

WRITING

ACROSS THE CURRICULUM

In the Disciplines and In the Workplace

2025



INTRODUCTION

■ PURPOSE AND SCOPE OF THE JOURNAL

Welcome to the twentieth edition (Fall 2025) of our journal of student writing at Lone Star College-Montgomery: Writing Across the Curriculum (WAC), In the Disciplines (WID) and In the Workplace (Vol. XX). The purpose of the publication remains twofold: (1) to celebrate examples of discipline, field, and profession-specific student writing from across the college, and (2) to provide students and faculty examples of such writing to use in the classroom.

■ ORGANIZATION OF THE JOURNAL

The journal is organized by program or discipline and within the latter, by genre or kind of writing important in the field. In this way, the journal showcases students using the same skills and producing the same kinds of writing that faculty and other professionals produce to communicate successfully. We ask the faculty member who submits the writing from his/her class to include a brief introduction to each piece highlighting how the student selection reflects the kind of communication and specific writing skills important in that field or endeavor. The writing included represents a great range of experience and skill on the part of the student-writers.

■ WHO PUBLISHES THE JOURNAL?

The journal is underwritten by a faculty group, Communication Across the Curriculum (CAC). CAC encourages interdisciplinary and cross-disciplinary faculty dialogue and curricular experiments. It also supports the college's Writing Across the Curriculum Initiative and sponsors the annual CAC Student Presentation Conference.

■ WHO CAN SUBMIT WORK FOR PUBLICATION?

We publish student writing from both academic and workforce programs in the college. The course instructors select and submit writing on behalf of their students for consideration by the journal. Nevertheless, we encourage students who are interested in getting their work published to let their instructors know in revising and improving their work prior to possible submission by the instructor. It is the instructor, however, who decides whether to submit.

The instructor is the expert in the field. Therefore, the journal editors and advisors wish to emphasize that faculty who submit student writing accept responsibility for guiding the writer not only in the presentation of content but also in the process of revision, editing, and the correct use of the appropriate documentation style. Use of a particular documentation format is related to the discipline, the genre, and the preference of the instructor in each writing task.

■ WE WISH TO THANK

All the student writers and the faculty who submitted student work, and especially the journal editors, Professors Ron Heckelman (English), Nathalie Brandes (Geology), Kirk Cochran (English), Mark Whitten (Philosophy) and Nathan Zingleman (Coordinator, The Write Place) for putting it all together.

The writing consultants of The Write Place, the college's Writing Across the Curriculum-oriented writing center.

The organizers of the annual CAC Student Presentation Conference: Professors Melissa Dennis (English), Sunny Zhao (Speech Communication) and Mark Whitten (Philosophy).

■ SPECIAL THANKS

Dr. De' Reese Reid-Hart, LSC-Montgomery President

Dr. Brandy Harvey, Vice President, Instruction

Kirk Bennett, Vice President, Administrative Services

Instructional Deans: Roy Turner, David Benzol, Juan Lebron, Mischelle Hopper, Michael Walsh, Mary Mendoza, and Kendra Johnson

■ VERY SPECIAL THANKS

Jackson Freese, WAC Journal Graphic Designer

Gabe Cedillo, Graphic Designer 1, MarCom

Suzanne Moore, Coord III, Marketing, MarCom

INTRODUCTION CONTINUED

■ CALL FOR SUBMISSIONS, VOL. XXI (2025-2026)

We seek examples of discipline, field-specific and workplace writing for the twentieth edition of the journal (Vol. XXI) to be published in the summer/ fall 2026. Faculty in all disciplines, professional and/or certificate and workplace programs across the college are invited to submit student writing. Students who would like to submit writing should let their instructor know of their interest. Students will then revise their work under the guidance of their instructors before their instructors submit the writing to the journal. Submissions must be submitted ELECTRONICALLY in Microsoft Word. No PDFs please. Use the one-step submission form which is linked on the following webpage, or via the QR code at the bottom of this page:

<https://LSCMontgomeryCAC.com/WAC-Submissions/>

All completed submissions include: (1) An online submission form provided at the above link and completed by the instructor. (2) The faculty member's introductory paragraph included in the online form; and (3) a student release form signed by the student-writer. The release is a separate document from the online submission form, and is also available via the link above or QR code below.

The brief introductory paragraph (150-word limit) written by the submitting instructor must include the name and number of the course but most importantly, an explanation of how the submission effectively illustrates a kind of writing, and/or writing skills important in that form of expression in the discipline, field or profession.

Previous editions journal are also available at
<https://lscmontgomerycac.com/>

E-mail questions to:

Nathalie.N.Brandes@LoneStar.edu

LSC-Montgomery Writing Across the Curriculum
Initiative and The WAC Journal,
c/o: LSC-Montgomery Dept. of English



DEADLINE FOR SUBMISSIONS: MAY 31, 2026

■ HOW SUBMISSIONS ARE SELECTED FOR PUBLICATION IN THE WAC JOURNAL

The faculty editors of the journal seek to present writing from as many academic disciplines and workplace programs as possible, limited only by the number of usable submissions and space available in the publication. As explained under “Purpose and Scope” and “Organization,” the journal is organized first by discipline and then by genre. This is intended to show the variety of genres within a discipline or area, and to assist both faculty and students to use the selections as instructional models if desired.

Generally speaking, The WAC Journal does not include poetry, fiction, drama, photography and art per se. Additionally, it is not intended merely as a collection of assignments or “student writing.” The writing published is intended to represent “real” discipline-linked expression and communication, akin to what is found with- in particular fields as well as professions. Most of the genres included are tradition- ally associated with specific disciplines; however, we also consider pieces that vary from the traditional forms. Submissions of mixed- genre and experimental writing are welcome.

The journal celebrates writing qua writing and we thus ask each faculty member who submits a piece to write an introduction to it. This introduction, as much as possible, presents the writing as an effective demonstration of discourse in a field and genre, and/or those notable cross-disciplinary skills useful for clear and precise communication. This introduction generally contributes significantly to the editors’ and journal readers’ understanding of the specific contributions the piece makes in illustrating communication style within a discipline. The faculty intro is not intend- ed to be an introduction to the course or program of study per se.

The degree of revision required after a piece has been submitted is a factor in the selection process. To minimize editorial intervention after a submission has been received, the editors ask the submitting faculty to work with the writer very closely to revise and prepare the piece for submission and consideration. This includes but is not limited to fullness of citations where needed as well as consistent and appropriate documentation style.

A WAC Journal Submission Guide is available at the CAC website to assist both faculty and students with this process. The LSC-Montgomery writing center, The Write Place (G103) is also available for help with all writing matters.

■ THE WAC JOURNAL ONLINE SELECTIONS

Some writing, especially that with a significant visual component, is available at the journal website. Links and QR codes are provided in the journal for these selections.

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WAC JOURNAL 2025 SPECIAL WRITING COMMENDATIONS

The editors wish to commend the writers of the following work:

Outstanding Writing in Art History

- Zacharie Letter, "De Materia Medica: Cultural Influences on Style in the Juliana Anicia Codex and Codex Neapolitanus," research paper, (D. Longman, instructor) pg. 10

Outstanding Writing in English

- Jess Tran, "The Archetype of Rice in Three Vietnamese Folktales," cultural analysis, (R. Heckelman, instructor) p. 46
- Kaitlyn Glaesmann, "After the Storm: A Recovery Plan for Emilia," literary analysis, (W. Hanks, instructor) p.36
- Vanessa Reyna, "The Elusive Search for Absolutism," interdisciplinary analysis, (C. Gonzales, instructor) p. 42

Outstanding Writing in Science (Biology)

- Kirstin Lee, "An Infamous Mystery: An Overview of Major Depressive Disorder," research paper, (A. Howard, instructor) pg. 18
- Blake Restivo, "Isolating and Analyzing Fungi for Purposes of Bioremediation," poster (formatted as per National Conf. on Undergraduate Research (NCUR) Guidelines for National Conference presentation, April 2025), (A. Iyer, instructor) pg. 28

Outstanding Writing in Medical Radiologic Technology

- Katelyn Sorter, "Ultra-High Field MRI and its Diagnostic and Research Potential," research paper, (K. Kidder, instructor) pg. 70

Outstanding Writing in Nursing

- Abdulmajeed Alhamawi and Salem Klenk, "Stay Active, Stay Healthy – Why Fitness Matters," researched teaching project, (E. Cerreta, instructor) pg. 92

Outstanding Writing in Social Science (Psychology and Government)

- Francesca Yanos, "Brain and Behavior: The Diathesis-Stress Model of Schizophrenia in Autoimmune Disease Patients," research paper, (D. Oviatt, instructor) pg. 114
- Tristan Montebianco, "Analyzing Cybersecurity Challenges and Strategies in Texas Local Governments," research paper, (F. Ross, instructor) pg. 50

Outstanding Writing in Music History

- Cristian Rodriguez, "How the Piano Shaped Music: The Technological Influence on Sonata Style," research paper, (R. Burgan, instructor) pg. 77

Outstanding Writing in History

- Kaylee Hopkins, "Napoleon Crossing the Alps," contemporary art analysis, (C. Livingston, instructor) pg. 64

Outstanding Writing in Philosophy

- Joana Figueroa, "Deontological Discrepancy: Do Kantian Ethics Falter in the Face of Moral Luck?," argumentative essay, (M. Williams, instructor) pg. 100

De Materia Medica: Cultural Influences on Style in the Juliana Anicia Codex and Codex Neapolitanus

Research Paper by
ZACHARIE LETTER

ARTS 1303: ART HISTORY - PREHISTORY TO GOTHIC

Zacharie Letter provides an excellent examination of Byzantine manuscripts that stands as an exemplary model for interdisciplinary studies. Letter fuses scientific studies with formal and historical research in art history to provide a compelling argument for the choices made by Byzantine patrons and scientists when crafting herbal pharmacopeias.

- Darren Longman

Abstract

Pliny the Elder and his contemporaries of the first century debated the use of illustrations within herbal manuscripts, citing issues in the accuracy of copyists and a plant's varied appearance across seasons and life stages. Even so, many of the surviving recensions of famous herbal pharmacopeias of the time, including those of Dioscorides' *De Materia Medica*, are known for their stunning botanical imagery. Two such manuscripts from the Byzantine – the Juliana Anicia Codex and the Codex Neapolitanus – contain illuminations that display a dizzying contradiction of likeness and disparity. This paper examines the formal elements of plants depicted in these codices to determine their stylistic divergence in the reproduction of shared archetypal forms. These divergent traits are placed within a cultural context to elucidate the reasoning behind the stylistic choices of their creators. It concludes that patronage and intended use played the largest roles in shaping the variance between these sibling codices.

De Materia Medica

De Materia Medica, published under the original Greek title *Περὶ ὅλης ἰατρικῆς*, was an unillustrated herbal pharmacopeia detailing the medical applications of over 600 plants, 35 animal products, and 90 minerals (Janick and Stolarczyk 9). Originally published in 65 CE as a series of five books organized by drug affinity, *De Materia Medica* was the culmination of years of study and travel by author and physician Pedanius Dioscorides (Janick and Stolarczyk 9). This seminal work became the exemplar for herbal treatises and remained in circulation in various forms and at least seven languages for over 1500 years until the Enlightenment period. The secular nature of its subject matter kept it in circulation throughout centuries of shifting powers and religious upheaval as it remained popular throughout the Byzantine era amid the Christianization of Europe while also being heavily circulated throughout the Islamic Empires. This paper analyzes the stylistic influences of two particularly famous illustrated

recensions of *De Materia Medica* (DMM) produced during the Byzantine era: the Juliana Anicia Codex and the Codex Neapolitanus.

Origins and Formal Analysis

The Juliana Anicia Codex (JAC) is the oldest surviving illustrated version of DMM. The codex measures 380 x 310 mm and is executed with ink and tempera on vellum. It contains 492 folia (984 pages) including 383 full-page plant depictions, 66 depictions of animals, 23 bird depictions, and several other illustrative portraits including two depictions of Dioscorides among other well-known physicians and a donor portrait of Juliana herself (Chavannes-Mazel, *From Copy to Copy* 39). In addition to an alphabetized revision of DMM, the JAC also contains several chapters from the herbarium of Crateuas the Rhizotomist, excerpts from the works of Galen of Pergamon (Chavannes-Mazel, *The Long Shadow* 150), and various poems and sections of prose concerning herbs, poisons and antidotes, fish, and birds (Tomaselli). The JAC was created in Constantinople in 512 CE as a gift to Western Roman princess Juliana Anicia from the citizens of the Honorata district and currently resides in the Österreichische Nationalbibliothek in Vienna, Austria. The manuscript has long been lauded for its extravagant style and fine naturalism, setting it apart from the characteristic stylization often associated with Byzantine art (Fig. 1). Chavannes-Mazel introduces the JAC as “the most famous, most spectacular plant manuscript of all” (*From Copy to Copy* 39) while Janick and Stolarczyk praise its “gloriously illustrated” images (10). These illustrations were likely executed by several artists of varying skill as evidenced by slight variations in technique and quality.



Fig. 1. Comparison of the Dragon Lily in the JAC (left) and CN (right). Juliana Anicia Codex, c. 512 CE, ink and tempera on vellum, 380 x 310 mm, Österreichische Nationalbibliothek Vienna, Austria. Codex Neapolitanus, c. late 6th – early 7th cen. CE, ink and tempera on vellum, 287 x 260 mm, the Biblioteca Nazionale Naples, Italy.

The Codex Neapolitanus (CN) is smaller than the JAC with 172 folia (344 pages) also executed with ink and tempera on vellum. The CN, however, contains more images at 406, made possible by reformatting the images 2–4 to a page, with only 2 images allocated to their own page (Janick and Stolarczyk 11). This version of DMM contains only the plant components, alphabetized by their Greek names, with no animal or mineral information and none of the accompanying portraiture or additional literary works included in the JAC.

Although the exact origin of the CN is not certain, it has been dated to the late 6th – early 7th centuries and hypotheses for its birthplace in either Ravenna, Italy or Constantinople have been argued (Janick et al. 334; Thomas 246). Neither the patron nor the intended recipient of the manuscript are known, though its provenance traces its use in various institutions such as the monastery of San Giovanni Carbonara in Naples and the Medical School of Salerno (Janick and Stolarczyk 11). It currently resides in the Biblioteca Nazionale in Naples. In contrast to the JAC, the images of the CN appear more stylized with bolder line weight, fewer color variations, a greater tendency toward symmetry, and a more simplistic rendering of forms (Fig. 1). Like the JAC, the CN is likely the work of a whole team of artists and scribes.

Sibling Manuscripts: Classical Archetype Theory

Much of the scholarship surrounding these two manuscripts has concerned the classical archetype theory of transmission, which asserts that the plant images in both these and other Dioscoridean codices were based on an original set of archetype images created nearer to the time of the release of DMM (Janick and Stolarczyk; Thomas; Janick et al.). What form these lost archetype images took is not known, but hypotheses suggest that the images of these codices descend from a collection of illustrations owned by Juliana's great-grandfather, scholar and Roman emperor Theodosius II (Janick and Stolarczyk 15; Janick et al. 338). Others propose the images originated earlier and were rendered at a larger scale on *pinakes*, or whitened wooden boards (Thomas 262). Whatever form these images took, it is easy to see that illustrations of the JAC and the CN descend from a common ancestor.



Fig. 2a. Comparison of *Polygonatum multiflorum* in the JAC (left) and the CN (right). Fig. 2b. Comparison of *Carthamus lanatus* in the JAC (left) and the CN (right). *Juliana Anicia Codex*, c. 512 CE, ink and tempera on vellum, 380 x 310 mm, Österreichische Nationalbibliothek Vienna, Austria. *Codex Neapolitanus*, c. late 6th – early 7th cen. CE, ink and tempera on vellum, 287 x 260 mm, the Biblioteca Nazionale Naples, Italy.

In a study by Janick and Stolarczyk, each of the 352 images common to both manuscripts were analyzed for their similarity on a five-point scale. The researchers concluded that over 88% of the illustrations were either nearly identical or only slightly different, which is highlighted in Figures 2a and 2b (Janick and

Stolarczyk 12). Note the high degree of similarity in the arrangement of buds and leaves in the depictions of *Polygonatum multiflorum* (Fig. 2a) and the stem broken in precisely the same manner in depictions of *Carthamus lanatus* (Fig. 2b). These similarities also provide clear examples of their stylistic differences, begging the question: if the CN and JAC are both Byzantine versions of the DMM with illustrations based on the same archetypes, why are there such discrepancies in their formatting and style? The answer will require consideration of their respective places within a cultural and temporal context.

Context and Stylistic Influences of the JAC

To understand the JAC, a description of Juliana Anicia is particularly helpful. Born to western Roman emperor Anicius Olybrius and of imperial descent on both sides of her family, Juliana was known in her home city of Constantinople as a devoutly religious patron of the arts (Janick and Stolarczyk 10; Tomaselli). She, like many other women of Theodosian lineage, commissioned and refurbished several churches in and around the city including those dedicated to St. Stephen, St. Euphemia, St. Polyeuctus, and the Theotokos (Mary) (Tomaselli; Nowakowski 1). Such was her reputation that the nave of the Church of St. Polyeuctus was inscribed with a 76 verse epigram which translates, in part:

What quire is sufficient to chant the works of Juliana, who after Constantine, the adorer of his Rome, and after the holy golden light of Theodosius, and after so many royal ancestors, in a few years accomplished a work worthy of her race, yea, more than worthy? She alone did violence to Time and surpassed the wisdom of renowned Solomon by raising a habitation for God, whose glittering and elaborate beauty the ages cannot celebrate. (Paton 9 – 11)

Juliana made great efforts to solidify the authority and reputation of her family in a tumultuous time of shifting powers and religious views. As the power systems in western Rome continued to splinter and various sects of Christianity vied for supremacy, she emphasized her family's religious devotion with extravagant building projects and restorations as a show of wealth, power, and magnanimity, earning comparisons to earlier imperial leaders and builders like Constantine, Theodosius, and even the biblical King Solomon (Tomaselli). Much in the same way that Juliana was compared to rulers of the earlier imperial period, the naturalism seen in the JAC appears to have more in common with botanical art from the Imperial era than the Byzantine era that birthed it. A similar flow of form can be seen in Imperial fresco murals at sites such as the House of the Golden Bracelet in Pompeii (Fig. 3) and the Villa Livia at Prima Porta (Fig. 4). Similar approaches to line weight, color variation, movement, and asymmetrical design can be seen, separating the JAC from the more stylized botanical representations common in the Byzantine. Thomas uses these similarities to support his thesis on the nature of the classical archetype (254). I assert that such comparisons allude to a connection between the choice of the

JAC illuminators to pursue naturalism in an era when such styles were quite out of fashion and the reputation Juliana had constructed with specific ties to Imperial era leadership. The JAC was designed to reflect this reputation and harken back to the naturalism that was so prominent in the art of the era Juliana strived to embody through her deeds.



Fig. 3. Comparison of a detail from the *House of the Golden Bracelet* (left) and the JAC fol. 16v (right). Room 32, *House of the Golden Bracelet*, c. mid 1st cen. CE, fresco, Pompeii. Folio 16v, *Juliana Anicia Codex*, c. 512 CE, ink and tempera on vellum, 380 x 310 mm, Österreichische Nationalbibliothek Vienna, Austria.

Note. Notice the color variations, flowing forms, and asymmetry.



Fig. 4. Comparison of roses in a detail from the *Villa Livia* (left) and the JAC fol. 282r (right). Garden Room, *Villa Livia*, detail, c. 30 – 10 BC, fresco, Prima Porta, Rome. *Juliana Anicia Codex*, c. 512 CE, ink and tempera on vellum, 380 x 310 mm, Österreichische Nationalbibliothek Vienna, Austria.

Context and Stylistic Influences of the CN

Much less is known of the origins of the CN. Estimates place its creation some time in the early 6th – late 7th centuries. Scholars have argued for its origins in either Constantinople or Ravenna, Italy, but its exact birthplace remains unknown. It is known, however, that the CN spent a great deal of time in institutions such as the monastery of San Giovanni Carbonara where it was used by monks as medical reference material, and glosses show it was loaned to the Medical School of Salerno (Janick and Stolarczyk 11). It requires the fewest assumptions to conclude that the codex was serving its intended purpose.

Many of the stylistic choices demonstrated in the CN support the idea that it was designed to be used by physicians. As Janick and Stolarczyk point out, the “cruder” drawings of the CN, while less life-like, are more botanically precise in some cases (13). The lack of superfluous elements such as elaborate portraits and sections of poetry and prose also lends credence to the notion that the CN was created to serve a practical purpose as does the condensed format of having multiple entries per page. To fill a smaller space with more information and simplify images to the essentials for recognition makes sense in a manuscript intended for more mundane use.

Author Chavannes-Mazel addresses Pliny the Elder’s concerns on the usefulness of illustrations in herbal pharmacopeias and quotes art historian Ernst

Gombrich in concluding that identification based on a hyper-realistic design was rarely the point of botanical illustration in that era (*From Copy to Copy* 54-55). A simplistic, symmetrical image is more easily recalled than a detailed, asymmetrical one (Chavannes-Mazel, *From Copy to Copy* 55). The CN is a pharmacopeia, not a field guide. The professionals consulting the CN for use in preparing medicines would already have a standing knowledge of botany and plant identification. It is unlikely that the illustrations were depended upon completely for the identification of plants, rather these simplified depictions made for effective references for users who did not require a high degree of realism to recognize the plant they were looking at. An excellent example of this is seen in depictions of *Juncus maritimus* (Fig. 5). The stalks of *J. maritimus* in the JAC are arranged randomly with some stalks disposed vertically and others having a slight curve to one side in no particular pattern. In contrast, the stalks of *J. maritimus* in the CN are all curved to the left or right and cross each other in a very intentional manner such that a pattern of diamond shapes emerges in the negative space. While the JAC version is clearly truer to how this species of rush appears in real life, the CN version is highly symmetrical and, therefore, memorable.

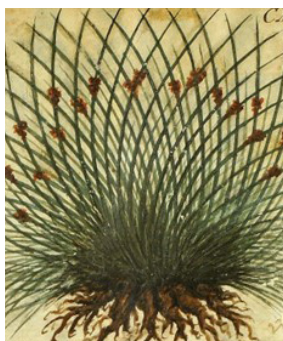


Fig. 5. Comparison of *Juncus maritimus* in the JAC (left) and CN (right). Juliana Anicia Codex, c. 512 CE, ink and tempera on vellum, 380 x 310 mm, Österreichische Nationalbibliothek Vienna, Austria. Codex Neapolitanus, c. late 6th – early 7th cen. CE, ink and tempera on vellum, 287 x 260 mm, the Biblioteca Nazionale Naples, Italy.



Fig. 6. Comparison of stylized botanicals in the apse mosaic of the Basilica Di Sant'Apollinare (left) and the CN (right). Apse of Basilica Di Sant'Apollinare, detail, c. 6th cen. CE, mosaic, Ravenna, Italy. Codex Neapolitanus, c. late 6th – early 7th cen. CE, ink and tempera on vellum, 287 x 260 mm, the Biblioteca Nazionale Naples, Italy.

Note. Notice the simplified blossoms, static positions, and rough symmetry.



Fig. 7. Comparison of stylized botanicals in the apse mosaic of the Basilica Di Sant'Apollinare (left) and the CN (right). Apse of Basilica Di Sant'Apollinare, detail, c. 6th cen. CE, mosaic, Ravenna, Italy. Codex Neapolitanus, c. late 6th – early 7th cen. CE, ink and tempera on vellum, 287 x 260 mm, the Biblioteca Nazionale Naples, Italy.

Culturally, the CN lacked the Imperial ties and influence embedded in the JAC and was thus executed in a much more characteristically Byzantine style. The bolder lines, simpler forms and color palette, and preference for a symmetrical disposition fit well within the larger corpus of Byzantine era depictions of flora and fauna. An excellent example of this can be seen in the apse mosaic of the Basilica Di Sant'Apollinare in Rome (Fig. 6, Fig. 7).

Conclusion

At first glance, it seemed as though the disparities between these two manuscripts would be largely budgetary. The research revealed a much more complex interaction of intentions and circumstances. The illustrations within are linked by a sort of DNA, a set of instructions whose conception predates them both and by whom they were shaped. But DNA was not the only determiner of their final form. Through a contextual lens, unique qualities emerged. These works are as much products of their individual purpose and the intent of their creators as they are of their shared ancestral archetype.

The JAC was a symbol of the magnanimity of its recipient and the gratitude of its presenters. The style of its illustrations borrowed from Imperial art in the same way Juliana embodied Imperial leaders. By contrast, the CN lacked the extravagance of the JAC because it had no use for such things, which would have distracted from its intended purpose. Its art was squarely Byzantine and perfectly designed to suit the needs of its audience rather than to convey a sense of realism or naturalistic beauty.

The largest gap in the research as it stands is the issue of the CN's provenance. Theories on the CN's early provenance such as those by Anichini (1956), Bertelli (1992), and Collins (2000) could not be accessed during the course of this research, and none have been definitively proven. Until the commissioner and recipient are known with certainty, all else of its intended purpose will remain theoretical.

To view the images from this article in color, please scan the top QR code on pg. 120 or visit <https://lscmontgomerycac.com/visual-communication-2025/>

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An Infamous Mystery: An Overview of Major Depressive Disorder

Research Paper by
KRISTIN LEE

BIOL 2401: HUMAN ANATOMY & PHYSIOLOGY I

Kirstin Lee's insightful paper, "An Infamous Mystery: An Overview of Major Depressive Disorder," skillfully explores the complex causes, symptoms, and treatments of MDD, demonstrating strong research, critical thinking, and academic writing.

- Anna Howard

Abstract

Depression is a common, globally distributed medical disorder that leads to devastating consequences if left untreated. Its study is complicated by the presence of numerous potential causative factors including genetic, hormonal, chemical, environmental, psychological, and even evolutionary. Despite the abounding mysteries regarding causation, assorted methods of treatment have developed that are successful in many affected individuals. The ones, of course, that are properly diagnosed. There does exist a diversity in the severity of the disease and response to therapy that makes the choice of treatment, including medication type, difficult. The nature of the variability is a ripe, active focus of current investigations.

Keywords: *depression, major depressive disorder, MDD, clinical depression, antidepressants, maladaptation, suicidal ideation, neurotransmitters, psychotherapy, causation, hypothesis*

An Infamous Mystery: An Overview of Major Depressive Disorder

According to the Mayo Clinic, depression is a mental ailment that has two well-known characteristics: a persistent feeling of sorrow and *anhedonia* (11). At times, depression itself is a symptom of a medical condition or a side effect of medication (11). As detailed on the Cleveland Clinic website, the affliction occurs in a wide variety of manifestations, including Clinical Depression or Major Depressive Disorder (MDD), the most severe type (3). Clinical Depression also has subcategories, such as Seasonal Affective Disorder (better known as Seasonal Depression), MDD with *peripartum* onset (prenatal/postpartum depression), and atypical depression (3). While each has characteristics that differentiate one from the other, all types of MDD have shared symptoms which can range from physical to mental and emotional in nature (3). The research focuses on the general characteristics and possible causations of Clinical Depression.

Discussion

Cause

The specific causes of depression, explained by Dr Filatova, are a medical mystery spanning years if not decades. No singular factor has been assigned a culprit, nor have any been ruled out. In other words, what is true for one group of afflicted patients is not true for another. The current understanding is that Major Depressive Disorder (MDD) is a multifactorial disease (5). As outlined in the Mayo Clinic website, the main factors that researchers suspect cause depression are brain chemistry, hormone imbalance, certain personality traits, genetic predisposition, stressful life events, and other medical conditions. The brain of a patient with MDD can have abnormal *neurotransmitter* levels or the neurotransmitters are malfunctioning in neurocircuits involved in mood stability. At times, the causation is a side effect of medications for another medical condition or result of substance abuse (11). Changes in hormone levels during puberty, pregnancy, and *endocrine*-related medical conditions may be involved in the development of MDD. Certain personality traits are associated with faulty cognitive reality like low self-esteem, over-dependence, frequent self-criticism, and pessimism (11). According to Lohoff, family studies indicate a twofold to threefold increase in the lifetime risk of developing MDD among *first-degree relatives*. Such a statistic indicates a possible genetic predisposition for developing depression (9). Dr. Filatova discusses that heightened cortisol levels often pre-empt depression (5). These heightened cortisol levels are usually seen during or soon after a stressful life event. These events, as detailed by the Cleveland Clinic, include abuse (physical, sexual, mental, emotional), loss of a loved one, a loved one suffering from a medical condition, severe relationship issues, financial difficulties, or other threats to living conditions (3). Chronic medical conditions (i.e. heart disease and cancer) as well as chronic pain have contributed to the genesis of Clinical Depression (3). Based on her study, Dr. Filatova proposed that the cause of MDD is an interdependent system of the prevailing theories formulated by investigating how the symptoms of depression evolved. Filatova outlines the prevailing theories: the Monoamine Hypothesis, the Hypothesis of Stress-Induced Depression, the Neurotrophic Hypothesis, The Inflammation/Cytokine Hypothesis, the Circadian Hypothesis, and the GABA-Glutamate mediated Hypothesis (5). The Monoamine Hypothesis contends that when levels of *monoamine* neurotransmitters, which include *serotonin*, *dopamine*, and *norepinephrine*, lower beneath a healthy threshold, neuroelectric misfunction occurs (5). See *Fig. 1*

The Hypothesis of Stress-Induced Depression holds that chronic stress causes the overuse and eventual exhaustion of the Hypothalamic-Pituitary- Adrenal Axis (HPA Axis), leading to its malfunction (5). See *Fig. 2*

The Neurotrophic Hypothesis contends that a malfunction of the *neurotrophic* system of the brain (5). More specifically there is a decreased level in neurogenesis factors resulting in neurodegeneration (5). The Inflammation/ Cytokine Hypothesis states that inflammation and imbalance of pro-inflammatory *cytokines* within the brain affect its function, the resulting behavior of the patient, and their physiology being resistant to treatment (5). See *Fig.3*

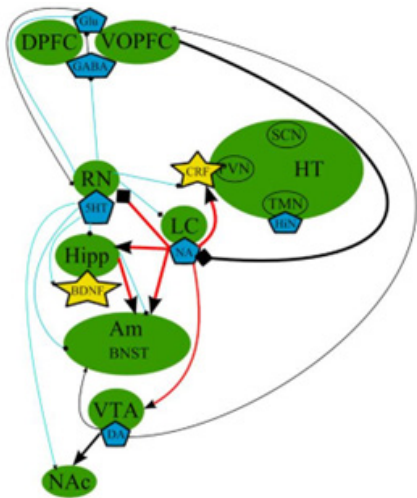


Figure 1. The Monoamine Hypothesis (5).

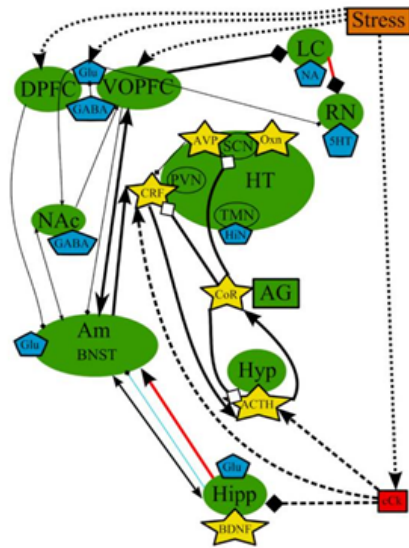


Figure 2. The Hypothesis of Stress-Induced Depression (5).

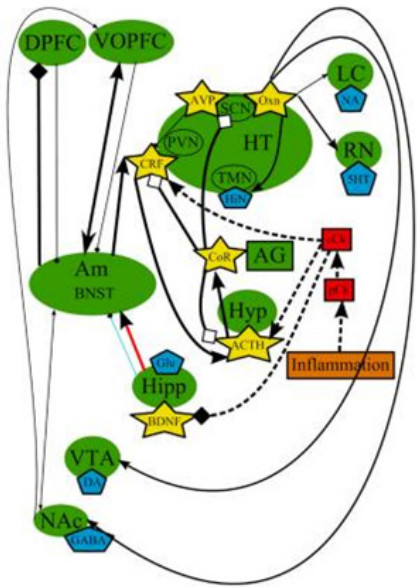


Figure 3. The Inflammation/ Cytokine Hypothesis (5).

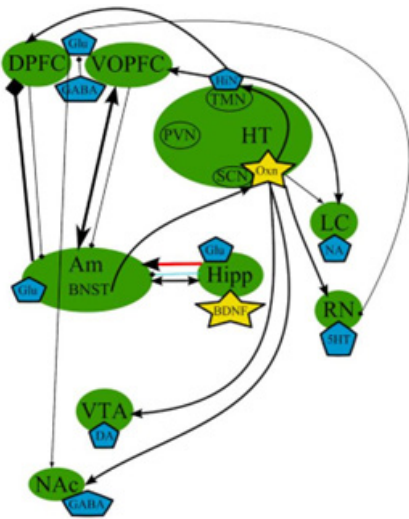


Figure 4. The Circadian Hypothesis (5).

Legend for
Fig. 1, Fig. 2,
Fig. 3, Fig. 4,
and Fig. 5

Shapes

Arrow =
Activating Effect
Black Rhombus =
Inhibitory Effect
White Rhombus =
No Detected Effect

Color

Red = NA
Neurotransmitter
Blue = 5-HT
Neurotransmitter
Black = Neurotransmitter
or other effector

Thickness

Thin =
Effect Reduced
Medium =
No Change in Effect
Thick =
Effect Increased

Line

Solid =
Internal Effector
Dotted =
External Effector

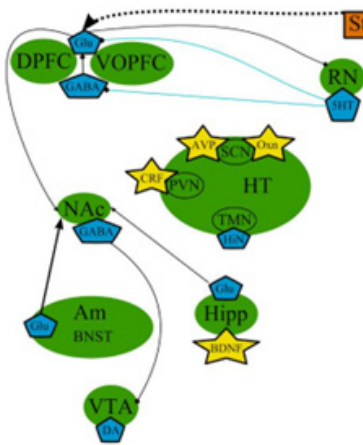


Figure 5. Excitatory Neurotransmitters (5).

The *Circadian Hypothesis* states that a lack of regular circadian rhythms is often a pre-disposing factor of developing depression (5). See Fig. 4

The *GABA-Glutamate mediated Hypothesis* states that an imbalance of the brain's excitatory - inhibitory systems, namely an increase in the *glutamate* levels and a decrease of *GABA* (*gamma-aminobutyric acid*), disrupts normal neural function (5). See Fig. 5

The proposed interdependence would explain how the various symptoms evolve (5).

Symptoms & Diagnostic Tests

The Cleveland Clinic, citing *DSM-5*, states that, for a formal diagnosis of Clinical Depression, the patient must have at least five MDD symptoms daily for most of the day over a minimum of two weeks (3). These symptoms are listed on the Cleveland Clinic and Mayo Clinic websites. In tandem, the two lists provide a useful tool for identifying the disorder in the afflicted. The patient has feelings of sorrow, hopelessness, and low self-worth often with no real causation (11). The individual experiences unusual irritability or frustration like an angry outburst over small matters (11). The person undergoes anxiety, agitation, and/or restlessness (11). Anhedonia is experienced (11). The individual has irregular circadian rhythms (11). The patient experiences unusual fatigue such as smaller tasks requiring more effort (11). The person endures slowed cognitive functions including concentration, decision-making, and memory (11). Efficiency in speaking or moving deteriorates (11). An individual's appetite changes, resulting in significant weight changes (11). The patient has thoughts or a history of self-harm (3). The person experiences suicidal ideation or has a history of attempted suicide (11). The patient has *medically unexplained physical symptoms (MUPS)* like headaches or aches and pains (11). One of the more unique features of MDD that makes it difficult to diagnose is its episodic nature. Episodes could last weeks to even months, hence why the *DSM-5* recommends a minimum of two weeks (3).

Due to the psychological nature of the disease, the physician will typically have patients fill out questionnaires to self-evaluate their symptoms (11). Usually, a physician orders various lab tests to check for an underlying medical condition such as malfunctioning thyroid, cancer, or complications from substance abuse (11).

Effect on the Body

The main organ system affected is the Nervous System, particularly the brain. In their study, Dr. Pan showed that individuals afflicted with Clinical Depression

have certain structural and functional differences within their brains compared to the healthy norm. These abnormalities impact cognitive function and emotional regulation (13). The main areas affected are the *prefrontal lobe*, *amygdala*, and *hippocampus* (13). Researchers found abnormal connectivity by measuring the *Regional Homogeneity (ReHO)* levels. Certain areas of the brain show a decrease in electric charge activity while others show an increase. These phenomena influence cognitive function and emotional regulation (13). Compounded with functional abnormality, the brains of those with depression have significant structural differences compared to the brains of healthy individuals. The aforementioned areas of the MDD-afflicted brain are often smaller than a healthy brain. Membranes of the *left temporal cortex* and *right parietal cortex* are thin, affecting neuroelectric conduction which impacts social interactions, language, and memory (13). In Fig. 6, a comparison of the PET scan of a healthy brain's activity versus that of a brain suffering from MDD shows a marked contrast. The dramatically lower activity in an MDD-afflicted brain indicates a structural issue. This evidence demonstrates a direct correlation between the amount of structural change and the severity of the disease (10).

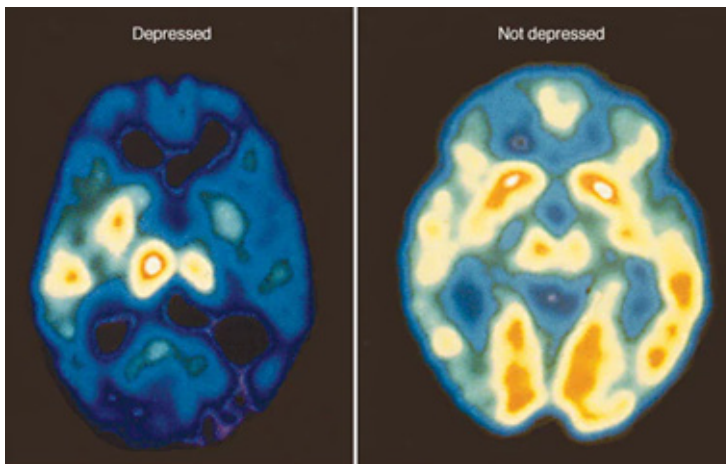


Figure 6. PET Scan comparing brain activity of a healthy versus a depressed brain (10).

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Treatments & Prevention

According to the Cleveland Clinic, treatment is mainly a combination of psychotherapy and a regime of *antidepressant medications* (3). If there is an underlying medical condition causing MDD symptoms, the same treatment will be used. However, the Mayo Clinic states that the specific issue will be addressed with the appropriate treatment (11). According to the Mayo Clinic, the purpose of psychotherapy is to first assist a patient in correcting their unhealthy, negative beliefs and behaviors together with identifying their sources of stress. The subsequent step is to help the patient develop healthier versions of their beliefs, behaviors, relationships, and coping mechanisms (11).

Medication

Outlined by the Mayo Clinic, antidepressants change the faulty brain chemistry associated with MDD. It is common practice for a psychiatrist to prescribe two types of antidepressants or an additional medication such as *mood stabilizers* or *antipsychotics*. This, of course, depends on the patient's unique needs. An afflicted individual may require *anti-anxiety* and/or *stimulant medication* for short-term use (11). Another factor that can influence medication selection is its potency (11). A person may be genetically predisposed to be resistant to a certain type or have negative side effects. Due to this, psychiatrists and their patients may need to go through trial and error to find the right kind (11). Suicidal ideation may increase during the first few weeks on a new anti-depressant, but if the medication is effective this symptom along with others will dramatically decrease (11). Medications commonly used to treat depression are *Selective Serotonin Reuptake Inhibitors (SSRIs)* and *Serotonin-Norepinephrine Reuptake Inhibitors (SNRIs)* as they have fewer problematic side effects compared to other options (11). If, however, the patient's condition does not improve, their physician may prescribe Tricyclic anti-depressants. In the most severe case, Monoamine oxidase inhibitors (MAOIs) are used. MAOIs require increased care due to increased side effects in conjunction with food and drug interactions making co-administration with some other drugs like SSRIs dangerous (11). Common SSRIs are Citalopram (Celexa), Escitalopram (Lexapro), Fluoxetine (Prozac), Paroxetine (Paxil or Pexevva), Sertraline (Zoloft), and Vilazodone (Viibryd) (11). Common SNRIs are Duloxetine (Cymbalta), Venlafaxine (Effexor XR), Desvenlafaxine (Pristiq or Khedezia) Levomilnacipran (Fetzima). Common Tricyclic antidepressants are Imipramine (Tofranil), Nortriptyline, Amitriptyline, Doxepin, Trimipramine (Surmontil), Desipramine (Norpramin), and Protriptyline (Vivactil). Common MAOIs are Parnate, Nardil, Marplan, and Emsame (11). Some medications do not fit neatly into the other categories and are therefore called atypical antidepressants. Common ones are Bupropion (Wellbutrin XL or Wellbutrin SR or Aplenzin or Forfivo XL), Mirtazapine (Remeron), Nefazodone, Trazodone, and Vortioxetine (Trintellix) (11). It is incredibly important for patients to strictly follow instructions regarding their medication. As discussed by Dr. Hall-Flavin, suddenly stopping will result in antidepressant withdrawal which to the patient feel like a more severe version of depression symptoms (6).

Behavioral Changes

As stated by the Mayo Clinic, patients' conditions improve by changing behavioral routines (11). Both the Mayo and Cleveland Clinics detail the following beneficial behavioral routines:

- Regular exercise (3)
- Healthy circadian rhythm (3)
- Healthy diet (3)
- Minimizing if not eliminating alcohol use (3)
- Establishing and maintaining healthy relationships through quality socialization (11)
- Develop healthy stress coping mechanisms (11)

Alternative Medicine

At times, patients with a particularly intense case of MDD or a greater resistance to anti-depressants benefit from supplemental treatment (11). Complementary medicine can include acupuncture, massage, hypnosis, and *biofeedback*. Those patients suffering from a highly severe case such as one with the addition of a *psychosis* may require brain stimulation therapy (11). Of those who seek treatment, the majority of individuals afflicted with clinical depression lead healthy and fulfilling lives (3). Because MDD is an episodic disease, many “cured” individuals may experience a return of symptoms. Such relapses require resumption of treatment (3). Because the exact cause(s) are unknown, depression cannot truly be prevented (3). One can only reduce the risk of it occurring by establishing healthy versions of sleep routines and stress-coping mechanisms (3). In conjunction, they participate in regular self-care activities such as exercise and meditation (3). Establishing Mind-Body connections is beneficial (11). Examples of this are learning relaxation techniques such as those taught in yoga and tai-chi, attending music/art therapy, or developing strong spirituality (11).

Statistics

According to a 2023 article by WHO, approximately 280 million people globally have depression. Approximately 50% more females suffer from the disease than men (14). According to the CDC site page on depression as of 2022, 12.5% of patients in emergency rooms had symptoms of depression on their medical charts (2). That same year, there were 14.8 suicides per 100,000 people totaling 49,476 deaths that year (2). In 2022, the most recent U.S. government study on depression in America was published (12). Out of approximately 21 million American adults (aged 18 years or above), 8.3% reported having a minimum of one major depressive episode. More than half of that group reported their disease having a major negative impact on their daily lives. Of those 21 million adults, approximately 61% underwent treatment. The largest group of adults who reported MDD symptoms was those aged 18-25 at 18.6% of those afflicted. This is twice as much as the second-largest group, individuals aged 26-49 (12). In 2021, 20.1% of adolescents (aged 12-17) reported having a minimum of one major depressive disorder episode. That totals approximately 5 million American adolescents suffering from MDD. Of those 5 million adolescents, less than half underwent treatment. The percentage of females who reported having episodes is approximately twice that of the males who reported. This is true for groups above and below 18 years of age. Those who reported having two or more episodes had a higher percentage of reported MDD than other groups, regardless of age (12). Dr. Albert’s study proposed that the hormonal changes that females undergo during puberty, menstruation, pregnancy, and menopause possibly contribute to the higher statistics (1). A study published in 2024 attempted to compare the amount of people who are diagnosed versus that of the undiagnosed (7). Of the 200 adults who took the diagnostic questionnaire, a little over 30% who did not have a diagnosis were suspected of having mild to severe depression (7). In a Brazilian study published in 2022, depression underdiagnoses afflicted over half of the over 70,000 participants (4). The researchers further noted

that the percentage was mostly made up of individuals who were male, from a lower-income household, and/or had a lower education level (4).

Conclusion

Despite its presence across the globe, depression is still a mysterious condition. The cause of depression is still an enigma due to the variability in symptoms and unknown factors in the development of the ailment. However, one current theory is that depression is a maladaptation of human biological evolution (8). One proposal in support of that theory was that anhedonia would help in the sense of prioritizing one's health over their enjoyable activities or to indicate to their social community that something was wrong (i.e. not feeling a strong connection with their community) (8). Depression is a multifaceted disease that, if left untreated devastating impacts on the patient's life, qualitatively and quantitatively. Psychological and biological factors impact patients. Thankfully, medical knowledge evolved to where various treatments, particularly those that combine medication and mental health counseling, are available. Different types address versions of MDD and the needs of the affected individual patient. This results in even greater recovery, whether for a time or permanently. Nevertheless, the mystery and a subsequent future of suffering remains.

Glossary

Adrenal: relating to the adrenal glands, endocrine organs located on the kidneys that regulate hormones such as cortisol

Amygdala: the part of the brain that is mainly responsible for emotional regulation

Anhedonia: a chronic feeling of disinterest in activities that previously induced pleasure in the individual

Anti-anxiety medication: a class of medical drugs that treats anxiety disorders usually by slowing neurotransmission

Antidepressant medication: class of medical drugs designed to combat depression and its associated medical conditions such as anxiety disorders or addiction

Antipsychotics: a class of medical drugs for psychotic disorders like bipolar disorder

Biofeedback: a therapeutic technique that uses electronic sensors to record the body's reaction to various stimuli in real-time; the patient uses the feedback to practice controlling their body's response to specific stimuli

Chronic: pertaining to a condition that persists for a long time or keeps re-occurring

Circadian: of or relating to Circadian Rhythm, which is the cyclic regulation of sleeping and waking, hormone production, and body temperature

Cortisol: a steroid hormone that increases blood sugar levels and enhances brain function in response to stress

Cytokines: a protein type that is integral to the regulation of immune response and cell growth

Dopamine: a neurotransmitter that is necessary to regulate attention, focus, and the experience of reward pleasure

DSM-5: "The Diagnostic and Statistical Manual of Mental Disorders" by the American Psychiatric Association; a vital diagnostic tool for many psychiatric professionals

Endocrine: relating to the hormone regulation system

First-degree Relatives: genetic relatives that are within one's immediate family i.e. parent or sibling

Gamma-aminobutyric acid (GABA): a neurotransmitter that blocks neurotransmission, thereby reducing neural excitation

Glutamates: a neurotransmitter whose role is to excite or stimulate neurons that are responsible for cognitive function, pain perception, and other neural functions

Hippocampus: a part of the brain located in the medial temporal lobe; its prime responsibility is memory formation

HPA Axis: the neuroendocrine system made up of the hypothalamus, the pituitary gland, and the adrenal glands; together they regulate stress-response

Hypothalamus: a part of the brain; it regulates blood pressure, appetite, mood, sex drive, and sleep

Left Temporal Cortex: one of two parts of the brain located in the temporal lobe; they play a role in memory, language comprehension, emotional regulation, etc.

Maladaptation: originating from an evolutionary adaption, it is a biological characteristic that has a negative impact on the species

Monoamine Oxidase Inhibitors (MAOIs): a class of antidepressants that inhibits monoamine oxidase (MAO), an enzyme responsible for the breakdown of neurotransmitters

Mind-Body Connection: awareness of how an individual's mental-emotional landscape and physical body influence each other

Monoamine: a class of neurotransmitters that includes dopamine, norepinephrine, epinephrine, and serotonin

Mood stabilizers: a class of medical drugs specifically for mood disorders such as bipolar disorder the symptoms of which include depression

Medically Unexplained Physical Symptoms (MUPS): chronic physical symptoms that cannot be attributed to a specific medical condition

Neurocircuit: an interconnected network of neurons that perform a specific function

Neurodegeneration: the process of neuron degeneration and death

Neurogenesis: of or relating to the creation of neurons

Neurotransmitters: the chemicals that act as messengers for electrical signals of the neurons; in the brain, they play a role in mood regulation, memory, learning, and cognition

Neurotrophic: of or relating neuron growth and development

Norepinephrine: a neurotransmitter that regulates the “fight-or-flight” response which includes sex drive, focus, alertness, and physiological functions such as blood pressure; it is also called *Noradrenalin*; its two medical symbols are NE and NA

Peripartum: relation to around the time of birth

Pituitary: relating to the pituitary gland, a part of the brain that regulates metabolism, stress response, and labor

Prefrontal lobe: a part of the Frontal Lobe of the brain, it is responsible for many cognitive functions such as social and emotional regulation

Psychosis: a category of mental disorder marked by a loss of contact with reality

Regional Homogeneity (ReHO): a method of measuring brain activity using magnetic resonance

Right Parietal Cortex: one of two parts of the brain located in the parietal lobe; they play a role in cognitive and sensory functions such as body awareness

Serotonin: a neurotransmitter that is important for regulation of mood, circadian rhythm, appetite, learning, and memory; its medical symbol is 5-HT

Serotonin-Norepinephrine Reuptake Inhibitors (SNRIs): a class of antidepressants that specifically blocks re-uptake of serotonin and norepinephrine from the synapse; the brain thus experiences the effects of both neurotransmitters longer

Selective Serotonin Reuptake Inhibitors (SSRIs): a class of antidepressants that specifically blocks re-uptake of serotonin from the synapse; the brain then undergoes the effects of serotonin longer

Stimulant medication: a class of medical drugs that increases the rate of neurotransmission which in turn increases alertness

Suicidal Ideation: Suicidal thoughts, specifically those in which an individual ruminates on or plans to commit suicide

Tricyclic anti-depressants: a class of antidepressants that blocks re-uptake of certain neurotransmitters from the synapse, lengthening the period of their effects. These neurotransmitters include serotonin and norepinephrine

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Isolating and Analyzing Fungi for Purposes of Bioremediation

Research Project Poster
by BLAKE RESTIVO

INDEPENDENT RESEARCH PROJECT / BIOLOGY

Blake Restivo initiated an independent research project exploring the bioremediation potential of fungi to break down motor oil. He designed and conducted a series of experiments aimed at identifying fungal species capable of degrading motor oil. To support his research, Blake applied for and was awarded a research grant from the Undergraduate Research Institute (URI). His abstract was accepted by the National Conference on Undergraduate Research (NCUR 2025) and he presented his poster at the April 2025 conference.

- Anitha Iyer

Abstract

The use of microorganisms to chemically degrade crude-oil derivatives, which often take the form of inert aliphatic and/or aromatic compounds and polymers, has been proposed as a potential means to reduce pollutant levels in global ecosystems and to recycle material into biologically active forms. Fungi have a unique array of enzymes and structural characteristics which allow for efficient and highly-specific organocatalysis of substrates inaccessible through most metabolic processes. The aim of our research has been to isolate suitable strains of local, fungal species in different environments with varying levels of exposure to petrochemicals in the form of motor oil, and to perform extractions and tests for secondary metabolite analysis.

Research in this area has shown promising results which demonstrate the efficacy of specific fungi, changes to chemical composition of polluted samples, and have shown trends correlating to specific enzymes. An inadequacy found in much of the literature published, however, is the reliance upon wild soil substrates for sample collection which excludes important fungal groupings such as sapotrophs. Lignin peroxidase and laccases, abundant in wood-degrading funguses, have been used for the benign treatment of wastewater due to their ability to break-down hazardous phenolic compounds.

In this project, specimen are collected from several environments using open agar plates which are coated in motor oil. Prevalent organisms are then further cultured under similar conditions with varying substrates including emulsified, liquid broth and polluted wood pellets of differing types. Metabolite extractions are performed using standard solvent-based techniques, as well as column chromatography. Products are analyzed using gas chromatography and IR-Spectroscopy. DNAextractions are performed on each species and indexed via barcoding.

Background

The Fungal Kingdom contains an estimated 1.5 to 5 million species of eukaryotic organisms, each with unique characteristics³. Analyses of these species show a diverse array of morphologies foreign to other kingdoms. Fungi have a strengthened cell-surface composed primarily of chitin, glucans, and glycoproteins, which allows for osmotrophic processes. Fungi secrete fluids which act as an external stomach, allowing them to digest nutrients of a given substrate extracellularly. Within these fluids, highly specialized digestive enzymes, as well as secondary metabolites can be found. This mode of digestion allows for the rapid metabolism of substrates which are inaccessible to most organisms.

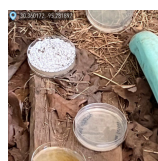
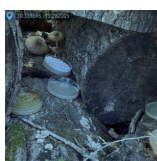
Secondary metabolites are organic products of an organism which are non-essential for its overall development¹. Different environmental conditions can affect gene expressions responsible for their production including temperature, pressure, carbon-sourcing, and air/soil composition.

An estimated 80 billion pounds of organochemical pollutants are produced by the United States annually with only ten percent being disposed of properly². The efficiency of fungal decomposition, in addition to the high-specificity of their reaction mechanisms pose an alternative to synthetic, chemical cleaners. Enzymes produced by fungi such as lignin peroxidase and laccases have been used in the treatment of industrial wastewater. Researchers from FUT Minna in Nigeria extracted soil samples near the Kaduna oil refinery in search of organisms with bioremediation potential for petroleum waste⁴. Five fungal species were isolated from polluted soil including: *Aspergillus flavus*, *Rhizopus oryzae*, *Aspergillus niger*, *Aspergillus fumigatus*, and *Microsporum audouinii*. Each of these species demonstrated potential in breaking down several pollutants.

Materials and Methods

Fungal Specimen Acquisition

Difco™ formulated Sabouraud Dextrose Agar (SDA) powder and distilled water were added to borosilicate glassware in a ratio of 65 g SDA/1 L distilled water and thoroughly mixed before being autoclaved at 121° Celsius for 40 minutes. Once sufficiently cooled, the sterile mixture was poured over medium to large petri dishes and allowed to solidify. Approximately 2 mL of 5W-30 motor oil was added. Plates were then placed without lids in their respective environments for two days to allow for the acquisition of local fungi. The plates were then retrieved, covered, rewrapped in parafilm. The plates were incubated at 28° Celsius for four days.



Locations for collection of wild fungi;
(A) Under mattress,
(B) Under bridge,
(C) Log pile,
(D) Barn

(A)

(B)

(C)

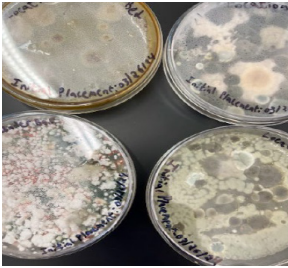
(D)

■ Research Project Poster

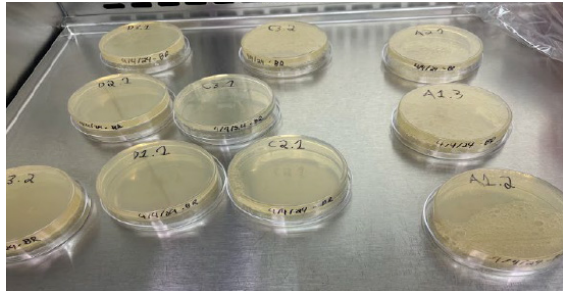
This process was completed each time new samples were required with slight alterations depending on the test being performed. During a later collection period, spent coffee grounds were supplemented into half of the SDA mixtures to observe effects of additional nitrogen sourcing.

Observation/Isolation of Samples

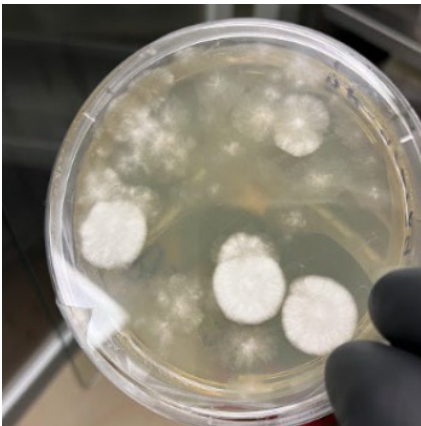
Following an incubation period, samples were observed within a laminar flow hood using sterile handling techniques. Plates with fungal growth were marked and transferred to separate plates for culturing. Qualitative data was written-down and photographed. Subsequent plate transfers and incubation periods were employed until clean cultures were obtained. Future tests will be performed using polluted liquid broth and hardwood pellets.



Wild specimens
post-incubation period



Streak plates inoculated with spore samples



Front and back of petri dishes containing bridge isolates

Extraction

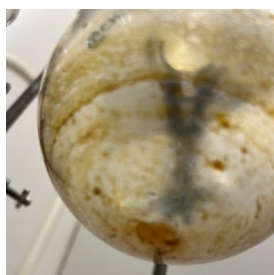
Samples were reintroduced to the pollutant separately on sterile plates with motor oil coating the surface in similar quantities to the collection plates. Fungal growth on these plates were monitored for several days in an incubator. Solvent-based, metabolite extractions were performed on test samples against control groups.

Samples were diced and deposited into organic-solvent resistant containers.

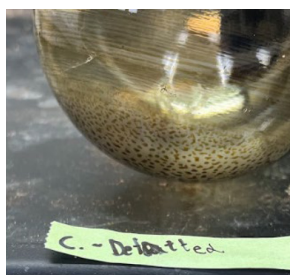
To each container, a 1:1 mixture of chloroform:methanol (CHCl_3 :MeOH) was added followed by overnight mixing using an orbital shaker. These were then filtered via Hirsch funnel. Each filtrate was then transferred to a round-bottomed flask followed by the addition of 90 mL CHCl_3 and 100 mL of deionized water, before being stirred for 1 hour. The bottom organic layer was then isolated using a separatory funnel and dried completely using a rotavap. This dry extract was then solvated within a mixture of 80 mL of a 1:1 solution of acetonitrile (CH_3CN):(MeOH) and 80 mL hexanes. This was then stirred for 1 hour and transferred to a separatory funnel, with the bottom, defatted layer being extracted then dried completely using a rotavap. The hexanes layers were also dried and tested similarly.



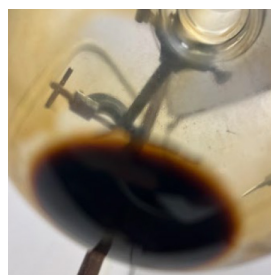
(Left) - Samples following overnight CHCl_3 :MeOH bath; (Right) - Separatory funnel: MeOH: CH_3CN (bottom-layer) and hexanes (top-layer)



Defatted extract from fungal sample



Defatted extract from motor oil control



Hexanes layer extract

Analysis

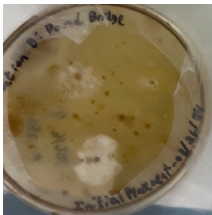
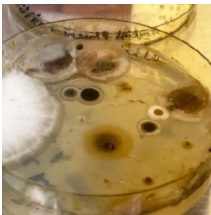
Infrared-Spectroscopy (IR) and Gas Chromatography (GC) were the two primary analytical methods for gathering data on the composition of sample extracts. IR-spectral data was collected with wavenumbers (cm^{-1}) between 4000 to 500. Each trial of GC testing had a runtime of 20 minutes with a temperature ramp increasing from 40°C Celsius up to 240°C Celsius. The slope of the ramp was altered at times to optimize graph resolution.

Identification of fungal samples, was primarily characterized using morphology and microscopy, though DNA extractions with subsequent amplification of information and barcoding are scheduled to provide genetic verification.

Results

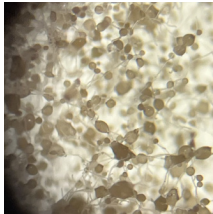
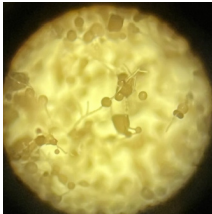
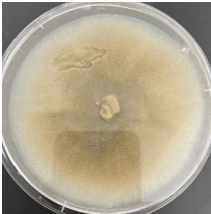
Fungal Growth

Several species of wild type fungi demonstrated the ability to tolerate environments polluted by motor oil.

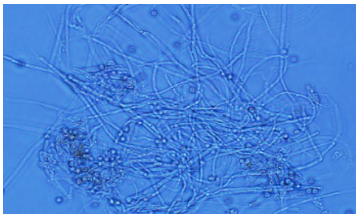
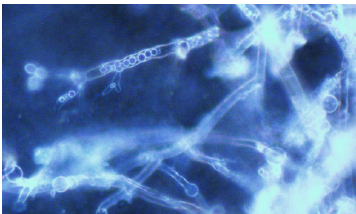


Multiple fungal colonies growing on oil-coated agar from spores collected under a mattress, pond bridge, and log pile respectively

One species appeared each time an acquisition of wild type fungi was carried out. Its morphology and sporangia structure indicate that it is a member of the genus *Rhizopus*, commonly known as “bread molds”.

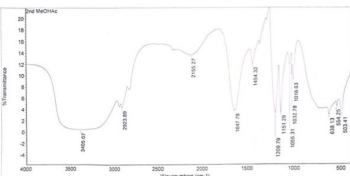
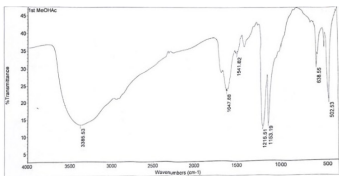


Left to right: 1X and 3X magnification, microscopic images of sporangia of suspected *Rhizopus* mold.

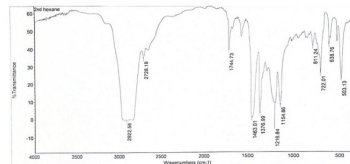
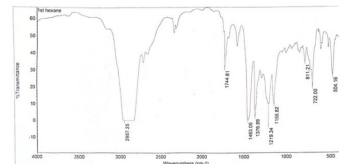


(Left) - Dark field image - mycelium (Right) - Bright field image - mycelium

IR-spectral analyses indicate that limited changes in functional groups occurred over the duration of fungal exposure.

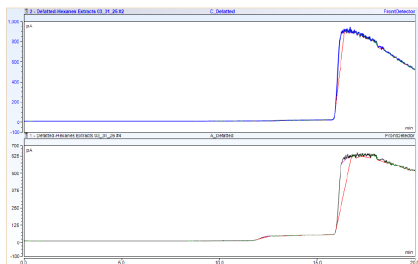


(Left) - Fungal defatted (Right) - Motor oil control defatted

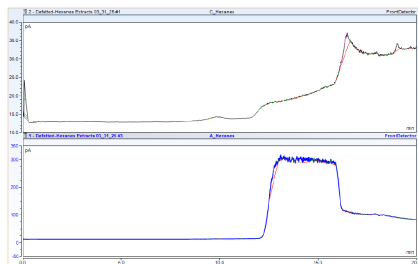


(Left) - Fungal hexanes layer (Right) - Motor oil control hexanes layer

GC data showed slight variance in vapor composition and retention times when comparing the defatted organic layers. Much greater variance was demonstrated when comparing the hexanes extracts, with the majority of material exiting the column by the 15-minute mark for the fungal sample versus the control sample having most of its components boiling off beyond the fifteen minutes. This is a potential indicator that the fungus is breaking down longer hydrocarbon chains into smaller subunits.



Retention times for CH₃CN:MeOH layers:
Control (top), Fungal (bottom)



Retention times for hexanes layers:
Control (top), Fungal (bottom)

Conclusions

- Multiple species of wild fungi demonstrated the ability to tolerate exposure to crude oil
- Morphological data suggests that fungi from the genus *Rhizopus* were most prevalent in polluted samples
- Infrared-spectral data and gas chromatography show that *Rhizopus* fungi may have the ability to aid in the decomposition of hydrocarbon waste without producing toxic byproducts



Full image of the original research project poster.

To view the images from this article in color, please scan the top QR code on pg. 120 or visit <https://lscmontgomerycac.com/visual-communication-2025/>

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Typhoid Mary in New York

Creative Project / Poem
by JAREN ROCHE

BIOL 2420: MICROBIOLOGY FOR NON-SCIENCE
MAJORS

The creative project is designed for students to use basic research about an infectious disease of interest to them as inspiration for a creative presentation using their personal aptitudes. In Jaren's case, Typhoid Mary caught his interest, and he utilized his talent for writing poetry to accurately describe Mary's plight to the rest of the class. Taking basic research and incorporating it into a creative endeavor requires higher-order thinking skills such as problem-solving and synthesis. Jaren's poem clearly demonstrates these skills.

- Kathryn Gronlund

In the streets of New York, live and busy,
where Mary Mallon wandered the city.
A cook she was, with dirty hands,
unknowing of the fever that crossed the land.
Though Mary felt fine, no symptoms of disease,
others were weak, New York grew unease.
Doctors sought answers, patience worn thin.
Police intervened, quarantining her in.
But Mary was puzzled, confined and alone,
accused of a sickness she had never known.
A promise she made to quit as a cook,
but her love for the kitchen was all it took.
Back in business
and changed her name.
Poor hygiene was all the same.
Typhoid Mary, a familiar face,
left *Salmonella* in every place.
Enough is enough, the city cried.
With thousands infected, five had died.
Her freedom taken and sent away,
like a prisoner confined for crimes to pay.
For twenty six years where she was left to pass.
Was this ethical or was this mad?
Her story remains, a lesson, I assume,
for doctors to take note and science to resume.

After the Storm:
A Recovery
Plan for Emilia

Fictional Recovery Plan
by KAITLYN GLAESMANN

ENGL 1302: COMPOSITION AND RHETORIC II

In her final project, Kaitlyn synthesizes concepts from her physical therapy studies with insights from English literature to create a fictional recovery plan for Emilia from Shakespeare's *Othello*. She skillfully analyzes the hypothetical emotional, psychological, and physiological aspects of Emilia's recovery. By merging her knowledge of therapeutic techniques with a nuanced understanding of Emilia's character, Kaitlyn develops a thoughtful and comprehensive recovery plan. What sets this project apart is its creative format, which incorporates personalized medical charts and documentation that blend seamlessly into the literary analysis. Kaitlyn's imaginative approach enriches her character analysis and expands the boundaries of traditional academic writing. It is an impressive example of interdisciplinary thinking, and an excellent example of writing across disciplines.

- Wendy Hanks

“For my final project in English 1302, I developed a theoretical recovery plan for Emilia, a character in Shakespeare’s *Othello*. By imagining how she might have healed had she survived—and drawing on my background in physical therapy—I used the biopsychosocial model to address the physical and psychological effects of her trauma. The plan is presented as a modern therapist’s patient chart, complete with clinical rationale, treatment goals, and a discharge report. I merged this clinical framework with literary analysis, rehabilitation science, and trauma-informed care to create a cohesive speculative therapy narrative.”

Patient Intake Form

Patient Name: Emilia

Age: Approx. 28–32

Occupation: Lady-in-waiting to Desdemona

Date of Evaluation: May 1, 2025

Referral Source: Court physician following psychological collapse and physical trauma

Presenting Complaint: Reports of fatigue, chronic shoulder/neck tension, disrupted sleep, emotional numbness, and unresolved grief. Recently involved in a traumatic confrontation resulting in psychological distress and minor physical injury.

Medical History: No known chronic conditions. Minor bruising, tension-related headaches.

Psychosocial History:

- Experienced prolonged emotional abuse and gaslighting by husband (Iago).
- Exposed to Desdemona's murder and confessed betrayal of moral values under duress.
- Displays signs of PTSD, moral injury, and grief.
- Limited social support system shaped by historical power imbalances in class and gender.

Patient Goals: Patient wants to feel strong again, find peace after all she's said and done, and to use her voice without fear.

SOAP Note

Date: May 1, 2025

Therapist: Kaitlyn Glaesmann, SPT

Patient: Emilia

Diagnosis Codes: PTSD (F43.10), Somatic Symptom Disorder (F45.1), Chronic Cervical Strain (M54.2)

S (Subjective): Patient reports persistent tension in upper body, frequent headaches, and difficulty sleeping. States she feels “torn between guilt and righteousness” after confronting the systemic injustice in Desdemona's death. Emotionally volatile, easily tearful during interview. Mentions feeling “like my body is still bracing for a blow.” Expresses desire to “be useful again,” but is overwhelmed by social fallout. Patient stated, “I will not charm my tongue; I am bound to speak.” – Act V, Scene 2

O (Objective):

- Palpable muscle tension in bilateral trapezius and cervical spine
- Limited cervical ROM due to guarding
- Postural assessment: anterior shoulder rounding, slight kyphotic posture
- Observed shallow breathing, mild tremors during emotional recall
- Depression and anxiety screening: Elevated on both scales
- No gross motor deficits or neurological red flags

A (Assessment): Patient demonstrates psychosomatic manifestations of trauma (PTSD), including muscular guarding, tension headaches, and disturbed sleep. Emotional and interpersonal trauma, stemming from gendered oppression and domestic abuse, is linked to moral injury and the betrayal of personal values. High potential for recovery with integrated biopsychosocial intervention.

P (Plan):

1. Physical Therapy Interventions

- Myofascial release and soft tissue mobilization for neck/shoulders
- Gentle ROM exercises for cervical spine
- Diaphragmatic breathing training
- Posture correction, and progressive strengthening
- Yoga-based grounding techniques

2. Psychosocial Integration

- Trauma-informed care: active listening, patient empowerment
- Refer to mental health therapist for PTSD support
- Introduce journaling or narrative therapy to process grief and moral conflict
- Encourage participation in women’s recovery group (feminist peer support)

3. Patient Education

- Mind-body connection and how trauma can be stored physically
- Breathing and mindfulness as tools for nervous system regulation
- Body as a source of truth and voice—reclaiming agency

4. Short-Term Goals (2–4 weeks)

- Reduce headache frequency by 50%
- Improve sleep quality to 5 nights/week uninterrupted
- Normalize cervical ROM
- Initiate one narrative healing activity (e.g., letter-writing, art)

5. Long-Term Goals (6–12 weeks)

- Restore full ROM and posture alignment
- Develop emotional regulation strategies
- Strengthening body-mind connection
- Rebuild sense of identity and voice

Personalized Rehabilitation Plan

Date: May 1, 2025

Therapist: Kaitlyn Glaesmann, SPT

Patient: Emilia

Diagnosis Codes: PTSD (F43.10), Somatic Symptom Disorder (F45.1), Chronic Cervical Strain (M54.2)

Biopsychosocial Framework: I’ve diagnosed Emilia’s recovery as requiring coordinated care across three domains:

	Focus	Goals
Biological	Restore physical function	Relieve muscle tension, improve posture, reduce somatic trauma symptoms
Psychological	Address trauma and moral injury	Rebuild emotional resilience, process grief, restore sleep
Social	Rebuild identity and agency	Reconnect with values, voice, and community

Phase 1: Stabilization (Weeks 1–2)

Goal: Establish safety (both physical and emotional) and begin releasing the chronic tension associated with silence and suppression.

Patient Statement: “I will not charm my tongue; I am bound to speak.” (V.2)
This marks the beginning of a somatic shift. After years of being silenced, she begins to release held tension in the neck, shoulders, and jaw—areas typically associated with emotional suppression.

Initial Presentation: Emilia enters this phase in a state of guarded tension, marked by stress-related postural dysfunction and shallow breathing. Her physical presentation reflects the emotional suppression she’s endured while serving Desdemona and remaining loyal to Iago.

- **PT Interventions:**

- Soft tissue release: trapezius, SCM, suboccipital
- Gentle cervical ROM and breathing coordination
- Diaphragmatic breathing training (3x/day)
- Postural retraining for grounded presence

- **Psychosocial Approach:**

- Create safe therapeutic alliance
- Begin journaling around bodily awareness and suppressed emotions
- Referral to trauma-informed mental health support

Phase 2: Empowerment (Weeks 3–6)

Goal: Develop strength, autonomy, and trust in her body, and begin integrating emotional processing with physical activation.

Patient Statement: “’Tis proper I obey him, but not now” (V.2).

Starting Statement: We focus on postural expansion and scapular engagement to physically counteract years of guarded, inward posture. Movements that open the chest and lift the gaze are key metaphors for reclaiming voice and agency.

- **PT Interventions:**

- Scapular and core strengthening with resistance bands
- Yoga-based mobility: thread-the-needle, cobra, cat-cow
- Functional journaling: tracking both physical progress and emotional themes
- Walking drills with upright posture and eye-level gaze

- **Emotional Integration:**

- Reflective writing: “Letter to Desdemona”
- Symbolic movement: open-chest and balance-based poses to represent truth and steadiness
- Peer support or fictional “women’s justice circle” as imagined safe space

Phase closing statement: This phase is about preparing Emilia to move through the world with strength and qualities she displayed in the face of danger when others stayed silent.

Phase 3: Integration & Transition (Weeks 6–12)

Goal: Restore full functional mobility and help Emilia reclaim her voice and identity through embodied empowerment.

Patient Statement: “I care not for thy sword; I’ll make thee known.” (V.2)

Starting Statement: We design this phase of the plan around long-term resilience, personal rituals of care, and a patient-led movement flow that mirrors her reclaimed sense of identity.

• **PT Interventions:**

- Final postural and mobility assessment
- Guided walking meditations
- Independent strength program for maintenance
- Self-designed movement sequence (“Reclamation Flow”)

• **Narrative Integration:**

- Emilia writes a “Reclamation Statement” about who she is now
- Optional creative session: drawing, poetry, or expressive art
- Closure conversation reflecting on how justice and loyalty live in her body now

Discharge Note

Date: July 24, 2025

Therapist: Kaitlyn Glaesmann, SPT

Patient: Emilia

Diagnosis Codes: PTSD (F43.10), Somatic Symptom Disorder (F45.1), Chronic Cervical Strain (M54.2)

Patient’s Reclamation Statement: “I was silent for too long, trained by fear, bound by duty. But truth tore itself from my throat when silence became betrayal. I speak now—not for vengeance, but for justice. Not just for Desdemona, but for every woman told her voice is a threat.

My body carries the weight of what I bore quietly. Now it moves in strength, no longer in shame. I am not what I suffered—I am what I chose: To rise, to speak, and to live.”

Summary of Care: Emilia completed a 12-week personalized rehabilitation program guided by the biopsychosocial model. Her plan focused on releasing chronic tension patterns, improving functional mobility, and integrating emotional and narrative healing. Care emphasized patient autonomy, trauma-informed principles, and symbolic empowerment through movement and storytelling.

At the first presentation of therapy, Emilia had chronic muscle tension (especially in the shoulders and neck), limited cervical range of motion, shallow respiration, and psychological distress secondary to moral injury and secret truth. Guilt, sadness, and struggle about loyalty, silence, and being an accomplice in the run-up to the death of Desdemona were noted.

Course of Progress: Throughout treatment, Emilia steadily regained mobility and physical ease, but her most meaningful gains were psychosocial. In early stages, we focused on breath retraining and postural awareness—helping her release patterns rooted in emotional suppression. As she progressed, we used strength training, yoga-based flow, and narrative exercises to help her reclaim personal power.

She engaged fully in reflective writing, creative expression, and a symbolic “Letter to Desdemona,” processing complex emotions around betrayal and justice. During her final sessions, she designed and performed her own “Reclamation Flow,” a personalized movement sequence reflecting strength, voice, and agency.

Outcome Measures:

- Cervical ROM: Full, pain-free in all planes
- PHQ-9: Score improved from “moderate” to “minimal” depression range
- Breathing pattern: Transitioned from shallow/apical to coordinated diaphragmatic breathing
- Postural Assessment: Neutral head alignment, open chest, symmetrical shoulder positioning
- Functional Tolerance: Able to sit, walk, and write comfortably without pain

Discharge Statement: “I care not for thy sword; I’ll make thee known.” (V.2) Emilia concludes her healing process as she did her life in *Othello*—with truth, courage, and clarity. Her final physical state mirrors this inner transformation: upright, centered, and unapologetically present.

Recommendations for Continued Growth:

- Maintain independent strength and mobility program 3x/week
- Continue journaling and narrative-based self-reflection
- Engage in supportive communities aligned with justice and equity
- Consider creative outlets (movement, art, writing) for emotional regulation
- Follow up with trauma-informed counseling as needed

Discharge Status: Goals met. Patient is safe to discharge with a high level of independence and insight. Emilia has demonstrated the capacity to regain physical function and redefine her identity through embodied healing.

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The Elusive Search for Absolutism

Research Paper by
VANESSA REYNA

ENGL 2322: SURVEY OF BRITISH LITERATURE -
ANGLO-SAXON TO 18TH CENTURY

In her research essay, Vanessa examines the author's purpose in "A Satire Against Reason and Mankind" by John Wilmot, Second Earl of Rochester. She demonstrates her understanding of literary history by exploring England's Restoration Era, and provides a close reading of the text to support her claims. In addition to her analysis of the poem, she carefully examines Rochester's literary oeuvre and the existential nature of his work. When analyzing the speaker's ambivalence, she critiques the paradox between Rochester's real-life actions and the virtues he appears to uphold in the "Satire." Vanessa's essay is insightful and well-organized. Her conclusion invites us to see the poem as more than witty satire; she brings us into the speaker's mind and persuasively aligns his views with Rochester himself. In doing so, she humanizes Rochester and reveals how his perspective is just as relevant today as it was in 1679.

- Chrisoula Gonzales

The charge leveled against mankind is its tendency to hinder its own happiness through reason and doubt. The plaintiff is John Wilmot, Second Earl of Rochester. In "A Satire against Reason and Mankind," a speaker repeatedly declares that beasts are wiser than men, and if he had the choice, he would be a creature of the wild. Despite its impressive structure, the poem is replete with contradictions; its defenses frequently circle back to its main points and undermine the very positions it initially rejects. Inevitably, paradoxes arise; the speaker rails against wisdom and wit, yet clearly has a wide capacity for both, as he demonstrates with eloquence and thorough reasoning. Although Rochester grew skeptical of Anglican Christianity at an early age, his upbringing had a notable role in the beliefs expressed in the satire, and his desire for a measured, balanced version of the truth persisted. As a libertine, he felt contempt for his contemporaries, wishing to separate himself from their knavery, which he admits he was unable to do. The disdain for humanity in "Satire" reflects Rochester's insatiable search for a belief system to awaken and sustain in him a strong sense of moral security.

The speaker's first claim is that mankind has developed "a sixth [sense] to contradict the other five: / And before certain instinct will prefer / Reason" (lines 9-11). This sixth sense results in more harm than good, leading men to doubt themselves instead of bolstering their esteem. The speaker's imagined adversary

counters with the notion that God created humans above beasts, of which our rationality is proof. The speaker takes on a cynical tone, dismissing his adversary with an extensive list of philosophers who wasted time dwelling on counterintuitive matters. Thought, he argues, is irrelevant; “[o]ur sphere of action is life’s happiness, / And he who thinks beyond, thinks like an ass” (lines 96-97). In moments of inactivity, men are not meant to turn to thought, but revel in life’s joys. However, at the beginning of the poem, he concedes that he is not “a free spirit to choose” (line 3). Isabelle White describes this instability of values as stemming from his being “implicat[ed] in that which he judges” (49). While the speaker concedes that there exists a “right reason” (line 99), he is not exempt from his criticism of man’s behavior. He is unable to relate an impartial view of the society that surrounds him, nor extricate himself from controversy on both sides. He sees that “wisdom did... happiness destroy / Aiming to know that world he should enjoy” (lines 33-34), yet by the end, he appeals to someone who “does believe / Mysterious truths, which no man can conceive” (lines 214-215). Here he presents yet another problematic paradox by challenging anyone with intangible faith to step forward, despite his opposition to this seemingly unfounded judgment.

Throughout his adulthood, Rochester was associated with so-called fops, rakes, libertines, and whores. Samuel J. Rogal dubs him “the courtier who looked upon his contemporaries as fundamentally envious and dull... bitter, disgusted, and irritable at himself for playing a leading role in the grand but meaningless game of Restoration life” (3). His disillusionment with his peers emerges in his writing: “For wits are treated just like common whores / First they’re enjoyed and then kicked out of doors” (lines 37-38). Fops, while initially producing pleasure for those they entertain, leave behind doubt, which festers into pain; pain breeds fear, and fear becomes hate. Society scorns them for dispersing the wisdom they uphold as truth. “Birds feed on birds, beasts on each other prey, / But savage man alone does man betray” (lines 129-130). Beasts kill each other out of necessity for sustenance; men betray each other for no viable reason. They assume disguises and invent pretenses to defend themselves, only acting bravely to satisfy their lust for power, honor, and fame. It seems futile to the speaker to break from the status quo, as all the knaves, in a rare moment of camaraderie, will come together to take advantage of his vulnerability. He sees no escape from this system of deception, “[a]nd all the subject matter of debate / Is only who’s a knave of the first rate” (lines 172-173). If the speaker thought these tricks amounted to a productive purpose, he might not feel repulsed by this display of human nature. Still, he offers no substantial justification for the deceit men impose upon one another.

The adversary of the speaker in “Satire” is presented as a “formal band and beard” (line 46)—in other words, a clergyman. This literary choice comes as no surprise given the poet’s history with the Church of England. Nicholas Fisher points out that in Rochester’s time, atheism was “a term used loosely that embraced agnostics, deists, heretics, outright disbelievers as well as, more generally, evil livers” (333). Seeing as how Rochester was constantly swept up

in a sea of debauchery and openly spoke out against the practices of the Church and consequently became a target of its institutional hostility. The clergy largely ignored the circumstances of Wilmot's early life. While many people focus on his father's service to King Charles II, making his son "not so much a product of the Restoration as of the monarch who reaped the benefits from that event" (Rogal 1), little attention is spared for his primarily Anglican background, in which his devout mother, Lady Anne, and the family chaplain (Wilmot's tutor) were influential figures. "The Bible and Prayer Book... had become a permanent frame of reference for him" (Fisher 325), and his surviving letters, even during his separation from the Church, contain scattered religious phrases that he would have studied in his youth. His "Satire" noticeably refrains from questioning specific Christian tenets; instead, he denounces the clergy's conduct and their use of religion to inhibit themselves and their instincts: "This supernatural gift, that makes a mite / Think he's the image of the infinite" (lines 76-77). The speaker does not deny the divine origin of reason but will not accept the idea that some men see themselves as superior simply for possessing reason. He demands, "Is there a churchman who on God relies, / Whose life his faith and doctrine justify?" (lines 192-193). It is not their belief in God he attacks; in fact, he argues that one should follow God justly and righteously. Rochester is embittered by the hypocrisy that is frequently excused within the Church, and has a tough time imagining there could be a worthy one among them.

Rochester's deathbed conversion, while surprising to some, was foreshadowed in "Satire." Severely afflicted with several venereal diseases, his last moments were spent in debate with Gilbert Burnet, a respected preacher and philosopher in the sphere of Anglicanism. Rochester was recorded in having rejected Burnet's attempts to defy his atheism with assertions that echo this line: "'Tis not true reason I despise, but yours" (line 111).

He regretted his actions since "he had made himself a Beast, and had brought pain and sickness on his Body," but could not be persuaded that a "Supreme Being" would grant him a human appetite only to demand it be restricted (Burnet 35). Even so, his biography reveals a lifelong yearning for absolute truth and an inability to return to the Church due to the rampant hypocrisy he observed there. When he attempted to find answers in the royal court, he encountered more deceit and man's betrayal of other men. The speaker in his satire proposes, "If upon earth there dwell such God-like men, / I'll here recant my paradox to them" (lines 216-217). He is doubtful that these men can be discovered, but he concludes his argument with a warning. If they were to step into the limelight someday, mankind should follow the virtuous examples they set. Until then, men are doomed never to support their fellow man.

With the recruitment of another chaplain and his reading of Isaiah 53, Rochester was moved to repent from the sins he had committed in his debauched past (Burnet 140-141). Perhaps it was one of the rare moments he felt such certainty in the outcome of a decision he made or saw himself in the man who was "despised and rejected of men; a man of sorrows, and acquainted with grief" (KJV Bible, Isaiah 53:3). Either way, "A Satire Against Reason and Mankind,"

published a few years before Rochester's untimely death, exposes to readers the thoughts of a man torn between conflicting desires, both carnal and spiritual. On a hunt for the absolute in a world rife with contradictions, the result can only be a mind pulled in irreconcilable directions—a consciousness ultimately divided. The truest act of mercy may be to accept that there is no singular solution, or perhaps to surrender to the very doctrines one once resisted.

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The Archetype of Rice in Three Vietnamese Folktales

Research Paper by
JESS TRAN

ENGL 1302: COMPOSITION AND RHETORIC II

In her research paper, Jess Tran adopts the lens of a folklorist to explore the archetypal significance of rice in three Vietnamese folktales and in Vietnamese culture more broadly. She grounds her analysis in Carl Jung's theory of archetypes—universal images and situations found in “myths, art, and dreams” that express cultural and psychological meaning. Jess selects three stories to illustrate the varied philosophical and political roles rice plays within each narrative. She also offers insightful speculation on rice's culinary and symbolic importance during Tết (the Vietnamese New Year) and in ancestor worship. The paper is highly organized, beginning with a clear introduction outlining her purpose, followed by a concise overview of Jung's framework. Jess thoughtfully applies Jungian concepts to analyze the archetypal function of rice in each tale, and her thorough research is a strong example of focused, interdisciplinary research.

- Ron Heckelman

Rice holds a central role in Vietnamese culture and cuisine. It occupies a central space in the daily lives of Vietnamese people, from farmers to businessmen, from the poor to the rich. In Vietnamese folktales, rice often appears as the primary source of nourishment—akin to bread in Western culture—which emphasizes its role as a cultural staple. This essay examines three well-known Vietnamese tales—“Thạch Sanh” “Thanh Giong” and “The Legend of Vietnam's Tet Cakes”—to explore the archetypal symbolism of rice in Vietnamese culture.

All living beings need to eat to survive and thus food and cooking naturally play a symbolic and archetypal role in many folktales. Carl Jung defines archetypes as “universal symbols that shape how people perceive the world and are expressed in myths, art, and dreams” (Heckelman). For example, the red poisoned apple in “Snow White” suggests temptation and envy. The image of rice in Vietnamese folktales also shows special meanings in different stories. Rice was first grown and consumed thousands of years ago. “Asia's first cultivated crop,” Vietnamese people have been farming rice ever since 9000 B.C.E. (Snodgrass 446). Rice is “the staff of life and the food of immortality,” and can represent “wealth, abundance and primeval innocence” (Chevalier and Gheerbrant 801). Its long-standing key position in Vietnamese culture is reflected in the tales, as rice typically functions as the main food stuff.

For instance, in “Thanh Giong,” while everyone is worried about how Giong, a three-year-old child, can fight as a soldier, he asks his mother to feed him rice to turn him into an adult. His mother “cooked a large pot full of rice.” He keeps eating all the rice until he becomes so large that his old clothes are torn apart. After he wins the war, Giong flies to heaven, as he refers to himself as “a general of heaven” (“Thanh Giong”). Rice, in this story, is “the food of power and immortality” (Chevalier and Gheerbrant 801). Because Giong has eaten a lot of rice, it leads to his growth, and in the end, and he ascends to live forever in heaven. Rice also provides him with strength and “an excellent supply of muscular energy” (Davidson 682). With all the power he gains from eating rice, Giong defeats his enemies and successfully protects his people, demonstrating rice’s nutritional and symbolic value.

Another illustration is the rice pot in “Thạch Sanh,” which provides a different meaning. After marrying the princess, Thạch Sanh incites jealousy among the other royals, who conspire to start a war. Thạch Sanh uses his lute to discourage the other parties and offers them a tiny pot of rice. Those people underestimate the significance of Thạch Sanh’s offering. They continue to eat, yet the pot “[is] still full of rice,” a miraculous sign of abundance (Mit). After this experience, they finally surrender. Hà Minh Tiêu writes, “*Niêu cơm bé xíu nhưng chính là tượng trưng cho uy quyền, cho sự thần thông biến hóa để được sự giàu có thịnh vượng, cho thỏa mãn ước mơ ở đời,*” which translates that the tiny rice pot is “a symbol of authority,” “the divine power to transform to be rich and prosperous,” and to “satisfy dreams in life” (“Niêu cơm Thạch Sanh”). The rice pot, although tiny, will never let anyone underrate its power, much like the resilience and enduring spirit of the Vietnamese people.

Apart from white rice, Vietnamese people also create and consume many dishes made of sticky rice. Sticky rice is considered “more nutritious and more aromatic than any other type of rice” (X. Nguyen). Two of the most classic Vietnamese foods that use sticky rice as the main ingredient are *bánh chưng* and *bánh giầy*, which even have a tale retelling their origin. While the brothers in the tale plan to offer luxurious food as part of a cooking contest, Lang Liêu is inspired to craft two symbolic cakes using sticky rice; one is square-shaped representing earth, and the other is round like heaven, because “Nothing can be as big as the heaven and the earth, or as precious as rice” (“The Legend of Vietnam’s Tet Cakes”). Lang Liêu presents his dishes, showing gratitude for the ancestors of their nation who have established the foundation of an agricultural country by cultivating rice crops. He also explains how the making of the square cake (*bánh chưng*) and the round cake (*bánh giầy*) are taken from the idea of the harmony of yin-yang, and the five elements (metal, wood, water, fire, and earth), which shows “fullness and completeness” (H. Nguyen 15). It can be understood that *bánh chưng* and *bánh giầy* are products that combine the most significant values of the Vietnamese people and culture, including respect and gratitude for ancestors and the belief in perfection and abundance.

White rice, though plain, has a very light sweet taste, and is the ideal carbohydrate, adaptable to nearly any side dish. A Vietnamese household meal

typically includes a pot of rice, three savory dishes, one bowl of soup, and sometimes a dessert. While other dishes can be substituted to enhance a family's menu, rice, especially white rice, is always available, occupying a permanent plate in daily meals. In poor households that can't afford to buy meat, white rice can be eaten with sesame salt (or salty sesame), pork fat, or soy sauce. Dishes like fried rice utilize repurpose cold or leftover rice to prevent the rice from absorbing the moisture of other ingredients. People can also use rice to make porridge, noodles, vermicelli, and even rice paper. Rice easily lends itself to the creation of innovative dishes that blend perfectly with other Vietnamese spices.



While plain white rice maintains its irreplaceable status in everyday meals, on special occasions, sticky rice plays an important role. During Tết (Vietnamese New Year), families prepare food that uses sticky rice to make offerings for their ancestors. Often, people in the northern region will have *bánh chưng* (the square cake), and people in central and the south-western region will have *bánh tét* (the cylindrical cake, with the same ingredients as *bánh chưng*). Though the cakes can be bought from merchants easily, many Vietnamese families keep the tradition of making *bánh chưng* and *bánh tét* at home, enjoying their time together around the firewood stoves. The neutral flavor of sticky rice absorbs the light green hue and subtle sweetness. Symbolically, it acts as a canvas that harmonizes the scent of *dong* leaf, the nuttiness of mashed mung bean, and the richness of pork belly into one perfect flavor. There are also options for those who don't prefer meat: *bánh tét chuối* (*bánh tét* with banana-filling) and *xôi gấc* (sweet gourd sticky rice). *Xôi Gấc* attracts everyone with its vibrant reddish-orange color; though not flavored too intensely or with any fillings, the subtly sweet, delicate taste of the sticky rice, with a hint of creaminess from coconut milk, is a great delicacy that archetypally represents a dance of yin and yang oppositions.

The role of rice in Vietnamese culture is undoubtedly archetypal and irreplaceable. It exists throughout the history of Vietnam and the Vietnamese

people, and of course, in Vietnamese passed down through generations. The archetype of rice represents strength, immortality, abundance, and perfection. The use of rice in the three tales “Thanh Giong,” “Thach Sanh,” and “The Legend of Vietnam’s Tet Cakes” shows how rice is vital and valuable to Vietnamese culture. To this day, Vietnamese people still cherish their rice, as it has never disappeared from their daily life, nor has it been permanently replaced by any other food. The tales that are discussed in this research are as immortal as rice, as they are continuously retold to younger generations, who show gratitude to their ancestors and value rice as a celebration of their cultural and culinary heritage.

To view the image from this article in color, please scan the top QR code on pg. 120 or visit <https://lscmontgomerycac.com/visual-communication-2025/>

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**Analyzing
Cybersecurity
Challenges
and Strategies
in Texas Local
Governments**

**Research Paper by
TRISTAN MONTEBLANCO**

GOVTH 2306: TEXAS GOVERNMENT (HONORS)

Tristan MontebLANco's research paper masterfully tackles a critical and underexplored issue in Texas government: the escalating vulnerability of municipal institutions to sophisticated cyberattacks, despite their custodianship of vast, sensitive data. Tasked with relating his degree major to a pressing issue in Texas government, MontebLANco first identifies and documents a notable gap in the scholarly literature; namely, how underfunded and overburdened localities navigate non-mandated state cybersecurity frameworks whilst countering unrelenting attacks. His methodology is unusually systematic, incorporating quantitative data on cybersecurity and remediation efforts, alongside crucial qualitative insights from his expert interview with the Chief Information Officer for the City of Dallas. Demonstrating a mature grasp of research writing and intellectual synthesis, MontebLANco's literature review is a model of academic prose and seamlessly lays the foundation for his primary source analysis. In totality, the paper exemplifies professional scholarship in terms of both design and delivery.

- Fiona Ross

Abstract

Using a primary interview with a government cybersecurity leader, this study seeks to analyze current cybersecurity programs in Texas local governments to identify vulnerabilities, assess barriers, and highlight further developments. With the increasing digitalization of governmental operations, sensitive information stored in government databases, and barriers in cybersecurity programs in municipalities, local governments are a vulnerable target for cyberattacks. Texas is ranked third in cyberattacks and the number increases every year. However, while recent cybersecurity initiatives in Texas help support local governments to improve their cyber programs through education, funding, and communication between tech leaders, one problem remains significant as studies on cybersecurity in local governments are generalized, with little research conducted specifically on Texas cyber programs. To address this gap, a semi-structured interview with Dr. Brian Gardner, the Chief Information Officer in Dallas City, was conducted to obtain a deeper

understanding of the effectiveness of cyber programs in Texas local governments. The results indicate that barriers are reduced due to legislation and federal and state grants. However, government still lags behind in cybersecurity compared to the private sector. While this study provides promising solutions to cybersecurity barriers for local governments, further research should evaluate cyber programs in small to medium-sized municipalities due to their unique resource challenges.

Introduction

Since 2018, cybercrime in the US has increased from \$2.7B to \$12.3B in financial losses, indicating that cyberattacks are becoming increasingly devastating (Crane, 2020; Lynch, 2024). In addition, local governments are a primary target, as they control utilities, government data, and civilian information in their databases (Norris et al., 2015). With over 90,000 local governments in the US, 28% experience daily cyberattacks, with some reaching over 10,000 a day (Norris et al., 2015). Local governments also face barriers in their cybersecurity programs, such as lack of staff and funding, cybersecurity awareness in government employees, and governance. Specifically in Texas, its growing population only makes the state a “large and ever-growing pool of potential targets” (“Cybersecurity”, 2018). Among the little research done on cybersecurity in local governments, there exists a literature gap evaluating specifically Texas local governments. Additionally, municipalities operate autonomously, meaning that there isn’t a single mandatory framework for cybersecurity programs in local governments. To fill this gap, this paper conducts a primary interview with a city tech leader from the City of Dallas to determine solutions to barriers, initiatives, and provide insight on the current state of cybersecurity in Texas local governments.

Methodology

This research first addresses the significance of cybersecurity in local governments in Texas and current threat levels. The following literature review explains an introduction to cyberattacks, cybersecurity frameworks, barriers local governments face, and the state of cybersecurity in Texas. In addition, examples of cyberattack on Texas local governments are discussed, as well as the Texas Cybersecurity Framework and recent cyber legislation. Following the critical literature review, a primary source analysis from a government tech leader adds depth to the analysis. The interview was conducted on November 7th, 2024 with Dr. Brian Gardner, the interim Chief Information Officer (CIO) of Dallas City to give a deeper understanding of current cybersecurity barriers and potential solutions.

Literature Review

As technology becomes increasingly engrained into the function of today’s society, organizations, businesses, and individuals become more susceptible to cyberattacks. Cyberattacks are attempts to access information, damage systems, or freeze user access of individual computers or large networks to serve hackers’

interests (Zhu-Butler, 2022). Furthermore, they can cause substantial financial loss for businesses and individuals. Figure 1 below shows data from the FBI Internet Crime Report of total losses from 2009-2018:



Figure 1 (Crane, 2020)

Since the record breaking total financial loss of \$2.7B per the FBI Internet Crime Report in 2018, there has been an increasing trend in cybercrime as 2023 recorded \$12.5B in losses in the USA (Crane, 2020; Lynch, 2024). It is important to note that although the number of cyberattack reports have remained consistent in this period, the increase in damage shows that attackers are becoming more efficient.

Cyberattacks

Cyberattacks come from a multitude of motivations, such as obtaining personal information and selling it, ransomware, political motives, or for fun (Hossain et al., 2024). Hackers can belong to organized cyber terrorist groups, “for hire” hackers targeting systems for financial or political gain, or hacktivist groups, all with different motives and missions. Interestingly, 82% of attacks come from other nations such as China (30%), Romania (28%), Bulgaria (7%), and Russia (5%) (Norris et al., 2015). Only 18% of attacks on US IT systems come from the US itself. For these hackers, there is also a plethora of cyberattack venues at their disposal, from web to cryptographic attacks, each with its own success rate and goal (Kaur & Ramkumar, 2021). However, the most common cyberattacks recently include phishing and malware (Norris et al., 2015). Figure 2 on the following page demonstrates the quantity of phishing sites versus malware sites from 2009-2019. Around 2018, there is a shift in active malware and phishing sites, where phishing sites grow exponentially, and malware experiences a decline. This data supports Norris et al.’s claim that most attacks use phishing rather than brute force attacks such as injection attacks or attempts directly on the firewall (Norris et al, 2015).

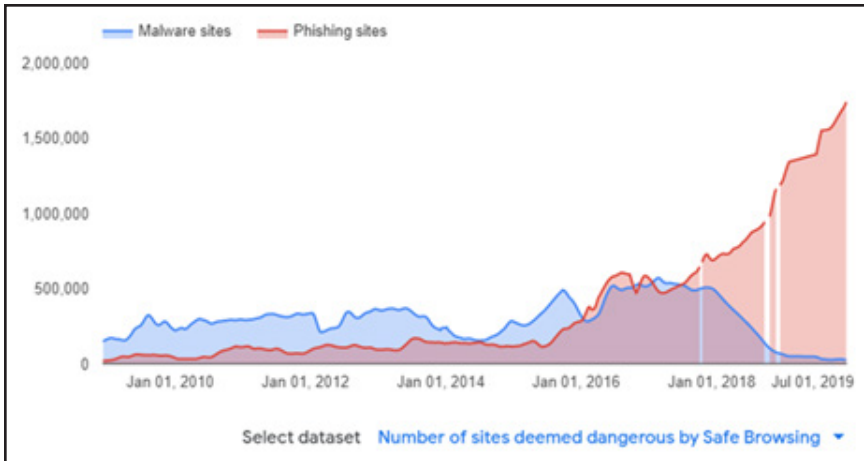


Figure 2 (Crane, 2020)

Phishing usually involves emails and using social engineering, where it convinces the victim to click a malicious link or makes the user unknowingly type in login information into a fake login website (Grubbs, 2022). The Texas Department of Information Resources notes that 74% of cyberattacks involve human error (2024). Additionally, attackers also might research the victim's life to personalize the attack to make it more persuasive and look legitimate (Grubbs, 2022). Although thousands of these automated emails are blocked before they arrive in a user's inbox, "the attacker only needs to be right once" to steal personal information (Havich, 2023a). Once given access to these accounts, hackers have access to medical records, personal information, and even government systems and information (Bailey, 2024). Ultimately, phishing is a very effective method of cyberattack as it manipulates victims.

Conversely, ransomware is less common but can cause catastrophic financial and system damage. Ransomware is defined as malicious software that prevents access to data from a computer or network, and returning access when ransom is received (Grubbs, 2022). On average, demanded ransom averages to about \$110,000, but cases such as the Coastal Pipeline ransomware attack in 2021 were reported to pay \$4.5 million to get access to their software back (Zhu-Butler, 2022; Nodeland, 2023). On top of massive financial losses due to ransomware, critical infrastructure can be affected. The Coastal Pipeline's computer systems located in Houston, Texas were shut down for six days straight, causing a fuel shortage and rise in gas prices (Venter, 2023). Additionally, hackers have found that targeting large organizations or businesses is more profitable than stealing individuals' information (Grubbs, 2022). Some large organizations such as hospitals or school districts are more vulnerable to cyberattacks than businesses. Hospitals are drastically affected as not immediately paying the large ransom means that inability to access medical information and tasks that rely on computer systems can turn out to be catastrophic (Greig, 2024). A school district in San Antonio, Texas has also lost

access to their networks, eventually paying \$500,000 in ransom on top of financial struggles from COVID-19 (Grubbs, 2022). Additionally, large private and public sector organizations in the U.S. were targets for attack, either causing large financial loss or millions with their personal identifiable information (PII) stolen.

Government Cyberattacks

Local and state governments in the USA are primary cyberattack targets. These governments are constantly under cyber threats, with some experiencing more than 10,000 cyberattacks per day (Norris et al., 2015). Each of the fifty state governments and more than 90,000 individual local governments in the United States contain information technology (IT) systems and cumulatively spend billions of dollars a year supporting them. These IT systems store and contain an abundance of PII, access to government funds, and sensitive personal and government information (Norris et al., 2015). Figure 3 below visualizes the types of data collected and stored by local government:

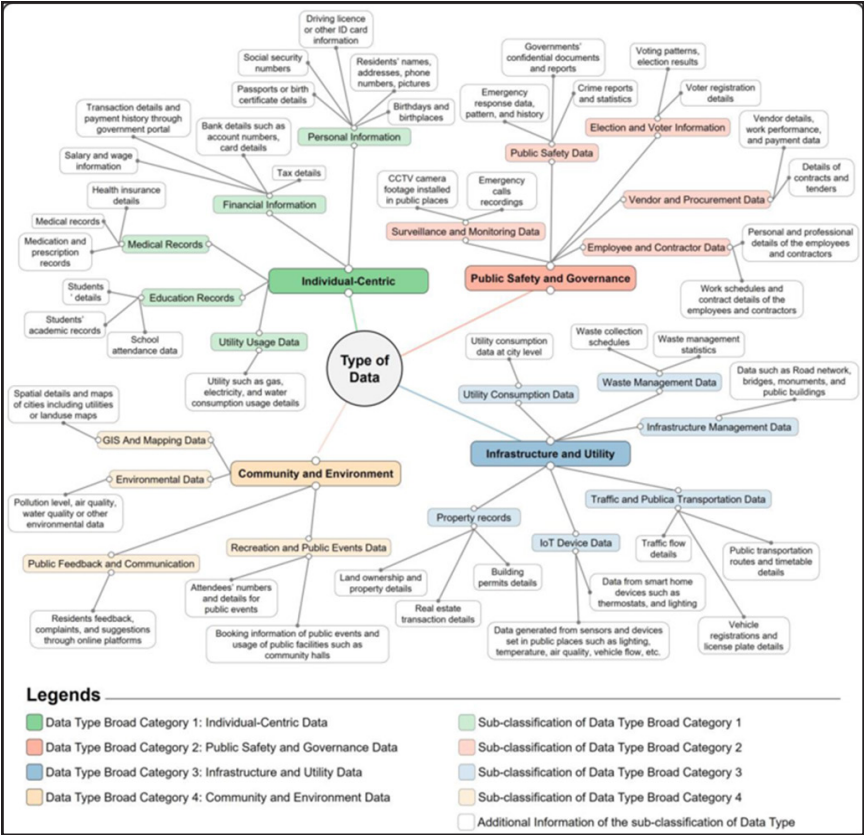


Figure 3 (Hossain et al., 2024)

However, local governments are especially vulnerable targets compared to state governments as the quantity and responsibilities they have can negatively affect

millions. Hossain et al. mentions that the digital transformation in managing city functions make urban life more efficient, however it also creates more vulnerabilities (2024). Cities are optimizing utility management, transportation, and public works through digital technology (Venter, 2023). Although local governments are more efficient in providing services and communication, about 27.7% experience hourly cyberattacks and 19.4% once per day (Hossain et al., 2024). A list of cyberattacks on local governments are displayed below in figure 4:

Year	Location	Attack Type	Description	Reference
2022	Somerset County, NJ, USA	Ransomware	The county suffered a ransomware attack, disrupting operations and limiting access to essential data like land records, vital statistics, and probate records, causing email service loss and internet-related services' disruption.	[12.70]
2022	Vilnius, Lithuania	DDoS	DDoS cyber-attacks in Lithuania disrupted state websites, causing the tax authority to temporarily shut down servers. The attacks targeted state and transport institutions, media, and private businesses, causing further threats.	[12.71]
2022	Palermo, Italy	Ransomware	The Palermo municipality experienced a major cyber-attack, disrupting services like surveillance, police operations, and online bookings. This was an issue for residents relying on tax machines and tourists struggling with online bookings, and it caused traffic zone card issuance to halt.	[12.72]
2022	Quincy, MA, USA	Ransomware	Quincy experienced a cyber-attack, compromising its systems and incurring ongoing costs, including USD18,000 for legal compliance fees. Many city departments, including Planning and Development, remain hampered, with certain functionalities like credit card payments for building permits still unavailable.	[12.73]
2019	Baltimore, MD, USA	Ransomware	A ransomware attack on Baltimore's local government operations, using RobinHood ransomware, disrupted real estate transactions and billing systems, causing significant operational and financial challenges for the local government. Baltimore refused to pay the ransom demanded, which was around USD75,000 in Bitcoin. The city's recovery and remediation efforts cost millions and took months.	[74.75]
2018	Baltimore, MD, USA	Ransomware	A ransomware attack in Baltimore disrupted the city's 911 dispatch system, causing the city to revert to manual emergency dispatching for 17 h. The incident highlighted vulnerabilities in the city's technological systems and highlighted the need for enhanced cybersecurity measures.	[6.11,15,58,74]
2015	Jefferson County, TX, USA		Jefferson County, Texas, experienced a significant data breach when the Social Security Numbers of thousands of residents were disclosed online, highlighting vulnerabilities in the county's data management systems.	[11]
2015	Dallas County, TX, USA		The county suffered a data breach, exposing residents' personal information for over six months, raising concerns about the local government's data management and cybersecurity practices.	[11]
2014	City of Akron, OH, USA		47,452 documents published online following a breach by a group.	[11]
2014	City of Detroit, MI, USA		A cyber-attack in Detroit compromised the personal data of 1700 city employees by locking access to sensitive files, including names, birth dates, and Social Security Numbers.	[11]
2013	Baltimore, MD, USA	Insider attack	Insider breach threatening the personal records of 12,000 county employees.	[11]

Figure 4 (Hossain et al., 2024)

Due to the vulnerability of IT systems, the information stored, and the quantity of attacks on the vast amount of government in the United States suggests the importance of both cybersecurity policy and frameworks.

Federal Cybersecurity Framework

Governments and organizations must implement or improve cybersecurity policies and frameworks to reduce the risk of cyberattacks. The National Institute of Standards and Technology (NIST) agency from the Department of Commerce updated Cybersecurity Framework (CSF) in 2024 (Hossain, 2024). This framework is an assessment tool for organizations' current cybersecurity posture to detect strengths, weaknesses, and areas of improvement. Specifically, using organizational profiles, tiers, and CSF core, the framework can determine and categorize the level of the organization's cybersecurity practices and risk management. The CSF has six functions which include govern, identify, protect, detect, respond and recover which are applicable universally, allowing organizations to align the framework with their goals (Hossain, 2024). However, since each of the fifty states operates separately, there is no centralized way of implementing policies and leadership in cyber governance (Havich, 2023b). States such as Texas, Utah, and Virginia implement cybersecurity laws by omnibus, considering all personal data, compared to sector-specific implementing states such as California, Nevada, and Washington (Key Data Privacy and Cybersecurity Laws, 2023).

To remediate the decentralization, the State, Local, Tribal, and Territorial Government Coordinating Council (SLTTGCC) works to coordinate infrastructure management across all levels of government Cybersecurity and Infrastructure Security Agency (CISA). These federal policies aim to support organizations’ cybersecurity goals.

Local Government Cybersecurity Barriers

Local governments face many challenges when it comes to policy and enforcing cybersecurity. In addition to the lack of research on this topic, about 60% of local governments in the USA lack cyber security policies (Hossain et al., 2024). Hossain et al.’s study compared the 38 categories from the NIST CSF 2.0 to local governments cybersecurity policy; the table is shown below.

			Govern					Identify		Protect			Detect		Respond		Recover							
			Local Government	Category Covered	Organisational Context	Risk Management Strategy	Roles, Responsibilities, and Authorities	Policy	Oversight	Cybersecurity Supply Chain Risk Management	Asset Management	Risk Assessment	Improvement	Identity Management, Authentication, and Access Control	Awareness and Training	Data Security	Platform Security	Technology Infrastructure Resilience	Continuous Monitoring	Adverse Event Analysis	Incident Management	Incident Response Reporting and Communication	Incident Mitigation	Incident Recovery Plan Execution
Australia	Central Highlands	4	✓	✓	✓								✓					✓		✓				
	Murray River	9	✓	✓	✓				✓	✓	✓	✓	✓					✓			✓			
	Sutherland	11	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓				✓						
	Bayswater	5	✓																					
	Western Australia	7	✓	✓				✓				✓							✓					✓
	New South Wales	12	✓	✓	✓	✓			✓	✓	✓	✓	✓						✓		✓	✓		
	Tasmania	3	✓																					
	Murrumbidgee	4	✓	✓	✓						✓								✓		✓	✓		
	Rous	12	✓	✓	✓	✓				✓			✓	✓	✓	✓		✓		✓	✓	✓	✓	
	King Island	5	✓	✓	✓								✓	✓	✓				✓		✓	✓		
Copper Coast	7	✓	✓	✓																				
Balmoral Shire	10	✓	✓	✓	✓						✓	✓	✓	✓	✓						✓		✓	
Canada	Vancouver	11		✓	✓				✓	✓		✓	✓	✓	✓	✓		✓		✓				
	Greenview	12		✓	✓	✓						✓	✓	✓	✓	✓		✓	✓		✓			
England	London	13	✓	✓	✓	✓		✓				✓	✓	✓	✓	✓		✓		✓			✓	
	Enfield	4	✓	✓	✓	✓																		
	Northwest Leicestershire	9	✓	✓	✓	✓					✓	✓	✓	✓	✓	✓		✓		✓				
	Credition	4	✓	✓	✓	✓																		
	RBWM	8	✓	✓	✓	✓																		
India	Saughall and Shotwick Park	8	✓	✓	✓		✓			✓	✓								✓					
	Aylesford	7	✓									✓	✓	✓	✓	✓						✓		
	Telangana	7	✓	✓	✓	✓						✓	✓		✓	✓		✓				✓		
	Odisha	15	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓		✓		
	Jammu and Kashmir	9	✓	✓	✓	✓													✓		✓		✓	
USA	Tamil Nadu	11	✓	✓	✓	✓				✓		✓	✓	✓	✓	✓		✓		✓		✓		✓
	Assam	11	✓	✓	✓	✓				✓		✓	✓		✓	✓		✓		✓		✓		✓
	Tripura	5	✓	✓	✓	✓												✓		✓				
	Woodburn	16		✓	✓	✓				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	San Francisco	3	✓	✓	✓	✓																		
	New York	14	✓	✓	✓	✓		✓				✓	✓	✓	✓	✓		✓		✓			✓	
	Pleasantville	11	✓	✓	✓	✓						✓	✓	✓	✓	✓		✓		✓			✓	
	Beaverton	11	✓	✓	✓	✓				✓	✓	✓	✓	✓	✓	✓		✓		✓			✓	
	Albuquerque	1	✓																					
	Portland	5	✓									✓	✓	✓	✓	✓		✓		✓			✓	
Scappoose	10	✓			✓				✓			✓	✓	✓	✓		✓		✓			✓		
Madras	10	✓			✓				✓			✓	✓	✓	✓		✓		✓			✓		
Norwich	7	✓	✓	✓	✓																			
Lebanon	16	✓	✓	✓	✓				✓	✓		✓	✓	✓	✓	✓		✓		✓	✓	✓	✓	✓

Figure 5 (Hossain et al., 2024)

Alarmingly, 6 out of the 11 cities in the USA in this study addressed less than 10 categories of the NIST CSF, with three cities aligning with five or less.

In addition to the lack of or under enforced policy, the barriers that local governments face include insufficient funding and staff, lack of knowledge or understanding of importance for cybersecurity, and governance and federation (Norris et al., 2015). Insufficient funding makes it difficult for local governments to provide adequate cybersecurity protection and hire qualified IT and cybersecurity staff. This has led local governments to find alternative ways of dealing with cybersecurity, such as outsourcing or transferring data and programs to cloud

computing infrastructure (Norris et al., 2015). Addressing this issue, a one billion federal dollar grant targeted State, Local, Tribal, and Territorial (SLTT) government within the Cybersecurity and Infrastructure Security Agency (CISA) over four years (Havich, 2023b). This was the first federal initiative exclusively for local governments, however, due to complex rules, small and medium sized local governments will not meet funding or staff size requirements to receive the grant (Havich, 2023b).

Concerning the lack of knowledge or attitude towards cybersecurity in government, a study by Sulaiman et al. examined government employees' behavior towards cybersecurity in Malaysia using the Protection Motivation Theory (PMT) (2022). With this, they evaluated perceived severity, vulnerability, barrier, self-efficacy, and security response efficacy in these employees. They found that threat and security awareness were found to improve perceived severity and mitigate cybersecurity security risks (Sulaiman, 2022). This implies that cybersecurity education and training are essential for government employees.

Cybersecurity governance also faces challenges as local and state governments are federated among the three branches of government. IT departments usually are in the executive branch but have no real authority over the judicial and legislative branches (Norris et al., 2015). An interviewee in Norris et al.'s study mentions that they have "responsibility over all three branches of government," but "can't legally enforce policy, due to pesky constitution, over legislative and judicial branches" (Norris et al., 2015). In addition, there are many departments within the executive branch, with one participant from Norris et al.'s study saying that they have "35 different departments, each with varying levels of risk tolerance," and aligning the goals of each department with policy that can support each one proves to be difficult (2015). Also, local tech managers have little relationships with state government tech leaders, ensuing a gap in policy and communication across state and local government (Havich, 2023a).

Texas Cyberattacks

Cybersecurity should be a large concern in Texas government. According to the U.S. Federal Bureau of Investigation Internet Crime Complaint Center, Texas is ranked third in cases of cybercrime victims and second in financial losses ("Cybersecurity: Statewide Overview", 2018). Due to the growing Texas population, the comptroller says that Texas is a "large and ever-growing pool of potential targets" for cyberattacks ("Cybersecurity: Statewide Overview", 2018). Figure 6 on the following page shows the total financial losses due to cybercrime in Texas from 2016-2020. The increasing trend of financial losses may continue to increase as Texas experienced one billion dollars lost due to cybercrime in 2023. Although the massive financial loss in Texas due to cybercrime is at an all-time high, cybersecurity contributes about \$35.5 billion to the Texas economy as well as a growing job market ("Cybersecurity: Statewide Overview", 2018). Utilities in Texas are also being targeted. For example, the cyberattack on Coastal Pipeline located in Houston, Texas disrupted operations and causing millions in damage (Venter, 2023).

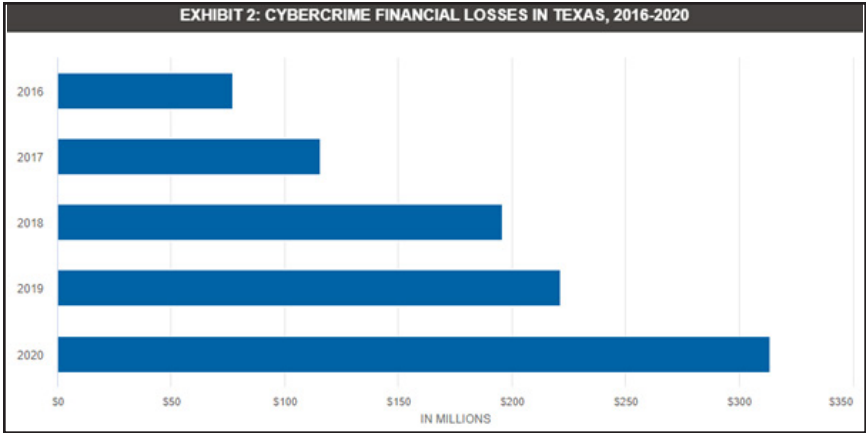


Figure 6 (Grubbs, 2022)

Texas Local Government Cyberattack Examples

Local governments in Texas were also victim to cyberattacks in recent years. On October 19, 2023, Dallas County experienced a ransomware attack by ransomware group “Play” which later released personal information of 201,404 people with 67,701 Texans affected by the attack (Bailey, 2024). Dallas County’s quick response to the attack involved posting cybersecurity resources to protect individuals’ personal information, deployed Endpoint Detection and Response to force password changes and block malicious IP addresses and provided two years of credit monitoring and identity theft protection services to victims of the attack (“Notice of cybersecurity incident”, 2023).

Further Texas municipality was also attacked on July 30, 2024, where the city of Killeen experienced a ransomware attack that shut their utility collections division (Greig, 2024). The city’s response was coordinated with the Texas Department of Resources (DIR) in which they disabled utility payment systems, cutting off connections with Bell County to contain the issue and relying on backup systems to restore servers (Greig, 2024). To deal with these cases, Texas has implemented guidelines that will give cybersecurity departments actions to prepare for and respond to cyberattacks.

Texas Cybersecurity Legislation and Frameworks

To defend against cyberattacks and prepare for potential breaches, Texas has launched new cybersecurity policies and implemented frameworks. According to the Texas DIR, Texas created the Texas Cybersecurity Framework (TCF) to address cybersecurity risk using cost-efficient, business-oriented, and limited regulation on agencies (“Texas Cybersecurity Framework. Department of Information Resources”). The framework is aligned with the NIST CSF with concurrent functions and 42 total security control objectives, with a Maturity Model to categorize the implementation of the objectives at an organization. A visual is provided on the following page in figure 8.

Functional Area	Description
Identify 	Develop an organizational understanding to manage cybersecurity risk to systems, people, assets, data, and capabilities.
Protect 	Develop and implement appropriate safeguards to ensure delivery of critical services.
Detect 	Develop and implement appropriate activities to detect the occurrence of a cybersecurity event.
Respond 	Develop and implement appropriate activities to take action regarding a detected cybersecurity incident.
Recover 	Develop and implement appropriate activities to maintain plans for resilience and to restore any capabilities or services that were impaired due to a cybersecurity incident.

Figure 7 ("Texas Cybersecurity Framework. Department of Information Resources")

Maturity Level	Keywords	Description
0	None, Nonexistent	There is no evidence of the organization meeting the objective.
1	Ad-hoc, Initial	The organization has an ad hoc, inconsistent, or reactive approach to meeting the objective.
2	Consistent, Repeatable	The organization has a consistent overall approach to the meeting the objective, but it is still mostly reactive and undocumented. The organization does not routinely measure or enforce policy compliance.
3	Compliant, Defined	The organization has a documented, detailed approach to meeting the objective, and regularly measure its compliance.
4	Risk-based, Managed	The organization uses an established risk management framework to measure and evaluate risk and integrate improvements beyond the requirements of applicable regulations.
5	Efficient, Optimized	The organization has refined its standards and practices focusing on ways to improve its capabilities in the most efficient and cost-effective manner.

Figure 8 ("Texas Cybersecurity Framework. Department of Information Resources")

To view the rest of this article, and its images in color, please visit <https://lscmontgomerycac.com/2025/tristan-montebianco/>

Final Essay - Immersive History

Research Paper by
CASSIDY GALLAGHER

HIST 1301: UNITED STATES HISTORY I

This course used board games and role-playing simulations to introduce students to key themes in U.S. history. In this well-structured paper Cassidy reflected on the various historical games played during the semester. The assignment tasked students with selecting four games and identifying a unifying theme. Cassidy clearly identified the games and demonstrates how they helped her understand history. She integrates the required primary and secondary sources into her analysis while explaining how the games placed her at the center of decisions. The essay explains how the games helped her understand the complexities of the past. Her essay explores the themes of each game, and she makes clear and strong connections between them. Cassidy accurately identified patterns of conflict, resource acquisition and the pursuit of power. This paper is an excellent example of the sort of critical thinking and writing that the course is designed to cultivate. By stepping into the roles of historical figures, she came to recognize that history is not a collection of names and dates, but a dynamic series of events, actions and decisions involving fallible human beings.

- Betsy Powers

This semester, history felt alive in ways I never expected. Through interactive games like *Jumonville*, *Lewis & Clark*, *Raising the Eleventh Pillar*, and *The Fate of John Brown*, I didn't just learn about pivotal moments in American history, I experienced them. Each game placed me at the heart of critical decisions, struggles, and debates, forcing me to confront the messy, complex realities of the past centered in greed and ideas of American superiority. This essay reflects on the historical themes these games explored, the primary sources that brought them to life, the overarching connections between them which ultimately were deemed to be conflict, resources, and power, and how this unique approach reshaped the way I see history.

Jumonville introduced me to the volatile tensions of the French and Indian War, where colonial expansion and indigenous alliances collided. The game forced me to consider how Native Americans navigated their roles as mediators, moderators, and participants in these conflicts. In this game, I played the role of Tanacharison, the "Half King" and self-proclaimed leader of the Indians. His account revealed not just the political stakes but also the human confusion and

missteps that turned a skirmish into an international crisis. He was once aligned with the French, then the English to “project sufficient power and influence into the region”, all while leveraging his use of the Indians as resources. The use and leverage of the Indians by the “Half King” is shown by Tanacharison’s promise to the English that he could “bring the Ohio Indians into the English camp if the English made him their viceroy” (*Jumonville Faction sheet* [Tanacharison], 1). This game emphasized how easily misunderstandings can escalate into something far greater and how resources, power, and conflict were the three fueling forces in the French and Indian War.

The *Lewis & Clark* game felt like an expedition in every sense of the word. It highlighted themes of exploration, survival, and the fragile relationships between indigenous tribes and U.S. explorers. Through the differences and secrecy shown in the primary sources of *Jefferson’s Secret Message to Congress* and his *Instructions to Meriwether Lewis*, it was shown that the actions of the President, use of Congressional funds, and actions of American explorers were not aligned. However, one common theme between the two sources was interaction with the Indians was necessary for advancement. On one side of the conversation Congress was being told that in order to make the Indians more compliant with American goals, it was necessary to “encourage them to abandon hunting, apply to the raising stock, to agriculture and domestic manufacture” all while being shown how they did not need all their land (*Jefferson’s Secret Message to Congress*). On the other side of the conversation, Meriwether Lewis was being instructed to bring “light articles for barter and presents among the Indians” leading him to believe the intention was to truly build relationships with the Natives to advance America (*Jefferson’s Instructions to Meriwether Lewis*). The Lewis and Clark expedition was shown, through this game, to not just be a story of discovery but a story of leveraging relationships to gain land and in turn greater wealth and opportunity for America. The overarching themes of this experience were resources, power, and being ahead of future conflict.

The Eleventh Pillar was all about leveraging ideas, relationships, and intimidation strategies to, in theory, either gain power or level the power between groups. It brought to life the heated debates over the U.S. Constitution, where the document became a battleground between Federalists and Anti-Federalists. In this game, I acted as a Moderate, specifically as Dirk Wyncoop. As a moderate, my stance was derived in “desperation to keep New York in the Union”. (Coby 2023) It struck me how fragile the idea of a more perfect Union really was when some of the people who were responsible for writing the Constitution were functioning in desperation. The United States political system was established from polarity, creating a choice without representation for additional viewpoints or representation for minorities. It did, however, take compromise, discussion, and moral justification to moderate the Constitutional Convention and the viewpoints of Federalists and Anti-Federalists. The ideas represented in this debate reflected a similar pattern to the others of power, representation, and conflict.

The Fate of John Brown felt like stepping into a storm. Brown was such a polarizing figure, and the game forced me to understand and empathize with his

radical commitment to ending slavery and the violence he believed was justified to achieve that goal. In this game I was assigned the role of Governor Henry Wise who was “noted for his keen sense of honor” and was responsible for deciding the fate of John Brown regarding his execution. (Offutt 2023) The discussions during this game brought up interesting points of debate such as how far is too far when fighting for what’s right and what happens when law and morality collide? The discussions emphasized that the opinions of those involved in the discussions truly do not matter with how the justice system and governmental functioning existed and perhaps exists still today. The power is granted to the official entrusted with making the final decision who, in this case, was me. My role sheet emphasized that my true goal was to remain in a position of political power, ensuring my reelection as Governor and potential election as President. My character viewed the debate over John Brown’s life as “a great political opportunity [that had] fallen into his hands”. (Offutt 2023) My goals included finding a solution that “advanced Wise’s political ambitions”. (Offutt 2023) The undertones of selfishness in a debate about morality, justice, and equality is truly disturbing to conceptualize. Through these experiences, the same overarching themes prevailed – power, conflict, and ‘resources’ which in this case were slaves, land, and cotton.

As mentioned throughout this paper, the themes that tie each of these games together are power, resources, and conflict often involving inequality. Every game asked the players to immerse themselves in a historical figure’s beliefs and align, whether through exploration, debate, resistance, or activism, with what they deemed important. Sadly, what was deemed important, in most cases, to these historical figures was power, money, and expansion. Through all these stories, I saw how deeply freedom has always been contested and how much it has demanded from those who dared to pursue it. Through these games, I learned that history is not as textbook as I once viewed it. It’s not just about the dates and events, it’s about the people making impossible choices, caught between their values and the realities of their time. Playing these games helped me empathize with historical figures, whether I agreed with them or not. In conclusion, using games to learn history was extremely engaging. By stepping into the roles of historical figures, I was not just learning about history, I was immersed in it. I felt the weight of decisions, the pull of conflicting priorities, and the humanity of the people involved. Primary sources grounded these experiences, adding depth and authenticity. Playing historical games did not just make history more engaging; it made it personal. Through these games, I came to see history not as a textbook record of the past but as a dynamic, ongoing conversation. They reminded me that history is full of hard choices, messy compromises, and relentless struggles for justice. Sadly, humanity has often grounded itself, not in unity, but in selfishness, competition for power, and economic superiority.

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Napoleon Crossing the Alps

Art Analysis by
KAYLEE HOPKINS

HUMA 1302: THE AGE OF NAPOLEON

Art is part of the humanities curriculum. In HUMA 1302 "The Age of Napoleon" students analyzed two paintings. One had to be a contemporary work dating from the life time of Napoleon between 1769-1821. Kaylee formulated ideas about the painting she chose during a lecture on Napoleon's second Italian campaign. Her essay places the painting into its proper period of art classification and contextualizes it as a wonderful piece of propaganda celebrating a triumph that, like the etchings in the stone suggest, secured Napoleon place in history as both gifted general and wise law-giver. Professor Livingston provided guidelines and a sample essay he wrote to demonstrate format requirements and the analytical style. Kaylee took 3.5 hours to complete her research and write the essay's first draft.

- Craig Livingston

Napoleon Crossing the Alps (1800)

by painter Jaques-Louis David

oil on canvas, 8 feet high

Château de Malmaison, Rueil-Malmaison, France¹

Napoleon Bonaparte (1769-1821) crossed the Alps through the Great St. Bernard Pass to expel Austrian forces from the region of north Italy he had conquered three years prior. What started as a means to show the ever-babbling French citizens that he had not lost his touch ended as one of the most momentous victories of his entire military career. At the Battle of Marengo (14 June 1800), despite no sight of reinforcement at the battle's start, the French army fought bravely under Napoleon's command. The Austrians drove back the French at first, but General Desaix at the head his division finally arrived and led a counterattack that shocked the Austrians, leading to their frantic retreat.² To commemorate the event, King Charles IV of Spain commissioned Jacques-Louis David to paint *Napoleon Crossing the Alps* in hopes of gaining favor with Napoleon, the First Consul of France.³

David was one of the most influential painters of the time. A supporter of the French Revolution, he soon became fond of Napoleon and a follower of his regime. Thus, when Napoleon's reign ended and the Bourbon dynasty returned to power in France, David went into self-exile in Brussels until his death in 1825.⁴

This work is painted to look almost mythological and clearly contains a level of propaganda. Napoleon sits on the back of a furious steed, his men

hauling cannons up the St. Bernard Pass behind him. In reality, the general rode a mule and his men used hollowed-out logs to slide the artillery barrels on the snowy terrain. Napoleon's name is carved into the rocks among those of Hannibal and Charlemagne to show that he has secured his place alongside them in the history books. He is in full uniform, sword at his side, general's hat donned, his bright cloak blowing exaggeratedly in the wind. His decorated uniform demonstrates his prominence. A subtle light shines on his face, as if to show that the gods of war aided the victory at Marengo.



In addition to painting Napoleon as a glorious general, David may also have had a deeper motivation for such a favorable depiction. Backtracking for a moment to Napoleon sitting on the furious steed, he seems to be quite cool and collected while doing so. His expression is calm, no hint of fear or tension present. Furthermore, he is controlling the horse with only one hand, perhaps

suggesting confidence in the face of chaos. His other hand, ungloved, points towards the heavens, maybe even to say that God Himself commissioned Napoleon for the role he was going to play. Indeed, by looking at this painting, it might be witnessed that the future of France could be entrusted to the heroic general.

The painter rejects the frivolous Rococo style of the mid-1700's. France was returning to more classical ideals that focused on simplicity and symmetry rather than ornateness and light-hearted themes. As these paintings came from a renewed interest in the classical period of ancient Greek and Roman times, they are described as being neoclassical.⁵

To view the image from this article in color, please scan the top QR code on pg. 120 or visit <https://lscmontgomerycac.com/visual-communication-2025/>

Endnotes

1. "The First Consul crossing the Alps at the Great St. Bernard Pass," *National Museum of the Castles of Malmaison and Bois-Préau*, <https://musees-nationaux-malmaison.fr/chateau-malmaison/collection/objet/le-premier-consul-franchissant-les-alpes-au-col-du-grand-saint-bernard> [accessed 2 March 2025].
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3. "Kehinde Wiley meets Jacques-Louis David," *National Museum of the Castles of Malmaison and Bois-Préau*, <https://musees-nationaux-malmaison.fr/chateau-malmaison/agenda/evenement/kehinde-wiley-rencontre-jacques-louis-david> [accessed 2 March 2025].
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The Divorce of Empress Josephine

Art Analysis by
REBECCA LOGHRY

HUMA 1302: THE AGE OF NAPOLEON

Art is part of the humanities curriculum. In HUMA 1302 “The Age of Napoleon” students analyzed two paintings. One had to be a modern work completed after Napoleon’s death in 1821. Rebecca formulated ideas about the painting she chose during a lecture about his desire for a male heir. One requirement was to point out details that the viewer might miss. Her analysis reveals how artists after the Napoleonic Empire wanted to remember one of the most dazzling romances of all time.

- Craig Livingston

The Divorce of the Empress Josephine (1846)

First wife of Napoleon Bonaparte

Empress of the French

By painter Henri Frédéric Schopin

Oil on canvas 55.8 x 80.5 cm

The Wallace Collection, Exhibition 2, London, England

Marie-Josèphe-Rose Tascher de la Pagerie, later to become Josephine Bonaparte, married Napoleon Bonaparte mere months after meeting him, most likely as a means of security after the French Revolution (1789-1799).¹ Josephine had two children with her first husband (beheaded during the Revolution), both of whom Napoleon treated like family. At first Josephine did not give the same level of devotion as Napoleon did to the marriage. She eventually stopped but Napoleon carried on with affairs as his fame grew.² But it was not the betrayals that led to the end of their marriage. It was the absence of an heir to continue the Bonaparte dynasty.³ “The Divorce of the Empress Josephine” by Henri Frédéric Schopin depicts the end of the marriage between Napoleon and Josephine with Josephine signing the legal papers 15 December 1809.⁴

Henri Frédéric Schopin (1804-1880) was a French painter born in Lubeck, Germany. He was the winner of Prix de Rome, a French scholarship for his painting “Achilles pursued by the Xanthus” (1831). Henri Frédéric Schopin is known for his historical and religious paintings, as well as portraits and landscapes.⁵

The painting shows the grandness of the French Empire. Napoleon sits on a throne with a French Imperial eagle on top. Josephine, the focal point, is painted in her white gown and veil. Her daughter (also Napoleon’s step-daughter) hugs her mother whose somber look matches others in the room. Napoleon appears solemn, reinforcing the idea that he still loved Josephine despite the divorce. An additional detail to note is the fact that Napoleon has his hand on Eugène de Beauharnais, Josephine’s son from her first marriage, possibly a sign of comfort

during this emotional moment. Another notable detail is the dark blue tapestry with gold bees covering the walls in the painting. The bee was the family symbol of Napoleon's dynasty inspired by the origins of France, the Merovingian dynasty (481-511). Indeed, the bee connects Napoleon's dynasty to the past, a nod to the rebuilding of France after the turmoil of the French Revolution.⁶



The people in the painting reveal the overall feeling of the event. In the background with less detail are two women, one holding a handkerchief to her eyes. Further back in the painting the viewer can make out a number of onlookers. Closer in the foreground are key figures in the Empire: Charles-Maurice de Talleyrand (1754–1838) Vice-Grand Elector, Eugène de Beauharnais (1781–1824) the Viceroy of Italy (and step-son to Napoleon and one of his generals), Joachim Murat (1767–1815) the King of Naples, Marshal Michel Ney (1769–1815), and Marshal Jean-Baptiste Bessières (1768–1813).⁷ Their inclusion brings gravity to the scene and allows viewers to glimpse this moment inside the Tuileries Palace.

Schopin paid attention to detail. From Josphine's gloves to the way Schopin signed his name as an embellishment to the carpet, viewers get an intimate look at an event that would otherwise be left to imagination.

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6. "The Symbols of Empire," *Napoleon.Org*, June 2004, <https://www.napoleon.org/en/history-of-the-two-empires/the-symbols-of-empire/>.
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Ultra-High Field MRI and its Diagnostic and Research Potential

Research Paper by
KATELYN SORTER

RADR 2305: PRINCIPLES OF RADIOLOGIC IMAGING II

In her research paper, Katelyn Sorter utilizes her knowledge as a medical radiologic technology student to compare the efficiency and shortcomings of Ultra-High Field (UHF) Magnetic Resonance Imaging (MRI). Katelyn incorporates a detailed review of scholarly literature comparing the recent advances in MRI diagnostic imaging in relation to neuroradiology. She explores the innovations and contributions that each current technology utilizes while providing a detailed description of distinct differences in the diagnostic value of neurological imaging. Katelyn highlights the importance of quality diagnostic images achieved through high Signal-to-Noise, Contrast-to-Noise, and susceptibility sensitivity when imaging the complexity of the human brain through UHF imaging.

- Krystal Kidder

Abstract

The focus of this paper will be on ultra-high field (UHF) magnetic resonance imaging (MRI) and its many potential benefits as well as its possible downsides. UHF will be compared to standard, lower-field MRI as it has several inherent differences in how it functions. Specifically, the Iseult MRI machine operating at 11.7 Teslas (T) will be of primary interest, as it is the strongest MRI magnet that has been tested on living humans to date. The specifications and structure of the Iseult, its advantages including high SNR, shortened acquisition times and more, as well as the results of its first imaging tests will be discussed. Additionally, UHF has great potential for research and as such this will be discussed in depth. Specifically, researchers are prospective about research into the brain and neurological pathologies such as Alzheimer’s Disease. The primary method of research that will be covered is related to human brain organoids, and how imaging them using UHF MRI could lead to great breakthroughs in research.

Introduction

MRI machines use powerful magnets to obtain images of the body’s internal structures. An MRI machine’s magnetic field strength is measured in Teslas, with most machines using 1.5 T or 3 T (Platt et al., 2021). UHF MRI machines, however, have at least 7 T magnets, which can obtain far more detailed images with shorter acquisition times than standard MRI, among other advantages. The French Alternative Energies and Atomic Energy Commission (CEA) has developed

an 11.7 T MRI machine known as the Iseult (Boulant et al., 2023). It took its first images in 2021, then it obtained its first images of living volunteers in 2024 (Boulant et al., 2024). Research supports that UHF at 11.7 T can assist in studying the human brain and may possibly lead to breakthroughs related to neurodegenerative disease, psychiatric disorders, and more (Versace et al., 2024). This paper will primarily focus on UHF and the Iseult machine, its specifications and imaging results, and its vast potential for better diagnosis and research.

Literature Review

The works referenced in this paper discuss UHF MRI and how it compares to standard MRI, the Iseult machine and its specifications, as well as its imaging experiences. They discuss how UHF can improve medical imaging through clinical application, and how it will provide opportunities for research into the brain, focusing on psychiatric disorders, neurodegenerative diseases, neurotoxicity, etc. These sources will be used to explain the importance of UHF MRI with a focus on the Iseult machine.

7 Tesla and Beyond

This work introduces UHF MRI and how it can be applied to improve medical imaging. It discusses its advantages and disadvantages, such as how certain types of MRI benefit far more from UHF than others. For example, quantitative susceptibility mapping (QSM), functional MRI (fMRI), and susceptibility-weighted imaging (SWI) all benefit greatly from stronger magnetic fields, while others can be negatively impacted and lose image detail. The article discusses in detail how UHF affects signal-to-noise ratio (SNR), contrast-to-noise ratio (CNR), and susceptibility sensitivity. Additionally, the article also focuses on how UHF can positively impact the field of neuroradiology. The article finishes by discussing how UHF will continue to be a valuable tool for research.

Commissioning of the Iseult CEA 11.7 T whole-body MRI: current status, gradient–magnet interaction tests and first imaging experience

This work discusses the specifications of the Iseult machine and the results of its first ex vivo images. It covers the basics of the magnet's design and discusses quench protection for the machine in the form of a magnet control system (MCS) and a magnet safety system (MSS). It also explains how they provided field stability for the magnet and built the external interference shield (EIS) to limit the effects of external magnetic fields from interfering with the machine. Next, the article discusses field homogeneity and the tests the Iseult went through to gather more data about how it functions. Lastly, it explains the results of the Iseult's first images, which were of a pumpkin and an ex vivo brain, specifically focusing on how the SNR and field homogeneity affected their quality.

First in vivo images of the human brain revealed with the Iseult 11.7T MRI scanner

This work discusses the history of the Iseult project and its recent progress, including its first ex vivo and in vivo images of the human brain. In the original

ex vivo images, the primary obstacle encountered was with field inhomogeneity, which becomes more of a problem as field strength increases. It then discusses how this issue was successfully addressed with the first in vivo images and the findings related to those images. This study also showed that images on the mesoscopic scale of the brain could be obtained in a fully manageable amount of time, which is valuable for future neurological research. Additionally, their study revealed that there were no measurable negative effects on the subjects due to the powerful magnetic field.

11.7T Diffusion Magnetic Resonance Imaging and Tractography to Probe Human Brain Organoid Microstructure

This work focuses on UHF's potential to image human brain organoids, which are artificially created 3D cellular models made from human induced pluripotent stem cells (hiPSC). Organoids mimic the structure of developing organs, and as such can be used to study neural function and connections, potentially leading to new discoveries related to brain pathologies. This study used 11.7 T MRI to image organoids in detail. It discusses how they formed and cultured the organoids used for this study, and the overall imaging process. The results are promising, as UHF may allow for complete visualization of brain organoid structures which other imaging methods cannot currently achieve.

Discussion 1: UHF vs Standard MRI and the Iseult Machine

UHF MRI has many advantages and disadvantages, including how it impacts SNR, CNR, and susceptibility sensitivity, as well as the cost (Platt et al., 2021). Higher SNR can be achieved with UHF due to its powerful field strength. In contrast to standard MRI, this allows images to be obtained with both quality spatial resolution and much shorter acquisition time, or with much higher spatial resolution and the same acquisition time as standard MRI. Having higher spatial resolution will allow for better diagnosis and treatment of brain cancer, as it becomes easier to differentiate between healthy and cancerous tissue. Next, CNR is affected differently in UHF. Generally, CNR is formed through the interaction between atoms within the body and their surrounding environment when acted upon by the MRI machine. The magnetic field from the machine excites these atoms, which then go through a relaxation period. With higher field strengths, this relaxation can take more time, which is advantageous in certain vascular imaging but will result in longer acquisition times in exams which require full atomic relaxation before each excitation (Platt et al., 2021). Additionally, UHF has high susceptibility sensitivity, meaning that the information in the image is impacted more by how different tissues act when magnetized. Some tissues will concentrate the magnetic field while others will disperse it ("Susceptibility Artifact", 2024). This can result in susceptibility artifacts which present as geometric distortions. However, higher susceptibility sensitivity is useful in QSM, fMRI, and SWI, which utilize this sensitivity to achieve better images. Overall, using more powerful field strengths affect how images are obtained in MRI, and as such there are many advantages and challenges which are still being studied (Platt et al., 2021).

Next, years of development preceded the Iseult machine and its first images (Boulant et al., 2023). It has a niobium-titanium magnet which is actively shielded and surrounded by a superfluid helium kept at 1.8 degrees Kelvin for cooling. Additionally, the MCS and MSS were developed for the machine, which use over 300 devices to monitor and protect it from any error which may lead to quenching. Next, field stability is maintained due to the development of non-persistent mode. Other UHF machines are stabilized using persistent mode, where the coils can be set to a specific current which allows the machine to be disconnected from its power supply. However, this would be difficult for the Iseult due to its complex design. As available power supplies are not stable enough for the Iseult on their own, non-persistent mode was developed to compensate for this and as a result the field remains stable. They also developed the EIS to prevent other magnetic forces (from buses, trains, elevators, etc.) in the environment from interfering with the magnet. Without the EIS a bus driving by the building would significantly disturb the field, but with the EIS its effect was minimal. Extensive testing was done to ensure quality of the equipment, as well as to determine exactly how the machine would work, and in 2021 the Iseult took its first images of a pumpkin and an ex-vivo brain. The images showed highly increased SNR despite significant inhomogeneity artifacts. Ensuring field homogeneity was the primary obstacle at the time, and while phase-shimming was not sufficient on its own to reduce inhomogeneity they also used parallel transmission, which assisted to reduce this effect. Overall, the Iseult is highly complex and expensive, however its potential for research and diagnosis cannot be understated (Boulant et al., 2023; Platt et al., 2021).

Discussion 2: Iseult's First in Vivo Images and Research Potential

The Iseult machine took its first in vivo images of a human brain in April of 2024 (Boulant et al., 2024). These images were obtained on 20 healthy adult volunteers, with each having a 90-minute exam performed with the Iseult. They also used a control group of volunteers which went through the same tests as the original group but without actual exposure to the magnet. One of the key areas of interest for research is on the mesoscopic scale of the brain, with the hope that more fully understanding the brain on this level will lead to breakthroughs related to brain pathologies and their treatment. Next, to provide field homogeneity, parallel transmission soft- and hardware were developed and then further optimized for the Iseult machine, which resulted in images without inhomogeneity artifacts. Additionally, the SNR of the images was significantly increased even when compared to 7 T images. Diagnostic-quality images could even be obtained in 5 minutes with the Iseult. Next, there were concerns that humans could be negatively affected by such high magnetic fields. Using 11.7 T on mice has resulted in some vestibular effects and genotoxic effects with chronic exposure. However, expansive testing was done on the volunteers before, during, and after exposure to the magnet and no negative effects were detected. Overall, UHF at 11.7 T has vast potential for research and diagnostic imaging (Boulant et al., 2024).

Next, a study has been done imaging brain organoids at 11.7 T (Versace et al., 2024). Because organoids mimic the appearance and organization of developing organs, imaging brain organoids can provide a greater understanding of neuronal connections and function, potentially leading to breakthroughs related to psychiatric disorders, neurotoxicity, and neurodegenerative diseases such as Alzheimer's. The hippocampus is often atrophied in patients with Alzheimer's, and as such this study specifically imaged hippocampal brain organoids. These organoids were 2-mm in diameter and were suspended in paraformaldehyde within 5-mm tubes during the imaging process. The resulting images showed the organoid structure in detail. This is primarily a proof-of-concept study, and as such, further research needs to be done to validate the results of the study. However, it proved that UHF has great potential for organoid research and a high likelihood of providing accurate imaging of their internal structure. Ideally, immunostaining techniques which will not compromise the structure of the organoids should be used to cross-check the results of the MRI images. However, current technology must be developed further for this to be feasible. Nonetheless, great progress has been made using UHF MRI at 11.7 T, and much more is sure to follow as this is a new method of research (Versace et al., 2024).

Summary

UHF MRI uses powerful magnets to obtain high-quality images, and much progress has been made recently toward furthering this technology with the 11.7 T Iseult machine. There are advantages and disadvantages related to SNR, CNR, and more. The Iseult took its first images in 2021, and its first in vivo images in 2024, with much research and development preceding these images to ensure their quality. UHF provides high SNR even with short acquisition times and can be used extensively in research. For example, a study showed that UHF may be useful for research into brain organoids, which could lead to breakthroughs related to neurological pathologies, including Alzheimer's.

Conclusion

UHF MRI can be used to obtain extremely high-quality images, which makes diagnosis and treatment easier and more effective and offers potential for new research. The 11.7 T Iseult is the strongest MRI machine used on living people to date, and its images show far more detail than standard MRI. And with certain subtypes of MRI, UHF can work especially well. Of course, this can be used for more accurate diagnoses but also for research. Specifically, neurological research is of interest. Neurodegenerative diseases, psychiatric disorders, and other pathologies related to brain functions will be researched using UHF. There are downsides to UHF, such as the high cost and complexity of the equipment, which may limit its application clinically. However, it is an excellent modality for diagnostic imaging and research, and it should continue to be used and developed to maximize its vast potential.

Multiple Choice Questions

1. *What is ultra-high field MRI?*

- a. a type of ionizing imaging equipment
- b. a particularly strong MRI magnet
- c. a particularly weak MRI magnet
- d. an extremely compact MRI magnet design

2. *Ultra-high field MRI has especially high SNR*

- a. true
- b. false

3. *How many volunteers were tested on using the Iseult machine?*

- a. 1000
- b. 200
- c. 20
- d. 150

4. *What temperature is the superfluid helium surrounding the Iseult magnet kept at?*

- a. 1.8 Kelvin
- b. 18 Celsius
- c. 200 Kelvin
- d. -25 Celsius

5. *What material is the magnet itself in the Iseult made of?*

- a. tungsten
- b. aluminum
- c. lead
- d. niobium-titanium

6. *What are brain organoids made from?*

- a. a type of stem cells
- b. adipose tissue
- c. nephrons
- d. neurons

7. *What did the Iseult obtain its first images on?*

- a. volunteers
- b. a pumpkin
- c. patients
- d. various fruits

8. *In what year were the Iseult's first images of living people obtained?*

- a. 1999
- b. 2023
- c. 2025
- d. 2024

9. *Overall, the Iseult's design is quite simple.*

- a. true
- b. false

10. *There is particular interest in using ultra-high field MRI to research:*

- a. spinal pathologies
- b. the lymphatic system
- c. brain pathologies

Answer Key

1. *What is ultra-high field MRI?*
b. a particularly strong MRI magnet
2. *Ultra-high field MRI has especially high SNR*
a. true
3. *How many volunteers were tested on using the Iseult machine?*
c. 20
4. *What temperature is the superfluid helium surrounding the Iseult magnet kept at?*
a. 1.8 Kelvin
5. *What material is the magnet itself in the Iseult made of?*
d. niobium-titanium
6. *What are brain organoids made from?*
a. a type of stem cells
7. *What did the Iseult obtain its first images on?*
b. a pumpkin
8. *In what year were the Iseult's first images of living people obtained?*
d. 2024
9. *Overall, the Iseult's design is quite simple.*
b. false
10. *There is particular interest in using ultra-high field MRI to research:*
c. brain pathologies

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How the Piano Shaped Music: The Technological Influence on Sonata Style

Research Paper by
CRISTIAN RODRIGUEZ

MUSIH 1307: MUSIC LITERATURE HONORS

In his research paper, Cristian focuses on the technological development of the piano and how it impacted the music that was written for the instrument. The study introduces the pianoforte as it existed in the Late Baroque era and traces the technological advances of mechanisms and the resulting improvement of its capabilities, then the improved capabilities of the instrument are identified in sonatas through a comparative analysis of works from the Classical and Romantic Eras. This writing fills an important gap often present in historical understanding of musical development by showcasing how composers are both limited and inspired by the tools at their disposal.

- Reese Borgan

Abstract

This study explores how advancements in piano construction influenced stylistic changes in composition between the Classical and Romantic periods (1750-1820). Specifically, it examines how improvements in dynamic range, sustain, and structure allowed composers to write more expressively than was possible with earlier instruments. While the piano's evolution has been widely acknowledged, most studies focus either on mechanical innovations or individual composers, rather than connecting the two. The research focuses on the first movements of four sonatas: Mozart's Sonata No. 6 in D Major, K. 284, Schubert's Sonata in E Major, D. 157 and Sonata in A Major, D. 959, and Chopin's Sonata No. 3 in B Minor, Op. 58.

These works were selected for their historical placement and stylistic development. Mozart's sonata reflects the Classical ideals of balance and clarity. Schubert's sonata traces the shift from Classical restraint to Romantic expressivity. Chopin's sonata fully embraces Romantic form, showing how advanced pianos enabled deeper emotional and technical exploration. The piano's evolution, from early 18th-century instruments to 19th-century models, opened new possibilities for composers. Greater range, sustain, and responsive mechanics directly shaped musical ideas, leading to more ambitious and personal works. This study emphasizes the close link between technological innovation and artistic expression. Future research might expand this connection by analyzing how composers like Liszt and Brahms further responded to continued developments.

The Piano

The piano, originally known as the *gravicembalo col piano e forte*, which

translates to “harpsichord with soft and loud,”¹ is a keyboard instrument that produces sound when a key is stuck, activating a hammer that hits strings.² The piano evolved from earlier keyboard instruments, particularly the harpsichord and clavichord. While the harpsichord resembles the piano in appearance, it lacks the ability to produce dynamics (the intensity of volume with which notes and sounds are expressed).³ No matter how forcefully or softly a player presses the keys, the sound remains at a constant volume.⁴ On the contrary, the clavichord, which was more common in Eastern Europe, including Germany, Austria, and Bohemia (modern day Czech Republic), allowed for dynamics but lacked the projection and resonances that the harpsichord produced. The need for an instrument that combined the harpsichord’s volume and the clavichord’s dynamic control led to the invention of the piano. While there is some evidence of earlier instruments with a similar concept, Bartolomeo Cristofori is credited with creating the first *pianoforte* around 1700.⁵ His invention marked a turning point that would influence the way composers began to think about musical expression through the keyboard, laying the foundation for innovations that would soon take shape in different regions across Europe.

In order to understand how the piano evolved over the Classical and Romantic eras, it is imperative to first understand its mechanics. As Ripin explains, “The modern piano consists of six major elements: the strings, the metal frames, the soundboard and bridges, the action, the wooden case and the pedals,” and later adds, “the action consists of the keys, the hammers, and the mechanism that impels the hammers towards the strings when the keys are depressed.”⁶ Cristofori’s most significant innovation was replacing the harpsichord’s plucking mechanism with hammers that strike the strings, allowing dynamic variation. His design introduced a system where the hammer would hit a string and immediately rebound, allowing the string to vibrate freely. This action is known as escapement. This ensured that the hammer didn’t block or dampen the string’s resonance after the strike.⁷ Cristofori’s escapement involved a complex lever system that accelerated the hammer’s movement while allowing precise control, including a “check” to catch the hammer after it rebounded. This innovation allowed for both dynamic control and articulation, paving the way for expressive phrasing in keyboard music.⁸ However, Cristofori’s invention was not widely

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1. Ripin, Edwin M. et al. “Pianoforte.” *Grove Music Online*. 2001.
 2. Randel, Don Michael, ed. 2003. “Piano.” In *The Harvard Dictionary of Music*, 4th ed. Harvard University Press.
 3. Thieme, Matthias. “Dynamics.” *Grove Music Online*. 2001.
 4. Ripin. “Pianoforte”.
 5. Ripin.
 6. Ripin.
 7. Ripin.
 8. Ripin.

recognized during his lifetime, and it was only after his death that piano makers in the late 18th and early 19th centuries adapted and improved his model.

While Cristofori's original design was mechanically complex, it was difficult for other builders to replicate, and many resorted to more simplified versions. Across Europe, different regions adapted the escapement concept in their own ways. In Austria and Germany, builders developed *Prellmechanik* (Viennese action), which retained light hammers and allowed for quick articulation. In contrast, English builders, such as Americus Backers and John Broadwood, built on Cristofori's heavier approach with a more powerful sound and greater repetition control. Eventually, Sébastien Érard in France furthered the escapement action with a double escapement in 1821, which allowed for even faster repetition without the key fully resetting.⁹ These different variations reflect the growing need for instruments that could match the technical demands of evolving musical styles.

The Viennese Piano (1750-1800)

In Germany and Austria, piano makers were crafting pianos that more closely resembled the clavichord, featuring a lighter touch and clear tone.¹⁰ These pianos used the *Prellmechanik* action, which Belt explains as “the addition of a nut at the rear to determine the speaking length of the strings, and the replacement of the tangent by a hammer hinged to the back of the key.”¹¹ Schott explains *Prellmechanik* as a German and Austrian type of piano action in which the hammer heads face towards the player and are either fixed by a type of hinge on, or held in, a *Kapsel* (a kind of fork with beds for the hammer's axle) attached to the key. As Vienna was the centre for piano makers using the *Prellmechanik*, it became known as the ‘Viennese action’.¹² The Viennese action was most used in the early-mid 18th century, and future German/Austrian builders used it to improve upon the piano's function.

Johann Andreas Stein (1728-1792), an Austrian instrument maker, is credited for refining the Viennese action and setting its foundation for future innovation. Belt notes that, “An important feature in such pianos [of Stein] is the extremely small and light hammers; their thin leather covering (instead of felt) is vital to these instruments' clavichord-like delicacy of articulation and nuance. Typically, the Stein action has either round hollow hammers.”¹³ Stein's pianos were five-octaves and contained either hand or knee operated stops, which allowed players to disengage the strings and sustain notes. The development of the damper mechanism saw improvement as Mobbs explained, “[in the] late 18th- and early 19th-century pianos were often constructed with ‘split damping’,

9. Ripin.

10. Belt. Phillip R. et al. “Pianoforte.” *Grove Music Online*. 2001.

11. Belt.

12. Schott.

13. Belt. “Pianoforte”.

that is, with separate control of the bass and treble registers. German and Viennese grands of the 18th century had this feature.”¹⁴ Viennese pianos of this period commonly included this feature, which expanded the performer’s ability to control the instrument’s sound.

The English/French Piano (1800s)

While the Viennese piano dominated central Europe during the 18th century, the piano’s development in England and France began to take a different turn, resulting in two distinct mechanical and tonal differences. These instruments slowly started developing separate distinctions, from the lighter, more delicate sound of the Viennese piano. The earliest major innovation in this tradition came from Americus Backers, an English builder credited with developing the English action around the 1770s. Unlike the Viennese *Prellmechanik*, which utilizes lightweight hammers and short key dip, the English action featured a heavier construction and deeper key dip, favoring a fuller, more powerful tone that was suitable for public performances and large venues.¹⁵ Backer’s action included an escapement jack, check, and hammer roller, which are all essential to controlling hammer rebound and tone. This design was further refined by John Broadwood, whose pianos used heavier hammers and robust framing.¹⁶ English grand pianos were also among the first to adopt triple stringing to allow for more notes, which increased the instrument’s sustain and sound.¹⁷

French piano design began to flourish in the early 19th century, particularly through the innovations of Sebastien Érard (1752-1831). His most significant contribution was the double escapement action, patented in 1821, which allowed notes to be repeated without the key returning to its fully raised position. This mechanism used a repetition lever, enabling smoother note repetition and louder dynamics.¹⁸ In contrast, Ignaz Pleyel (1757-1831), another prominent French piano maker, designed instruments that used the English/French action with a lighter and more delicate touch. While Érard’s instruments were praised for its mechanical precision and power, Pleyel pianos were admired for their warmth and intimate tone quality.¹⁹ Pleyel’s instruments still retained aspects of the Viennese style, such as leather-covered hammers and a lighter action, while still evolving alongside French design preferences.

Viennese Vs. English/French Piano

A key difference between the Viennese and English/French pianos lies in their

14. Mobbs, Kenneth. “Stops and Other Special Effects on the Early Piano.” *Early Music* 12, no. 4 (1984): 471–76.

15. Ripin. “Pianoforte”.

16. Cole, Micheal. “Pianoforte.” *Grove Music Online*. 2001.

17. Cole.

18. Ripin. “Pianoforte”.

19. Ripin.

mechanical weight and responsiveness. Viennese actions offered a light touch and clear articulation, ideal to express the clarity found in Classical music. In contrast, the English and French pianos prioritized power, sustain, and tonal richness, which made them better suited for Romantic expression and performances in larger spaces.²⁰ Additionally, while Viennese builders continued using leather-covered hammers well into the 19th century, English and French builders transitioned to felt covering, creating a darker and more round tone. By the early 19th century, the divergence of the Viennese and English/French pianos had been fully established. This split reflected broader cultural and musical shifts across Europe; the Viennese piano supported the Classical aesthetic of clarity and order, while the English and French pianos laid the foundation for Romanticism's emotional depth and technical innovations. To fully understand how these developments influenced composition, it is necessary to examine the historical context in which they emerged.

The Classical Period

The Classical period (1750-1820) marked a shift from the complex polyphonic texture in the Baroque era toward clarity, balance and formal structure. Composers of this era include Haydn, Mozart, and young Beethoven, who emphasized simplicity, tonal-harmony, single-line melodies. These components stem from the Age of Enlightenment, a time that prioritized an intellectual way of thinking. These ideas were also reflected in music and the ways in which composers of this era composed. Vienna was the musical epicenter of Europe where classical music began to flourish. With the decline of aristocracy and the rise of the middle class, there was a demand for accessible music, leading to more solo keyboard music.²¹ Consequently, the piano became a central vehicle for musical innovation and education. As composers created music for the relatively delicate and responsive Viennese piano, the instrument's capabilities shaped the form, phrasing and technical approach of Classical sonatas. This connection between instrument and aesthetic would become even more significant as musical values changed during the Romantic period.

The Romantic Period

The Romantic period (1820-1910), marked the departure from the typical Classical form, embracing individuality and emotional expression. Composers started to convey personal emotion and explore new ideas within musical expression. This era emphasized originality, with music that had expansive melodies, rich harmonies, and dramatic dynamic contrast. The use of chromaticism and modulation to distant keys became more common, allowing for greater emotional depth and complexity in compositions. The Romantic period was influenced by the sociopolitical climate at the time, such as the aftermath of the French Revolution and the rise of nationalism. Composers

20. Cole. "Pianoforte".

21. Connect 4 Education, Inc. (2020). <OnMusic History Survey>.

was influenced by the sociopolitical climate at the time, such as the aftermath of the French Revolution and the rise of nationalism. Composers began to incorporate elements of their national identities into their music, using folk melodies and rhythms to express a sense of cultural pride.²² Composers of this era such as Schubert, Liszt, and Chopin, embodied these traits that left a lasting impact in Classical music.

Mozart

Wolfgang Amadeus Mozart (1756-1791) was one of the most influential composers of the classical period, whose contributions laid much of the groundwork for later developments in Western Music. Born in Salzburg, Austria, Mozart showed advanced musical talent from a very early age, composing his first pieces as a child and touring Europe under the guidance of his father, Leopold Mozart, a respected musician in Salzburg.²³ His musical education was grounded in the traditions of Baroque and early Classical styles, but Mozart quickly developed a distinct voice that combined elegance and clarity. He is known for composing for a multitude of genres found within the Classical period such as symphonies, operas, concertos, chamber music, and sacred music, but especially his piano sonatas.²⁴ While sonata form was well established by the mid-18th century, he used it not as a strict set of rules but as a flexible structure where he could explore his expressive and thematic ideas. On Mozart's methods, Hertzmann states, "Before Mozart wrote down the fair copy of a composition it had been worked out mentally in the form of an imaginary sketch from which he copied the music, as it were, from memory."²⁵ He composed with melodic ideas already in his head and knew what he wanted to write. He didn't have difficulty writing music; his wife Constanze wrote, "He wrote down music in the same way he wrote letters."²⁶ Hertzmann explains further that "Mozart could do so at any time of the day or night... a musical genius, to whom the dearth of invention was unknown and who composed music continually."²⁷ When comparing the compositional process of Mozart and those of the Romantic period, Mozart focuses on the style of the music and makes sure it is pleasing for others and not exclusively about his perception. In a letter to his father, he wrote, "But since passions, whether violent or not, must never be expressed to the point of exciting disgust, and as music, even in the most terrible situation, must never offend the ear, but must please the listener, or in other words must never cease to be music." This connection between Mozart's compositional process and the

22. Connect 4 Education, Inc. (2020). <OnMusic History Survey>.

23. Hertzmann, Erich. "Mozart's Creative Process." *The Musical Quarterly* 43, no. 2 (1957): 187-200.

24. Hertzmann.

25. Hertzmann.

26. Constanze Mozart, quoted in *The Letters of Mozart and his Family*, 1939.

27. Hertzmann. "Mozart's Creative Process."

fortepiano is essential to understanding his music. His stylistic choices were shaped not only by aesthetic values but also the physical limitations and expressive potential of the Viennese fortepiano. The qualities of the fortepiano reflect the ideals of those of the Classical period with emphasis on balance, control, and grace. He was particularly fond of pianos built by Stein and Anton Walter, one of the leading piano makers in the late 18th-century. Just like the pianos of Stein, Walters' instrument was regarded for its light, responsive action, and clear tone. His piano had a lighter touch, smaller hammers, and a thin leather covering, which allowed for delicate articulation and rapid note repetition, but with a more limited dynamic range. Mozart composed with the Viennese fortepiano's five-octave range, which limited compositional possibilities compared to later, more developed pianos. Even with this limitation, he was still able to explore the instrument's bright treble and light bass that shaped his music with clarity.

Schubert

A key figure in charting the evolution from the Classical to Romantic style was Franz Schubert (1797-1828), an early Romantic Austrian composer. Like Mozart, Schubert demonstrated a high level of musical skill from an early age. He studied at the Stadtkonvikt, where he was exposed to a rigorous musical education and performed regularly in ensembles, which developed his Classical forms.²⁸ Despite his Classical grounding, Schubert's music started to display increasing harmonic experimentation, lyrical lines, and emotional depth. McKay notes that even in his early teenage years, Schubert's works were "unusually songful,"²⁹ and that he carried "the German Lied to heights of expressive intensity previously unimagined."³⁰

The piano accessible to Schubert played a significant role in shaping his compositional style. McKay explains in her biography of Franz Schubert, "The piano which his father promised Schubert in the autumn of 1814 probably arrived only early February (1815). Whereas until then Schubert had only shown remarkably little interest in solo piano music, after the piano arrived and over the next two to three weeks, while still composing signs, he wrote several solo piano works, including Variations in F D157, and his first sonata, D157. From these compositions it can be assumed that the compass of the instrument was five octaves + two tones." Malcolm Bilson explains that the type of piano Schubert likely used would have had a much lighter construction than modern instruments, such as wooden frames, then strings under relatively low tension, and small leather-covered hammers.³¹ The Viennese action was extremely light

28. McKay, Elizabeth Norman. *Franz Schubert: A Biography*. Oxford: Oxford University Press, 1996.

29. McKay.

30. McKay.

31. Bilson, Malcolm. "Schubert's Piano Music and the Pianos of His Time." *Studia Musicologica Academiae Scientiarum Hungaricae* 22, no. 1/4 (1980): 263-71.

and quick, offering a direct response where each hammer was attached directly to the key and flipped toward the string when played. This action allowed Schubert to achieve a more intimate, refined sound that favored quick articulations and subtle dynamic shifts.

Schubert's piano music often features delicate textures, rapid figurations, and expressive contrasts that would have sounded natural on a Viennese instrument. Bilson notes that Schubert's works, such as the *F minor Fantasy for Four Hands* (D.940), reflect the physical ease and tonal color afforded by such instruments, where rhythmic lightness and airy articulations could be executed effortlessly.³² Moreover, the pianos Schubert composed on usually included simple pedal mechanisms such as a damper pedal and shift pedal, giving him expressive control over tone color even without the massive sustain capabilities of later Romantic pianos.³³ As a result, his approach to texture, pedaling, and timbre of the instrument was very different from later composers such as Chopin and Liszt, reflecting a closer connection to Classical ideals of balance and transparency while still pushing towards Romantic expressivity.

Chopin

Frédéric Chopin (1810-1849) was a Polish-French composer and one of the most important figures of the Romantic period. Born in Zelazowa Wola, Poland, Chopin demonstrated tremendous talent from an early age. He received his earliest training from Wojciech Zywyn and later studied at the Warsaw Conservatory under Jozef Elsner, who recognized Chopin's distinctive voice early on and encouraged him to develop freely without the constraints of the Baroque and Classical style.³⁴ Chopin composed at a time where the piano was undergoing major technological changes, particularly the transition from the Viennese fortepiano to the more powerful English/French piano, including Pleyel and Érard models. Chopin explored the newly extended range, improved sustain, and more sensitive action that he played on skillfully. He favored Pleyel's for their clarity and delicate tone, which complemented his subtle touch and refined dynamic palette.³⁵ His compositions are technically challenging, reflecting a deep understanding of the instrument's mechanics. Chopin experimented with finger, pedaling, and keyboard technique in ways that transformed the piano's expressive potential. As Goldberg notes, "even his most complicated pieces lie easily under a pianist's fingers because the works are idiomatically suited to the instrument"³⁶ He expanded traditional forms through

32. Bilson.

33. Bilson.

34. Goldberg, Halina. "Frederic Chopin." In *Europe 1789-1914: Encyclopedia of the Age of Industry and Empire*, edited by John Merriman and Jay Winter. Detroit, MI: Charles Scribner's Sons, 2006. *Gale In Context: Biography*.

35. "Frédéric François Chopin." In *Encyclopedia of World Biography Online*. Detroit, MI: Gale, 1998. *Gale In Context: Biography*.

36. Goldberg. "Frederic Chopin".

poetic and often improvisational writing, especially in genres such as the nocturne, waltz, mazurka, and prelude. His larger works such as the ballades, scherzo, and sonatas have a more dramatic narrative and deeply personal expression.

Sonata Form

A sonata is a multi-movement work, typically written for a solo instrument, with or without accompaniment. During the Classical period, sonatas often contained three or four movements, each with a distinct tempo and character. The first movement of many Classical sonatas followed what is now known as sonata form, a structure that became a recognizable framework of the era. Sonata form typically consists of three major sections: the exposition, development, and recapitulation. In the exposition, the composer presents two themes, where the first theme is in the tonic key, and the second in the dominant key (or relative major in minor key pieces); the section serves to establish contrast and prepare for thematic shape later in the movement. The development follows, functioning as a space for dramatic tension, harmonic instability, and transformation. Composers could modulate freely, fragment themes, or even introduce new ideas. Finally, in the recapitulation, the original themes from the exposition return, but now both appear in the tonic key, restoring balance and creating a sense of closure. During the Classical period, this formal model became normal, and composers like Mozart and Haydn stuck to its structure; however, as time progressed into the Romantic period, composers began to view sonata less as a strict set of rules, and more as a flexible framework. James Hepokoski describes this shift as a move from “normative” structures to dialogic or expressive alternatives.³⁷ Rather than following the strict rules of sonata form, Romantic composers, such as Schubert and Chopin, began intentionally bending these formal expectations. These changes were meant to exhibit expressive decisions from the composers.³⁸

Mozart’s *Sonata No. 6 in D Major K. 284*

The first movement of Mozart’s *Sonata No. 6 in D Major; K. 284*, composed in 1775, is notable for its developed structure and depth but also reflects the qualities of the Viennese piano Mozart had access to at the time. In a letter to his father, Mozart praised Stein’s instrument writing, “The final one in D [K. 284] sounds beautiful on Stein’s piano,” highlighting his awareness of how the piano’s sound and touch influence the piece. These qualities are seen in his sonata.

The exposition starts with a strong D major theme with a clear theme and bright right-hand melody. The theme has repeated arpeggiated chords and scale figures that would have resonated well on Stein’s piano. The measures that follow demand agility and control, particularly in the fast passages with ornaments and sixteenth note scalar runs, which align perfectly with the Viennese *fortepiano*’s

37. Hepokoski, James. “Beyond the sonata principle.” *Journal of the American Musicological Society* 55, no. 1 (2002): 91+. Gale Academic OneFile.

38. Hepokoski.

lightweight action and responsive escapement. The instrument's quick rebound enabled for rapid articulation, allowing Mozart to write virtuosic flourishes that could be cleanly executed without loss of clarity. These textures are particular to the Viennese piano, which could not produce sustained resonance like the heavier English and French models but instead excelled at articulated phrasing and dynamics. The transition to the dominant key (A major) occurs with a modulating bridge passage full of scalar motion and ornamental flourishes, suited to the instrument's lightweight action. The second theme group contrasts the first, offering a more lyrical concept. Yet, the clarity of Stein's piano allows for a transparent voice-leading and balance between melody and accompaniment.

The development section is where Mozart stretches the expressive capacity of the instrument. It opens in A minor and quickly moves through a series of modulations, with diminished harmonies and fragmented motives drawn from the exposition. The limited sustain of the instrument means that dissonance does not linger but rather must be shaped through articulation and phrasing. Moreover, because Viennese pianos of the time were designed with a check mechanism and others without, those performers without had to maintain a lighter touch to avoid the hammers rebounding too aggressively. Since the development often alternates between voices, using the instrument's ability to execute fast repeated articulations without overwhelming volume exercises the mechanical capabilities that are embedded in the music.

The recapitulation reintroduces the primary material with subtle variation by returning to D major, thus affirming the Classical structure. The fortepiano's five-octave range is used effectively to differentiate the more formal sections and bring out contrasts in sound in the recap. The instrument's clean separation between registers allowed Mozart to maintain a balanced homophonic texture, throughout the piece.

The Viennese piano's light action, clear approach, and rapid escapement shaped the aesthetic choices of the sonata. From the motivic development to the clear articulation and balance phrasing, Mozart's compositional decisions reflect a deep understanding of the instrument's mechanics, embodying the expressive ideals and limitations of the Classical-era piano.

Schubert's *Sonata in E Major D. 157* and *Sonata in A Major D. 959*

Schubert's *Sonata in E Major, D. 157*, composed in 1815 when he was just eighteen, reflects his grounding in Classical forms while already hinting toward a more lyrical and harmonic exploration that would later define his mature style.

The exposition opens with a graceful theme in E major, built around arpeggiated chords and scalar passages. The first theme is presented with a playful passage, with the use of grace notes, giving it a spirited feel. Transitioning into the dominant

39. Litcham, Michael. "The Check in Some Early Pianos and the Development of Piano Technique around the Turn of the 18th Century." *Early Music* 21, no. 1 (1993): 29–42.

key (B major), the figuration of the keys naturally fit under the hand on a Viennese piano. The second theme is even more lyrical, and the piano's subtle dynamic range makes the phrasing clear, which would have been lost in the heavier English and French pianos.

The development is relatively short and harmonically simple compared to later Romantic work. It mostly plays with motives from the exposition, moving through minor keys, but avoiding dramatic, large-scale modulations. This restraint reflects Schubert's young and lighter sound on the piano, with quick decay and lack of overwhelming resonance, encouraging more clarity and forward momentum.

The recapitulation restates the original theme with only minor adjustments. Both themes return to the original key, keeping the Classical expectations. The movements' balanced form, melodic movement, and conserved modulation are fully compatible with the strengths and limitations of Schubert early Viennese piano.

By the time Schubert composed his *Sonata in A Major, D. 959* in 1828, the final year of his life, both his musical language and the pianos available to him had evolved dramatically. Schubert now had access to larger, more advanced pianos with broader dynamic range, richer bass, and sustain, that are reflected in his later sonatas.

The exposition begins with a broad, triumphant theme in A major, far grander and more assertive than his *D. 157*. The writing demands greater power, weight, and a fuller sound that the later Viennese pianos could now provide.⁴⁰ The wide-spanning arpeggios and rich textures are used effectively through the piano's expanded range and dynamic possibilities. The transition to the dominant (E major) features bold modulations, unexpected harmonic turns, and dramatic contrasts between lyrical chordal melodies and fast scalar passages, demonstrating his departure from Classical restraint. The second theme continues with the dramatic scalar passages, making full use of the piano's expanded range and dynamic capabilities.

The development is one of the movement's most striking sections. Schubert seamlessly transitions into a new melodic idea, in C major. He plays around with the melody modulating in between C major and B major. Here, Schubert sustains a quiet dynamic level, allowing him to explore suspended harmonies that decay slowly and emotionally. The harmonic journey is adventurous, with distant key areas and unexpected modulations, reflecting Schubert maturity as a composer and freedom offered by newer instruments.

The recapitulation restates the theme with slight changes. The return is colored with slight harmonic deviation and additional inner voices, showing Romantic tendency toward thematic transformation rather than a pure restatement. The broader dynamic ability the piano provided allowed these subtleties to come across with greater emotional weight.

Chopin's *Sonata No. 3 B Minor, Op. 58*

Chopin's *Sonata No. 3 in B Minor*, composed in 1844, stands as a pinnacle of the Romantic sonata tradition, both honoring and departing from

40. Bilson. "Schubert's Piano Music and the Pianos of His Time."

Classical models. While preserving the basic three-part sonata structure, Chopin's harmonic language, thematic development, and expressive goals are rooted deeply in the Romantic style. Importantly, the instruments he composed for, such as the Pleyel and Érard, were vastly different from the Viennese instruments used by Mozart and Schubert.

The exposition begins with a dramatic striking theme in B minor, marked *Allegro maestoso*. The first theme is richly layered, moving between full-bodied chords and technical right-hand gestures. The piece then transitions into a lyrical second theme in D major. The smooth lyrical lines reflect the deeper sound and evenness of touch that French piano enabled, allowing Chopin to explore expansive phrasing, extended registers, and harmonic coloration that would have been impossible to recreate on a Viennese piano of Mozart's era.

In the development, Chopin stretches harmonic language through rapid modulation and fugal textures, demanding an instrument with tonal balance across registers.

The movement's recapitulation begins with the second theme found in the exposition, originally in D major, in B major, closing the piece with a triumphant ending. The themes and ideas found in the recap are repeated in different keys with very little textural change, demonstrating Chopin's ability to use the instrument's expressive capabilities to maintain clarity, while heightening the dramatic feel.⁴¹ The final cadence, which ends with a vi-V-I progression in B major, shows his manipulation of expectations in favor of emotional resolution, highlighting the sound and tonal depth of the instrument.

Chopin's compositional decisions in this movement show intricate textures, harmonic development, and structural deviation, that can be seen along the technological advancements of the French grand piano. These expressive features contrast sharply with the clear articulation and limited dynamic range available to Mozart and early Schubert, whose instruments could not sustain harmonies or achieve the same level of emotional depth. His sonata demonstrates how composers in the Romantic era not only reimagined classical form but actively composed into the capabilities of the piano, using its strength to shape their musical ideas.

Conclusion

The evolution from the early 18th century to the late 19th century directly shaped the stylistic development of keyboard music, particularly within the sonata genre. By tracking the advancements in piano technology, it is evident that different escapement mechanisms, expansion of keyboard range, enhanced sustain, and improvements in hammer construction created new expressive possibilities that composers actively incorporated into their writing. The sonatas of Mozart, Schubert, Chopin highlighted how each composer's stylistic choices

41. Harold, Maverick. "Chopin's Piano Sonata No. 3 in B minor Op. 58: A Structural Analysis." University of Nebraska Omaha, 2023.

were directly influenced by the specific technologies available to them.

Mozart *Sonata No. 6 D Major; K. 284*, composed with the light-action Viennese piano in mind, demonstrated clarity, balance, and motivic development well suited to the instrument's quick decay and response. Schubert's *Sonata in E Major, D. 157* retained Classical structures but gradually began to stretch harmonic boundaries, while his late *Sonata in A Major, D. 959* embraced Romantic ideals through expansive melodic ideas and emotional depth made possible by improved Viennese pianos. Chopin's *Sonata No.3 in B Minor, Op. 58* pushed the expressive limits of the piano further, using its full dynamic, textural, and harmonic capabilities of French instruments like those made of Pleyel and Érard.

Ultimately, the piano was a tool that composers collaborated with. The change in instrument design incited progress in musical language, allowing composers to break from Classical norms and create increasingly personal, emotional, and structural innovative work. Future studies might extend this idea by examining how composers such as Liszt and Brahms responded to even later innovation, continuing the exchange between musical imagination and mechanical possibility.

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Stay Active, Stay Healthy – Why Fitness Matters

Teaching Project by
**ABDULMAJEED
ALHAMAWI and
SALEM KLENK**

RSNG 2362: CLINICAL NURSING LEVEL 2

Teaching a.k.a. patient education is an essential device in the nurses' toolbox. However, as every nursing student will discover, they have truly little time as well a patient attention to accomplish this task. Engagement is key to lasting learning. Abdul and Salem used excellent critical thinking and purposeful time management with their creative activities to engage seniors and promote participation in specific wellness through fitness learning. Their use of a logically written handout brochure to continue the learned exercises, and reminders of safe practices and local resources in the Woodlands / Montgomery area will continue to enhance their knowledge further...wherever they are in their fitness journey.

- Emily J. Cerreta

Introduction

Regular physical activity plays a vital role in promoting health and independence among aging adults. As the senior population grows, so do concerns regarding chronic disease management, fall prevention, and overall well-being. Many seniors hold misconceptions about exercise, believing they are too old or frail to benefit. This teaching project aims to empower older adults aged 60–90 at a local senior center by providing evidence-based education on the importance of safe, age-appropriate physical activity. The program promotes independence, reduces the risk of disease, improves balance and mental health, and offers seniors the tools to incorporate consistent movement into their daily lives (Centers for Disease Control and Prevention [CDC], 2022).

Comprehensive Assessment of Target Audience

The teaching session was conducted at a senior community center with participants ranging in age from 60 to 90. Most attendees had limited formal education about safe exercise, and some expressed fear of falling or pain with movement. They demonstrated varying levels of physical ability; some required mobility aids while others were active walkers. Emotionally, many were motivated by the desire to remain independent, engage with grandchildren, and reduce chronic pain.

In terms of developmental level, the group fell within Erikson's stage of ego integrity vs. despair. According to Erikson's psychosocial theory, older adults

in this stage seek meaning, reflect on life, and face potential feelings of despair if they perceive their life as unproductive or full of regrets (Cherry, 2022). Learning styles were assessed through observation and discussion—most preferred visual demonstrations, simple verbal explanations, and hands-on practice. Environmental factors influencing participation included access to safe walking spaces, weather, transportation to fitness centers, and the availability of family support.

Learning Need and Nursing Diagnosis

The group displayed a knowledge deficit regarding safe exercise practices as evidenced by statements like “I’m too old to start exercising” and “It will make my arthritis worse.” A priority nursing diagnosis identified was: Knowledge Deficit related to physical activity and fall prevention, as evidenced by verbalizations of uncertainty and inactivity (Ackley & Ladwig, 2020). A secondary diagnosis included Readiness for Enhanced Health Literacy related to interest in remaining mobile and active.

Teaching Objectives and Goals

Short-Term Goals:

1. Participants will verbalize three benefits of exercise by the end of the session.
2. Participants will correctly demonstrate one chair-based exercise before leaving.
3. Participants will identify one small, realistic fitness goal for the next week.

Long-Term Goals:

1. Participants will engage in physical activity at least three times per week for 20 minutes within six weeks (ACSM, 2019).
2. Participants will report decreased joint stiffness or improved mood in two months.
3. Participants will show improved balance or endurance based on self-report and observation of routine behaviors.

Teaching Strategies and Interventions

The teaching plan included a 5–10 minute individualized patient session tailored to various learning styles. Large-print handouts and brochures with colorful illustrations were distributed to address visual learners. A live demonstration of exercises, including seated arm raises and leg extensions, catered to kinesthetic learners and ensured safety. One-on-one conversation allowed for addressing individual concerns and providing reassurance.

The teach-back method was used to reinforce understanding. Sessions were brief and movement was low-intensity to reduce fatigue. A trifold poster displayed benefits of exercise and listed local fitness centers such as Plus Forty Fitness & Wellness Studio, Conroe Aquatic Center, and The Woodlands YMCA (Green & White Brochure, 2024).

Teaching Content Outline

1. Why Exercise Matters

- Prevents falls through improved strength and balance (Sherrington et al., 2019)
- Enhances cardiovascular health and lowers blood pressure (ACSM, 2019)
- Reduces joint pain and stiffness, especially with arthritis (CDC, 2022)
- Elevates mood and reduces anxiety (Mather et al., 2002)
- Stimulates cognitive health and memory (Erickson et al., 2011)

2. Safe Exercises to Try

- Chair exercises: arm raises, seated twists, leg extensions (National Institute on Aging [NIA], 2022)
- Walking program: start with 5 minutes daily, add 1 minute each week
- Balance training: heel-to-toe walk, standing on one foot with support
- Gentle yoga or Tai Chi (Li et al., 2005)

3. Local Community Resources

- Plus Forty Fitness (Conroe, TX): senior fitness classes
- The Woodlands Methodist Church: free Fit For Life classes
- Conroe Aquatic Center: water aerobics for arthritis
- YMCA at Shadowbend: senior cardio and strength classes (Green & White Brochure, 2024)

4. Tips for Getting Started

- Speak to your doctor before beginning
- Start slow and stay consistent
- Wear proper shoes and stay hydrated
- Stop if you feel pain or dizziness

Methods of Evaluation

Patient participation was evaluated through verbal responses, observed engagement, and demonstrated comprehension of content. Each participant actively engaged in conversation about their current physical activity habits and shared ways they could integrate safe movement into their daily routine. Several patients accurately demonstrated chair-based exercises and verbalized the physiological and emotional benefits of increased movement. Most participants expressed feeling more confident about starting a low-intensity exercise regimen, with some stating they planned to walk daily or perform stretches during TV breaks. These outcomes indicate successful knowledge transfer, increased motivation, and a readiness to adopt healthy behavioral changes following the educational session.

Conclusion

This project highlighted the value of nurse-led education in promoting physical health and self-efficacy among seniors. Teaching older adults about the importance of exercise helped dispel myths and created an environment of empowerment and community. With evidence-based strategies, seniors can learn safe, simple exercises and adopt active routines that support aging with strength and confidence.

Outline: The Importance of Exercise for Seniors

I. Introduction

- Importance of physical activity in aging populations
- Overview of benefits for independence and chronic disease prevention
- Need for targeted education in senior communities

II. Target Audience

- Seniors aged 60–90
- Residents and participants of a local community senior center

III. Comprehensive Assessment

- Prior knowledge: Many unsure of safe exercises or have fears about injury
- Developmental level: Older adults in Erikson's ego integrity vs. despair stage
- Physical/Emotional factors: Common limitations (joint pain, fatigue, balance), fear of falling, motivation to remain independent
- Learning styles: Visual, hands-on, and verbal preferred
- Environmental factors: Home safety, access to fitness centers, social support

IV. Learning Need/Diagnosis

- Knowledge deficit related to safe physical activity, as evidenced by misconceptions or lack of routine exercise

V. Goals & Objectives

- Seniors will verbalize 3 benefits of exercise
- Seniors will demonstrate 1 safe chair exercise
- Seniors will set 1 realistic physical activity goal
- Increase frequency of physical activity to 3x/week for 20 minutes within 6 weeks
- Report decreased joint stiffness or improved mood in 2 months
- Improve balance and stability at 3-month follow-up

VI. Interventions

- Provide large-print handouts and colorful visuals
- Demonstrate chair exercises with group participation
- Encourage group discussion and questions
- Use teach-back method for understanding
- Keep sessions under 5-15 minutes to reduce fatigue

VII. Teaching Content Outline

1. Why Exercise Matters

- Promotes heart and joint health
- Reduces fall risk and strengthens muscles
- Enhances mood and cognitive function

2. Easy Exercises to Start With

- Seated stretches, walking programs, gentle balance training

3. Local Resources

- Conroe Aquatic Center
- Plus Forty Fitness & Wellness Studio
- YMCA at Shadowbend (Woodlands)
- C.K. Ray Recreation Center

4. Staying Motivated

- Tracking progress, finding exercise buddies
- Working through pain safely

VIII. Methods of Evaluation

- Return demonstration of 1-2 exercises
- Self-reported exercise goals
- Verbal reflection on mood/pain changes



Why Stay Active?

Regular physical activity is essential for maintaining independence, reducing the risk of chronic diseases, and enhancing overall well-being. Engaging in community fitness programs also offers social connections and fun!

HEALTH AND WELLNESS

Senior Fitness Resources in Conroe & The Woodlands

Plus Forty Fitness & Wellness Studio

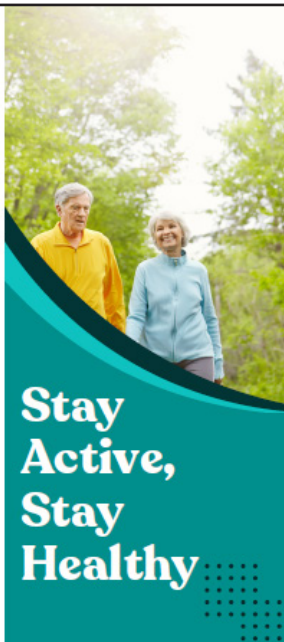
Conroe Aquatic Center

C.K. Ray Recreation Center

The Woodlands Methodist Church
- Fit For Life

The Woodlands Family YMCA at Shadowbend

The Woodlands Yoga Studio



Stay Active, Stay Healthy

Fitness Opportunities in Your Community

Conroe, TX:

Pine Forty Fitness & Wellness Studio

- Offerings: Personal training, group fitness classes including Zumba Gold, Modified Yoga, and Body Blast Boot Camp.
- Contact: (938) 235-2162
- http://www.plus-forty-fitness.com/?utm_source=chetsgt.com

Coors Academic Center

- Offerings: Water aerobics classes suitable for those with joint pain or mobility challenges.
- http://www.plus-forty-fitness.com/?utm_source=chatgpt.com

C.K. Ray Recreation Center

- Offerings: Virtue fitness classes included with membership or daily pass.
- http://www.findhelp.org/health/counselor-%2B-fitness-counselor-b7utm_source=chatgpt.com



The Woodlands, TX:

The Woodlands Methodist Church - Fit For Life

- Offering: Free exercise classes for adults 55+, focusing on muscle toning, strength training, and stretching.
- Schedule: Monday to Friday at 9:00 a.m.
- https://thewoodlandmethodist.org/fitness?utm_source=chadgpt.com

The Woodlands Family YMCA at Shadowbend

- Offerings: Group exercise classes tailored for seniors, including cardio, strength, and stretch sessions.
- http://www.pulse-forty-fitness.com/fitness-classes?utm_source=chatspot.com

The Woodlands Yoga Studio

- Offerings: Chair Yoga classes designed for seniors to improve strength, flexibility, and balance.
- http://www.thewoodlandyogastudio.com/class-descriptions/?utm_source=chatrnt.com

Tips for Getting Started

- **Consult Your Doctor:** Before beginning any new exercise program, discuss it with your healthcare provider.
- **Start Slow:** Begin with low-intensity activities and gradually increase as you feel comfortable.
- **Stay Hydrated:** Drink plenty of water before, during, and after exercise.
- **Listen to Your Body:** If you feel pain or discomfort, stop the activity and rest.

Hydration reminder: "Drink water before, during, and after exercise!"
Safety Tip: "Talk to your doctor before starting a new routine."

Easy Exercises To Try

Chair Exercises

- Raise arms up/down (10x)
- Straight leg hold for 5 seconds (each leg)
- Gentle seated torso twist

Walking Program

- Start with 5 minutes/day
- Add 1 minute/week
- Wear good shoes
- Walk with a friend

Balance Builders

- Stand on one foot holding chair (10 seconds)
- Heel-to-toe walk along wall
- Gentle yoga or tai chi (try a class!)

Tri-Fold Poster and brochure to be used for educational session and shared after:



To view the images from this article in color, please scan the top QR code on pg. 120 or visit <https://lscmontgomerycac.com/visual-communication-2025/>

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A Road Worth Wandering: On the Challenges and Benefits of Philosophy

Essay by
KELLIE DEAN

PHIL 1301: INTRODUCTION TO PHILOSOPHY

Today quite a few contemporary philosophers work outside academia, doing what is called public philosophy. They apply philosophical reasoning to a wide range of topics, while writing for a general audience. This is the approach I take to teaching my introduction to philosophy, and in a series of short essays, I ask students to identify and develop a specific point of interest to them. The short essay form is quite demanding, because it requires a high level of self-discipline to arrive at a clearly articulated focus, a tightly organized line of reasoning leading to a substantive conclusion, and clearly and concisely constructed sentences, all while sticking closely to a word count. In this essay, Kellie accomplishes all this while gracefully communicating a point that seems especially cogent in today's world of emotionally charged rhetoric.

- Britt Michelsen

Newcomers to philosophy might find themselves inquiring, “Why does philosophy matter? What use is it to me?” without realizing they are already engaging with the subject by simply wondering. But what about the answers to these questions? I wish to underscore that, while possibly intimidating to achieve, the benefits of philosophy are expansive and recognizing what they are will aid us in grasping the true meaning of thinking philosophically rather than passively. In this essay, I will first bring attention to some of the challenges of becoming a critical thinker, a necessary skill in the pursuit of wisdom. Then I will focus on the many ways studying philosophy can improve our lives on a personal level.

Perhaps philosophy’s most crucial lesson is that we cannot be meaningful thinkers without leaving our ideals vulnerable to attack. What’s more, we must be willing to pull these beliefs apart ourselves if we wish to reap the rewards of philosophical exploration. It can be uncomfortable to dissect our deeply rooted convictions, to admit to ourselves that our perceptions may not be true, but if we cannot overcome this hurdle, we put ourselves at great disadvantage. By being cozy in our unassertive thinking, we rob ourselves of the chance to strengthen our minds. As with other parts of the body, it atrophies when we fail to exercise it. Like an intense workout, philosophy can be strenuous, but pushing our minds to the limit is what helps them grow (Pardi).

The results of conquering such challenges are their own reward. As we learn to analyze our surroundings through a philosophical lens, we expand our world, moving past boundaries we may not have seen before. We become used to breaking

down our assumptions and practicing patience, which in turn makes us deeper thinkers and coherent problem solvers. Employing philosophy in our daily lives helps us to better understand ourselves cognitively, giving us greater control over our emotions and even allowing us to distinguish our personal values. Philosophy is like a stone we whet our minds against to grant us clarity and fuel our curiosity. It encourages us to peel back the layers of a quandary, and in doing so, we discover there is a smarter way to think.

Though it requires persistent self-confrontation, philosophy offers a variety of transformative benefits. It gives us access to intellectual stimulation and personal development that eclipses the initial growing pains of dissolving our preconceptions. It is no overstatement that the pursuit of wisdom is a long and often tough road. We must still acknowledge it as one well worth wandering.

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Deontological Discrepancy: Do Kantian Ethics Falter in the Face of Moral Luck?

Research Paper by
JOANA FIGUEROA

PHIL 2306: INTRODUCTION TO ETHICS

Much good philosophical writing demonstrates three virtues: precise analysis, concision of assumptions, and a clear, cohesive argument. In her Argumentative Essay, Joana manages to demonstrate all three. By establishing a narrow thesis—Does lacking full control over our actions undermine the core of Kant's moral philosophy?—Joana sets precise boundaries to her argument in a way which aids analytical depth. Next, centering the focus of her argument around the role and limits of volition in Kant's broader philosophy, she engages in a close textual analysis that reduces the number of outside assumptions. And in raising the challenge of moral luck to Kant's notion of volition, she provides a specific challenge for her argument to address. Joana weaves together these features to form a clear and cohesive argument that showcases strong philosophical writing.

- Matt Williams

I. Introduction

When deciding whether an action is morally right or wrong, one has two options to consider. Either one focuses on the agent's intentions, i.e. the reason why the action was done, or one focuses on the action's consequences. That is to say, one must decide if the action is morally right because it was made with good intentions, or because one deems the outcome desirable. The German philosopher Immanuel Kant argues for the former, insisting that one's actions can only be of the highest moral worth if they are driven by good will and practical reason. According to Kant, good will is a product of reason, never desire. This idea of intent's primacy, however, only works with the premise that all human beings have the same capacity for rational and the inherent, equal ability to make the same decisions. The philosophers Bernard Williams and Thomas Nagel argue that moral luck, the idea that moral judgement is inevitably affected by factors beyond an agent's control, undermines an intention-based view of morality. If agents cannot be in full control of their moral judgement, then the idea of a universal understanding and capacity of reason becomes treacherous. However, Williams and Nagel hold that Kant's deontological approach neglects to accommodate variables one cannot control, which are often present in real-life circumstances. This makes it a questionable framework for moral judgement. If there are things beyond an agent's control that affect moral judgement, then it becomes difficult to argue for morality based on intent, since

there is no longer an argument to be made for a universal basis for morality. This begs the question: Can moral worth truly exist outside the consequences of one's actions, or do Kantian ethics falter in the face of moral luck? I argue that Kant's framework stands up to the assault levied by moral luck.

II. Kant's Definition of Duty

To begin with, Kant places an emphasis on clearly defining duty. This is important because for Kant, duty is not merely a feeling of responsibility, but a complete denial of one's personal desires. In fact, Kant even mentions that a divine sense of duty could not be good, because it would be motivated by *thoughts* of duty, lack *natural inclinations*, and "necessarily [fulfill] moral requirements without feeling constrained to do so."¹ In other words, duty can only be considered such if it includes a perception of restraint, an active decision to forego one's desires while still understanding their presence. Only if a person is tempted to act on their desires but *chooses* not to, can they claim to be acting out of respect for duty. Kant's rejection of divine duty is pivotal to his understanding of morality because it upholds the principle of autonomy, which lies at the core of his deontology. Furthermore, it must be clear that one is not seeking approval or anything akin to praise by acting out of duty. Similarly, one should not simply conform to something because one dreads the consequences of failing to do so. That would negate the purpose of duty, as the action would stem from fear rather than because reason itself tells us the act is right.²

III. Kantian Deontology: The Categorical Imperative

While practical reason is important to Immanuel Kant's deontology, it is the categorical imperative that lies at its heart, which shall be discussed in more detail later in this section. Kant adheres to a strict *a priori* verdict of principles, which claims that the ethical judgement of an action's moral worth must occur independently of its empirical impact. In other words, only the intention of the agent must be evaluated, never the outcome of his act, and one must be able to determine the morality of an act simply through reason alone. According to Kant, to be of moral worth, such principles must always be of practical nature (objective), never of empirical nature (subjective). Such principles can only be achieved through unconditional practical reason.³ A principle, what Kant calls maxim, is a rule an individual adopts to guide their behavior.

When determining the moral worth of a maxim, one must consider whether it can be reconciled with the categorical imperative. In order to do this, the first question one must ask themselves is whether this maxim can be universalized.

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1. Robert Johnson and Adam Cureton, "Kant's Moral Philosophy," *Stanford Encyclopedia of Philosophy*, last modified Jan 21, 2022, <https://plato.stanford.edu/entries/kant-moral/>
 2. Johnson and Cureton, "Kant's Moral Philosophy," SEP
 3. Johnson and Cureton, "Kant's Moral Philosophy," SEP

This judgement ties back to the will of an agent. According to Kant, a good-willed person is “never to act except in such a way that [he] could also will that [his] maxim should become a universal law.”⁴ This is to say that an agent in possession of a good will acts only in a way that would, without exception, be reasonable for the agent to will everyone to act in. When it is, indeed, possible to claim that a maxim would be reasonable to universalize, we may call that maxim a *practical law*. However, when a maxim is not rationally applicable to everyone, it is of empirical nature and can only be considered an empirical principle. In the same manner, there is another aspect to be considered when examining the nature of a maxim. Specifically, one must ensure that it was established only based on will, and completely unconditional from “what is attained by its causality.”⁵ In other words, the will should *not* be concerned with the act’s outcomes or even its practical possibility. For Kant, if desire is the determining ground of the will, then the established maxim is one of empirical nature and cannot furnish a practical law.⁶ But assuming that the maxim fulfills the conditions of universalization and objective necessity, thus becoming a practical law, then this practical law may also be called an *imperative*.

To continue, once one has formed an imperative, one must now consider whether it is categorical or hypothetical in nature. This evaluation is done in a similar manner to when distinguishing between practical laws and empirical principles, because one must consider whether practical reason is the basis of the imperative. There are four considerations in this. First, if the imperative has an instrumental reason rather than a practical one, then it is hypothetical in nature, and forms a hypothetical imperative. Second, the imperative must be universally applicable because if the universalized imperative presents a contradiction, then it negates its purpose and cannot be a categorical imperative. This means categorical imperatives cannot be dependent on external circumstances. Third, one must evaluate whether the action treats all rational beings as ends in themselves, respecting their intrinsic human worth, and the action must be born from free will, not external pressure. Last but certainly not least, the imperative must express a duty, prescribing what ought to be done in a morally obligatory way. If all of the mentioned conditions are fulfilled, then the imperative may be considered a *Categorical Imperative*, which, according to Kant, is the “fundamental principle of our moral duties.”⁷

To summarize, Kant establishes the categorical imperative as his fundamental principle for moral duties. Moreover, Kant’s categorical imperative clearly defines how one must decide whether an action is to be considered moral. Given Kant’s understanding of duty, i.e. a constraint or *conscious* denial of one’s desires, it is

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4. Samuel C. Rickless, “From the Good Will to the Formula of Universal Law,” *Philosophy and Phenomenological Research* 68, no. 3 (2004), 554
 5. Immanuel Kant, *Critique of Practical Reason*, trans. Mary Gregor, Cambridge, United Kingdom: University Press, 2015, 19
 6. Kant, *Critique of Practical Reason*, 2015, 19
 7. Johnson and Cureton, “Kant’s Moral Philosophy,” *SEP*.

that morality, on his understanding, is a rational, almost untouchable concept that cannot be influenced by anything outside of reason. If one is *not* tempted to act immorally, then one cannot claim to have acted out of duty; if one *is* tempted to act immorally but fails to completely resist any sort of irrational or sentimental influence, then one's action *cannot* be considered morally good. Still, Kant's strict emphasis on reason as the sole basis for moral action has not gone unchallenged. Philosophers such as Bernard Williams and Thomas Nagel complicate this view with the concept of moral luck, which suggests that morality cannot be entirely separated from factors outside an agent's control.

IV. Moral Luck According to Bernard Williams and Thomas Nagel

Bernard Williams and Thomas Nagel argue that moral judgement cannot be based solely on intention, because factors outside an agent's control inevitably shape the way actions are evaluated. These external factors are what they refer to as luck. Both Williams and Nagel agree that luck enters the evaluative process of an action, meaning it is not possible to be entirely detached from things outside of pure reason. However, their claims differ slightly in the degree that such external factors meddle with moral judgement. Nagel sees its influence as deeply troubling. He accepts that luck shapes our moral thinking, even though it ideally should not, and considers this an unresolved tension in moral philosophy. Williams, by contrast, sees luck not just as an influence but as a direct rival to moral judgment itself. He concludes that our judgement, since affected by a cogent understanding of the outcome, is a matter of rational justification rather than moral justification. In other words, when we assess actions through their results, we are appealing to reason, not morality. It is, therefore, not reasonable to regard moral justification as the supreme source of value. Furthermore, Williams argues that rational justification inevitably defeats moral justification because the latter cannot withstand the ethical significance of outcomes without denying how we actually judge right and wrong.⁸ In view of this, he essentially states that the Kantian understanding of morality is ultimately self-defeating.

There are four different types of moral luck. The first type is resultant luck. This kind of moral luck describes the luck affecting a situation's outcome. Two agents with identical intentions and actions may still find themselves with different outcomes due to factors beyond their control. Consider how in surgery there is always the small but nonetheless real threat of failure. Two surgeons with similar levels of experience, doing the same surgery on different patients may see drastically different results. While the first surgeon may succeed, the other very well may fail due to variables outside his control, such as a hemorrhage in the patient's brain. Williams argues that we will judge the surgeon's actions based on the outcome of the surgery, somewhat regardless of their intentions. The former surgeon will be held in a higher regard than the latter, despite their moral worth being identical, if one were to look simply at

8. Judith Andre, "Nagel, Williams, and Moral Luck," *Analysis* 43, no. 4 (1983), 202

intention. A successful result often overshadows an inherent risk, whereas failure magnifies the perceived responsibility of the surgeon.

Constitutive luck is the second form of moral luck and refers to an agent's traits and dispositions. The argument is that who people are and who they become is largely dependent on factors they cannot control. Parents and other relatives, social interactions, and culture all shape one's perception of morality and right or wrong. The traits and dispositions acquired are a result of socialization and not independent action. The values people hold undoubtedly affect the actions and decisions they make. Inequalities in character and temperament mean that not all agents face the same moral challenges, which raises questions about the fairness of holding everyone to the same moral standards.

Circumstantial luck is the third kind. This refers to the circumstances an agent may find themselves in due to no fault of their own. Nagel presents the example of a soldier in Nazi Germany who committed heinous crimes against humanity. One might condemn him for such unforgiveable actions, but one ought to consider circumstantial luck in this case. The soldier only committed those acts because his circumstances made it possible to begin with. If this soldier had been removed from the situation, perhaps being sent abroad, he might have lived a different life. If one distinguishes one's moral judgement of the soldier in Germany and the one of his fictitious counterpart abroad, one has a case of circumstantial luck. This example shows that even though the Nazi soldiers and their hypothetical counterparts may not differ in moral character or disposition, one might judge them differently simply because their circumstances differ.⁹

The final category of moral luck is causal luck. This category addresses the idea that every action, though it may appear independent at first glance, is simply the summation of consequences beyond one's control. Interestingly, Nagel claims that causal luck is the "classic problem of free will."¹⁰ More specifically, Nagel argues that one's actions are the consequences of things outside of one's control, even the "stripped-down acts of the will,"¹¹ meaning that neither one's actions nor one's will are fully free. This poses a direct challenge to Kant's understanding of duty, which should always stem from free will, not circumstances or external coercion.

V. Discrepancy with Kantian Deontology

The discrepancy between moral luck and Kant's deontology becomes evident in their fundamentally opposing approaches to moral judgment. When assigning moral worth to an action, as previously stated, one must base that decision either on intention, as Kant argues, or on outcome. For Kant, the moral worth of an action is determined *solely* by the good will of the agent and their

9. Dana K. Nelkin, "Moral Luck," *Stanford Encyclopedia of Philosophy*, last modified Jan 20, 2025, <https://plato.stanford.edu/entries/moral-luck/>

10. Nelkin, "Moral Luck," *SEP*.

11. Nelkin, "Moral Luck," *SEP*.

adherence to duty, regardless of the outcome. The case of moral luck forces us to consider that an agent is, at least to some degree, judged by the outcome of his actions. For instance, resultant luck illustrates this discrepancy by showing that two individuals performing identical actions with identical intentions may still be judged differently due to varying outcomes. While Kant would argue that both hold the same moral worth, society often evaluates the successful individual more favorably than the unsuccessful one, regardless of their shared intent. Likewise, moral luck challenges the fairness of judging agents for their intent in the first place. Kant's framework does not accommodate these variations, as he assumes an equal capacity for rational moral judgment across all agents. The question is whether moral luck alone challenge Kant's primacy of intent. Is there still the possibility for a universal understanding of supreme moral worth outside the consequences of one's actions?

As previously established, Kantian deontology is inherently incompatible with variations of moral judgement. For Kant, the highest principle of morality is the categorical imperative, which must stand unconditionally and without exception. However, as A. W. Moore argues, Kantian deontology does allow for the existence of moral luck, because moral *approval* is not the same as moral *assessment*.¹² Yet, this is only the case if one considers moral luck as analogous with *bad* luck. Essentially, it may be reasonable to condemn someone for something that is beyond their control, but it would not be reasonable to praise them for something beyond their control. The example Moore raises is that of a reckless driver. If the driver is unfortunate enough to cause someone's death, then many would find it justifiable to condemn the driver. However, if the reckless driver is blessed enough not to harm anyone, then most would not consider him praiseworthy.¹³ Effectively, if one accepts Moore's distinguishment of moral approval and moral assessment, moral luck *can* coexist with Kant's understanding of moral worth, so long as it is *bad* moral luck, which does not challenge moral approval, i.e. worth. The ability to judge an agent for something beyond their control does not necessarily imply the ability to praise them for something beyond their control. Thus, since Kant's categorical imperative seeks to approve someone's actions as moral, the concept of bad moral luck does not pose a problem.

A final consideration: The whole discussion of whether moral luck challenges Kant's ethical framework is built on the premise that moral luck itself is a flawless concept. However, the scholar Michael Slote argues that moral luck challenges most philosophical theories, as it is an "untidy mess to ethics."¹⁴ Similarly to Moore, Slote is concerned with the concept of blameworthiness, claiming that it is the core issue of moral luck. Nonetheless, Slote claims that "common sense [...] tends [...] to hold that blameworthiness cannot be a matter

12. A. W. Moore, "A Kantian View of Moral Luck," *Philosophy* 65, no. 253 (1990), 303

13. Moore, "A Kantian View of Moral Luck," 303

14. Michael Slote, "The Problem of Moral Luck," *Philosophical Topics* 22, no. 1/2 (1994), 398

of luck or accident,”¹⁵ which is the opposite of Moore’s conclusion. That said, Slote’s intention is to showcase a variety of inconsistencies found in the theory of moral luck, with his final conclusion being that moral luck itself has a large set of problems “that require [one] to throw away elements of common sense within some larger theoretical framework.”¹⁶

VI. Conclusions

Kant’s deontology is a strongly pragmatic approach to morality with little to no room for circumstantial factors. Although Kant recognizes that humans, by their nature, are inclined to be influenced by desires and other uncontrollable circumstances, he does not tolerate any excuses to stray from duty. Or at least he does not believe that one can claim to be acting with a respect for duty if one allows these external factors to affect them. The idea of moral luck, however, presumes that Kant’s understanding of morality is unfair because, as Bernard Williams argues, it is rooted in a premise that is both inhuman as well as unrealistic. Additionally, moral luck does require a fair amount of theoretical exploration that may not always feel intuitive, e.g. the reckless driver. This is not to say that Kant’s categorical imperative is intuitive, but it is difficult to challenge Kant’s ethical framework with a concept that is not necessarily more instinctual. As Slote’s and Moore’s arguments show, it is unreasonable to conclude that moral luck is a definite rebuttal of Kant’s deontology. While moral luck challenges Kant’s emphasis on intent as the sole determinant of moral worth, it does not refute the overall deontological framework. Principally, we still maintain that moral worth can exist outside the consequences of our actions, since moral luck is not more consistent than Kant’s categorical imperative. While Kantian ethics are not without flaws, they do *not* falter in the face of moral luck.

15. Slote “The Problem of Moral Luck,” 399

16. Slote, “The Problem of Moral Luck,” 407

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Imagination as a Source of Knowledge

Research Paper by
ZOHHA HAIDER

PHIL 1301: INTRODUCTION TO PHILOSOPHY

A lesser appreciated quality of philosophical writing is the balance needed to make one's points accessible without sacrificing their depth or argumentative rigor. Zoha demonstrates this skill via arguments by example. An argument by example utilizes specific cases to illustrate the soundness of more general claims and is an important aspect of philosophical thought experiments. Zoha uses three vivid, well-placed examples to do precisely this. It is a difficult method to pull off well; when the broader point is argued through narrow examples, using poorly chosen examples more readily opens one's argument to criticisms. Zoha gracefully wields her carefully chosen examples as arguments that further her central claim that imagination can be a source of knowledge.

- Matt Williams

I. Introduction

There is ongoing debate in contemporary philosophy of whether imagination can be a source of knowledge. Part of the problem is that, traditionally, knowledge is treated as the product of a true belief that is justified. This traditional picture treats knowledge as a binary. Either one has it or doesn't; there is no intermediary case. What makes this problematic for imagination is that it is unclear in what contexts imaginings can produce true beliefs, let alone justified ones. Imagination, after all, is often divorced from truth and reality. However, I argue, there are cases where imagination can produce justified true beliefs when it is constrained by rationality.

Imagination can be a source of knowledge, so long as there are rational constraints. The use of imagination can lead to new discoveries, inventions, or solutions. While not all that is imagined is real, some thoughts have the potential to be real. If knowledge must be based on reality, then imagination with logical restrictions should be considered a source of knowledge. Logical restraints, for our purposes, include adhering to the physical and the rational laws of reality. This sets the parameters of knowledge-producing imaginings to only include what can be logically possible in reality. Knowledge is deeper than simply obtaining information; it involves the application of that information in reaching a logical conclusion. Through analysis of the process by which a conclusion is reached under appropriate constraints, I will argue that imagination is a source of knowledge. Imagination, constrained by logic and rationality, provides defeasible justified beliefs that allow us to obtain knowledge.

For our purposes, imagination is defined as a thought experiment, utilizing visualization to produce a pseudo-sensory experience. Knowledge, in this case is a reasonable conclusion with a high probability of truth, which can be further defined as a mental state that remains in cognitive contact with reality.¹ In essence, this means that imagination, in order to be a source of knowledge, must adhere to rational constraints. By restricting imagination through rational constraints, we limit the medium to thought experiments that explore reality rather than ignore it.

II. Sartre on Imagination as Absence

Before we can talk about the possibility of imagination as a source of knowledge, we must first define the necessary and sufficient conditions for what imagination itself *is*. The work of Jean-Paul Sartre provides a useful initial framework. For Sartre, there are four key conditions for any act of imagining. These conditions are that every act of imagination:

1. Is a *form* of consciousness (or a way of thinking), not an object of consciousness.
2. Emphasizes the absence of its objects (we recognize it as separate from our present reality).
3. Is pseudo-sensory (i.e., has an experiential component to it).
4. Is an intentional act (one does not imagine without willing themself to).²

An example that Jean-Paul Sartre uses involves his friend Pierre. Sartre knows that his friend Pierre is currently in Boston, not Paris. When they are both in Paris, Sartre and Pierre regularly meet for coffee at a local cafe. Because he misses Pierre, Sartre imagines that him as being there the next time he enters the cafe and sees an image of Pierre as of being there. But Sartre is aware that Pierre is not *actually* there; it is an image of the mind, a product of his imagining.³ Here we see all four features of Sartre's theory of imagination at work. The imagining is (1) an act of consciousness that (3) in a pseudo-sensory fashion (2) presents Pierre as present where Sartre knows him to be absent, and (4) the act of imagining is one Sartre wills from his desire to see his friend again.

It is what we derive from the image of Pierre that matters for knowledge. The difference between knowledge gained from external stimuli versus internal processes is obsolete in this example. Why is this important? If we rely on mental images to store information, then their use in imagination allows them to be a basis for knowledge. That the mental image is synonymous with the reality it represents allows for conclusions to be drawn based on the attributes of the image. If both the image in the mind and the reality of the image is the same, then the same conclusions can be drawn from either. For this reason, imagination can be seen as a means of reflecting the actual world, rather than representing an

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1. Shen-yi Liao and Tamar Gendler, "Imagination," *Stanford Encyclopedia of Philosophy*, last modified January 22, 2019.
 2. Jean-Paul Sartre, *The Imaginary: a phenomenological psychology of the imagination*, translated by Jonathan Weber, New York, NY: Routledge Publishing, 2010: 5 - 11
 3. Sartre, *The Imaginary*, 2010: 46

sion with a high probability of truth, which can be further defined as a mental state that remains in cognitive contact with reality. In essence, this means that imagination, in order to be a source of knowledge, must adhere to rational constraints. By restricting entirely separate reality. This allows us to run experiments in our heads that can draw accurate conclusions, with the assumption that we take the precaution to adhere to rational constraints. Imagination with rational constraints serves as a method for one to process information and reach a justified belief. If that belief is also true, then it qualifies as knowledge. The result of utilizing imagination with proper restraints can produce a reasonable conclusion about the truth, given the imager has justifiable bases in their thought experiment that help increase the probability of truth.

Additionally, imagination may aid in the mental storage of knowledge. Images can be tied to certain bits of information which are accessible through imagination. Mental images are a form of memory, which is a form of information. Imagination thus exists as a source of knowledge associated with memory.⁴ In the instance of an ordinary imager, these complex simulations may not seem plausible. Still, there is epistemic importance to the role of imagination in remembering. Take the character Sherlock Holmes as an example. He uses his “mind palace”, an imagined space, to organize bits of information. Imagination in this case serves as a mental folder, aligning information into categories based on visual cues. How does this serve as a source of knowledge? It is the same as organizing files on a computer, making it easier to access relevant bits of information. This information, useful for Sherlock Holmes, is then applied to solve crimes. His memorization technique is like a database, organized and accessed through imagination. Holmes’ method of solving crimes employs the use of imagination in two ways. First, by storing bits of information; second in applying that data to a scenario by running a simulation. Imagination can be used as both a database and a simulation to acquire knowledge.⁵ However, this imagined simulation must accurately depict the crimes that take place to solve the case.

III. How Can Knowledge be Derived from Imagination?

Imagination, with proper restraints, is a rational process of practical reasoning. Knowledge must align itself with the way things logically can be. By adding constraints to an imagining, so that it mirrors reality, one doesn’t just restrict the imagined scenario but also defines what is relevantly possible for it. If a belief is true and we have appropriate justification for it, then it is knowledge. The point can be made that the justification necessary for knowledge does not need to be *undoubtable*. Knowledge does not have to be justified by

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4. Amy Kind, “How Imagination Gives Rise to Knowledge,” in *Perceptual Imagination and Perceptual Memory*, edited by Fiona Macpherson and Fabian Dorsch, New York, NY: Oxford University Press, 2018: 233-35.
 5. Amy Kind, “How Imagination Gives Rise to Knowledge,” in *Perceptual Imagination and Perceptual Memory*, 2018: 242-243.

the process that produces it, but rather by a set of parameters for the result. Laurence Bonjour highlights four key elements of knowledge. The first is that knowledge is “a valued and desired cognitive state,” meaning that knowledge is of fundamental importance to our lives – that it is *better* to know than not know. Next, knowledge must harbor complete cognitive success; a thing is either known or not. There are no degrees of knowledge. Thirdly, in contrast, our justification admits of degrees for knowledge. Lastly, knowledge must have a probability of truth.⁶

Ultimately, what we call ‘knowledge’ depends on perceiving it as *likely* to be correct given *all* available evidence. The first criterion does not matter when talking about our sources of knowledge, while the other three do; the first simply highlights knowledge’s importance, rather than providing a stipulation about what constitutes it. Of the remaining three, the most important to establish in determining whether knowledge is derived from a given imagining is the condition of justification. If knowledge permits variable degrees for justification, then imagination produces knowledge so long as the other two criteria are met. To properly predict the most likely outcome, the information used to predict the outcome must be reliable as a source of justification. But such reliability can vary. For example, I can accurately imagine whether my cats will complain in hunger because I feed them at roughly the same time every day and I know from past experience that they *do* complain if I’m even three minutes late in feeding. In contrast, when pet sitting for my friend who feeds her cats at irregular times, my imagining of when they will cry would be inaccurate if modeled after when *my* cats cry. I can justifiably believe that her cats are likely to cry when they are hungry; just not that they would do this at a regular time. This constrains the reliability of what I can know by imagination.

For knowledge derived through imagination, one must define imagination strictly as a thought experiment guided by the intention of finding the most likely outcome. Amy Kind identifies two constraints necessary for any knowledge-producing instance of imagination: The Reality Constraint and the Change Constraint. In essence, these constraints restrict knowledge by imagination to a kind of inference. The Reality Constraint says that, like with inferences, our starting point must be based in how things are or at least how we justifiably believe them to be. The Change Constraint, meanwhile, requires that the result of the imagining both (i) involve some change from the initial conditions of what is imagined and (ii) that the result cannot be fanciful—it must also adhere to the Reality Constraint by being a logical consequence of the change.⁸ These restrictions limit knowledge-producing instances of imagination

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6. Laurence Bonjour, “The Myth of Knowledge”, *Philosophical Perspectives*, 24 (2010): 58-59.
 7. Timothy Williamson, “Knowing by Imagination,” in *Knowledge Through Imagination* edited by Amy Kind and Peter Kung, New York, NY: Oxford University Press, 2016: 116.
 8. Amy Kind, “Imagining Under Constraints,” in *Knowledge Through Imagination*, edited by Amy Kind and Peter Kung. New York, NY: Oxford University Press, 2016: 149-153.

to the likeness of a simulation, which constrains the possibilities it simulates.

Although imagination writ broad, unlike simulations, cannot harbor complete cognitive success on its own, it can be retooled as a method to obtain knowledge by adding additional constraints. To extend the simulation metaphor, we can divide imagination into three relevant features. The first is our prior information or beliefs about reality. This prior information serves as the dataset that acts as the foundation for our simulation. The second feature is the constraints on the imagining, which, like the mathematical parameters of the simulation, serve to direct towards relevant outputs. The final one is the simulation's output, which is the knowledge obtained from the imagining.

IV. Imagination is Comparable to Computer Simulations

Computer simulations are similar to what can be achieved through visualization in the mind. Simulations come in three forms: (i) open-ended simulations, which do not need to mirror reality; (ii) counterfactual simulations, which explore alternate possibilities given different initial conditions (historical fiction is a good analogue for this); and (iii) predictive models, which seek to produce the most likely outcome(s) given specific starting conditions. If a computer simulation can be used in science and math to predict the outcome of scenarios, and the use of these simulations can be trusted, then the use of imagination, when similarly constrained, can be justified in the outcomes it predicts. Our reliance on these programs is warranted by the fact that they are often correct. Simulations of possible scenarios can be played out to determine the best course of action. An example is weather forecasting; forecasting involves using current weather conditions (relevant inputs) and knowledge of how different forces interact (the constraining parameters) to predict how that weather is likely to change (the probable output). The current weather acts as part of the Reality Constraint, while the knowledge of how different physical forces interact define the connection between the Reality Constraint and the Change Constraint.

In the case of scenarios with more complex factors, such as feelings or emotions, imagination serves as a better mechanism to determine the more probable possibilities. One notable example of someone who utilized imagination in this manner is Temple Grandin, who used visual thinking to redesign dip vats for livestock. Older dip vats were concrete trenches in the ground, with steep inclines and slippery surfaces that dropped the cattle into a pool of chemical water. Cattle resisted entering the dip vats, had trouble passing through, and herding them was a chore. Temple Grandin used her prior understanding of cows' natural behaviors in relation to how they move through the dip vats to envision an alternate design that streamlined the process by employing these natural tendencies. The new model she envisioned included a non-slip surface and softer incline that allows for more secure footing; a wider opening and an adjustable hold-down that help guide the cattle into the dip; and a set of stairs leading out of the dipping vat that alleviate stress on the hooves.

What Grandin did mirrors the predictive model of imagination presented

above. She was able to imagine how the cows would react to her dip vat design by considering all the behavioral aspects that she knew applied to the scenario. The existing dip vat design acted as the basis for the Reality Constraint. This was point of departure for Grandin's imagined design. However, just going off the existing design could not produce a better one. Grandin needed to factor in the cows' general behavior and in reaction to the existing design. The cows' behavior is relevant to the Change Condition. Since Grandin wanted to increase the efficiency of the design, it needed to consider the cows' comfort. Without considering this, any imagined changes would fail to mirror the desired reality. Thus, the cows' behaviors were central to extending the Reality Constraint into the imagined scenario as well.

Grandin's in-depth knowledge about the behavior and movement of the cattle allowed her to find the perfect solution to the dip-vat problem, by accounting for something a computer could never fathom. The efficiency of her design is attributed to her ability to understand the cattle, maximizing comfort, and minimizing distress to the cows. The one criterion for knowledge that debatably goes unmet in our Grandin example is the requirement of complete cognitive success. It is difficult to say that Grandin *knew* her design would work without the additional effort of drafting the blueprints. A quick response to this objection is that the specifics of design—such as the grade of the incline and height of the steps—need not have been exact so long as the general features of the design were well justified.

V. Conclusion

Imagination can be used to explore possibilities. When rationally constrained, we can use imagination to obtain new knowledge. Under these constraints, we utilize prior knowledge and experience to come to accurate conclusions about could be true based on what currently is so. The ability to create a simulation that can replicate possibilities constitutes knowledge because it allows us to acquire new information based on rationally restricted parameters. If the results of a computer simulation are regarded as reliable, then the same process replicated within the mind should be as well.

So long as both (i) the initial conditions are grounded in reality and (ii) the outcome is a logical and likely consequence of those conditions given the parameters for the imagined change, the result counts as knowledge. Information is key to knowledge and imagination both. In the case of imagination, what counts as information is relevant justified true beliefs, i.e. knowledge. This belief is justified because of its ties to reality and because of our insight into the problem. By starting with present knowledge, we can derive further justified beliefs about what is probable given what we already know. Through imagination we can push the borders of knowledge, expanding what we know to include previously unconceived or dismissed possibilities. Imagination, under at least some limiting conditions, is a source of knowledge. The possibility for something to exist in the real world is reflected in our ability to create. Imagination plays a central role in the creation of new realities.

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Brain and Behavior: The Diathesis-Stress Model of Schizophrenia in Autoimmune Disease Patients

Research Paper by
FRANCESCA YANOS

PSYCH 2301: HONORS GENERAL PSYCHOLOGY

In her research paper, Francesca explores the pathogenesis of schizophrenia in autoimmune patients, utilizing a well-known theoretical framework, the diathesis-stress model. In so doing, she demonstrates her keen ability to synthesize and integrate findings from two distinct disciplines – psychology and biology. Her strong sense of organization allows the reader, who may not be well versed in either discipline, to follow her arguments as she precisely weaves a balanced narrative regarding the usefulness of viewing the development of schizophrenia through a diathesis-stress lens. Although the conclusion of the paper indicates that more research needs to be completed, her persuasive and novel use of the model offers a direction for such research. This is an excellent example of writing that is common in many psychological journals.

- David Oviatt

Abstract

With an aim to assess the potential link between schizophrenia and autoimmune diseases of the nervous system (ADNS), this study applies the diathesis-stress model to the pathogenesis of schizophrenia in autoimmune patients. While researchers Johansson et al. (2014) found no significant correlation between schizophrenia and ADNS, Jeppesen et al. (2019) reveal that those diagnosed with ADNS have an increased risk of up to 44% of developing schizophrenia. Furthermore, limited research exists concerning the pathogenesis of schizophrenia within ADNS patients despite the potential correlations established in previous literature. In order to address this gap, a qualitative analysis of neurobiological research was conducted to apply the diathesis-stress model—developed by Paul Meehl, Manfred Bleuler, and David Rosenthal—to this correlation. The results of the collective analysis reveal that the diathesis of schizophrenia stems from the deterioration of the blood-brain barrier (BBB) over time as the autoimmune disease incapacitates defenses in the brain. The stress ranges from psychologically traumatic events to teratogens that disrupt fetal development. ADNS comprises a variety of disorders characterized by systematic decline without a recognized cure; nonetheless, delineating its association with schizophrenia may present opportunities for therapeutic advancement. Further research should be conducted on pharmacotherapy enhancing BBB integrity in order to prevent or alleviate schizophrenia symptoms in ADNS patients as it remains understudied.

Brain and Behavior: The Diathesis-Stress Model of Schizophrenia in Autoimmune Disease Patients

Though schizophrenia is recognized as an infamous psychological disorder, experts still lack a comprehensive understanding of its multifaceted etiology; thus it remains a topic of interest for current research. Delusions, hallucinations, thought disorders, and movement disorders are some of the common characteristics of schizophrenia (World Health Organization, 2022) though it's only a fraction of what experts know about the condition. Cumulative research has attempted to uncover the enigmas of the disorder and expert debate over its pathophysiology has emerged over time. One of the more recent debates concerns the phenomenon of autoimmune patients acquiring schizophrenia with contradicting studies from researchers. The lack of knowledge regarding schizophrenia's link to ADNS may hinder potential therapies that would aid autoimmune patients in ameliorating their psychiatric symptoms. Individuals affected by schizophrenia, especially those who experience severe psychosis, often find it strenuous to perform daily activities as the disorder debilitates their quality of life.

Multiple investigations have endeavored to unravel the pathophysiology of schizophrenia and its connections to ADNS, resulting in novel discoveries such as the role of neuroinflammation. The recent debate between experts about how the disorder emerges within ADNS patients is critical to further understanding the complexities of the psychiatric condition. Thus, this paper aims to further elucidate this potential link by applying the diathesis-stress model to this relationship, and ultimately analyzing the biopsychosocial factors that promote the onset of schizophrenia in individuals with ADNS.

The Role of Immunity in Schizophrenia

Schizophrenia is a severe psychiatric disorder that affects millions of individuals globally and has a detrimental effect on overall health. The disorder's exact etiology is unclear; however, studies have determined multiple factors—biological, psychological, and social—that contribute to its pathogenesis. Among the biological factors, experts have focused on the role of immune dysfunctions in schizophrenia. A plethora of meta-analyses and original studies such as Howes et al. (2017) agree upon the hyperactivation and increase of microglia in the immune system of the central nervous system (CNS). Microglia are crucial in CNS immunity as they are involved in the inflammatory process and neuronal pruning, or the elimination of dead neurons and synapses (Howes et al., 2017; Ozturk, 2022). Additionally, studies have detected elevated interleukin, a proinflammatory cytokine, and C-reactive proteins which are released as a response to inflammation in schizophrenia patients (Cao et al., 2023). The studies exhibit consistent evidence of neuroinflammation with the detection of various inflammatory markers and cytokines within the brain. Furthermore, there has been evidence in multiple studies of cortical tissue loss in schizophrenia patients due to inflammation and neuronal pruning (Spielman et al., 2020). Depletion of tissue and neurons could trigger the development of psychiatric symptoms observed within schizophrenia. The cumulative research suggests

that immune deregulation, specifically neuroinflammation, plays a vital role in the inception of the disorder. Nonetheless, all factors involved with the onset of schizophrenia conspire to cause the condition.

Schizophrenia's Pathogenesis: The Diathesis-Stress Model

The diathesis-stress model which stemmed from the ideas of psychologists Paul Meehl, Manfred Bleuler, and David Rosenthal (Kendler, 2020) provides an understanding of the pathogenesis of schizophrenia and other psychiatric disorders. The model posits that an individual's susceptibility to a psychiatric disorder, whether or not one may develop the disorder, is contingent upon their environmental stressors (Sussman, 2023). For instance, a person with a family history of clinical depression may be more vulnerable to acquiring the disorder if faced with childhood trauma. Teratogens (e.g. smoking, viral infections, etc.) that cause complications during fetal development have contributed to an increased risk of schizophrenia (Spielman et al., 2020). In addition, multiple studies have established the involvement of genetics in the condition's etiology. Identical twins have a 50% risk of developing schizophrenia due to their genes being completely shared (Spielman et al., 2020). However, according to the diathesis-stress model, the disorder may not emerge unless a traumatic event triggers it. Other variations of the diathesis-stress model have also been established since its initial coinage.

Studies have also been conducted concerning a neural diathesis-stress model involving cortisol levels. Jones et al. (2007) state that stress acts upon a pre-existing vulnerability to cause or exacerbate the symptoms of schizophrenia by altering the synthesis of cortisol. Essentially, the neural diathesis-stress model is a neurobiological adaptation of the original model. This adaptation focuses on the involvement of the hypothalamic-pituitary-adrenal (HPA) axis which moderates cortisol release and how it impacts dopamine communication (Walker et al., 1997). Excessive dopamine has been associated with the pathogenesis of schizophrenia (Spielman et al., 2020). The neural diathesis-stress model elucidates how certain stress-related neurobiological effects cooperate with the predisposition of schizophrenia to manifest symptoms. The literature delineates that psychiatric disorders such as schizophrenia are multifactorial as many variables are responsible for its initial incarnation in an individual. Undeniably, the brain and CNS play a major role in the disorder.

The Central Nervous System (CNS) in Schizophrenia

CNS involvement in schizophrenia is substantial as the disorder affects several neuroanatomical aspects and functions. According to Luvsannyam et al. (2022), a large reduction in gray matter in the brain is one of the adverse effects of schizophrenia in patients. This coincides with a meta-analysis by Haijma et al. (2013), asserting that there is a decrease in gray matter with the disorder's progression. Gray matter makes up most of the superficial and deep portions of the brain and is involved with movement, emotions, processing, and memory (Mercadante and Tadi, 2021). The abundance of gray matter indicates its significance as it is responsible for an abundance of the body's typical functions.

A plausible cause for gray matter loss is the hyperactivation of microglia covered earlier in this paper (Howes et al., 2017). Brain ventricular enlargement caused by schizophrenia symptoms has also been a notable observation by researchers. A ten-year longitudinal study investigating CNS neuroanatomical changes over time found ventricle dilation within chronic schizophrenia patients illustrated on Figure 1 (DeLisi et al., 2006). The ventricles contain the choroid plexus which is the site of cerebrospinal fluid (CSF) production. Increased CSF causes ventricular enlargement and a substantial reduction in cortical tissue (American Association of Neurological Surgeons, 2019; Spielman et al., 2020). Abnormalities of the ventricles typically cause instabilities within the CNS, affecting its critical functions. In support of this, a 2019 meta-analysis found that CSF was elevated in individuals suffering from schizophrenia in comparison to their healthy counterparts (Orlovskaya-Waast et al., 2019). Elevated CSF in the brain may signify inflammation or infection which has been associated with schizophrenia (Mount Sinai Health System, n.d.; Orlovskaya-Waast, 2006). The relationship between schizophrenia and the CNS is prominent as aberrations such as increased CSF levels, ventricular enlargement, and gray matter reduction are present. Collectively, the corresponding studies and meta-analyses provide insight into the abnormal effects of schizophrenia in the CNS and are crucial to further understanding immune involvement.

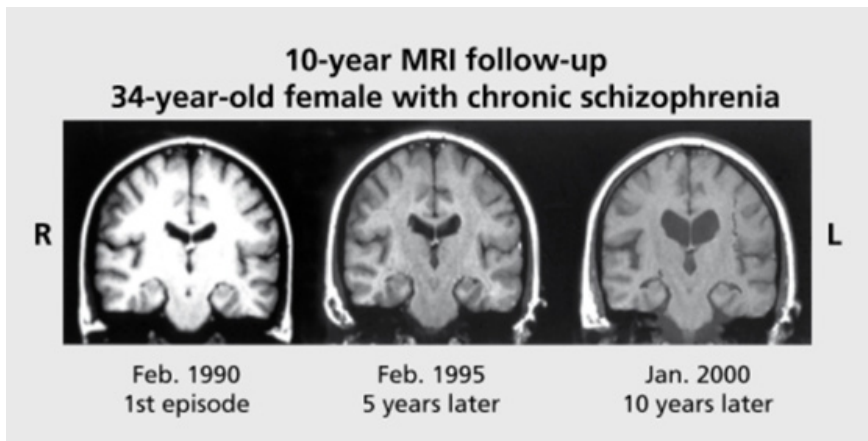


Figure 1. DeLisi et al. data, ventricle dilation, 2006.

Schizophrenia-ADNS Correlation

Over time, scientists have discovered an existing link between autoimmune diseases of the nervous system (ADNS) and psychiatric disorders such as schizophrenia. Some of the earliest research dates back to the 1930s, when a schizophrenia patient was detected with autoantibodies by researcher Herman Lehmann-Facijs (Kayser et al., 2011, Jeppesen et al., 2019). Further research was conducted in the following decades concerning the recurring diagnosis of Celiac Disease among those suffering from schizophrenia (Jeppesen et al., 2019).

These foundational studies laid the groundwork for numerous investigations that ascertained the pathopsychological elements of ADNS. Despite the discovery of this positive link, a study by Johansson et al. (2014) negates previous studies as the results exhibited a negative link between ADNS—specifically Multiple Sclerosis (MS)—and schizophrenia, but a positive association with depression and bipolar disorder instead. A register-based study from Denmark identified that the risk of schizophrenia in MS patients was increased by 44%, contradicting Johansson and their colleagues’ study (Jeppesen et al., 2019). Evidently, this topic evolved into a contentious discourse between experts over time, yielding contrasting results from both sides of the dispute. This ultimately led to the study’s primary objective: further elucidating the schizophrenia-ADNS link.

There appears to be a bidirectional relationship between ADNS and schizophrenia according to experts. A study by Benros et al. (2014) determined that the risk of ADNS diagnoses following the onset of schizophrenia heightened to 53%. In the same vein, a study from Benros et al. (2011) found that there is an elevated risk of 29% of schizophrenia in ADNS patients. There may be a potential neurological abnormality that demonstrates why both conditions are mutual risk factors for one another. Pinpointing this common denominator may prompt new treatment targeting both conditions or may even hinder the onset of either condition if diagnosed with one or the other.

Moreover, it was found that infections and inflammation contributed to the risk of ADNS in schizophrenia patients and vice versa (Benros et al., 2011; Benros et. al, 2014). Figure 2 below indicates a higher incidence rate of schizophrenia in association with infections and autoimmune diseases. The number of infections is directly proportional to the risk of acquiring schizophrenia.

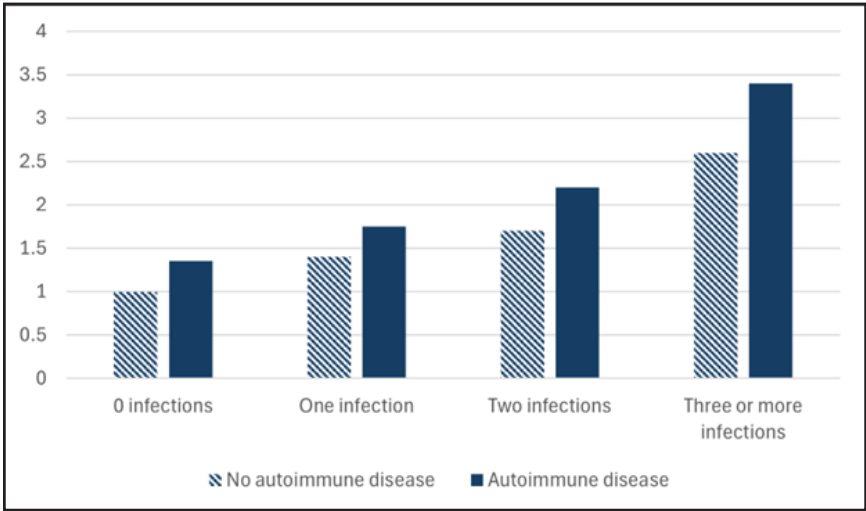


Figure 2. Recreation of bar graph from Benros et al., incidence rate ratio, 2011

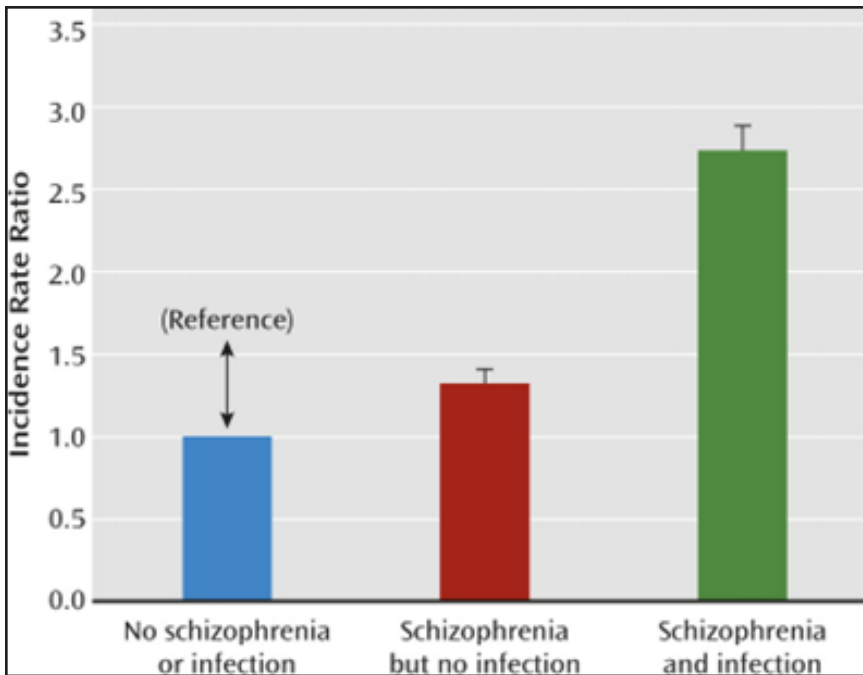


Figure 3. Benros et al., incidence rate ratio 2, 2014.

A meta-analysis by Ermakov et al. (2022) delineates that anomalies in the immune system are responsible for neuroinflammation that may lead to schizophrenia and that infections also promote an intrinsic inflammatory status. For instance, the prevalence of proinflammatory cytokines was observed in patient serums and increased inflammatory markers were found in the brains of patients (Ermakov et al., 2022). The pervasiveness of infections and inflammation may be involved in the debilitation of neurological defenses and neural tissues that would allow the emergence of schizophrenia or other psychiatric disorders. Additionally, a combined diagnosis of schizophrenia with the presence of infections demonstrated an elevated risk for ADNS with an incidence rate of 2.70 as shown in Figure 3 (Benros et al., 2014). This applies to the diagnosis of schizophrenia as well if a patient has a history of infections and a prior onset of ADNS (Benros et al., 2011). Multiple findings suggest that the presence of inflammation caused by infections in either ADNS or schizophrenia is strongly associated with the development of both conditions. The dysfunctions of body systems exhibit an apparent chain reaction that makes it easier for physical and mental conditions such as schizophrenia to develop.

VISUAL COMMUNICATION AND OTHER ONLINE SECTIONS

This online section includes writing with a significant visual component and reflects the increasing importance of visual rhetoric in and across disciplines, as well as generally in contemporary culture. The instructor introductions to the pieces may be found in the pages of the print version of the journal. We expect this part of the journal to continue to expand as the importance of the visual aspect of texts continues to evolve.



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