Emesis*: vomiting (Farlex, 2012)

*Erythropenia*: low red blood cell count (Farlex 2012)

*Extracorporeal membrane oxygenation*: the use of a heart-lung machine to remove carbon dioxide from the blood and replenish it with oxygen before return to the tissues (Mayo Clinic)

*Febrile seizures*: a seizure caused by fever (McGraw Hill Concise Dictionary of Modern Medicine, 2002)

*Leukopenia*: low white blood cell count (Farlex, 2012)

*Pharyngitis*: inflammation of the tissue of the pharynx (throat; Farlex, 2012)

*Malaise*: general feeling of unwellness (Farlex, 2012)

*Myalgia*: muscle pain (Farlex, 2012)

*Rhinorrhea*: watery nasal discharge (Farlex, 20120)

### **The Impact and Potential Treatments of 2019-nCoV and Related Coronaviruses**

On March 11, 2020, the World Health Organization officially declared the disease caused by the 2019 novel coronavirus (2019-nCoV) to be a pandemic, indicating “a worldwide spread of a new disease” that people do not possess immunity for (Chappell, 2020; WHO, 2010, para. 1). Outbreak of 2019-nCoV, now identified as SARS-CoV-2, began in late 2019, and the viral origin has been associated with the Huanan Seafood Market in Wuhan, China, with cases appearing only a month before the Spring Festival of China (Deng & Peng, 2020; Ralph et al., 2020). However, the virus was not identified as a novel coronavirus until 2020 and has since caused 972,303 infections and 50,321 deaths globally, as of April 3, 2020 (Kim et al., 2020; WHO, 2020). This review of the current literature will explore the identification methods for coronaviruses, their effects on mammalian organ systems, the risk factors for infection, any distinctions between the species, and existing as well as potential treatment and isolation practices. Furthermore, while there are several species of coronavirus, this review will mostly focus on SARS-CoV-2 and, to a lesser degree, those closely related to it, such as sudden acute respiratory syndrome coronavirus (SARS-CoV) and Middle East respiratory syndrome coronavirus (MERS-CoV). This focus is the result of human coronaviruses (HCoVs) often sharing similarities in clinical aspects.

#### **Literature Review**

SARS-CoV-2 is a species of  $\beta$ -coronavirus ( $\beta$ -CoV) within the family *Coronaviridae*, the members of which are named after the crownlike spike glycoproteins attached to their envelopes (Ralph et al., 2020). These glycoproteins aid in the infection of host cells by facilitating attachment and entry when binding to cell

membrane receptors (Ralph et al., 2020). Another characteristic feature of CoVs is their single-stranded, positive sense RNA genome, which can directly undergo translation into viral proteins via a host cell (Kim et al., 2020). Because of their ability to replicate viral genes and undergo homologous recombination, CoVs are able to experience rapid mutations, further lending to their ability to infect various animal species (Crossley, Mock, Callison, & Hietala, 2012; Li et al., 2017).

Within *Coronaviridae* are  $\alpha$ -,  $\beta$ -,  $\Gamma$ -, and  $\delta$ -coronaviruses, and although host tropism is primarily mammals,  $\Gamma$ -coronaviruses and  $\delta$ -coronaviruses can also infect bird species (Li et al., 2017). Coronavirus particles have also been detected in reptiles though no complete viral samples have been identified (Crossley et al., 2012). Particular mammalian species vulnerable to CoVs, as carriers or hosts, include bats, rabbits, rats, hedgehogs, cats, dogs and pandas, cattle, and humans (Gao et al., 2009; Monchatre-LeRoy, 2017; Osumi et al., 2018; Sampath et al., 2005). Infection of human hosts can occur through cross-species transmission within wet market environments, such as the transmission of SARS-CoV through bats and civet cats in the wet markets of Guangdong, China (Berry, Gamielien, & Fielding, 2015; Li et al., 2017). However, CoVs can also spread through other forms of contact with intermediate hosts, like dromedary camels in the case of MERS-CoV, or through human-to-human transmission (Deng & Peng, 2020; Harbi & Gupta, 2019). One of the more commonly established reservoirs of CoVs remains bats (Berry, Gamielien, & Fielding, 2015).

Altogether, the symptomatology associated with CoV infections ranges from asymptomatic to mild to severe (Kim et al., 2020). Most symptomatic cases (up to 80% according to the Novel Coronavirus Pneumonia Emergency Response



Epidemiology Team) are mild and involve cold-like symptoms, such as a fever and dry coughing, as well as gastrointestinal symptoms like abdominal pain, emesis (vomiting), and diarrhea (Berry et al., 2015; Gostic, Gomez, Mummah, Kucharski, & Lloyd-Smith, 2020; Ralph et al., 2020). This is due to CoVs' ability to use epithelial cells expressing angiotensin-converting enzyme 2 (ACE2), such as in the upper respiratory and gastrointestinal tracts, as entry into and infection of the host (Berry et al., 2015; Pang et al., 2020; She et al., 2020).

Recently, loss of smell (anosmia) and taste (ageusia) have been identified as other potential COVID-19 symptoms (Yan, Faraji, Prajapati, Boone, & DeConde, 2020). More severe cases of CoV infection involve respiratory difficulties, including requiring ventilation assistance, and extreme organ dysfunction or failure (Liu et al., 2020). However, as will be further discussed later on, these cases are less common and are more prevalent among individuals 60 or older as well as those with compromised immune systems and/or chronic health conditions like obesity (Kim et al., 2020; Nassar, Bakhrebah, Meo, Alsuabeyl, & Zaher, 2018; Ralph et al., 2020). For most CoV species, the incubation period lasts between one and fourteen days, with symptoms following thereafter (Deng & Peng, 2020; Nassar et al., 2018).

The first 2019 coronavirus disease (COVID-19) cases were reported in Wuhan, China, which is within the Hubei province, around December of 2019, though some researchers suspect that cases may have occurred without identification as early as October or November of that year (L. King, PhD, personal communication, January, 28, 2020; Nesteruk, 2020; Ralph et al., 2020). According to Ralph and others (2020), the first confirmed case was identified on December 30, 2019 and quickly grew to 27 cases by December 31. This number then

expanded to 59 by January 5, 2020 while COVID-19 cases spread to countries outside of China, to include Japan, Korea, and the U.S. (Ralph et al., 2020). By January 28, 2020, there were over 4,500 documented cases worldwide and over 105 deaths, which grew to 40,261 cases and 900 deaths by February 10, 2020 (Ralph et al., 2020; She et al., 2020). As of April 3, 2020, there have been 972,303 cases and 50,321 deaths (Ralph et al., 2020; WHO, 2020). Most of these cases, which were once mostly confined to China, have since occurred at significantly higher rates in countries like the United States, Spain, and Italy (She et al., 2020; WHO, 2020). Comparatively, SARS-CoV caused roughly 8,000 cases and almost 800 deaths between 2002 and 2003, and MERS-CoV caused over 2,260 cases and over 800 deaths between 2012 and 2019 (Han et al., 2019).

The reproduction number ( $R_0$ ) of SARS-CoV-2, which represents the predicted number of people a carrier of the virus may come in contact with and infect, is estimated to be between 1.4 and 5.5, likely closer to 2.2 (Pang et al., 2020; Thompson, 2020). As reference, any number over one indicates a high chance of steady spread rather than a dissipation (Thompson, 2020). With this added to the growth of cases, SARS-CoV-2 appears to be more contagious than MERS-CoV and SARS-CoV--possibly even twice as contagious as SARS-CoV--but involves a lower mortality rate than MERS-CoV overall (Deng & Peng, 2020). Drastic increases in the numbers of SARS-CoV-2 cases are probably due to improvements in identification, retrospective testing, and superspreader events, such as in enclosed environments (Chen et al., 2020; Deng & Peng, 2020; Ralph et al., 2020; She et al., 2020). As an illustration of superspreader events, one patient in China infected as many as 14 healthcare workers (Ralph et al., 2020). Additionally, a woman in Korea

infected 37 others in her church in February of 2020 (Lanese, 2020).

### **Identification**

CoVs can be accurately identified through various methodologies, like the use of reverse transcriptase polymerase chain reactions (RT-PCR). For the sake of thoroughness and early identification of CoV infections, this paper will include multiple available forms of identification but will emphasize the reliance on techniques like RT-PCR for confirmation of CoV infection.

As with the identification of other pathogens, culturing CoVs and observing them microscopically lends some information about their identity through knowledge of their morphology and distinct structures (Sampath et al., 2005). This is especially useful with scanning electron microscopes, as the magnification power can reveal the glycoproteins on the surface of CoV-infected cells (Berry et al., 2015; Kim et al., 2020). Additionally, electron microscopy can be used to measure the sizes of CoV particles, which are noted to be between 70 and 90 nanometers (Kim et al., 2020). However, the appearance of the individual CoV species may not vary significantly, so microscopy should not be used alone to identify CoVs. Two other strategies for identifying CoV infections and the pathogen responsible for them are symptomatology and genome sequencing, respectively.

The majority of CoV cases appear with upper respiratory infection symptoms, such as fever, cough, and dyspnea (shortness of breath; Chen et al., 2020). Other symptoms may include chest pain and myalgia as well as typical cold-like symptoms like rhinorrhea, pharyngitis, and malaise, and even gastrointestinal symptoms like diarrhea and emesis/nausea (Chen et al., 2020; Nassar et al., 2018). In more severe cases, symptoms can progress to pneumonia and

acute respiratory distress syndrome (Berry et al., 2015; Ralph et al., 2020). In a study by Harbi and Gupta (2019), researchers used visual triage to identify potentially infected patients in a hospital in Qassim with the use of a scoring form. The form rated the hallmark symptoms of MERS-CoV, including fever, coughing, and dyspnea, especially when occurring less than 14 days after exposure to people with MERS or to camels (Harbi & Gupta, 2019). Scores above four indicated potential MERS-CoV infection, and the suspected patients were sent to a respiratory area of the hospital as well as given instructions on how to prevent the spread of MERS (Harbi & Gupta, 2019). Further identification measures could take the form of blood analyses and chest X-rays, as some patients may also have low leukocyte counts and pulmonary abnormalities, such as pneumonia (Harbi & Gupta, 2019; Ralph et al., 2020). Computerized tomography (CT) scans of the lungs of patients infected by SARS-CoV-2 also reveal a ground glass appearance along with the presence of consolidations and the thickening of interlobular septa, giving the lungs a further honeycombed appearance (Jin et al., 2020). Notwithstanding the ease with early identification, distinguishing CoVs from other viruses through symptoms alone is unreliable, as the symptoms closely resemble those of other upper respiratory tract infections, including influenza (LeMieux, 2020). Likewise, CoVs generally share the same symptoms and thus also cannot be discriminated by visible symptoms alone (LeMieux, 2020). However, visual triage and other physiological analyses of the patient are beneficial to preventing transmission of the virus, with the exception of rare asymptomatic cases (Harbi & Gupta, 2019). The most precise identification technique is use of reverse transcription of the coronavirus's RNA followed by a



polymerase chain reaction (PCR) of its cDNA (Sampath et al., 2005). A polymerase chain reaction is a research technique that amplifies (creates several copies of) specific sections of DNA that are targeted by primers, and thus identifies pathogens based on the existence of particular gene sequences (Garibyan & Avashia, 2013). This process can analyze genes from mixed cultures and identify individual species with the use of species-specific primers, or short sequences of DNA that are extensions of the primer during the PCR process (LeMieux, 2020; Sampath et al., 2005). CoV genes of interest with PCRs include O, R, N, and E (Lemieux, 2020). In general, sputum and pharyngeal swab samples from patients are sufficient to yield a viral DNA sample for RT-PCR analysis (Kim et al., 2020). While RT-PCR is a reliable and valid method of CoV identification, the procedure is sensitive to contamination, requires information on nucleic acid sequences, and presents a small risk with primers binding to incorrect target areas (Garibyan & Avashia, 2013). Overall, the ability to obtain accurate results with this method outweighs the limitations and thus still makes the RT-PCR an ideal identification method for identifying CoVs.

### ***Clinical Characteristics***

Although symptoms of CoV infections, including for SARS-CoV-2, tend to be mild for most affected individuals, there is still risk of damage to the respiratory, digestive, central nervous, cardiovascular, and reproductive systems, especially in cases involving sensitive populations like those 60 and older or those with comorbidities (Kime et al., 2020; Nassar et al., 2018; Ralph et al., 2020). However, the digestive and respiratory systems are the most susceptible to injury by members of *Coronaviridae* (Berry et al., 2015; Nassar et al., 2018). Organs that can become inflamed include the lungs, liver, kidneys (especially the

nephrons), and brain (Berry et al., 2015). Similarly to human cases, non-human mammals that contract CoVs can experience organ damage and inflammation. One example involving CoVs affecting non-human mammalian species includes alpaca CoV, which can cause respiratory illness and even abortions in alpacas (Crossley et al., 2012). Additionally, canine CoV can cause hemorrhage of the lungs, liver, intestines, and spleen as well as edema of the intestines and intestinal lymph nodes of *Canidae* species like giant pandas, and feline CoV can cause skin lesions and nodules, stomatitis, anemia, fever, and nasal discharge in *Felidae* species (Gao et al., 2009; Osumi et al., 2018). Despite the clinical manifestations of CoV infection in humans sharing some similarities with those present in other mammals, the characteristics are not identical, even across different HCoV infections.

Though the symptoms and physiological effects of HCoV infections are comparable, especially in regard to the organ systems that they impact most, there is some variability in clinical traits and patterns across the different HCoV infections. With SARS, patients may present with “atypical pneumonia...with pneumocytes being the primary target of infection” and experience a worsening of symptoms by the second week of infection, including fever, dyspnea, and oxygen desaturation (Berry et al., 2015, p. 999). Additionally, the alveoli of the lungs are susceptible to hemorrhage and thickening, and the pneumocytes may become multinucleated or desquamated (Berry et al., 2015). As a consequence of alveolar injury or other pulmonary damage, pneumomediastinum may also appear (Hui, Chan, Wu, & Ng, 2004). In cases of MERS, pneumonia is also a potential outcome of infection, but as are acute respiratory distress syndrome (ARDS), pericarditis, and disseminated intravascular coagulation

(DIC; Berry et al., 2015). Pneumonia is also a common outcome of HCoV-NL63 infections, but other reported physical manifestations have been bronchiolitis, febrile seizures, croup, and exacerbation of existing conditions like chronic obstructive pulmonary disease (COPD) and asthma (Berry et al., 2015). In severe cases of COVID-19, pneumonia (usually bilateral), failure of organs and organ systems, ARDS, lung lesions, pulmonary edema, acidosis, coagulation dysfunction, and hypoxemia may be present (Chen et al., 2020; Deng & Peng, 2020). In addition to some clinical characteristics differing between HCoV infections, mortality rates also vary per infection. Mortality rates for SARS, MERS, and COVID-19 are estimated to be 10%, 35%, and 11%, respectively, with the majority of deaths likely resulting from organ failure and hemorrhage, particularly of the lungs and alveoli (Chen et al., 2020; Mayer et al., 2016). On the other hand, CoVs like CoV-229E, OC43, NL63, and HKU1 rarely result in more than cold-like symptoms, and while self-reported symptom severity was roughly the same for HCoV-OC43, 229E, NL63, and HKU1 in one study, HCoV-HKU1 had slightly worse GI symptoms on day four (Bouvier et al., 2018; Kim et al., 2020). However, it is still important to note that death is not the result of the majority of HCoV infections, including with SARS-CoV-2, and is mostly associated with high-risk age groups and those with comorbidities.

Lab results can also vary with CoV infections and thus may lend further indication of infection. In patients with SARS, leukopenia (especially of the lymphocytes) and thrombocytopenia, higher lactate dehydrogenase and creatine kinase levels, and proteinuria are common (Hui et al., 2004; Ralph et al., 2020). With MERS, leukopenia (other than neutrophil counts, which were elevated), erythropenia, and

thrombocytopenia are also normally recorded along with elevated levels of serum creatinine, liver enzymes, and lactate (Nassar et al., 2018; Ralph et al., 2020). For SARS-CoV-2 cases, leukocyte counts were either elevated or lowered while albumin and hemoglobin levels were normally low (Chen et al., 2020). Many cases also displayed elevated alanine and aspartate aminotransferase, lactate dehydrogenase, C-reactive protein, and glucose levels (Chen et al., 2020; Deng & Peng, 2020). Chen and others (2020) also found that 2019-nCoV seems to target lymphocytes, especially T-lymphocytes, more than other leukocytes.

### ***Risk Factors***

In general, any person is susceptible to CoV infection. Increased risk of contraction is normally associated with contact with carriers, including human and non-human hosts, and improper social distancing and preventive practices (Berry et al., 2015; Harbi & Gupta, 2019). In particular, risk of contraction associated with contact with a SARS-CoV-2 positive person is greater with distances less than six feet, especially within households, and exposure within a week of symptom onset (Cheng et al., 2020). However, there is also a weak correlation between the male sex and general CoV infection, including for SARS-CoV-2, which could be due to biological reasons (i.e., the Y chromosome) and/or social ones (e.g., a higher contact rate with carriers, such as camels; Ahmeda et al., 2018; Bajema et al., 2020; Chen et al., 2020; Nassar et al., 2018). Certain seasons, such as fall/winter months of temperate areas and spring/summer months of tropical and subtropical areas, have also been correlated with a rise in CoV infection cases (Berry et al., 2015; Harbi & Gupta, 2019). Non-human carriers or hosts of CoVs include a variety of species, with dromedary camels acting as reservoirs for MERS-CoV; palm civets and raccoon dogs acting as reservoirs for SARS-CoV; and bats

acting as a reservoir for most CoVs (Berry et al., 2015; Han et al., 2019; Harbi & Gupta, 2019; Li et al., 2017). Transmission to humans can occur through close contact with the animals, especially in a wet market environment, or through their products, such as their milk and meat (Berry et al., 2015; Nassar et al., 2018). Additionally, certain host species (e.g., camels) and environments (e.g., wet markets) allow for mutation of viruses like CoVs into viruses capable of infecting humans (Li et al., 2017; L. King, PhD, personal communication, January, 28, 2020).

Symptom severity and mortality risk largely depend on age, the presence of comorbidities, and any other conditions or habits that weaken the immune system. Although some research places newborns and younger children within a higher at-risk group for MERS- or SARS-CoV infection, likely due to many of the former and some of the latter having underdeveloped immune systems or comorbidities, most of the research identifies those 60 and older as the most at-risk group for severe symptomatology and mortality (Chen et al., 2020; Gerba, Rose, & Hass, 1996; Nassar et al., 2018; Ralph et al., 2020). This is the case with SARS-CoV-2 as well. Further adding to that, other researchers have found that individuals 19 or younger are more likely to experience only mild cold-like symptoms and thus less likely to experience severe complications (Berry et al., 2015; CDC, 2020; Deng & Peng, 2020; Hui et al., 2004). In older populations, namely those 60 and older, there is a higher chance of immunocompromisation and insufficient bodily resources to fight off a viral infection, which exposes them to greater risks of damage and fatality (Chen et al., 2020; Gerba et al., 1996). This is further compounded by the fact that this population is more affected by chronic comorbid diseases (Chen et al., 2020). Comorbidities

that tend to increase symptom severity and lead to disease complications are generally ones affecting the cardiovascular, endocrine, nervous, digestive, or respiratory systems, with the most commonly pernicious ones being diabetes, HIV or influenza infection, hypertension, Parkinson's disease, asthma, and COPD (Ahmed et al., 2018; Berry et al., 2015; Chen et al., 2020; Deng & Peng, 2020; Nassar et al., 2018). Out of these, hypertension and diabetes equate to the most risk of severe symptoms and health decline (Deng & Peng, 2020). To add to this, other risk factors include obesity, smoking, and receiving anticancer treatments (Chen et al., 2020; Gerba et al., 1996; Ralph et al., 2020).

One final consideration with CoV risk factors is the CoV species. Again, SARS-CoV, MERS-CoV, and now also SARS-CoV-2 are responsible for greater severity of symptoms, physiological toll, and fatality rates than other CoVs, though this is still more restricted to sensitive populations (Berry et al., 2015). In addition, though the timelines for both SARS and MERS are similar, SARS was associated with a shorter period of time before death (Ralph et al., 2020).

### ***Treatments and Isolation Practices***

Currently (i.e., as of August 14<sup>th</sup>, 2020), there are no official vaccines or antiviral treatments for CoV infections. Instead, the most effective ways of reducing effects of the viruses are to provide supportive care, treat any health complications that may arise, and enact quarantines and other preventive methods. In particular, protective measures should be implemented in hospitals to prevent transmission to hospital staff and other patients, thereby lowering the chances of a hospital outbreak (Deng & Peng, 2020; Harbi & Gupta, 2019). These measures include regular handwashing, for both hospital staff and infected patients; N95 mask usage for those infected and personal protective equipment for staff; coverage of

the mouth and nose when sneezing or coughing; disinfection with heat and ether-containing chemicals; keeping patients separate unless confirmed cases; and disposal of any contaminated objects (Deng & Peng, 2020; Harbi & Gupta, 2019; Jin et al., 2020). For example, the SARS epidemic in 2003 was controlled through supportive care, antibiotics for secondary bacterial infections, and quarantine of identified and suspected carriers of the virus (Berry et al., 2015). With that said, it is important to investigate and target viral origins in order to control present outbreaks and prevent subsequent ones, especially given the likelihood of recombination of CoVs from zoonotic sources (Berry et al., 2015). Similarly, individuals exhibiting symptoms should be quarantined, and those who have been in contact with them should restrict their interactions with others until cleared of suspicion (Bajema et al., 2020; Berry et al., 2015; She et al., 2020). To facilitate isolation of the infected, the CDC has arranged for healthcare staff and public officials to send in alerts of suspected persons for laboratory testing, including suspected patients in hospitals (Bajema et al., 2020).

At this time, one of the most important steps of treatment (and prevention of spread) is to diagnose CoV infections and start care as early as possible; this could be achieved through means of visual triage, x-rays/CT scans of the chest for detection pneumonia-like symptoms (like lung infiltrates), and other early screening processes like risk prediction models based on epidemiological and symptomatic risk factors for CoV infection, especially before performing lab analyses like RT-PCR for confirmation (Ahmed et al., 2018). Additionally, CoV testing kits, while usually only accessible to research institutions like the CDC, could be made more available to certain hospitals for early detection of the virus (LeMieux,

2020). However, in this case, documenting and publicizing any common viral infection characteristics is imperative to efficient limitation of spread and early treatment (Ahmed et al., 2018).

Because around 80% of SARS-CoV-2 infections are from symptomatic hosts, the spread can be reduced through containment and other preventive tactics (Bajema et al., 2020; Thompson, 2020). Some of the screening and containment practices in place are thermal screenings at airports and borders, fever observation rooms in train stations and airports, isolation of passengers from high risk areas (like with UK passengers traveling from Hubei), and imposition of travel restrictions (Bajema et al., 2020; Deng & Peng, 2020; Ralph et al., 2020; Shanmugaraj, Malla, & Phoolcharoen, 2020; Thompson, 2020). One country rigorously employing these practices is China, which has isolated those with SARS-CoV-2, imposed travel restrictions on those in the Hubei province, including for public transportation like buses, as well as terminated study abroad trips (She et al., 2020).

Most treatments for CoV infections rely on supportive care as well as approaches to remedying co-occurring health issues. With MERS, most patients require mechanical ventilation and sometimes even renal replacement therapy or extracorporeal membrane oxygenation (Ralph et al., 2020). Supportive care for patients with SARS-CoV-2 also offers noninvasive or invasive mechanical ventilation, extracorporeal membrane oxygenation, interferon- $\alpha$  (IFN- $\alpha$ ; an antiviral treatment) aerosol inhalation, circulation support, and antibiotic and antifungal treatments for secondary infections, especially within combination therapies (Chen et al., 2020; Deng & Peng, 2020). Overall, oxygen therapy is especially crucial to the wellbeing of patients with ARDS, hypoxemia, and any other severe

respiratory problems, and extracorporeal membrane oxygenation should be reserved for patients with unresolved hypoxemia (Jin et al., 2020). Glucocorticoids may also be prescribed for three to five days to alleviate symptoms related to inflammation (Deng & Peng, 2020; Mayer et al., 2016). However, the use of glucocorticoids and antibiotics should be limited to aid in the immune response and reduce the chances of selecting for antibiotic resistance (Jin et al., 2020). Other drug options to lessen the severity of symptoms include anti-inflammatory drugs (e.g., ibuprofen), proton pump inhibitors, heparin, and M1/M3 receptor anticholinergic drugs (Jin et al., 2020). Treatments like fluid resuscitation, vasoconstrictors, and vasopressors may be used to treat septic shock (Jin et al., 2020). Other interventions include traditional Chinese medicine practices, such as moxibustion; the use of Chinese herbs as dietary supplements, in foot baths, or for wearing within bags; drinking herb-infused teas; and prescribing medicines like “Huoxiang Zhengqi capsule or Huoxiang Zhengqi Shui (in half dose)” (Jin et al., 2020, p. 15).

While there is no approved treatment for CoVs (as of August 14<sup>th</sup>, 2020), ongoing research has selected candidate drugs, and the Coalition for Epidemic Preparedness Innovations has planned to conduct vaccine testing by June 2020 (Pang et al., 2020). Antiviral drug candidates include lopinavir and ritonavir, IFN- $\beta$ , oseltamivir, ganciclovir, IFN alfacon-1 with corticosteroids, and remdesivir (Chen et al., 2020; Hui et al., 2004; Johns Hopkins Center for Health Security, 2020; Mayer et al., 2016; Ralph et al., 2020). Additionally, Kim and others (2019) discovered that bis-benzylisoquinoline alkaloids cepharanthine, tetrandrine, and fangchinoline may be a treatment option for HCoV-OC43 and other  $\beta$ -CoVs. All three alkaloids were found to

inhibit viral growth and replication as well as prevent destruction of host cells without cytotoxic effects on the MRC-5 lung cells used (Kim et al., 2019). On the other hand, candidates for CoV vaccines include a “viral vector-based vaccine, DNA vaccine, subunit vaccine, virus-like particles (VLPs)-based vaccine, inactivated whole-virus (IWV) vaccine and live attenuated vaccine” and are particularly needed in countries that are resource poor (Pang et al., 2020; Shanmugaraj et al., 2020). In particular, researchers are expressing interest in antibodies and vaccines that act on angiotensin-converting enzyme 2 or other viral proteins (Shanmugaraj et al., 2020). As of June 17, 2020, SARS-CoV-2 vaccines like mRNA-1273, CoronaVac, and Oxford-AstraZeneca have progressed into Phase III testing after expressing success in Phases I and II (Asian Scientist Newsroom, 2020; Pang et al., 2020; Tirrell, 2020). For now, the treatments with the most promise are IFN- $\beta$  and IFN- $\alpha$ , lopinavir and ritonavir used conjunctively, and remdesivir (Pang et al., 2020; She et al., 2020).

Final notes on CoV infection treatment and prevention are to administer mental health treatment along with treatments for the physical symptoms and to monitor patients’ blood oxygen saturation, enzyme levels, and other health indicators to gauge convalescence or disease progression (Deng & Peng, 2020; She et al., 2020). Once patients’ symptoms of infection have disappeared, medical personnel should wait three days before releasing patients from monitoring (Jin et al., 2020).

### Conclusion

The 2019 novel coronavirus, or SARS-CoV-2, is a  $\beta$ -coronavirus within the family *Coronaviridae* that has expressed a greater reproductive number and thus a greater infection rate than any of the other CoVs, including SARS-CoV and MERS-CoV, though its fatality rate is lower than MERS-



CoV. Common clinical characteristics of CoV infection include a fever, dry cough, and fatigue as well as abnormal lung imaging. Knowing the symptoms of SARS-CoV-2 and other CoVs can help with early diagnosis and treatment along with electron microscopy and, for confirmation, RT-PCR. Ultimately, SARS-CoV-2, like other CoVs, poses the most risk to those over 60 and those with already existing health complications, especially ones involving the respiratory and digestive systems. Nevertheless, COVID-19 is transmissible through infected humans and nonhuman animals to any person in close contact with them and thus is more frequently acquired by those regularly interacting with potential or confirmed hosts. As of now (i.e., August 14<sup>th</sup>, 2020), there are no truly effective treatments and prophylactic approaches to COVID-19 and other CoV diseases; supportive care and interventions directed at treatable physical and psychological health issues that may arise with the infections are the best choices at this time. However, researchers are currently developing and planning testing for antivirals and vaccines, such as lopinavir, ritonavir, and remdesivir, and social distancing and antiseptic/disinfectant techniques should limit the spread of SARS-CoV-2.

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## **The Impact of Substrate and Desiccation on Survivability of Brazilian *Elodea* (*Egeria densa*)**

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### **Abstract**

*Egeria densa* is an aquatic freshwater plant that has invaded and is wreaking havoc on the waterways of the United States. This plant's resilience to various environmental conditions gives it an edge when trying to compete against local species (Yu, Shen, Yu, Yu, & Liu, 2018). For the past forty years or so, it has caused ecological, economic, and industrial issues (Cabrera, Magali, Mattioli, Carruthers, & Anderson, 2013). As a result, studies that introduce silver species (Bernas, Winkelmann, & Palmer, 2017) and the impact that climate change has on growth (Havel, Kovalenko, Thomaz, Amalfitano, & Kats, 2015) are leading the charge to see how to curb growth and ultimately kill *Elodea*. Due to the relatively unsuccessful efforts thus far (Richardson, 2008), the overall purpose of this experiment was to try to find an effective means for killing this invasive species without damaging the ecosystem as a whole. There was a two-pronged approach for this research project: find out what substrate the plant grows best in as well as discover how long the plant can be dried out while maintaining survival. This experiment involved obtaining samples from a local waterway (Lindsey Creek), storing them in aquarium tanks with bubblers and no soil as an overall control, and then performing the experiments on smaller samples of the population obtained. This project was conducted over 69 days. Upon completion of the study, it was found that the plants did not do well when faced with desiccation conditions. The rocky substrate was the best for *Elodea* growth, followed by sand, while clay seemed to hinder growth. These are promising results considering that we now understand that prolonged desiccation not only curbs growth but also kills the entire plant down to the roots.

### **Author Biographies**

Chad Reynolds and John Waller are both alumni of Columbus State University. As undergraduates, they were premed biology students with a passion for research. After graduating, Chad continued to medical school at Edward Via College of Osteopathic Medicine. John was accepted to a graduate position at New Mexico State University where he will research the roost selection of bats within urban spaces.

John started as a premed student but discovered his love of research as an undergraduate. Bats became his research focus after accepting an invitation to study mammals in the cloud forests of Panama. He has been accepted to a M. S. Biology position at New Mexico State University where he will compare habitat usage of bats against a gradient of urbanization.

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### **The Impact of Substrate and Desiccation on Survivability of Brazilian *Elodea (Egeria densa)***

*Elodea* is a fast growing, invasive species that is causing a variety of issues in the United States and in waterways all around the world (Cabrera et al., 2013; Huotari, Korpelainen, Leskinen, & Kostamo, 2011; Underwood, Mulitsch, Greenberg, Whiting, Ustin, & Kefauver, 2006). The fact that it has few natural predators allows it to grow unchecked, forming colonies of staggering sizes (Cabrera et al., 2013). The ability to grow so quickly and in a diverse set of environments allows this plant to take over a body of water quickly and with incredible ease (Dutarte, Haury, & Jigorel, 1999).

When left unchecked, this plant can cause a variety of ecological, economic, and industrial issues (Huotari et al., 2011). Perhaps one of the biggest ecological impacts is that it outcompetes native plant species for sunlight. Not only does this cause those plants to die off, or at the very least restrict their growth, it also impacts the animals, bacteria, fungi, and protists that feed on those native plant species (Huotari & Korpelainen, 2013). Upsetting the food web in this way is detrimental to the fishing industry as well, which is vital to the United States' economy as a whole. The Hamilton Project says that the commercial fishing industry was worth 59 billion dollars in 2012, with only 17.1 billion dollars coming directly from salt water sources (Hamilton Project, 2014). That means that 71% of the United States' commercial fishing industry relies on fresh water sources in some way, totaling up to 41.9 billion dollars in 2012.

In France, industries have seen a dramatic impact on their functioning and overall economic well-being (Dutarte, Haury, & Jigorel, 1999). *Elodea* tends to grow in very thick mats, making it difficult

for watercraft to navigate (Huotari et al., 2011). Irrigation canals, drainage ditches, and industrial pipes quickly become clogged with vegetation (Huotari et al., 2011). Hydroelectric power sources are also negatively impacted by *Elodea* as it clogs up the turbines of dams as well (Huotari et al., 2011; J. Ballenger, personal communication, February 2018). Another widespread problem this plant causes is concerns with drinking water. *Elodea* and the algal growth associated with it are quite difficult to remove completely from the water supply. Even though it is possible to remove the plant and its associated algae, it is impossible to remove the foul taste and odor from the water. Research is being conducted to determine if this strange taste in the water is caused by anything that could be harmful to various life forms. Numerous research projects are currently being conducted to find the possible impacts it has on humans, and its overall potential as a public health issue. However, no results have been obtained as of yet (J. Ballenger, personal communication, February 2018).

Because *Elodea* can grow in a number of different conditions and substrates, and because it can reproduce from as little as a miniscule fragment of stem, it has proven to be very difficult to kill. Physical methods include dredging, water draw-downs, and even hand-pulling of these plants from the water (J. Ballenger, personal communication, February 2018). Chemical means, such as silver species (Bernas, Winkelmann, & Palmer, 2017), copper (II) ions, and copper oxide nanoparticles (Nekrasova, Ushakova, Ermakov, Uimin & Byzov, 2011), are also being employed in an attempt to control the population. Biological approaches include introducing specialist herbivores from *Elodea*'s native growing range, such as the leafminer fly (Cabrera et al., 2013). In addition, a study

focusing on *Melaniudes tuberculata*, an invasive species of mollusk to Brazil from Africa, (Medeiros & Henry-Silva, 2017) has been introduced in the hopes of at least helping slow the spread. Nonetheless, *Elodea* is still spreading despite all of these efforts. It is clear that no single one of these methods is particularly effective. Even using them all in conjunction still fails to produce satisfactory results (Thiebaut, Gillard, & Deleu, 2016). The stated methods are still being researched, so scientists have no idea what kind of efficacy they will observe. They also do not know what ecological impacts could result from using any of these methods, specifically chemicals, in conjunction.

Physical characteristics of waterways have been studied with regards to how well *Elodea* can grow in varied aquatic circumstances. It is known that *Elodea* does not grow well in areas that are deeper than one to two meters, but a recent study conducted in County, California found that water velocity and turbidity have little to no impact on the spread or growth of *Elodea* (Durand et al., 2016). This is in contrast to previous observations stating that water flow and turbidity were determining factors in the survival of the plant (Durand et al., 2016). Studies such as this will help pinpoint which areas could be best for employing various control measures.

Ever since it was observed that invasive aquatic plants were causing issues in America's waterways, all of the aforementioned methods of curbing its growth have been frantically used with no true proof that they are effective. Research on which methods are most effective and how they are impacting other forms of life in and out of the water is still being performed. While it is not realistic to think that any one method will entirely eradicate this invasive species, the hope is that one particular method will be found to help

slow the spread while other methods are further researched and optimized for maximal impact.

The goal of this study is to increase the current knowledge of *Elodea* in order to aid in efforts to control it. Our research seeks to answer two questions. First, can desiccation be used to eradicate *Elodea*, and if so, how long will the environment need to be dry? Second, what substrate does this species grow best in? We hypothesized that the plants would not show signs of growth after a five-week drying period, that the two-week period would survive almost entirely, and that the four week period would reveal some plants with no growth. These predictions were made considering that, since *Elodea* is an aquatic species, it will have decreased survival rates as the period of desiccation increases. Next, we hypothesized the substrate it grows best in would largely be composed of sand and that the substrate it grows worst in would be largely composed of clay. Our first question seeks to find a viable option for controlling the growth of *Elodea* while the second hopes to identify areas that may be of future concern. Combining the poor growing conditions as well as the ideal desiccation time is perhaps the best overall and least ecologically detrimental method for attempting to curb the growth while research concerning other methods can be completed.

## Method

We obtained approximately 18 kilograms of *Elodea* as a sample from Lindsey Creek in Columbus, Georgia. A few individual stems with leaves attached were then cut from the obtained population in order to verify that it was *Egeria densa*. Both a compound light microscope and a dissecting microscope were used to aid in the identification process. We utilized numerous online manuals that helped in distinguishing

Elodea from other, similar plant species.

Our samples were identified as Elodea through phenotypic means. We started off by researching that the leaves are in a whorled arrangement, with anywhere from four to ten leaves per whorl. Our observations were that the whorls in our population typically contained five to seven leaves. Additionally, Elodea has serrations on the leaves that are only visible with the aid of a microscope. In nature, Elodea is known to grow in large, sometimes feet-thick colonies, which was the case for the location we obtained our sample from (J. Ballenger, personal communication, February 2018). The leaves of live Elodea are noted to be green and relatively transparent, but this can differ depending on the type of substrate and amount of light the plant has access to. The last distinguishing factor that helped confirm that our sample was Elodea was the smooth surface on the midrib of the leaves. This helped us to distinguish our sample from a close relative, *Hydrilla*, which has spines on the midrib (J. Ballenger, personal communication, February 2018).

After identification of our sample was completed, the plants were washed using tap water to remove any debris and as many organisms as possible, so as to have ideal conditions for growing them in a controlled environment. Upon completion of the washing process, the plants were randomly divided up and placed into five different tanks, all of which were given enough water to sufficiently submerge them, and a bubbler to provide a source of air. These sample populations were not given any substrate in order to ensure that they would live and grow at a relatively controlled rate.

We then went back to the site from which we obtained our population and obtained samples of three different types of substrate: sand, clay, and gravel. About 30

kilograms of sand were obtained, and 12 kilograms of clay and gravel each were collected. Then we processed these substrate samples by removing as much debris and as many animal and plant species as possible, although complete “cleaning” of the substrates was deemed unrealistic.

The containers were placed on a rack with four shelves, each of which had grow lights above it, with a timer set to provide 12 hours of light and 12 hours of darkness each day. This rack was stored on campus in the preparatory room of the greenhouse. Natural light was a factor in the room, but this was blocked by hanging a curtain of white denim on the rack. This ensured that all of the plants received the same amount of artificial light and also that none of them received any natural light that the others did not, removing this as a variable for this experiment.

Prior to placing the plants in their respective containers, each was measured. Specifically, the stem and the longest root were measured to the nearest half-centimeter. At the end of the experiment, all the plants that survived were again measured to the nearest half-centimeter in the stem and the largest root. It is also worth noting that at the end of the experiment, a majority of the plants grew a new stem off of the old one as well as sprouting multiple new roots, which is what this plant does by nature. Measurements were taken on these new stems to the nearest half-centimeter as well, and this was used as a way to determine how successful the individual plant was at surviving in its container. Only the longest root was measured and recorded at the end of the experiment.

After the initial measurement, all 21 containers were divided to have enough samples for testing each experiment. The desiccation experiment took 12 while the



substrate test took nine. Each container was labeled into three parts: A, B, and C. The plants were then placed in their corresponding containers and sections of the container with the roots buried in the substrate and the stem positioned above the surface. Then aged water was added until all of the plants were completely submerged. Due to evaporation and heat factors, more aged water was added every week to each container not being put under desiccation conditions. To avoid another variable, all of the aged water was obtained from the same container each time. Upon rehydration of a container, aged water was added until all of the plants were completely submerged.

For the desiccation aspect of this project, sand was used as the substrate. Three individual plants, each containing a stem with leaves over five centimeters, were placed into a plastic container with 1,000 milliliters of sand. Three of the 12 containers were submerged in aged water from the outset of the experiment to serve as a control for comparison. Three more containers were not given any water at all until a two-week desiccation period was over. Still, three more containers were not given any water until a four-week desiccation period was completed, and the last three containers were not given any water until a five-week desiccation period passed. Observations were obtained two weeks after the last group of containers were rehydrated, which was seven total weeks after the experiment started.

In testing their growth in different substrates, three different types were used, all three of which were derived from the same location where the plant samples were taken from Lindsey Creek. The substrates used were sand, rocky sand, and mud/clay. The growth rate was tested in nine individual containers with the plants in tanks used as the control. The first three

containers were each filled with 100 milliliters of sand. Each container had three plants, labeled A through C, with their roots buried in the sand. Water was added to the containers until the plants were completely submerged. The same method was used on both muddy and rocky substrates. All plants were measured in two areas before they were set in their respective substrate: the stem and the longest roots. These were both measured to the nearest half-centimeter to determine a baseline for the growth over the total 69-day period.

At the end of the seven-week experimentation period, all of the plants that survived were measured again on the original stem, a new stem (if applicable) and the longest root. For consistency, measurements were again obtained to the nearest half-centimeter. All of the experimental plants were compared to the control to judge how much significant growth took place. After measurements were obtained on all of the experimental variables, the plants were dumped in the campus garden so as not to contaminate any of the local waterways. The plants growing in the five aquarium tanks were kept for future research projects. The data were analyzed using a one-way analysis of variance (ANOVA) and a Tukey post hoc test.

## Results

After collecting data on stem and root lengths, the new stem lengths were added together to get the total amount of new growth. All the data were analyzed through a one-way analysis of variance (ANOVA) and a Tukey post hoc test, which compared the growth rates of the plants based on the substrates they were planted in. The mean growth shows a rocky substrate is best for Elodea, with 6.278 centimeters of growth (one-way ANOVA,  $F_{2,16}=5.818$ ,  $P=0.013$ ; Figure 1). Rocky substrate was followed by the sandy substrate with 4.944 centimeters

of growth. The individuals planted in clay had a negative mean with -1.722 centimeters of growth.

The results of the desiccation experiment were very straightforward and promising as a means of controlling the spread and growth rates of Elodea. The substrate that was chosen for this experiment was sand, which was chosen because an abundance of the sample taken was found growing in sand. The nine control specimens all survived the length of the experiment with an insignificant amount of growth. Upon completion of the project, a total of 39 experimental plants were examined and all were found to have been killed by the drying period, regardless of the duration. This is in contrast to the hypothesis, which stated that the plants exposed to the two-week drying out period would survive, that the four-week plants would have about half-and-half dead and alive, and that the five-week plants would all die.

### **Discussion**

The data and observations made during this experiment are important in that they may assist scientists who are fighting this species to halt or at least slow the growth. This will give them time to find a more efficient and possibly less ecologically risky method for dealing with Elodea. Furthermore, the methods and processes used and outlined in this experiment can be used for future research on Elodea as well as other aquatic plants, such as *Hydrilla*. Desiccation proved to be very effective on the survival of this species. However, further research will be needed on a larger scale and in an environment more akin to the habitat such plants are growing in, in order to be considered for application on a larger scale.

Our hypothesis was supported by the desiccation experiment in showing that

desiccation was an effective means of killing the research specimens. One may be hesitant to use such methods on a much larger scale for fear of unforeseen ecological impacts. However, a study conducted in the wetlands of France looked at the overall impact that desiccation can have on native species, and they received encouraging results (De Wilde et al., 2017). This study found that the desiccation period had no negative impacts on the richness of the native species. This is a good sign that desiccation is an effective method to control Elodea because it can be used to kill Elodea while also possibly increasing the levels of native plant species. Desiccation was a particularly impactful means of controlling the population of Elodea, but it is worth noting that researchers cannot rely on just one method of control for this species.

An article published in *Hydrobiologia* suggested another unusual approach to controlling invasive species while minimizing overall ecological impact. In it, the authors stated that invasive species are often excluded from new environments by the natural inhabitants (Havel et al., 2015). This is an interesting idea because invasive species are known to cause decreased diversity in an ecosystem. Reintroducing the native species back into their original environment could prove useful in restoring the ecological health of the habitat while also providing a means of competition for the alien species. Using these reintroduction methods along with desiccation could prove to be too much for Elodea to handle.

Previous observations by various professionals who have observed both Elodea and *Hydrilla* have noted that drying out times had little to no impact on the survival of the plants. One hypothesis for such an observation looks at tubers buried

under the soil. Tubers have been known to survive for years with little to no water or nutrition and sprout a new stem when conditions are favorable again. Another possibility is that the new bloom brought about after the desiccation period was simply an influx of plant fragments from upstream that took root when the area was rehydrated. This theory is likely what is occurring with the invasive populations of this species. It has been observed that only male flowers are present in waterways of the U.S., suggesting *Elodea* is reproducing through fragmentation instead of sexual reproduction (Thiébaud et al., 2016).

It is also interesting that algal growth was found floating on the surface of the water in the experimental containers. This further suggests that there is an association between the algae and *Elodea*, but the nature of this relationship is still unknown. We also observed a foul odor, similar to what has been described previously. Algal growth was observed in all but a few of the containers, control and experimental alike. The experimental containers saw more growth than the control containers. This is curious since they are thought to coexist, and these findings could provide the basis for further exploration into the exact relationship between *Elodea* and algae. Further research could include identification of the algae present and the ecological impact of removing one from the other.

The control plants saw growth well below the average that has been observed in the wild, which is up to 0.4 centimeters per day (Darrin, 2009). This could be explained by the fact that nutrients were inadequate for sufficient growth in the containers. Another explanation is that these plants were exposed to solely artificial light, as natural light was excluded through the use of a denim sheet. Furthermore, they were exposed to nearly constant temperatures

because they were kept inside. These conditions may have impacted the amount of growth that took place. Two more possible explanations for such slow growth may be the soil being a shallower depth in the container than normally found in the wild and a lack of water current in the containers. It is thought that water current could influence growth rates.

Testing growth rates of *Elodea* by comparison within substrate types allows us to find two major areas of interest for potentially controlling this invasive species. By finding the substrate in which *Elodea* grows best, we can start looking for areas that could be taken over more easily. This allows for preventative measures to be taken. Additionally, by finding areas that are less conducive to the growth of *Elodea*, we can isolate areas to test the combined effects of poor substrate and desiccation.

These results are interesting in that they give much more availability to researchers in terms of trying to control the growth of the species. It is noteworthy to reiterate that the desiccation experiment was carried out using sand as the substrate, which dries out quicker than the gravel and clay substrates. Taking this into account, it is hypothesized that different results might be achieved in future experiments if a different substrate were used.

### **Conclusion**

The results of this study suggest that desiccation could be the perfect solution to rid our waterways of *Elodea*, although further studies need to be conducted on a larger scale in order to confirm this management strategy. The fact that all of the experimental specimens died suggests that desiccation has more of a profound impact than previously thought. It was originally thought that the length of duration increased the effectiveness of desiccation, but the specimens that were

dried out for two weeks died just like the weeks before desired results are achieved.

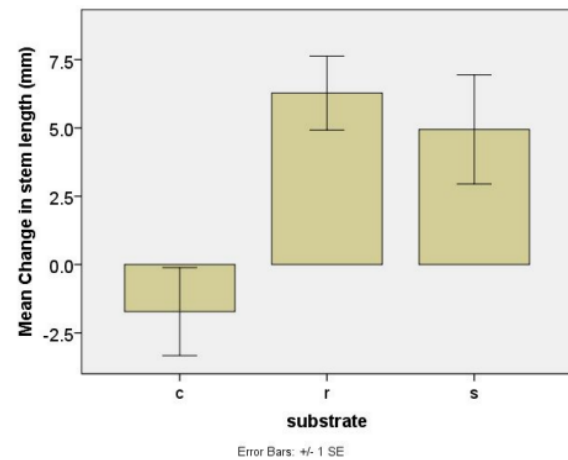
The ecological impacts of the current interventions being employed have yet to be researched, which is why they are all being used sparingly. A slow drawdown of a given body of water would ensure that any animals living there would be able to escape to another area (Durand et al., 2016). Plants that are native to the area run the risk of being killed as well, but that risk may be worth it considering that Elodea has a good chance of outcompeting the native species (J. Ballenger, personal communication, February 2018). In all, the potential risks have to be weighed against the potential benefits when deciding which method should be used. As was previously stated, further research needs to be conducted in order to decide which one is best.

This experiment was performed on Brazilian Elodea, but a potentially bigger threat is *Hydrilla*, which has been observed growing faster and in more areas than elodea. The reason we used Elodea in this experiment is that *Hydrilla* cannot be found during the winter, which is when the sample population was collected. Based on the similarities between Elodea and *Hydrilla*, we see Elodea as a good model to conduct these experiments in the absence of *Hydrilla*. While the data clearly show that desiccation worked for killing off Elodea, it is important to note that the procedure developed in this experiment can easily be adapted for repetition with other conditions and other species to find the best possible solution to the problems that these invasive species pose for our waterways.

Testing the substrates does not provide a direct solution to the problem. However, it can help to identify potentially problematic areas before they are overrun. Future preventative actions can then be applied to

specimens that were dried out for five weeks in these areas that are favorable for Elodea growth.

**Figure 1.** We compared the mean changes in stem length ( $\pm 1$  S.E.) of the plants in clay (c), rock (r), and sand (s) substrates.



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## **The Lion in the South China Sea: Strategy Proposals and the Cost of Passivity in the South China Sea**

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### **Abstract**

The rise of China, from a developing nation to the second-largest economy in the world, has caught the US off guard. The United States foreign policy in the South China Sea has been weak and reactive. This paper examines why the US has implemented this ineffective policy. It also analyzes the risks of continuing on the current trajectory. Additionally, this research shows the importance of the region for numerous militaristic, economic, and diplomatic reasons, and the cost of surrendering the region to China. Finally, this paper proposes aggressive solutions to the issue revolving around strategies that have been looked at by the US Naval College. These strategies include a time-sensitive rollback, containment, and multi-faceted offset punishments. Combining all aspects of the research should show the consequences of inaction and the potential end of unmatched US global supremacy.

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Timothy Sabau is a freshman at Columbus State University from Youngstown, Ohio. He graduated from Champion High School in 2013. Before attending college, he worked in Army Special Operations as a member of the 3rd Ranger Battalion. He is currently a double major in Political Science and Liberal Arts, and a new member of the CSU Honors College. Upon graduation, Timothy would like to have the opportunity to serve again, preferably working as an analyst in one of the intelligence agencies. He has a lot of interest in Africa, South America, and Asia and hopes to specialize in one of those regions as an intelligence analyst.

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### **The Lion in the South China Sea: Strategy Proposals and the Cost of Passivity in the South China Sea**

In Chinese culture, the lion symbolizes strength, stability, and superiority (“Lion – symbolism,” 2014). China has often been referred to as the lion (Jinping, 2014; Lanteigne, 2009; Ng and Chen, 2014). Going back as far as the early 1800s, the great general and conqueror Napoleon Bonaparte is thought to have said, “China is a sleeping lion. Let her sleep, for when she wakes, she will move the world” (Bonaparte, as cited in Jinping, 2014, paras. 18). Today, 200 years later, that quote was referenced in a speech celebrating Sino-French relations by Xi Jinping (2014), the president of China, when he said, “Now China the lion has awakened” (paras. 18). What Napoleon could not have predicted was how large this lion would become. In those 200 years, China transformed from a developing nation plagued with in-fighting and uncertainty of its future to challenging the United States for global dominance, and for those 200 years, Chinese strategy had focused on long-term planning (Fawcett, 2017). In particular, they worked to keep a low profile on the world stage and, most importantly, stay off the US radar (Lanteigne, 2009). While the US was focused on Russia and the Middle East, China focused on economic growth (Sukharev, 2019). China slowly bought up 1.2 trillion dollars of US debt and started developing cyber warfare capabilities rivaling the US (Kania, 2018; Yeung, 2019). China did not want an arms race until they had the cyber capabilities to steal US military technology, and economic leverage to make the US hesitant to retaliate (“Chinese Hackers,” 2019; Griffiths, 2019). One of the most significant edges the US has maintained is its dominant economy and control over global trade, but China has a plan to deal an impactful blow to both of

those areas in one move: taking over the South China Sea.

The South China Sea is one of the most heavily traveled and traded geographic areas globally (Kaplan, 2015). The South China Sea (SCS) is invaluable for global trade. Most analysis on the SCS predicts that around 50% of all sea-based trade goes through this region, and the energy trade relies heavily on this area (Kaplan, 2015). The amount of oil that passes through the SCS is three times more oil than the Suez Canal and 15 times more than the Panama Canal (Kaplan, 2015). Additionally, roughly 33% of all maritime traffic globally moves through this sector (Kaplan, 2015). With one out of every two trade vessels globally going through this area, whoever controls it also has direct influence over trillions of dollars in the global economy (Kaplan, 2015; “World Factbook,” 2020). The US navy currently controls most of the area and has an unwavering stance on freedom of navigation and, as such, typically only intervenes to protect ships being illegally targeted or enforces directives approved by the United Nations (“United Nations Convention on Law of Sea,” 1982). What makes SCS even more appealing is that underneath the sea is an estimated 900 trillion cubic feet of natural gas (Kaplan, 2015). Trade and resources are not the only commodities that are involved with controlling the region. Equally important is the political capital from the countries that benefit from using the SCS. Geopolitically, US allies in the area, including Japan, South Korea, and Taiwan, rely on the SCS for over 60% of their energy supplies (Kaplan, 2015). Militaristically, the SCS has numerous islands that enable the creation of landing strips, anti-air defenses, or even forward operating bases that would give China a massive geographic advantage in first-strike capabilities against our allies in the region.

### Recent Escalation

The SCS has devolved significantly over the years; in fact, many in the US Navy and Defense Department have started referring to the SCS as a "warm" war between the US and China (Fabey, 2017). China has increasingly been testing the level of coercion it could apply without consequence (K. Zhang, 2019). Since about 2010, China has dramatically surpassed the other countries in the region in terms of strength, including US allies that no longer have the capabilities to fend off China without the help of the US (Scobell, 2018). In 2014, China pushed into a contested territory of the SCS and sent in the coast guard to harass Philippine ships around Second Thomas Shoal (Scobell, 2018). The situation devolved even further when the People's Republic of China (PRC) sent in coast guard ships close to the Philippine vessels to the point that both the US and PRC scrambled aircraft in preparation to engage each other (Scobell, 2018). Around the same time, China started to build islands, after losing the legal battle to claim absurdly large portions of the SCS (Brands and Cooper, 2018). Most policy analysts agree that since 2014, tensions have been escalating at levels much faster than usual (Brands and Cooper, 2018). The worst aspect of the situation is not just the aggression but the preemptive steps China has been taking in preparation to remove the US from the SCS, if needed, through force (Erickson, 2016). These steps include developing hypersonic missiles capable of making it through our naval air-defense systems, building military runways on the man-made islands, and preparing anti-air defenses for the region (Erickson, 2016). China has also become increasingly vocal about wanting the US removed from the SCS, as highlighted by Luo Yuan (2019), the deputy head of the Chinese Academy of Military Sciences when he gave a speech at the 2018 Military Industry List

summit he said, "What the United States fears the most is taking casualties. . . [An attack on an aircraft carrier would claim at least 5,000 lives] . . . We'll see how frightened America is," (as cited in Simkins, 2019, paras 3-5).

### Thucydides Trap

It is clear that the SCS situation is becoming increasingly hostile; however, before proposing solutions, it is important to understand why the policy from the US has been so weak. The US policy in the SCS has been a policy of reaction at best, capitulation at worst. One of the main reasons for this precedent is to avoid Thucydides Trap (Erickson, 2016). This argument is based on a theory that, throughout history, an existing superpower sees an emerging power as strong enough to be a threat, which causes an often irrational fear that leads to conflict (Lee, 2019). Harvard political scientist Graham Allison first proposed it through analysis of Athens and Sparta and the resulting Peloponnesian War; additionally, he was able to identify 16 cases of emerging powers, and 12 resulted in war notably with Germany and Britain in WW1 (Muscato, n.d.). This idea was deeply implemented into Sino-American relations and accepted as precedent (Erickson, 2016). The major problem with this idea is that it is outdated in many aspects. The 75% predictive indicator of conflict is derived from 12 out of 16 of the emerging powers resulting in war, but the theory relies on many ancient cases, potentially skewing the results ("Can America and China Escape Thucydides's Trap," n.d.; Da Costa, 2018). There was no war in the 1990s between the UK and France vs. Germany, or the US vs. Russia, mostly because of the risk of nuclear annihilation ("Can America and China Escape Thucydides's Trap," n.d.). Since the advent of the UN and atomic weapons, Allison's theory has been correct 0% of the time, so it may be more helpful as a minor

variable in foreign policy rather than the end-all be-all it is today (“Can America and China Escape Thucydides’s Trap,” n.d.). Admittedly, supporters of the Thucydides Trap point out that the period between WW2 and today is extremely short; therefore, it is unfair to claim that the theory is obsolete. That is a valid point, but using a theory with a predictive indicator that has been entirely incorrect for 75 years is unheard of. At the very least, this theory has handicapped the US while giving China the ability to push the US around in the region, causing tensions to rise rather than lower.

### **Consequences of Inaction**

If the US changes nothing and allows China to continue operating the way it has been, eventually, China will attempt to take over the region one step at a time (Scobell, 2018). China gaining full control of the region could cause a trickle-down effect of problems (Chubb, 2019; Kaplan, 2015; K. Zhang, 2019; Scobell, 2018). The first and most predictable change would be the US losing control of trade in the region since whoever controls the territory also has the most significant impact on trade in the region. Submitting this sector would mean the US would be giving up control of 50% of global sea-based trade (Kaplan, 2015). Additionally, complete Chinese control of the SCS would put the responsibility of fair trade and regional protection primarily on China. With Chinese control of the area, US military escorts or naval protection for US allies in the region could potentially be hindered as the Chinese Communist Party (CCP) has moved towards a more assertive position in the area (Chubb, 2019). The effects of reduced US escorts are more distressing when taking into account the increase in Chinese activity in contested waters (Chubb, 2019). Before 2012 it was common to have little or no activity in these zones typically, there would be 0 incidents per month with one month hitting 24

incidents (Chubb, 2019). After 2012 these instances have exploded with incidents rarely getting below 24 and hitting upwards of 140 incidents a month (Chubb, 2019). Unfortunately, China has been hostile with our partners in the region and is often openly coercive, sometimes militarily, to the necessity of US naval intervention (K. Zhang, 2019; Scobell, 2018). China could easily embargo or otherwise sanction any one of our allies, and it would take an increased amount of time for the US to respond due to the increased geographic distance. With the trillions of cubic feet of natural gas in the SCS, China's problem with energy sustainability would be mitigated or gone; as a result, their economy would have increased resources to grow even faster (J. Zhang, 2011; Shen, 2001). Based on the world economic analysis done by HSBC, it's already estimated that China will pass the US economy by 2030 (Henry, 2018). Adding a massive influx of natural gas and oil would likely increase the speed at which China would overtake the US (J. Zhang, 2011; Shen, 2001).

Regarding the energy supply of US allies in the region, these countries rely heavily on the SCS for oil imports (Kaplan, 2015). If China controlled the SCS, they could exploit this reliance and use it as a powerful negotiating tactic. The counter-argument to this is implied US intervention if China starts to demonstrate this kind of behavior, but this opens the door for another problem. Once the US submits control of the area, it would be challenging to reassert control (Erickson, 2016). Considering the artificial islands, the growing strength of the Chinese navy, and the surplus of missiles they have been building, US readmission in the area would be nearly impossible (Erickson, 2016). Some secondary effects of losing control of the SCS include losing a massive militaristic transportation highway without Chinese consent while simultaneously

giving China the ability to set up missiles, troops, and military resupply centers dangerously close to US allies (Chubb, 2019; Erickson, 2016). Lastly, submitting the SCS to China would allow them to increase decentralized first and retaliatory strike capabilities and build a broader, more powerful sphere of influence (Buszynski, 2012).

### **Proposed Solutions**

#### **Rollback**

The strategy change I am proposing has three aspects, all of which are modified strategies that have been looked at by the Naval War College: a time-sensitive rollback, containment, and offset (Brands and Cooper, 2018). Rollback is the most aggressive part of the plan and involves pushing the Chinese out of the areas they have illegally obtained through coercion and island-building. This option would put the US back in full control of the region but has the highest probability of devolving into military conflict (Brands and Cooper, 2018). Some argue the risk is too high, but it could also be argued that the risk of not doing it is much higher for the US. As it stands right now, China is in the middle of a massive crisis due to attempted removal of sovereignty in one of its most profitable cities, Hong Kong (Editorial Board, 2019). What makes it even more advantageous for the US is the fact that this crisis has brought to light the numerous human rights abuses occurring in China (Ochab, 2019). The events and resulting fallout from Hong Kong have stripped China (temporarily) of the advantage of global and domestic public perception (Silver, 2019). Until this incident blows over, China cannot afford to look morally bankrupt. It is doubly impactful because of the Chinese foreign policy strategy. They have a massive emphasis on long term planning, which is how they have outmaneuvered the US thus far (Fawcett, 2017). The Chinese are more than willing to

take a massive loss if they believe it can turn into a substantial win years down the line (Fawcett, 2017). China would be very unlikely to risk starting a war they are not equipped to win yet, especially if it means possibly losing the population's support in the process, given the CCP's deep reliance on public perception (Sun, 2011). More likely, they would resist heavily but eventually allow a rollback to occur. Even if it is not a complete rollback, it is essential to retake every inch the US can while they still have naval supremacy in the sector (Brands and Cooper, 2018).

#### **Containment**

The next important step the US needs to take is containment. This strategy is essentially refusing to submit any additional territory to China (Brands and Cooper, 2018). It is considered less risky than rollback; however, the reduction in risk comes at the price of a reduction in efficiency (Brands and Cooper, 2018). This strategy has supposedly seen implementation already, but without the willingness to actually use military force to hold steady, it becomes woefully ineffective (Brands and Cooper, 2018). Hypothetically, if this strategy is going to be used by itself and work as planned, it would solve most US problems for a little while. By not giving up any additional territory, the US would still be in control of the trade routes, and they would also still maintain the ability to use the SCS as a way to freely move military and civilian vessels (Brands and Cooper, 2018; Kaplan, 2015). Additionally, the US would be well-positioned to keep its allies safe and, thus, stop the centralization of regional power in China's hands. However, given potential complications, one way to increase the chances of success for this method is to include some degree of rollback first.

A large part of China's foreign policy is built around long-term planning, so China



likely realizes that containment alone still allows them to accumulate strength (Fawcett, 2017). China's economy is expected to surpass ours in the next few decades, combined with their cyber capabilities; they will have the tools to start surpassing the US in a militaristic sense (Henry, 2018; Ying-Yu Lin, 2019). Once that happens, any foothold they have can be used as a spearhead to start removing the US. If China gains militaristic superiority in the region and the US does not retake the islands they have built or illegally claimed, the US will be fighting at a severe disadvantage (Brands and Cooper, 2018). With anti-air systems and hypersonic missiles staged on those islands, the US would be highly unlikely to win in a militaristic sense (Freedberg, 2019; Mizokami, 2019, 2020, in press). The US Navy did war games in both 2013 and 2018, offering further evidence that containment without rollback would likely result in the US being outmatched in the SCS with China winning both times handily (Freedberg, 2019; Mizokami, 2019). A 2019 war game showed that utilization of the most up to date missile technology could result in a win for the US (Mizokami, 2020). The 2019 war game also shows the severe risk of allowing China to establish man-made islands as staging areas for hypersonic missiles (Mizokami, 2020). The second important part of containment is the US heavily beefing up their naval presence to disincentivize the likelihood of an attempted counter rollback or similar ploy (Brands and Cooper, 2018).

### **Offset**

Part three of the plan is offset. Offset involves indirect punishment when China misbehaves (Brands and Cooper, 2018). For example, if China builds an island illegally, then US/UN sanctions should be strictly implemented. If China decides to attack a Philipian ship, the US should offer funding

or indirect military assistance to a close Chinese neighbor they are at odds with. Offset can also be used inversely by rewarding China for positive steps taken. This type of offsetting strategy is one of the most popular among analysts, mostly because of its low risk but still potentially damaging to Chinese interests, additionally, it has seen implementation more recently (Brands and Cooper, 2018; "Guide US-China Trade War," 2020). Unfortunately, this is a strategy that needs to be used with rollback and containment, and/or taken to the extreme; otherwise, it is nothing but a minor inconvenience for China. A tariff on oil does not matter if they just seized trillions of cubic feet of natural gas because the US was unwilling to hold the containment line. Offset should be used as an enhancement to a more aggressive strategy, not an entire policy. When looking at US policies globally; offset appears to be one of the experts' favorite methods of keeping nations in check with offsets affecting the Balkans, Belarus, Burundi, Cuba, the DRC, Iran, Iraq, Libya, North Korea, Somalia, Sudan, Syria, and Zimbabwe (Elmerraji, 2020). Rightfully so, it has been useful in getting misbehaving governments to submit to US requests. For example, it has been successful in countries like Russia, who have been deeply affected due to years of hard-hitting offset punishment (Slobodian, 2018). Same for North Korea, who had no choice but to negotiate or crumble into chaos without the ability to feed its people thanks to sanctions (Albert, 2019).

Unfortunately, offset seems to have minimal effects by itself in regard to China (Chen, 2019). It causes certain inconveniences for China, but hardly enough to incentivize them into behaving, as clearly demonstrated by their refusal to listen to anything the US requests, even if it means helping an unstable North Korean dictator



subvert UN sanctions (Cohen, 2018). There are a few reasons offset is not as effective with China as it is with other nations. First, unlike North Korea, the Chinese economy is an absolute powerhouse (Chen, 2019; Henry, 2018). US sanctions may cost them a few billion dollars, which would cripple a country like North Korea, but for the Chinese, it is just another drop in the bucket (Chen, 2019; Henry, 2018). The second reason it is not adequate by itself is the fact that the Chinese people have highly restricted access to the news around the world (Griffiths, 2019). Information painting the CCP in a negative light, including information that they are suffering economically because of some punishment imposed on the country for doing illegal things, is very difficult to come by (Griffiths, 2019). Something as small as sanctions should not be difficult to hide from the population given the “Great Firewall” the CCP has designed and implemented (Griffiths, 2019). Due to the combined effects of Chinese governance, China is likely to get reduced pressure from the citizens to start behaving in contrast to a country like Russia. When you combine offset with rollback and containment, it becomes substantially more effective because China is not only feeling economic and diplomatic pressure but also militaristic and geographic restrictions when they violate international law. The combination of strategic effects makes any retaliation a costly endeavor.

### **Comprehensive Strategy**

#### **Full Breakdown**

The strategic recommendation I am proposing would combine rollback and containment, with an enhanced version of offset. The overarching policy goal of this strategy is to invert or mitigate the current relationship in the region. As of the current relationship, time positively influences the Chinese position in the region while

significantly harming the US position. This dynamic is because China is positioned better geographically to control the region, and time is closing the economic and militaristic deficit that has advantaged the US thus far (Henry, 2018).

#### ***Part One, Rollback Breakdown***

The first step in changing this relationship would be a massive build-up of US naval power in the area. This build-up would allow for greater strategic mobility, as containment and offset are heavily reliant on the US's projection of strength (Brands and Cooper, 2018). The next step would be the rollback through the utilization of US military strength to blockade parts of the Spratly Islands, with an emphasis on the artificially militarized features China has built. The Spratly Islands have incredible strategic importance ranging from the abundance of natural resources to their positioning among important trade routes (Hasan, 2019; Kaplan, 2015). Additionally, the Chinese build-up of artificial islands in the area is extremely abnormal (illegal) since the claim to the islands are heavily disputed between China, The Philippines, Malaysia, Vietnam, Brunei, and Taiwan (Brands and Cooper, 2018; Hasan, 2019).

#### ***Part Two, Containment Breakdown***

Containment would consist of (a) restricting China from the recapture of the Spratly Islands, (b) heavily patrolling areas of strategic importance, and (c) monitoring areas outside Chinese territory (As allotted by UNCLOS, or other legal agreements) to prevent future construction of artificial islands. There should also be an emphasis on Scarborough Shoal as it was de facto taken over by the Chinese in 2012 despite the Philippines having both a historical and legal claim to the area based on the UNCLOS exclusive economic zone (EEZ) (Granados, 2019). While not as strategically important as the Spratly Islands, it would provide political capital for the US in the

Philippines, and signal to other allies in the region the US has their backs (Hasan, 2019).

### ***Part Three, Offset Breakdown***

The final part of the strategy would consist of incredibly hard-hitting economic and diplomatic offset maneuvers by the US. Economically, (a) US manufacturing and technology companies should limit exposure or completely pull out of China as quickly as feasible, (b) all US foreign aid should be cut to China, (c) foreign investment in China should be heavily restricted, and (d) tariffs should be levied accordingly based on Chinese aggression. These steps may seem overly aggressive when looked at in a vacuum; however, when aspects outside the SCS are taken into account, they appear more moderate. Removal of US companies in China is likely necessary even without considering the SCS since China has been stealing or attempting to steal from US companies that are present in China and implementing coercive intellectual property (IP) regulations that make this process even easier (Jyh-An Lee, 2020). China currently has credible evidence indicating serious and numerous human rights abuses, so US foreign aid or independent foreign investment could indirectly help subsidize some of these abuses ("Congressional Executive Commission on China," 2015). Tariffs have already been levied against China, so modification of said tariffs to better compliment an SCS strategy is neither extreme nor unreasonable (Jyh-An Lee, 2020).

Diplomatically, stripping China of political capital should be emphasized as a proactive and reactive maneuver for aggression in the region. Specifically, this should be used to prevent China from using committee or organizational positions to bully US allies. As China's coercive and aggressive maneuvers have escalated, it is not unrealistic to predict the increased use of political capital to force US allies into

unwinnable positions (K. Zhang, 2019). For this plan to work, the US would need to diplomatically work on keeping the other regional countries united against China. The US would need to lead by example to show solidarity and reduce fears of US abandonment if regional allies were to stand up against China. Supplementing US allies in the region with militaristic and financial support could also eventually lead to the US being able to partially withdraw some of the increased naval presence this strategy calls for.

The combination of this multi-angle offset punishment would hamstring the Chinese economy, potentially slowing it down enough to halt or even reverse the current gains being made on the US, especially given how important foreign investment is to the Chinese economy (Jyh-An Lee, 2020). It would also assist in proactively countering potential future attacks on US allies in the region through non-conventional means. The tertiary effect of using a strategy this aggressive is it leaves room for positive reinforcement. For example, due to the relatively weak nature of the current policy, the US does not have any feasible economic incentives to offer China outside reducing tariffs. With the proposed aggressive strategy, the US can provide loosened restrictions on foreign aid, foreign investment, and the readmission of US companies, all of which would have incredibly positive effects on the economy compared to simply lifting tariffs (Jyh-An Lee, 2020).

### **Conclusion**

The South China Sea is incredibly valuable by almost any conceivable metric; additionally, the US has militaristic, diplomatic, and economic interests that rely heavily on the SCS (Brands and Cooper, 2018; Erickson, 2016; Kaplan, 2015). If the US were to lose control of the area, not only would they be negatively impacted in all of

those areas, but it would have a compounding effect (Chubb, 2019; Kaplan, 2015; K. Zhang, 2019; Scobell, 2018). It would help supercharge the Chinese economy, handicap US allies, and embolden China as they potentially surpassed the US in global influence, and militaristic strength (Brands and Cooper, 2018; Buszynski, 2012; Shen, 2001). On top of that, China has a long history of human rights abuses, aggressive diplomatic relations, and disregard for international law (Brands and Cooper, 2018; Editorial Board, 2019; K. Zhang, 2019). The last place the US wants to be is at the mercy of this lion. Thus far, weak international relations were based on a theory that seems to crumble when examined solely in terms of the current world order (Erickson, 2016; Lee, 2019). With China playing the long game, the US must increase pressure or risk being at the mercy of China in the not so distant future (Fawcett, 2017; Henry, 2018). One of the best routes moving forward is to quickly roll back Chinese advances while it is still possible, while also containing any future land grab attempts made by China (Brands and Cooper, 2018). Indirectly the US should punish China diplomatically, economically, or even through the threat of militaristic punishment, every attempt they make to take to knock the US or its allies out of the region (Brands and Cooper, 2018). It is beginning to appear as though the days of unipolar US supremacy in most aspects of global relations is ending. The US needs to evolve to survive. Just as China has awakened, the US must find a way to open their eyes and stop assuming that being on top for so long means they will always be there.

### **Future Work**

The proposed strategies for the SCS leaves the door open for research into the evolution of economic and territorial warfare, especially when taking into account the economies that are clashing are the top

economies in the world, and there have been massive territorial movements without a shot being fired. The "warm" war that has developed in Asia will undoubtedly affect US alliances, so an avenue of research may be looking at whether or not/how the US shifts diplomatic priority away from Europe and the Middle East and into Asia. Lastly, the relationship between China and the US could be a goldmine of future research, as both sides want to avoid war, but unlike the cold war, we do not see proxy wars either, instead an economic race to establish as much control in developing countries as possible.

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