DeVry University
Keller Graduate School of Management

DeVry University

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DEVRY UNIVERSITY JOURNAL OF SCHOLARLY RESEARCH

DeVry University
Keller Graduate School of Management

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A MESSAGE FROM THE ASSOCIATE PROVOST

On behalf of DeVry University professors and Academics colleagues, I am proud to share this issue of the University's *Journal of Scholarly Research*. Included in this issue are insightful contributions, each providing a view into the diverse scholarly work in which our esteemed faculty are engaged.

This edition is an incredible reflection of the ongoing scholarly work that the faculty at DeVry University have been proud to present. Research work that focuses primarily on two key areas that drive the mission of DeVry University. Faculty delve into current topics in the market and industry, from a practitioner perspective, to draw out the key aspects of emerging trends and innovation. These findings help strengthen the teaching expertise of our faculty and it further equips our students for the workplace and a successful career.

The second primary area of research that our faculty pursue is in the evolving world of digital teaching and learning. The way education is delivered, absorbed, and applied continues to change and so along with that our faculty are consistently looking for the best ways to design their instruction to create engaging experiences for our students. Faculty are continually research, publishing internally and externally, including presenting their findings and personal best practices, as a way to promote and improve learning for all.

A couple of key areas that our faculty both display and present their ongoing scholarship is via our annual Virtual Symposium, our Center for Teaching Excellence and through external conferences and publication venues. This year for our annual symposium, the major theme of the presentations by faculty was innovation, both from the lens of emerging innovation in the marketplace, plus the need for innovation in digital teaching and learning. Faculty from all disciplines presented and attended with everyone leaving the event more equipped than they were before they came.

Enjoy the outstanding work provided by DeVry University professors. I hope other faculty members and Academics colleagues will join these professionals in submitting a paper or book review to share their knowledge with our learning community. With that in mind, do help us mark the 10th Anniversary of the DUJOSR. The next issue will celebrate our vision of the future of online education in business, healthcare and technology.

Together, we will continue DeVry's commitment to best practices in teaching and learning and live our mission to prepare and empower learners to thrive and advance their ambitions.

Darryl Field, PhD
Associate Provost – Academic Operations

A MESSAGE FROM THE MANAGING EDITORS

We welcome the DeVry University community to the latest edition of the *DeVry University Journal of Scholarly Research* (DUJOSR, Vol. 7, No. 1).

The DUJOSR continues to uphold the goals of the founding board to advance knowledge in higher education and in our program areas, and particularly to establish our name as we build the literature in our domain of online learning. We provide a platform to share the scholarship of our community and to offer support to our members who seek to publish for the first time. We urge you to consider working on collaborative research projects with colleagues and students within and outside our community.

All forms of scholarship are welcome, including academic papers, case studies, and From the Classroom articles, which describe practical approaches for supporting student success in the classroom. We also welcome letters to the editors and book reviews that stimulate interest in recent publications - all of which foster further scholarly discussion and debate.

We would like to acknowledge the efforts of the members of the DeVry University community who have published in this issue of the DUJOSR. As our rapidly evolving technical landscape appears to evolve every more quickly, we look forward to publishing Dr. Eric Addeo's review of relevant metaverse-enabling technologies that directly support the imminent realization of a DeVry "Metaversity."

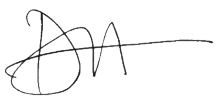
We welcome papers from our colleagues Dr. Nicos Antoniades, Dr. Natalie Sommer, and Dr. Miguel Buleje. Once again, we will enjoy book reviews from scholars Matthew Schumacher and Shawn Schumacher.

We thank John Kavouras, our College Editor for Liberal Arts & Sciences, for his substantial contributions to the DUJOSR. In the words of one of our colleagues: "Your steadfast, kind, generous, sincere, insightful, and talented presence will be missed. We wish you a well-earned retirement."

We appreciate the contributions of all the authors and the DUJOSR team and encourage all members of our community to consider the full range of opportunities to publish in the Journal as well as to contribute as a reviewer or member of the editorial board.

Finally, and very importantly, we echo Associate Provost Darryl Field's encouragement to help us celebrate the DUJOSR's 10th Anniversary. The next issue will celebrate our vision for the future of online education in business, healthcare, and technology - Authors could consider this in the context of DeVry University's NetZero initiative and the UN's 17 Sustainable Development Goals (SDGs, https://sdgs.un.org/goals).

Please visit the DUJOSR via the library and CTE, and in the Journal archive in the DeVry University Newsroom: https://www.devry.edu/newsroom/academic-publications.html



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JOURNAL INFORMATION
The *DeVry University Journal of Scholarly Research* (ISSN 2375-5393 1) is a semi-annual multi-discipline, peer-reviewed, journal devoted to scholarship and education research.

MANUSCRIPT SUBMISSIONS INFORMATION

The journal welcomes unsolicited articles, case studies, reviews, and letters on scholarship, education research or related subjects. Text and citations should conform to APA style as described in the Publication Manual of the American Psychological Association (7th ed.). Because the journal employs a system of anonymous peer review of manuscripts as part of its process of selecting articles for publication, manuscripts should not bear the author's name or identifying information.

Electronic submissions of manuscripts (MS Word) and all other communications should be directed to: *DUJOSR@devry.edu*

EDITORS AND REVIEWERS

DeVry faculty who wish to apply for positions on the Journal's board of editors or as reviewers of manuscripts should contact Deborah Helman or Michael Bird.

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The following DeVry faculty served as peer reviewers for this issue. We thank them for their service.

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DeVry University has an Institutional Review Board (IRB) to protect the rights and welfare of humans participating as subjects in a research study. The IRB ensures the protection of subjects by reviewing research protocols and related materials. DeVry University's colleagues and students who want to conduct research must first contact the IRB for an application. Once received, the IRB will review the application and supporting materials to determine if all criteria have been met before approving the research. In support of helping colleagues and students gain an in-depth understanding of ethical research processes, the IRB requires CITI certification for all applications. The application is available on the CTE website. Applicants should contact Sandy Kampenga *skampenga@devry.edu* for approval and reimbursement of the CITI certification costs.

For additional information, you can contact the DeVry University IRB through the following email address: *dvuirb@devry.edu*.

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CALL FOR PAPERS, SPRING 2024 ISSUE

The *DeVry University Journal of Scholarly Research* (DUJOSR) continues to expand its pages to include a variety of publishing opportunities for faculty. Academic scholarship remains a staple for the journal, but new categories include Case Studies, Book Reviews, Letters to the Editor, and a "From the Classroom" section, in which faculty can share vital experiences and best practices. These categories of submission are fully described below. Specific deadlines and instructions for submission conclude this "Call for Papers."

ACADEMIC SCHOLARLY ARTICLES

For the Spring 2024 issue, we continue to solicit "working papers" (3000 to 5000 words) in our scholarly article category.

Papers of all types are welcome including theory, empirical, or methodology papers, as well as literature reviews, from both positivist and naturalistic traditions. Research- and evidence-based papers emphasizing practical relevance that resonate with our readers are preferred. We regard submissions as "working papers" that can be submitted to other journals for consideration (but have not been previously published elsewhere).

The review process requires that each paper is coded and blind reviewed by two peer reviewers with expertise in the author's discipline. Faculty volunteers (for whom profound gratitude is expressed) comprise the peer review board. Final publication decisions are made by the editorial board, consisting of College and Managing Editors.

Authors who have previously submitted academic scholarly papers for past issues are encouraged to re-submit their revised papers. Papers should be sent with an additional document that specifies detailed responses to reviewers' and editors' feedback.

CASE STUDIES

DUJOSR solicits case studies (ranging from approximately 500-word short cases, to 1000 to 3000-word long cases) that have not been published elsewhere but are considered "working papers." The purpose of this initiative is to create a repository of case studies that can be used by faculty to teach DeVry University graduate and undergraduate courses. Our aim is to provide students with a unique and valuable learning experience that has been generated by our faculty.

Case studies of all types are welcome, including multi-media. We would prefer case studies that emphasize practical relevance that resonate with our faculty and students. Case study submissions must also be supported by a set of directions, i.e., Faculty Teaching Notes. The teaching notes must indicate the relevant courses and TCOs associated with the case study, as well as suggested question strategies and pedagogical practices.

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The case study should be, significant, complete, compelling, inclusive of alternative perspectives, qualitative, sufficiently evidenced, aligned with one or more Course Objectives, and written with accuracy and relevance.

The review process for case studies is the same as for academic scholarly papers. Case studies will be evaluated on the following criteria:

- Timeliness of case & relevancy (tied to 1 or more Course Objectives)
- Theoretical framework, and practical applications
- Opportunity to expand knowledge,
- Implications for field of studies
- Case notes for faculty
- Writing quality: Clarity, conciseness, and organization, grammar and mechanics,
- APA format, including in text citations and reference page.

There is no submission deadline; case studies will be accepted on an ongoing basis.

BOOK REVIEWS

Book reviews continue to be a regular feature in the journal pages. They are an important part of scholarly life. They alert colleagues to new developments in the academy, foster discussions that can lead to new scholarship, and ultimately provide us with both a broader and deeper view of the world, which we in turn can share with our students.

Reviews of either fiction or non-fiction works should adhere to the following publication guidelines:

1. Reviews should be between 500 to 1000 words in length, double spaced, and include the following: author, title, place of publication, publisher, year, price, page length (including introduction and text), and International Standard Book Number (ISBN).
2. Reviews should include a brief summary of the scope, purpose, content of the work, and its significance in the literature of the subject. Reviews should evaluate the strengths and weaknesses of the work as well as attend to its use of sources, including documentation, methodology, organization, and presentation.
3. Reviews should be fair, balanced, and treat authors with respect.
4. A signed permission form to publish a review is required.

LETTERS TO THE EDITOR

Letters to the Editor are a welcome addition to the journal pages. Letters that reply to or extend academic scholarship published within DUJOSR pages are particularly welcome, as these add rich texture and dialogue to ideas presented. Letters should be professional, well-tempered, and engage with content meaningfully. Letters that do not necessarily attend to previously published work but are timely and relevant are also welcome.

Letters responding to published articles in DUJOSR should identify the month and year of the article, review, or previous letter on which it is commenting. The full title of the article, review, or letter as well as the author(s) should be included. Letters should be double-spaced and 500 to 1000 words in length. Letters may express well-tempered opinions but should include citations in cases where academic integrity requires documentation. Letters should be fair, balanced, and treat authors with respect.

FROM THE CLASSROOM

This section of the journal is newly offered to faculty who have rich pedagogical experiences worthy of sharing with a larger audience. Papers in this category may use research to support ideas but may also consist of valuable experiences about which research may not have yet caught up. Well-crafted papers that demonstrate increased student engagement in the classroom are particularly prized. In this category, the recommendations for length are 750 to 1000 words, but longer papers of exceptional quality and relevance will be considered. Content should seek to express pedagogies that transcend the commonplace or that provide an interesting new spin on well-trod best practices.

EDITORS' INSTRUCTIONS FOR AND SUBMISSION AND DEADLINES

All submissions are expected to follow the APA style sheet. Templates and APA source materials are available through the DeVry Commons intranet community site, *DeVry University Journal of Scholarly Research*, under the following headings:

- Guide to APA Research Writing and Formatting Template Revised 2020
- Guide to APA Research Writing and Formatting Revised Nov 2013
- DeVry University APA Handbook
- APA 7th Guide to Citing Sources

The submission deadline is March 1ST, 2024. Please submit your work and a Turnitin Report in any category to Managing Editors, Deborah Helman and Michael Bird, at *DUJOSR@devry.edu.*

The Managing Editors reserve the right to edit all submissions in any category of submission for length, tone, and content, over and above recommendations made by peer reviewers and College Editors.

LETTER TO THE EDITORS:

PERSPECTIVES ON AN UNFOLDING METAVERSE

Dear Editors,

When it comes to a Metaverse, there is a vision being pursued by engineers, scientists, and technologists of widely available access to the best colleges and universities in the world, of improved and more cost-effective health care, of access to new forms of entertainment, and of a more natural sense of personal presence at a distance. The vision is of an immersive, three-dimensional, remote communications experience with high resolution video, spatial audio, and even smell and tactile feedback, enabled by the powerful computing, signal-processing, wireless, and software technologies that have emerged over the last several years.

The rapidly evolving technical landscape is filled with a plethora of relevant enabling technologies that directly support the notion that many of the key technological underpinnings needed to realize a Metaverse are already in place! Of course, there are some known technological challenges in wireless communications and edge computing. However, the technical community assesses these technical challenges as tractable, and solutions are expected in the relative near term. This big enabling bang resulting from a development of solutions will likely be seen in our lifetimes and result in a graceful and rapid unfolding of a high performance Metaverse. It is coming sooner than we think!

A Metaverse is a logical extension of the evolving Internet of Things (IoT) with some additive key technologies that will be subsequently discussed. Many of the underlying technologies used in the IoT are harmonized and integrated with emerging technologies to realize a dramatically new outcome that we are calling a Metaverse. To appreciate the fuller meaning of a Metaverse, it is worth exploring the precursor landscape of the IoT.

There are many definitions of the IoT. The three most prominent ones have been proposed by the Internet Engineering Task Force (IETF), the International Telecommunications Union (ITU), and the Gartner Group. I prefer the IETF's definition: "The IoT is a worldwide network of interconnected objects uniquely addressable using standard communications protocols." I like to call it the Internet of Everything because that is where we are heading.

The key characteristics of the IoT are that it is an intelligent network that expands the communications domains between humans, from one thing to another, and to/or from things to humans. Current examples of the IoT landscape give us a hint of IoT synergies with a Metaverse of things. Representative examples include the following:

- Smart City applications like "Smart garbage cans" will tell waste-management staff when they need to be emptied.

- Pill Bottles will be linked to care providers to see if patients are taking their medications on schedule.
- In the wine vineyards, wine grapes will be monitored for perfect sugar content to optimally time harvesting.
- Internet citizens of the 21st century will have the capability to provide vital biometrics to hospital staff and physicians.
- Soon doctors will be able to give physical examinations at a distance using "Data Gloves," or dexterous force feedback devices, which can provide detailed tactile feedback over a communications network linked to a remote twinset of data gloves at the patient's site.

Given the truly exponential pace of technical advances, we already have the underlying technologies that can support a rich IoT applications space. The following examples are representative of the dramatic advances in electronic devices, content and applications, the wireless landscape, and communications networks that have been achieved from 2010 to 2020.

- In the devices area, we have gone from perpendicular storage to nano-computers.
- In the domain of content and applications, we have gone from capabilities for rich media searches to large vocabulary, speaker-independent voice recognition systems.
- In the Wireless landscape, we have leap-frogged from VoIP to cognitive radio and Giga bit per second throughputs.
- In networks, we have progressed from application aware networks to IpV6 and high function personal wearable networks.

We are already in the IoT age with more than fifty billion wireless endpoints using RFID and other sensors, and a realization of the Metaverse has begun! At its centroid, a Metaverse links the physical and digital worlds to realize an immersive experience. A Metaverse provides an immersive, three-dimensional virtual-reality interface, which can enable users from any location to be connected in a user-defined virtual world. A Metaverse synergistically uses a variety of technologies, such as sensing, communication, and computing, and leverages the integration of virtual reality. Users can access a Metaverse with augmented reality headsets, smart glasses, and even computer interfaces. Hence, a Metaverse spans the physical and virtual worlds, and inherently provides an interoperable fabric that enables a users' avatars to explore a three-dimensional space in a Metaverse. The technical underpinnings of a Metaverse include the IoT space, Ubiquitous global communications, AI, Edge computing, Block chain, and a mix of augmented reality and virtual reality capabilities.

Dynamic, on-the-fly linking of these building blocks is the enabling mechanism of a Metaverse. The functional architecture of a Metaverse links the physical plane (the real world) to the virtual plane (the digital world) via an intermediate link plane. The linking between the physical and the virtual planes is bilateral, although not necessarily symmetrical. The link plane provides block chain consensus and an important immutability of transactions between the physical plane and the Digital Twin in the virtual plane.

The link plane also provides the following capabilities:

- Networking and communications
- Data integration and storage
- Computing, signal processing, and compressive multimedia coding

The overall end-to-end network of a Metaverse is an integrated global communication. Metaverse-driven applications have stringent performance requirements in an end-to-end heterogenous worldwide network. This network requires the following characteristics:

- End-to End Latencies of < 100 microseconds.
- Support for data rates > 100 Gb/s
- Reliability equal to or better than 99.99999% (this equates to a down time of no more than approximately 3 seconds per year!)

Computing at the network edges, enhanced by Artificial Intelligence (AI), can be used to realize these performance requirements.

A standard von Neumann architecture, augmented with Digital Signal Processors, highly compressive codecs, and an AI-enabled engine (a novel addition to edge computing), provides semantic extraction and pre-processing of the multimedia information stream at the edges of the network. For example, with AI-enabled information filtering, redundant transmission of repetitive or unimportant frames can be greatly reduced. The addition of an AI engine in the edge computing environment is an essential capability needed to meet the stringent end-to-end performance requirements of a Metaverse.

Applications are emerging that are already using elements of the previously described technologies to realize the first generation of a Metaversity. For, example, the Immersive Learning Research Network (ILRN) consortium led by scholars from North America and Europe, are partnering with Virbela (a Metaverse applications vendor) to construct a multifunctional campus for conferencing, research, and teaching. Currently, a Virbela Metaverse applications engine is used to replicate the dynamics and design of the campuses at the University of California, San Diego (UCSD) and Waseda University in Tokyo, Japan. This synthesized virtual campus provides a shared space for interactive presentations and collaboration.

These applications of a Metaverse are getting traction and support from an expanding list of contributors from the industrial research sector. We are on our way! To be sure there are technological challenges – but no showstoppers! The rollout of 6G wireless technologies in conjunction with AI-enhanced edge computing will enable many of the capabilities that we need to realize a high-performance Metaverse!

Remember we are living in Exponential Times - A Metaversity is nearly here!

Sincerely,
Prof. Eric J. Addeo
EIS Editor, DUJOSR

LETTER TO THE EDITORS:

INFORMATION LITERACY IN THE MODERN LANDSCAPE: DEVELOPING A TOOLSET FOR LIFELONG LEARNING – AN UPDATE

Dear Editor,

In May 2021, I wrote a letter to the editors of this journal outlining the need for our students to learn information literacy skills as part of their toolset for lifelong learning. In that letter, I also addressed sharing information literacy concepts with faculty, as our faculty colleagues have a great and direct impact on student learning of information literacy concepts. I went on to share information about a pilot program to provide an information literacy workshop for our faculty. The goals of this workshop were to "increase awareness of information literacy concepts, encourage collaboration between faculty and librarians, and expand our understanding of what information literacy instruction could be".

The workshop was initially developed to take place over four weeks, covering general information literacy concepts, with a particular focus on the Association of College & Research Libraries' Framework for Information Literacy for Higher Education. The Framework for Information Literacy for Higher Education is comprised of six sections (or Frames), each outlining a particular aspect of information literacy (e.g., Searching as Strategic Exploration or Information Creation as a Process) with attendant knowledge practices and dispositions. The workshop, delivered via the Canvas platform, consisted of several modules, each of which entailed pre-selected readings from the literature on information literacy, an online discussion of the readings and the relevant Frame, and occasional online meetings for review.

The pilot was a success, at least insofar as it was learned that the content and format were appropriate but that the pace was a trifle ambitious. After adjustments to the pacing of the content and edits graciously suggested by the pilot team of faculty, the workshop was rolled out in earnest in the Spring of 2022. Ten faculty members, representing a range of our colleges and programs, earned the DeVry University Information Literacy Badge in December 2022!

Using feedback from the 2022 edition of the Workshop, in 2023 the content was expanded to include practical applications, and the format was amended to allow greater flexibility in participation. Eleven faculty participants are currently enrolled with an anticipated completion date of December 2023. Further enhancements are already planned for the next iteration of the DeVry Faculty Information Literacy Workshop. Be on the lookout for an invitation for 2024.

Sincerely,

Joe Louderback,
Reference & Instruction Librarian

DeVry University Journal of Scholarly Research (2023) / Volume 7, Number 1

THE CIS MODEL AS A DRIVER OF DEMOCRATIC COUNTRIES' ECONOMIES: PATH TO THE BALLOT BOX

NICOS ANTONIADES
COLLEGE OF BUSINESS & MANAGEMENT

Author Note: Nicos Antoniades, PhD. Professor, DeVry University, Keller Graduate School of Management, New York, NY

ABSTRACT

This paper adapts the CIS Model[1] (i.e., the capability to Create, Inform, and Support), demonstrating how democratic governments all over the world can utilize the CIS Strategy to lead Generation Z to the ballot box. According to the CIS Model, governments need to capitalize on three interrelated capabilities: (1) the capability to Create an idea (political product), (2) the capability to Inform adequately about the idea; and (3) the capability to Support the idea. To give answers to political apathy and abstention, I tested the impact of the CIS Model on Generation Z's intention to vote. Using regression analysis and an online questionnaire, this study tests the relationship between the CIS Model and each one of the following five major public issues: Economy, Environment, Health Care, Immigration, and Foreign Policy. More precisely, I hypothesize that (a) the more a government uses the CIS Model, the more Generation Z's satisfaction with each of the abovementioned issues, and (b) the more the use of the CIS Model, the higher Generation Z's intention to vote. Data were collected from people born in the late 1990s and early 2000s (Generation Z) from four geographic areas (i.e., USA, Europe, Asia, and Africa). Two hundred seven people responded to the questionnaire. The results show that the more a government uses the CIS Strategy on issues relating to the economy, the more Generation Z's satisfaction, and the more their intention to vote.

Correspondence regarding this article should be addressed to Dr Antoniades at nicos.antoniades@devry.edu

Keywords: Democratic governments, Economy, the CIS Model, Gen Z, Voting intention

1 The CIS Model is an award-winning model developed by Dr. Nicos Antoniades and presented at the 7th International Conference on Management and Education Innovation, University of Greenwich, London, UK (April 2019). Title: "Packaging Government Ideas to Achieve Citizen Satisfaction and Loyalty: Creating, Informing, and Supporting."

POLITICAL MARKETING AND THE CIS MODEL

Political marketing defines how governments, political parties, politicians, and practitioners employ marketing tools (Lees-Marshment, 2019). Political marketing's goal is to identify and satisfy voter-citizen needs (Antoniades & Mohr, 2019) and put people at the center of attention (Antoniades, 2020). However, political marketing as a discipline must develop its own frameworks and models by adopting those from the core marketing literature.

A new political marketing model developed by Antoniades (2022, 2023) defines that a government, a political party, or a political actor must utilize three interrelated political determinants when "packaging" a political product (an idea): the capability to Create, the capability to Inform, and the capability to Support their idea. Politicians must build on their capabilities to communicate their ideas effectively (Antoniades & Mohr, 2019). According to Antoniades (2022, 2023), (1) creating a political idea represents the development of a new product or service, (2) providing adequate information about the idea to the citizens represents the back side of a product's package and must include all the necessary information, and (3) supporting the idea represents any communication used to approach the citizens.

Antoniades and Mohr (2019) examine the impact of the CIS Model on U.S.-elected politicians (as sellers) and Millennials (as consumers) and confirm that there is a positive impact of the CIS Strategy on Millennials' satisfaction. Antoniades (2021) also confirms the positive relationship between the CIS Model (i.e., Creating, Informing, and Supporting) and the U.S. government's performance during the pandemic. More recently, two new studies show the impact of the CIS Model on global warming and nation branding (Antoniades, 2022, 2023).

GEN Z AND ABSTENTION

Abstention is a significant determinant in political marketing, especially among young people (Antoniades, 2019). Antoniades (2019) reports that political apathy and abstention are growing due to a lack of political capabilities. Wagner et al. (2012) argue that interest in politics is by no means lower among young people although their political knowledge is lower. According to Glynn et al. (2009), family and friends affect college students' intention to vote, whereas Hooghe and Boonen (2015) argue that the father has a significant influence on his children's intention to vote.

AIMS OF THE STUDY

Members of Generation Z were born after 1997. According to Parker et al. (2017) of the Pew Research Center, the people of this generation demand their governments play a more active role in solving their problems; this phenomenon has resulted in voter apathy. The above mentioned studies open the opportunity for the research reported here to explore the effect of the CIS Model on a number of major public issues relating to the Generation Z cohort and their intention to vote.

DEVELOPMENT OF RESEARCH HYPOTHESIS

Using regression analysis, I tested the relationship between the CIS Model and each one of the following five major public issues: Economy, Environment, Health Care, Immigration, and Foreign Policy. More precisely, I concluded with the following Hypotheses:

H1: The more a government uses the CIS Strategy (CIS), the higher Generation Z's satisfaction with issues relating to the Economy.

H2: The more a government uses the CIS Strategy (CIS), the higher Generation Z's satisfaction with issues relating to the Environment.

H3: The more a government uses the CIS Strategy (CIS), the higher Generation Z's satisfaction with issues relating to Health Care.

H4: The more a government uses the CIS Strategy (CIS), the higher Generation Z's satisfaction with issues relating to Immigration.

H5: The more a government uses the CIS Strategy (CIS), the higher Generation Z's satisfaction with issues relating to Foreign Policy.

H6: The more a government uses the CIS Strategy (CIS), the more Generation Z's intention to vote.

RESEARCH METHODOLOGY

Generation Z represents one-third of the global population (Parker et al., 2017). Their future economic well-being is important to their ability to thrive in the future. The size of this demographic prompted me to research how to engage more of them to vote. In 2020, 630 online invitations to participate in a study on voting attitudes were sent via email. Thirty students aged 18-25 who study in New York, thirty students aged 18-25 who study in Rome, and thirty students aged 18-25 who study in Nicosia (Cyprus) were invited to participate. These students were randomly selected by each professor's institutions in New York, Rome, and Cyprus (see Acknowledgments). Each student sent the survey link to 7 friends/ classmates aged 18-25. The final sample was 207 completed questionnaires, reaching a 33% response rate. The survey took place between 20 July and 20 November 2020.

This online survey was completed by each participant voluntarily and anonymously. Participants came from different areas around the world; the researcher divided participants into two groups: (a) Geographical Area (i.e., USA., Europe, Asia, and Africa), and (b) Gender (Male, Female, and X).

This study used a structured approach with closed statements based on a 7-point Likert rating scale (1932) ranging from 1 (Strongly Disagree) to 7 (Strongly Agree), to measure each one of the proposed issues (i.e., Economy: one item; Environment: one item, etc.), the level of use of the CIS Strategy (three items) and Voting Intention (five items). The range captured the intensity of Generation Z's feelings for a given item, i.e., the capability to Create (see *Appendix A*).

PRESENTATION OF RESULTS

LISTENING

This study's sample consisted of 39% Men, 60% Women, and 1% X. Twenty-six percent of the participants came from the USA, 48% came from Europe, 14% came from Asia, and 12% came from Africa.

HYPOTHESIS TESTING

According to *Table 1 (see page 16)*:

H1: The more a government uses the CIS Strategy (CIS), the higher Generation Z's satisfaction with issues relating to the Economy. The results are significant with a p-value of 0.04.

H2: The more a government uses the CIS Strategy (CIS), the higher Generation Z's satisfaction with issues relating to the Environment. The results are not significant with a p-value of 0.32.

H3: The more a government uses the CIS Strategy (CIS), the higher Generation Z's satisfaction with issues relating to Health Care. The results are not significant with a p-value of 0.31.

H4: The more a government uses the CIS Strategy (CIS), the higher Generation Z's satisfaction with issues relating to Immigration. The results are not significant with a p-value of 0.21.

H5: The more a government uses the CIS Strategy (CIS), the higher Generation Z's satisfaction with issues relating to Foreign Policy. The results are not significant with a p-value of 0.37.

Table 1: **CIS Model as a Driver of Democratic Countries' Economies**

SUMMARY OUTPUT	
REGRESSION STATISTICS	
Multiple R	0.2064145
R Square	0.0426069
Adjusted R Square	0.0187912
Standard Error	1.6311765
Observations	207

ANOVA	*df*	*SS*	*MS*	*F*	*Significance F*
Regression	5	23.80061	4.760122	1.789024	0.116603
Residual	201	534.8081	2.660737		
TOTAL	206	558.6087			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	3.8309747	0.577663	6.631853	3E-10	2.691918	4.970031	2.691918	4.970031
ECONOMY	-0.187048	0.090666	-2.06304	0.040394	-0.36583	-0.00827	-0.36583	-0.00827
ENVIRONMENT	0.076773	0.077872	0.985891	0.325372	-0.07678	0.230323	-0.07678	0.230323
HEALTH CARE	-0.102255	0.100547	-1.01699	0.310381	-0.30052	0.096007	-0.30052	0.096007
IMMIGRATION	0.0947564	0.075051	1.262559	0.208211	-0.05323	0.242745	-0.05323	0.242745
FOR. POLICY	0.080797	0.090706	0.890752	0.374127	-0.09806	0.259655	-0.09806	0.259655

DISCUSSION AND CONCLUSIONS

Generation Z has the potential to become the largest voting population. They have a great opportunity to put their unique needs on the political agenda. But if they repeatedly fail to engage, their needs will continue to be under-addressed. Government decisions on major public issues affect the young generation more than any other generation. According to the results of this study, a big issue for governments to consider is the economic status of their countries, a significant determinant in the young generation's decision to vote.

As indicated in the introduction, family and friends affect the younger generation's intention to vote (Glynn et al., 2009). However, the results of this study show that this cannot be an excuse for politicians. Politicians must act fast to motivate the future generation. The voting apathy of the young generation must come to an end. The CIS Model and the results of the current study show that the more a government uses the CIS Strategy to deal with issues relating to the economy (i.e., the capability to create, inform, and support), the higher Generation Z's satisfaction with these issues. In turn, the more a government uses the CIS Strategy, the more Generation Z's intention to vote. These results are a call to politicians to encourage co-creation and involve the young generation (i.e., Gen Z) in various levels of decision-making (Kushwah et al., 2017).

IMPLICATIONS OF THE STUDY

As mentioned in previous sections, Generation Z is the latest generation to come of age, and their

According to *Table 2:*

H6: The more a government uses the CIS Strategy (CIS), the more Generation Z's intention to vote. The results are significant with a p-value of 0.02.

Table 2: **CIS Model as a Driver of Democratic Countries' Economies**

SUMMARY OUTPUT	
REGRESSION STATISTICS	
Multiple R	0.158724
R Square	0.025193
Adjusted R Square	0.020438
Standard Error	1.713655
Observations	207

ANOVA	*df*	*SS*	*MS*	*F*	*Significance F*
Regression	1	15.5584	15.5584	5.298077	0.022354
Residual	205	602.0056	2.936613		
TOTAL	206	617.564			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	4.491574	0.279538	16.06787	3.86E-38	3.940437	5.042712	3.940437	5.042712
CIS	0.166889	0.072505	2.301755	0.022354	0.023938	0.309841	0.023938	0.309841

participation in politics has never been more crucial. Currently, mankind faces many pressing issues that need to be addressed, both nationally and globally. Youth engagement could lead to a bright future for our communities, countries, and planet. This study operationalizes the CIS Model as a driver of Gen Z's intention to vote and lead their future. At the same time, the results of this study provide political actors with a mechanism for understanding the positive impact of the CIS Model on major public issues like the economy; to find solutions (Create), provide adequate information to their people about these solutions (Inform), and Support why their solutions will benefit society. Not only it will benefit the younger generations, but it will lead young people to the ballot box to manage the future of this world.

LIMITATIONS

A small sample size from Asia and Africa was one of this study's limitations. Second, the researcher did not have control over data collection. As stated, the students who were sent the invitations were the ones to manage the invitations sent to their friends/classmates (aged 18-25).

FURTHER RESEARCH

Further studies could obtain data from several democratic countries. They could also collect a larger sample (a) from Asia and Africa; and (b) from more demographic groups (i.e., Generation X and Baby Boomers). More research could test the relationship between the CIS Model and a government/political actor's performance concerning several other public issues (i.e.,

housing affordability, student debt, etc.). Future studies could consider having more control over the data collection.

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APPENDIX A
OPERATIONALIZATION OF CONSTRUCTS

Major Issues for Gen Z

The Economy is a major issue

The Environment is a major issue

Health Care is a major issue

Immigration is a major issue

Foreign Policy is a major issue

The CIS Model (CIS)

My government creates political products (i.e., ideas, proposals) that satisfy my needs (CIS1) - Create

My government gives adequate information regarding its political products (CIS2) - Inform

My government supports its political products efficiently (CIS3) - Support

Note. Adapted from Antoniades (2022, 2023).

Voter Satisfaction

I am satisfied with my government's efforts to deal with major issues.

Voting Intention (VTI)

By voting, I am making my voice heard (VTI1)

By voting, I am making my needs and values known (VTI2)

By voting, I am strengthening Democracy (VTI3)

I always vote (VTI4)

I would always vote if I could do it virtually (VIT5)

Note. Adapted from Antoniades (2019).

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DETECTING WHEEZES AND CRACKLES IN RESPIRATORY SOUND DATA THROUGH MULTI-LABELING AND DEEP LEARNING

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ABSTRACT

In this work, a novel and promising approach to multi-labeling spatiotemporal data to autonomously detect different types of breathing sounds in audio recordings as a supplement to traditional auscultation is presented. This multi-labeling technique assigns labels to different auscultation sites (i.e., regions of interest), and a given label describes a type of breathing sound (normal, wheezing only, crackling only, wheezing and crackling) to be monitored in the spatial location that it represents. While considering several areas of the chest and corresponding labels simultaneously, a Convolutional Neural Network and Long Short-Term Memory-based network is trained to classify the pulmonary sounds spatially. Moreover, in order to represent the audio data, Mel-Spectrograms as well as raw waveforms are used, and their performances are compared with a metric commonly used in multi-labeling, Hamming Loss, along with confusion matrix-based measurements. Favorable testing results are shown for the Mel-Spectrogram multi-location/label model with an average Hamming Loss of 0.10, and average F-Score of 0.90. The experimental results in this work support the use of this approach to classify different forms of spatiotemporal data.

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Keywords: CNN, LSTM, machine learning, multi-labeling, respiratory sounds, Hamming Loss

INTRODUCTION

Classical chest auscultation with an analog stethoscope has been used for the past two centuries since its invention by Rene Theophile Hyac in the Laënnec in 1816. Correct interpretation of breathing sounds has been shown to be dependent on the skill level and interpretation of the observer (Andrès et al., 2018; Bohadana et al., 2020). This problem may benefit from having a technological counterpart in detecting breathing sounds. A possible solution would be to use an electronic stethoscope, capable of capturing digital sound data, in conjunction with a machine learning-based classification algorithm. Gurung et al. (2011) support the fact that computerized sound analysis may improve diagnostic accuracy when used in conjunction with conventional chest auscultation. An improvement in diagnostic accuracy is crucial as auditory human perception can be quite subjective. For example, a study by Bohadana et al. (2020) showed that a group of 143 healthcare professionals were able to identify normal breath sounds correctly about 17% of the time, wheezes about 85% of the time and crackles about 67% of the time. Similarly, Hafke-Dys et al. (2019) found that even pulmonologists, who are respiratory disease specialists, achieved an average of 20% accuracy when identifying normal breathing sounds, an average of 62% accuracy when identifying wheezing and an average of 41% accuracy when identifying crackling.

Since the correct recognition of breathing sounds is challenging through chest auscultation with a traditional stethoscope, methods that offer improvements are sought after. As electronic stethoscopes gain popularity with their filtering and amplification abilities, human interpretation of the sounds has not been shown to improve significantly with these added features (Gottlieb et al., 2018). This could be explained by the undesirable difference in acoustic characteristics between electronic and analog stethoscopes (Rennoll et al., 2020). Nonetheless, electronic stethoscopes offer the ability to capture sounds for automated analysis as a complement to professional interpretation. For example, electronic stethoscopes were used in a small study (Huang et al., 2020) of positively tested COVID-19 patients' abnormal breathing sounds. Disparity among the interpretation of these sounds, which included wheezing and crackling among others, by a group of physicians supports the need for additional diagnostic tools (i.e., signal processing) to minimize incorrect diagnosis.

Wheezing and crackling, among other adventitious sounds, are common abnormal breathing sounds, which point to lung disease. They can be present in lung diseases such as asthma, Chronic Obstructive Pulmonary Disease (COPD), and pneumonia. Accurate detection of these sounds is also important for early detection of COVID-19 symptoms associated with the lungs. These sounds, whether localized to one lung (unilateral) or diffused to both lungs (bilateral) can indicate the type of disease and its severity (Sgalla et al., 2018). In addition to listening to both lungs, a thorough examination also comprises of auscultating anterior and posterior sides of the chest (Andrès et al., 2018; Proctor & Rickards, 2020; Sarkar et al., 2015; Zimmerman & Williams, 2021).

In this research, a promising approach to detecting *different types* of breathing sounds *concurrently at various spatial locations* through a novel spatiotemporal multi-labeling technique is presented. The multi-location nature of chest auscultation to capture temporal lung sounds lends itself well to the proposed multi-labeling technique. This approach differs from traditional multi-labeling methods. In prior research, multi-labeling means that one or more descriptors (classes) can be assigned to the data in question. For example, when classifying music genre, a musical piece might have elements of multiple styles such as pop, Deep House, and Reggae groove, and these classes will become the elements of its multi-label (Oramas et al., 2017). This type of multi-labeling does not have the spatial information that the proposed multi-labeling approach has. This research is supported by previous works (Sommer et al., 2020, Sommer et al., 2021), which used a spatiotemporal multi-labeling technique with deep learning to classify simultaneous levels

of activity at different locations of surveillance video data, and different sides of the brain's motor cortex during finger tapping exercises captured through fNIRS data, respectively.

The initial inspiration for this labeling approach was León's research (León, 2017). Various regions of the brain were monitored concurrently to detect levels of activation as a result of hand motor imagery captured with EEG data. Detecting levels of brain activation can ultimately help disabled (paralyzed) people interact with their environment as they think about moving fingers on their hands. In the quest to classify breathing sounds, a novel multi-labeling technique which designates a label to a specific auscultation site on the chest is suggested. Instead of the common technique of assigning a '0' or a '1' to each possible descriptor (Wu & Zhou, 2017) to indicate its absence or presence, a set of classes to choose from for each spatially descriptive label is chosen. Since the interest lies in detecting wheezes and crackles, the four classes will be based on the absence of wheezing and crackling (i.e., normal breathing) ('0'), the presence of wheezing only ('1'), the presence of crackling only ('2'), and the presence of both wheezing and crackling ('3'). Acharya et al. (2020) also use these four classes when detecting these two abnormal breathing sounds. However, their work is different since only one type of sound is classified at a time. This research is based on a spatially informative set of multiple labels, which can detect abnormal breathing sounds simultaneously in various regions of the lungs.

The goals of this paper's proposed approach encompass incorporating a novel spatial aspect to a multi-label in that each label gets assigned to a specific region of interest. The four regions of interest represent four lung auscultation sites, namely Anterior Left, Posterior Left, Anterior Right and Posterior Right. Each region is assigned a label representing one of the four classes. The four classes correspond to four breathing sounds, namely normal, wheezing only, crackling only, and a combination of wheezing and crackling. These multi-labels, assigned to sound data in either a raw waveform format or Mel-Spectrogram format, help train deep learning models to detect abnormal breathing sounds. This is currently a unique way of handling the detection of wheezing and/or crackling simultaneously in different parts of both lungs. Therefore, an atypical but promising method of detecting wheezes and crackles in breathing sounds with the use of multi-labels is presented. The ICBHI 2017 Challenge Respiratory Sound Database (Rocha et al., 2018) was used for this research. Classification results from two different formats of the input data are compared to published research, which uses the same database.

PROPOSED METHOD

In this study, a multi-label vector is used to represent distinct spatial regions that correspond to chest auscultation sites. As previously mentioned, knowing the locations of wheezing and crackling sounds is very important. Comparing the sounds produced on one side of the lungs to the other side helps medical professionals ascertain whether the abnormal sound is localized or widespread. In this study, the four auscultation sites of interest, namely AL, AR, PL, and PR are shown in *Fig. 1* below. Although more auscultation sites were available in the database, adding more regions of interest would increase the possible number of different label vectors, and label balance would be harder to maintain.

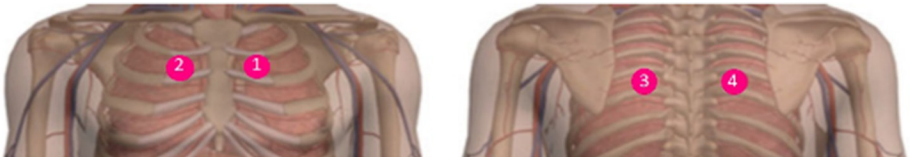

Figure 1: **Spatial Multi-labels Correspond to Auscultation Sites 1. Anterior Left (AL). 2. Anterior Right (AR). #. Posterior Left (PL). 4. Posterior Right (PR)** *(Rocha et al. 2018)*

In an attempt at improving the classification results, two different models based on different input data formats and representation were created. In the first case, the sound input files were converted into spectrograms, since this is a common approach in sound data classification (Acharya & Basu, 2020; Aykanat et al., 2017; Pham et al., 2020; Pramono et al., 2017; Villanueva et al., 2020, Kim et al., 2021). This offers an image-like representation of the spectrum of frequencies contained in the sound signal over time. In the second case, raw waveform files were concatenated together to train and validate a second model. The input data, whether in a raw waveform representation or in a Mel-Spectrogram representation was formatted in adherence to custom quadrant-like configurations. A visualization of the two layouts is shown in *Fig. 2* and *Fig. 3*.

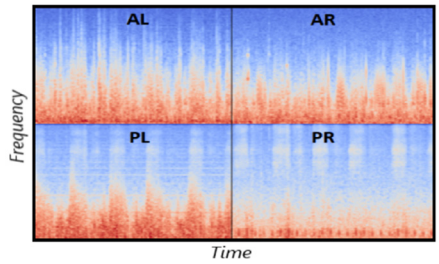

Figure 2: **Mel-Spectrogram Legend**

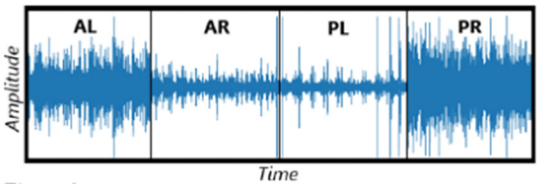

Figure 3: **Waveform Layout**

For the labeling schema, each spatial region is assigned to one of four possible breathing sounds: normal breathing, wheezing only, crackling only, and the combination of wheezing and crackling. The spatially descriptive multi-labels enable the recognition of concurrent breathing sounds in different auscultation sites of the lungs simultaneously, and the identification of different breathing sounds through a multi-class descriptor for each label.

Since pulmonary sounds acquired through auscultation are spatiotemporal, network models based on a Convolutional LSTM algorithm were chosen to be able to detect the spatial and temporal properties of breathing sounds. It is important to note that Acharya et al. (2020), Alqudah et al. (2022), and Petmezas et al. (2022), among others, support using an LSTM with a CNN for improved classification results.

The labeling structure, which will be presented in detail in the Dataset, Multi-labeling Structure and Evaluation Criteria section, was designed to represent different breathing sounds at different spatial locations simultaneously. These network models are presented in detail in the next two subsections.

NETWORK MODEL USING SPECTROGRAM INPUT DATA

The structure of the first network model, which uses both CNN and LSTM layers, quadrant formatted Mel-Spectrogram input data and the proposed multi-labeling schema, is shown in *Fig. 4 (below)*.

As seen in *Fig. 4*, the input to the proposed network model is formed like a quadrant, wherein top-left, top-right, bottom-left, and

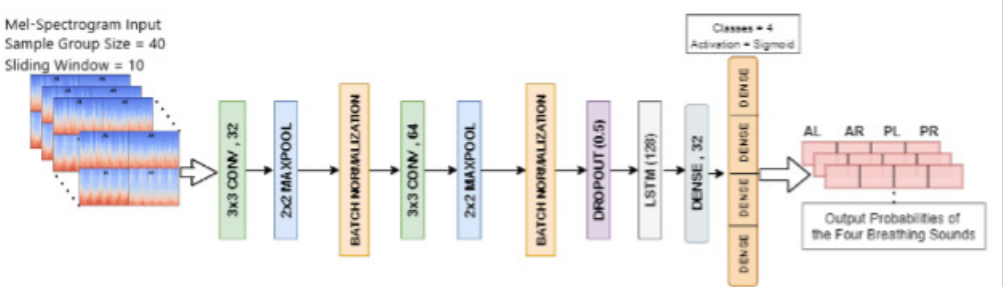

Figure 4: **Proposed Spectrogram Model Structure**

bottom-right quadrants contain parts of the Mel-Spectrograms of AL, AR, PL, and PR regions of the lungs for each participant. Corresponding chunks from the four auscultation sites formed the quadrants for each input frame. Batches of these frames were then used to train the network.

MODEL BASED ON RAW WAVEFORM INPUT DATA

The details of the second network model, which also employs a CNN/LSTM structure, data formatted to contain raw waveform data from four regions of the lungs (AL, AR, PL, PR), and the proposed multi-labeling schema, are shown in *Fig. 5 (below)*.

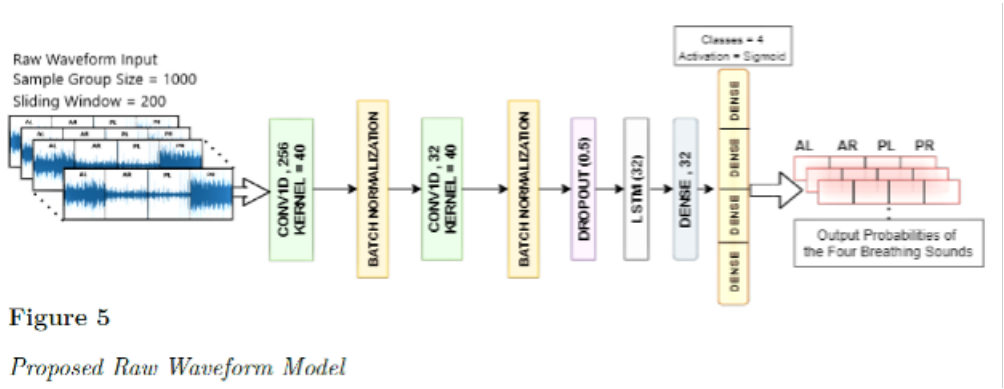

Figure 5

Proposed Raw Waveform Model

Figure 5: **Proposed Raw Waveform Model**

As seen in *Fig. 5*, the input to this proposed network model is formed to provide a sequence, wherein the arrangement (from left to right) contains parts of the raw waveforms of AL, AR, PL, and PR regions of the lungs for each participant. Corresponding chunks from the four auscultation sites formed the illustrated sequence for each input frame. Batches of these frames were then used to train the network.

DATASET, MULTI-LABELING STRUCTURE AND EVALUATION CRITERIA

DATASET

In this research, the sound files were extracted from the ICBHI 2017 Challenge Respiratory Sound Database (Rocha et al., 2018), which contains 920 recordings from 126 patients in Portuguese and Greek hospitals compiled in 2017. Respiratory experts annotated each breathing cycle with one of four classes: normal breathing, wheezing only, crackling only, and both wheezing and crackling. The recordings were captured with different stethoscopes and microphones. For this study, the dataset is comprised of the recordings captured by the AKG C417L Microphone. As suggested by Kochetov et al. (2018), using one type of recording source to maintain consistency is important. Although the database contained recordings from seven different auscultation regions (Trachea, Anterior Left, Anterior Right, Posterior Left, Posterior Right, Lateral Left, and Lateral Right), the dataset for this study was built out of four regions of interest, Anterior Left (AL), Anterior Right (AR), Posterior Left (PL), and Posterior Right (PR), since these were the locations, which were consistently recorded for the majority of the patients due to their importance. Each of these four regions of interest was assigned a label and one of four possible classes.

Using samples provided for the AKG C417L Microphone (downsampled to 4 kHz), 62 input files were generated. Out of these files, 54 were chosen for training and validation. The rest were used for testing. Quadrants from the Mel-Spectrograms of the sound recordings of the four regions of interest (AL,AR,PL,PR) shaped the input files as shown in *Fig. 2*. The raw waveform data for the four regions of interest was concatenated as shown in *Fig. 3*. These regions of interest define a multi-label and correspond to the auscultation sites shown in *Fig. 1*.

Since wheezes are characterized by a maximum dominant frequency of 1200 Hz and crackles have a maximum dominant frequency of 500 Hz, a sampling rate of 4 kHz is considered appropriate (Andrès et al., 2018; Gurung et al., 2011; Petmezas et al., 2022; Pramono et al., 2017; Sarkar et al., 2015). The classes provided by the database for these four spatial locations were combined to create the multi-labels. Each of the 54 input files lasted 20 seconds resulting in 18 minutes of multi-labeled respiratory data for training and validation. After training, the two classifiers were then tested on the remaining 8 similarly configured respiratory sound files that were not in the training and validation set. Results were then compared to ground-truth labels obtained from the expertly annotated files in the database.

PROPOSED MULTI-LABELING STRUCTURE

For this research, all data, whether Mel-Spectrogram quadrants or raw waveform data from four regions of interest, were assigned to a multi-label which describes four auscultation points of AL, AR, PL, and PR. Each spatial region of interest was given a value of '0', '1', '2', and '3' to describe four different types of breathing sounds. The definition for each type of breathing sound in this labeling schema is shown in *Table 1*.

Table 1: **Four different types of sounds are to be detected in each of the four auscultation sites of interest**

TYPE OF SOUND	DEFINITION
0	Normal Breathing Sound
1	Wheezing Sound Only
2	Crackling Sound Only
3	Wheezing & Crackling Sounds

As the recordings from four regions of interest (AL, AR, PL, PR) for each input file were combined, the corresponding annotations from the database for each multi-label were incorporated. For example, suppose that for a particular second of sound recording, the AL, AR, PL, and PR regions are annotated to have wheezing (breathing type = '1'); normal breathing (breathing type = '0'); both wheezing and crackling (breathing type = '3') and crackling (breathing type = '2'), respectively. The multi-label of [1, 0, 3, 2] would be assigned to the pertinent samples of the sound recording as shown in *Table 2*.

Table 2: **Example of the Spatially and Breathing Type Description Schema**

Label #1 AL	Label #2 AR	Label #3 PL	Label #4 PR
1	0	3	2

For each input data format, testing was performed on 8 quadrant-configured sound files that were not in the training and validation set. After testing, predictions were made for each group of Mel-Spectrogram frames for the first case and group of raw waveform sound samples for the second case. Each type of breathing sound was assigned a probability for the respective region of interest. The class of the sound ('0', '1', '2', or '3') with the highest prediction probability was then chosen as part of the predicted multi-label.

EVALUATION CRITERIA

To be able to compare the results of this study to research which was conducted on the same database, results based on the micro metrics of Sensitivity(Recall) and Specificity (Acharya & Basu, 2020; Kochetov et al., 2018; Petmezas et al., 2022) along with F-Score and Accuracy (Perna, 2018; Petmezas et al., 2022) are considered. In addition, the measure of Hamming Loss, a common metric used in multi-label research is presented. It offers a comprehensive look at a classifier's prediction error (Pereira et al., 2018). Metrics for multi-label classification results can be instance-based or label-based. An instance-based metric considers the entire multi-label prediction for each time period of testing data. The Hamming Loss metric falls in this category. On the other hand, a label-based metric considers the label assigned to each region of interest in the testing results separately. Micro-averaged Sensitivity(Recall), Specificity, F-score and Accuracy (Pereira et al., 2018; Tsoumakas & Katakis, 2007; Wu & Zhou, 2017) fall within this latter category.

i)Hamming Loss. For each instance (in this case, one second of sound), a comparison was made between the group of four predicted classes of sound in a multi-label with the database's expert notations. The average Hamming Loss for each testing audio recording was calculated as shown in *Eq. 1*, where S represents the number of seconds in a testing respiratory sound recording, and pi,j and gi,j indicate the predicted type of sound and the ground truth type of sound, respectively. Therefore, for each label within a multi-label, a mismatch is assigned a '1'. These values are then added and averaged over the product of the number of labels (4) in a multi-label and the time span of the recording in seconds (S).

Equation 1

$$\frac{1}{4S}\sum_{i=1}^{S}\sum_{j=1}^{4}[if(p_{i,j}=g_{i,j},0,1)]$$

ii)Micro-Averaged Sensitivity, Specificity, F-Score and Accuracy. In order to provide a complete set of performance criteria, label-based (i.e., single auscultation site-based) metrics, such as Micro-averaged Sensitivity, Specificity, F-Score and Accuracy are also considered. Since the labels can be assigned one of four classes: '0', '1', '2', or '3', to represent four types of breathing sounds, it is best to perform a micro-average of these parameters. For instance, instead of taking an average of the calculated Sensitivity (Recall) for each type of sound, the overall Sensitivity (Recall) for all types of sound at once is considered. The calculations of Micro-Averaged Sensitivity (μA_Sensitivity), Micro-Averaged Specificity (μA_Specificity), Micro- Averaged F-score (μA_Fscore), and Micro-Averaged Accuracy (μA_Accuracy) are shown in *Equations 2, 3, 4, and 5,* respectively. In the case of Micro-Averaged Specificity, since there are more than two classes (breathing sound types), True Negatives are defined by using the one against all approach. In these equations, TP_i, FP_i, TN_i, FN_i represent the number of True Positives, False Positives, True Negatives, False Negatives for breathing sounds i, respectively, where $i \in \{0, 1, 2, 3\}$.

Equation 2

$$\mu A\_\text{Sensitivity} = \frac{\sum_{i=0}^{3}(TP)_i}{\sum_{i=0}^{3}((TP)_i + (FN)_i)}$$

Equation 3

$$\mu A\_\text{Specificity} = \frac{\sum_{i=0}^{3}(TN)_i}{\sum_{i=0}^{3}((TN)_i + (FP)_i)}$$

The harmonic mean of Micro-Averaged Precision and Micro-Averaged Recall is the Micro-Averaged F-score, which can also be calculated the following way:

Equation 4

$$\mu A\_\text{FScore} = \frac{\sum_{i=0}^{3}(2 * TP)_i}{\sum_{i=0}^{3}((2 * TP)_i + (FP)_i + (FN)_i)}$$

Equation 5

$$\mu A\_\text{Accuracy} = \frac{\sum_{i=0}^{3}((TP)_i + (TN)_i)}{\sum_{i=0}^{3}((TP)_i + (TN)_i + (FP)_i + (FN)_i)}$$

EXPERIMENTAL RESULTS

Two different formats of respiratory sound data were evaluated. The goal was to detect different types of breathing sounds in four different spatial locations of lung auscultation simultaneously. Through a novel multi-labeling schema and deep learning-based algorithm, deep learning models were built to be able to perform automated classification of spatiotemporal breathing data and determine where (within four regions of interest) normal sound, wheezing, crackling, and/or both wheezing and crackling were exhibited at the same time. The results of this evaluation are detailed in this section.

SIMULTANEOUS AND REGION OF INTEREST ANALYSIS ON MEL-SPECTROGRAM DATA

The training/validation dataset included 54 input files. The number of instances for different classes/breathing types, for these 54 files, was void of skew and imbalance. Each recording lasted 20 seconds resulting in 18 min. of multi-labeled respiratory recordings for training and validation.

After training and validating on 54 input files, the classifier is then tested on an additional 8 similarly configured respiratory sound files captured with the AKG C417L Microphone. Results were compared to the labels provided by the expertly annotated files in the database. The overall Hamming Loss using *Eq. 1* was determined by calculating the average for all groups of four labels for the testing audio files. These results are shown in *Table 3*. These values indicate that the classifier is capable of making correct predictions for the multi-labels for the testing audio recordings an average of about 90% of the time.

Table 3: **Average Hamming Loss Per Testing Respiratory Sound File for the Mel-Spectogram Dataset**

Test #1	Test #2	Test #3	Test #4
0.125	0.138	0.125	0.113
Test #5	**Test #6**	**Test #7**	**Test #8**
0.088	0.138	0.100	0.088

Additional metrics, namely Micro-Averaged Sensitivity (Recall), Specificity, F-score, and Accuracy values, were also calculated for each quadrant. The model's ability to predict various respiratory sound types in different spatial chest areas is based on the compilation of test file results for each label. Results are presented in *Table 4*.

Table 4: **Auscultation Site-Based Label Metrics for the Mel-Spectogram Dataset**

METRIC	AL	AR	PL	PR
µA_Sensitivity	0.9467	0.9467	0.8736	0.8322
µA_Specificity	0.9754	0.9815	0.9563	0.9471
µA_F-Score	0.9430	0.9534	0.8750	0.8478
µA_Accuracy	0.9350	0.9520	0.8764	0.8750

SIMULTANEOUS REGION OF INTEREST ANALYSIS ON RAW WAVEFORM DATA

For the experiments with the raw waveform data, training and validation was also based on the same 54 sets of sound recordings. Testing was performed on the same 8 sound files previously used with the Mel-Spectrogram-based experiment but formatted according to the raw quadrant format. The average Hamming Loss using *Eq.1* was determined for all groups of four labels for the testing audio files, and the results are shown in *Table 5*. The Hamming Loss values indicate that the classifier made incorrect predictions about 26% of the time. It is important to seek the lowest value possible for this parameter since it would mean that the better the classifier is at predicting the overall group of

breathing sound types for the four auscultation sites simultaneously.

Table 5 : **Average Hamming Loss Per Testing Respiratory Sound File for the Raw Waveform Based Model**

Test #1	Test #2	Test #3	Test #4
0.213	0.213	0.250	0.223
Test #5	**Test #6**	**Test #7**	**Test #8**
0.300	0.325	0.275	0.325

Micro-Averaged Sensitivity (Recall), Specificity, F-score, and Accuracy values, were also calculated for each quadrant, and are shown in *Table 6*.

Table 6: **Auscultation Site-Based Label Metrics for the Raw Waveform Based Model**

METRIC	AL	AR	PL	PR
µA_Sensitivity	0.7692	0.7769	0.7243	0.7218
µA_Specificity	0.9001	0.9119	0.8921	0.8868
µA_F-Score	0.7408	0.7761	0.7092	0.7196
µA_Accuracy	0.7217	0.7569	0.7246	0.7167

FURTHER DISCUSSION OF RESULTS

Although training and validation metrics were robust for both types of simultaneous region of interest/spatially descriptive input data, the Mel-Spectrogram format provided better classification results on test data. More specifically, the Mel Spectrogram-based Hamming Loss shows that, on average, the classifier made incorrect predictions for the multi-labels about 10% of the time, whereas the raw waveform-based Hamming Loss almost tripled to approximately 26%. This trend was further supported by all the other metrics. Micro-Averaged Sensitivity (Recall) was greater than 0.90 on average for all four spatially labeled locations for the Mel-Spectrogram sound format as compared to a range of values between 0.72 and 0.78 for the raw waveform input format. Micro-Averaged Specificity, F-Score, and Accuracy also showed better results for the Mel-Spectrogram format, as seen in *Table 4* in comparison to Table 6. Thus, these results support the use of Mel-Spectrogram input data with deep learning in classifying sound recordings with *spatially descriptive multi-labeling*. This is further supported by Becker et al. (2018), who obtained a higher accuracy with spectrogram-based data than raw waveform-based data when classifying audio signals of spoken digits (0-9) in English. Xie et al. (2019) also confirmed that the Mel-Spectrogram is the best type of spectrogram to use with a CNN model when classifying bird sounds. Finally, Kim et al. (2021) used Mel-Spectrograms with a CNN to classify breathing sounds from a different database.

The multi-labeling and simultaneous region analysis technique presented in this paper is unique and offers a spatial aspect to multi-labels. For existing studies, which have used the same database, the approaches consist of using a single label, which gets assigned a class or a group of classes provided by the annotations from the database. Most studies focused on a smaller number of classes and have not addressed the spatial aspect as mentioned above. For instance, the results by Perna (2018) were based on generalized categories of healthy and unhealthy sounds in one case, and then healthy, chronic and nonchronic diseases in the other case. Accuracy of 83% and F-Score of 88% for the former case, and accuracy of 82% and F-Score of 84% for the latter case were presented, which are lower than the results obtained with the Mel-Spectrogram format, since an average accuracy of 91% and an average F-Score of 90% was achieved. The categories (classes) for the multi-labels in this study were specific to the ones provided by the database and not generalized into broader groups, so the results can be considered more robust. Acharya et al. (2020) and Kochetov et al. (2018) used all four types of breathing sounds. The best reported averages of Sensitivity/Specificity scores were 71.81% and 67.9%, respectively. The simultaneous and spatially descriptive analysis of regions of interest with Mel-Spectrograms in this study outperforms these numbers achieving average scores of 90% and 97%, respectively.

CONCLUSION

A promising approach to multi-labeling spatiotemporal data to detect different classes in several regions of interest simultaneously and its application to autonomously detect different types of breathing sounds ((normal, wheezing only, crackling only, wheezing and crackling) in audio recordings has been presented. Multi-labels represented four auscultation sites (AL, AR, PL, and PR). A CNN and an LSTM-based network classified the pulmonary sounds spatially. Audio data was represented through Mel-Spectrograms as well as raw waveforms and their performances were compared while using a novel multi-labeling approach. Results of this study support the use of simultaneous and spatially descriptive Mel-Spectrogram input data and labels along with deep learning to successfully classify sound recordings with an average Hamming Loss of 0.10, and average F-Score of 0.90. It was reported that the diagnosis of normal breathing sounds through classical auscultation has an accuracy of about 20% (Bohadana et al., 2020; Hafke-Dys et al., 2019). In this study, the optimal average accuracy for sound type ’0’ (normal breathing) after testing was 84.8%. Although wheezing and crackling detection, with a diagnosis based on the use of a conventional stethoscope, had higher accuracy values of 85% and 67%, an automated classification of recordings of these sounds would still be beneficial. The model presented in this paper would offer an accuracy of 88.8% for detecting wheezing (sound type ’1’) and 86.7% for detecting crackling (sound type ’2’). Although similar accuracies were reported by Kim et al. (2021), their classification lacked the spatial information and simultaneous detection of breathing sounds. Ultimately, creating an application which can offer monitoring of breathing sounds can aid in determining the correct moment to offer medical intervention (Belkacem et al., 2021; Kim et al., 2021). Finally, the advantage that the research in this paper presents lies in the possibility of offering an improved assessment of the locality, severity and progression of pulmonary disease through the autonomous detection of different types of breathing sounds in various chest locations concurrently.

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SOCIAL ENGINEERING: TOWARDS A USER INTROSPECTIVE COUNTERMEASURE APPROACH

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ABSTRACT

This paper addresses social engineering as one of the most common and intriguing forms of cyber-attacks as it aims to manipulate human psychological weakest points and related vulnerabilities. Furthermore, social engineering weaponizes human vulnerabilities for network intrusion and cyber theft. Multiple methods and taxonomies are presented in the literature and attempt to depict the correlation between social engineering attacks and human behavior. On the other hand, the literature mixes and matches conceptualizations within the domain and fails to characterize the connection between social engineering and humans as the weakest link. The paper proposes a User Introspective Countermeasure Approach (UICA) to analyze social engineering attacks. The approach will also serve as an opportunity for individuals to redefine social engineering strategies while embracing an introspective evaluation of any potential social engineering attacks. Finally, the paper proposes sound alternatives and prevention strategies to minimize any risk of becoming a victim of social engineering attacks.

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Keywords: Cyber Security, Social Engineering Attacks, Vulnerabilities Exploited, Human Weakness, Prevention Strategies.

INTRODUCTION

This paper aims to contribute to social engineering (SE) research and body of knowledge. First, an in-depth literature review was conducted in the space of SE, including the classification of multiple vectors offered in the literature for SE attacks. Next, SE's taxonomy and conceptual models were introduced, emphasizing human factors (Mitnic, 2011; Nohberg & Kowalski, 2008; Mouton et al., 2014; Harley, 1998; and Laribee, 2006). Also, the principles of influence by Cialdini (2009) related to social engineering attacks were introduced. The six principles of persuasion by Cialdini are reviewed to help understand how an attacker leverages influence and persuasion as part of SE attacks. Next, the models of personality proposed by McCrae and Oliver (1992) are showcased. The five dimensions shown in the model by McCrae and Oliver help understand human characters and help predict behavior for SE attacks. This information helped to inform a framework to depict the correlation between SE attacks, influential motives, and personality traits. A User Introspective Countermeasure Approach (UICA) for social engineering attacks is highlighted in the paper. Finally, as shown in the model, the study offers valuable defense suggestions for social engineering attacks focusing on human weakness.

LITERATURE REVIEW: SOCIAL ENGINEERING

In information security, social engineering is the attack that aims to manipulate the human psychology of a person (i.e., Cognitive Biases) for the purpose of information gathering so that the attacking goals can be achieved. Stolen data usually ends up on the dark web and sold to cybercriminals to commit fraud or identity theft. According to a recent report, in December 2019, the personal data of over 267 million Facebook users were exposed online (Bajak, 2019). Recently, in April 2021, more than half-billion data from Facebook user accounts emerged on the dark web, where they were posted in a low-level hacking forum. According to AP News (2021), personal data includes phone numbers, IDs, full names, email addresses, locations, and birth dates. It is unclear if the 2019 data dump is related to the personal data that have been exposed online in 2021, the report suggests.

Social engineering heavily relies on human interaction. According to Proofpoint's 2019 Annual Human Factor Report, more than 99 percent of cyberattacks require human interaction to execute— enabling a macro, opening a file, following a link, or opening a document—the element of SE is key to successful attacks. Cybercriminals use SE negatively as a malicious tool for creating back doors that give a secret way into any system. It may be argued SE has proven to be the most effective malicious tool to victimize people.

SOCIAL ENGINEERING TAXONOMY & HUMAN FACTORS

Multiple frameworks and taxonomies are presented in the literature for cyber-security attacks with clear, descriptive presentations around the phases and procedures for social engineering attacks. A diversity of methods and taxonomies are presented in this paper from different theories informed by prior publications. Further, the methods given in the literature are limited and failed to address social engineering and the connection to humans as the weakest link (Mitnic, 2011; Nohberg & Kowalski, 2008; Mouton et al., 2014; Harley, 1998; and Laribee, 2006). Multiple notions and theories were reviewed and attempted to address human behavior and related characterizations. Additionally, the current literature mixes and matches various conceptualizations for entities and inter-relations within the domain. As a result, it is very difficult to generalize the reviewed literature in favor of a sound taxonomy in the space of social engineering attacks and their correlation to human behavior.

Mitnick (2011) proposed the social engineering attack cycle (SEAC). SEAC is characterized as a descriptive approach applicable to academics and practitioners in the cyber-security space. Mitnick's framework is oversimplified, lacks details to articulate preventive suggestions, and ignores the exploited iterative and human behavior specifications. In this scenario, the model by Mitnick would be limited for practical purposes.

Nohberg and Kowalski (2008) proposed a descriptive model that depicts "deceptive" crimes in social engineering. Kohlberg and Kowalski characterized their approach as naïve inductive and introduced the concepts of the "attacker," "defender," and "victim." Moreover, the three fundamental concepts are blended as part of the model and create the "deception sphere." Finally, the model serves the needs for training the best practices around social engineering, monitoring, and reporting SE attacks, and understanding the implications of defenses.

Mouton et al. (2014) presented a very interesting taxonomy to address social engineering and introduced the "ontological model" for social engineering attacks. The ontological model presented by Mouton (2014) explicitly defines relationships by the entities within any given domain. The model captures the commonly accepted domain definitions and delivers a notional model for social engineering attacks. Mauton et al. (2014) also define the concept of the social engineer, and it is characterized as deceptive individuals with the ultimate goal to "manipulate" and extract confidential information from their victims. The paper by Mouton attempts to deliver an "encoded" characterization of the domain and the entire ecosystem to include structured definitions for each component in the model and their inter-relations.

Harley (1998) is referred in the literature as one of the first taxonomies in the social engineering space. Harley suggests multiple characterizations to include the fundamentals around "masquerading," "password-stealing," "dumpster diving," "leftover," "hoax alerts," and "spam and direct psychological manipulation." The model mixes and matches social and compliance doctrines. The model introduces seven human vulnerabilities to include: "gullibility," "curiosity," "courtesy," "greed," "diffidence," "thoughtlessness," and "apathy." Human vulnerabilities are stated to be the reasons behind the SE attacks and sensitivity to any SE attack.

Laribee (2006) offers a taxonomy around two fundamental dimensions, including a "trust model" and an "attack model." The models discussed by Laribee (2006) characterize the steps by any social engineer or threat actor before, during, and after an attack. The attack model is introduced as iterative, as the social engineer would have to repeat the steps before achieving the objective. Finally, the attack model can leverage the trust model to gain another layer of information as part of the social engineering attack.

ATTACK CLASSIFICATION & TYPES

There are multiple classifications and categories in the literature related to SE attacks. Salahdine and Kaabouch (2019) argued that Social Engineering could also be classified into three categories: social, technical, and physical-based attacks. Peltier (2006) suggested that social engineering attacks can be divided into human-based or computer-based classes. Therefore, this section categorizes social engineering attacks into two types. *Figure 1* illustrates the two types of social engineering attacks.

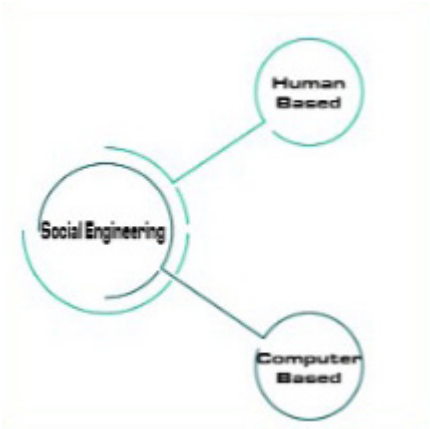

Figure 1: **Type of Social Engineering Attacks, adapted from Peltier (2006).**

In a human-based social attack, the attacker interacts with the target to gather data. The modern threat landscape is increasingly focusing on people rather than infrastructure. In the security chain, humans are the weakest link and are more vulnerable than computers when it comes to attacks. Pretexting and Dumpster Diving are examples of human-based attacks (Peltier, 2006).

In the computer-based social engineering attack, the attacker uses computer machines or mobile devices rather than humans to collect information from the targets. With computer-based attacks, attackers can target thousands of computer systems in a very short amount of time. For instance, phishing is an example of a computer-based attack because the attackers use fraudulent bulk emails to reach their targets in a few seconds. The main advantage of automated attacks is that the number of possible targets within a brief period of time is incomparably high, as Krombholz et al. (2013) discussed.

CLASSIFICATION OF VECTORS

This section proposes a classification of common social engineering attack vectors. Cybercriminals use many variants of SE attacks. Krombholz et al. (2015) outlined the different types of social engineering attack techniques. Examples of social engineering attack vectors include phishing, diversion theft, fake software, tailgating, pop-up windows, robocalls, pretexting, pharming, spear phishing, baiting, water-holing, quid pro quo, ransomware, online social engineering, and reverse social engineering. *Figure 2* classifies these social engineering vectors employed by malicious hackers or cybercriminals to target individuals and organizations.

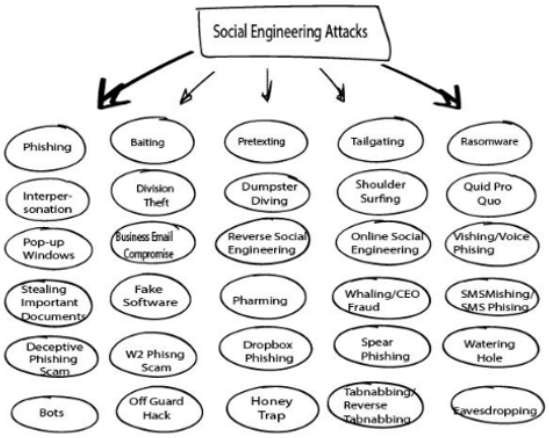

Figure 2: **Forms of Digital Social Engineering Attacks.**

Table 1 describes the attack vectors. The table combines both technical and non-technical attack vectors.

Table 1 : **Terms and Definitions**

TERM	DEFINITION
PHISHING	Phishing is a deceptive effort to obtain confidential information to compromise security.
BAITING	Baiting is the act of enticing the target with an attractive offer to pique a victim's curiosity.
PRETEXTING	Pretexting is the act of lying or creating a fictional backstory to obtain confidential data.
TAILGATING	Tailgating is the act of following a person to get access to a restricted area. Here, the attacker may give fake reasons like missing the ID badge, etc.
RANSOMWARE	The act of infecting the target's computer with malware prevents access to the victim's data unless a ransom is paid.
INTERPERSONATION	Interpersonation is the act of pretexting as another person to fool a target into allowing access to information.
DIVISION THEFT	Consist of persuading a delivery person or transport company to deliver a courier or package elsewhere – "Round the Corner."
DUMPSTER DIVING	Dumpster is the act of searching a company's trash for useful information.
SHOULDER SURFING	Shoulder Surfing is the criminal act of spying over victims' shoulders as they use a laptop to steal their personal data.

Table 1 : **Average Hamming Loss Per Testing Respiratory Sound File for the Raw Waveform Based Model (cont'd)**

TERM	DEFINITION
QUID PRO QUO	A quid pro quo attack is a variation of baiting. It involves a hacker requesting an exchange of information or service to convince the victim to act.
POP-UP WINDOWS	In this attack, a pop-up window will appear on the victim's computer screen, indicating that the connection is lost. Target victims need to re-enter their credentials to reconnect to the session that installs a malicious program and sends the victim's credentials to the attacker.
BUSINESS EMAIL COMPROMISE (BEC)	BEC is the criminal act using email fraud to trick individuals, government, commercial, and non-profit organizations into turning over financial information or processing a payment request to transfer funds.
REVERSE SOCIAL ENGINEERING (RSE)	RSE is a form of person-to-person attack in which an attacker approaches the victims to offer assistance and compels them into divulging sensitive information.
ONLINE SOCIAL ENGINEERING	The attacker pretends to be a member of the company's IT department, such as the network administrator and convinces the victim to provide usernames and passwords.
VISHING/VOICE PHISHING	Vishing or Voice phishing is the fraudulent practice of using telephony and pretense to conduct phishing attacks by convincing victims to act quickly to trick them into surrendering private information.
STEALING IMPORTANT DOCUMENTS	Stealing important documents consists of stealing data or documents right from someone's desk for personal interests.
FAKE SOFTWARE	In fake software attacks, also known as fake websites, the cyber-attacker makes victims believe they are legitimate and trusted applications or websites. Then, the victims enter their credentials into the fraudulent website, where they will be collected and reused on legitimate websites by the cyber-attackers.
PHARMING	Pharming is a cyberattack that uses Domain Name System (DNS) cache poisoning to a website's traffic to another, fake site.
WHALING / CEO FRAUD	Targeted phishing attacks aimed at high-level employees, board members, and executives to gain access to their email accounts or spoof them in order to fool accounting or HR into transferring money to a bank account or conducting an unauthorized transaction.
SMISHING/SMS PHISHING	Involves sending text messages with links to redirect victims to malicious websites on their phones and collect private information.
DECEPTIVE PHISHING SCAM	Deceptive phishing scam is the fraudulent act of replicating a legitimate company's email to prompt victims into handing over private information.
W2 PHISHING SCAM	W2 phishing is a form of whaling or Business Email Compromise (BEC). An attacker uses an executive's email to trick a victim to release W2s and W9s of the employees to gain private information and file fraudulent tax returns with the IRS.
DROPBOX PHISHING	Dropbox phishing involves phishing emails that use the Dropbox platform to get victims to click on suspicious emails to prompt to log in to the victim's Dropbox and become infected with Dropbox malware. The attacker then gets access to private files photos and takes the account hostage.
SPEAR PHISHING	Spear phishing, also known as whaling, is the act of sending phishing emails to specific individuals or businesses to obtain sensitive information.
WATERING HOLE	Infecting a website with malware to target common visitors or a particular group.

Table 1 : **Average Hamming Loss Per Testing Respiratory Sound File for the Raw Waveform Based Model (cont'd)**

TERM	DEFINITION
BOTS	Malicious bots run automated tasks to affect web browsers and send infected messages to the user on social network platforms. They interact with humans to influence decisions, infiltrate groups of people on social media to propagate specific ideas, create fake accounts, generate fake followers/likes, or be used illegitimately by attackers to enter an organization's network..
OFF GUARD HACK	Off guard hack is the practice of surprising the victims when they did not expect to manipulate them into sharing information.
HONEY TRAP	Honey Trap is an investigative practice where attackers fake to be romantically or sexually interested in the victims to get sensitive information or money.
TABNABBING/REVERSE TABNABBING	This attack allows tab titles to mimic a legitimate site and redirect victims from a parent site to malicious content to submit their login credentials.
EAVESDROPPING	Eavesdropping attack is an unauthorized listening to the private conversation of others to collect important information.

IMPLICATIONS OF HUMAN PERSONALITY & PERSUASION STRATEGIES

This paper presents social engineering as a unique type of cyber-attack as it aims to manipulate human behavior and weaponizes human vulnerabilities. This section addresses human personality and implications around persuasion strategies, as they are directly linked to social engineering attacks. Social engineering attacks work best when they are focused on human emotion. Hackers use human emotion as an effective social engineering tool to manipulate people. The human brain releases both dopamine and oxytocin during moments of pleasure. Research suggests that oxytocin interacts closely with the neural pathways responsible for processing motivationally relevant stimuli (Love, 2014). Therefore, savvy cybercriminals know how to use human emotion to their advantage to carry out social engineering campaigns. It is much easier to manipulate someone than hacking a computer network or discovering security vulnerabilities as humans allow emotions to influence decision-making. Cialdini (2001) presents six fundamental persuasion principles. Additionally, a clear understanding of the persuasion principles framework by Cialdini would help to understand how any attacker leverages persuasion as part of SE attacks. By understanding these principles, bad actors can use them in an unethical matter to increase their chance of manipulating people into actions. The following persuasion principles serve as a foundational block to the proposed User Introspective Countermeasure Approach (UICA).

- Authority: humans tend to listen to and obey individuals with power.
- Commitment: humans tend to execute tasks with verbal or written agreements. Furthermore, people honor a commitment that fits their self-image
- Consensus and Social Proof: humans tend to ask for an option by others when there is a risk related to any course of action.
- Liking: humans tend to execute tasks when asked by individuals they like.
- Reciprocity: humans tend to return favors to others. Hence, giving a little something to the victim might get something in return.
- Scarcity: humans tend to embrace unique, rare, and exceptional products. In this scenario, a human would want the product or service that is hard to find.

McCrae and Oliver (1992) introduced the five-factor model of personality. The model presents personality in five fundamental categories as follows: "extraversion, agreeableness,

conscientiousness, neuroticism, and openness. Many literature studies focus on the model as a forecaster for cybersecurity behavior (Shropshire, Warkentin, & Sharma, 2015). In addition, the literature characterizes human behavior as related to personality as the most vulnerable link in the space of cyber (Krombholz et al., 2015; Heartfield & Loukas, 2015; Mouton et al., 2016). To help define the factors presented in the model, McCrae and Oliver introduced "definers" for each factor as follows and serve as a foundational dimension to the proposed User Introspective Countermeasure Approach (UICA).

- Extraversion (E): "Active," "Assertive," "Energetic," "Outgoing," "Talkative."
- Agreeableness (A): "Appreciate," "Forgiving," "Generous," "Kind," "Sympathetic," "Trusting."
- Conscientiousness (C): "Efficient," "Organized," "Planful," "Reliable," "Responsible," "Through."
- Neuroticism (N): "Anxious," "Self-pitying," "Tense," "Touchy," "Unstable," "Worrying."
- Openness (O): "Artistic," "Curious," "Imaginative," "Insightful," "Original," "Wide Interest."

USER INTROSPECTIVE COUNTERMEASURE APPROACH (UIAC)

The literature links the human factor to cybersecurity incidents as attackers persuade human behavior and personality (Uebelacker & Quiel, 2014). Furthermore, multiple taxonomies and models are presented to characterize social engineering attacks as a process linked to humans and related vulnerabilities (Krombholz et al., 2015; Heartfield & Loukas, 2015; Mouton et al., 2016). On the other hand, the methods presented in the literature are limited and failed to address social engineering and the connection to humans as the weakest link (Mitnic, 2011; Nohberg & Kowalski, 2008; Mouton et al., 2014; Harley, 1998; and Laribee, 2006).

Cialdini (2001) discussed the six persuasion principles to clearly understand how any attacker can use persuasion as part of SE attacks. Additionally, the five-factor model personality suggested by McCrae and Oliver (1992) serves to forecast how humans would behave once they are faced with a particular persuasive stimulus. Furthermore, the principles by Cialdini serve as a foundational block to the proposed User Introspective Countermeasure Approach (UICA). The UICA leverages a solid understanding of SE attack types and vectors, the six persuasion principles by Cialdini (2001), and the personality model by McCrae and Oliver (1992) to produce a framework that analyzes social engineering attacks.

Table 2 shows the UICA framework. The framework is characterized across the SE engineering vectors depicted in this paper as suggested by Krombholz et al. (2015). In an exhaustive list, the authors of this paper mapped the SE attack vectors in the framework as a function of the six persuasion principles by Cialdini (2001) and the personality model by McCrae & Oliver (1992). Additionally, the UICA framework offers specifications for SE attacks as "technical", and "non-technical" vectors as recommended by Peltier (2006). The authors of the paper added one additional specification for the SE attack vectors for the "hybrid" alternative. Finally, the UICA framework will serve individuals to redefine SE attacks mitigation strategies while embracing an introspective evaluation of any potential social engineering attacks. In this scenario, organizations will use the UICA framework as a tool to understand SE attacks as they are related to humans as the weakest link. Furthermore, the UICA framework would help to propose mitigation strategies addressing characterizations for personality and persuasion vulnerabilities exploited by any specific attack. Reference the User Introspective Countermeasure Approach (UICA) is depicted in *Table 2*.

Table 2 : Introspective Countermeasure Approach (UICA)

SE Attack Vectors	Personality Categories					Persuarion Principles					
	EXTRAVERSION	AGREEABLENESS	CONSCIENTIOUSNESS	NEUROTOCISM	OPENNESS	AUTHORITY	COMMITMENT	CONSENSUS	LIKING	RECIPROCITY	SCARCITY
Computer-based											
Phishing		X			X	X			X		
Pop-Up Windows				X	X						X
SMSMishing/SMS Phishing		X		X	X	X			X		X
Ransomeware		X		X	X	X					X
Deceptive Phising/ Scam		X	X	X	X	X			X		X
W2 Phishing scam		X	X			X	X		X		
Dropbox Phishing		X	X			X			X		
Spear Phishing		X	X	X	X	X	X		X		
Vishing/Voice Phishing		X	X	X	X	X	X		X		X
Watering Hole		X		X	X						X
Bots		X		X	X	X			X		X
Tabnabbing/Reverse Tabnabbing	X	X			X				X		X
Pharming				X	X				X		X
Fake Software	X	X	X	X	X						X
Whaling / CEO Fraud		X	X	X		X			X		
Business Email Compromise (BEC)		X	X	X		X			X		
Online Social Engineering	X	X		X	X				X		

Table 2 : **Introspective Countermeasure Approach (UICA) - cont'd**

SE Attack Vectors	Personality Categories					Persuarion Principles					
	EXTRAVERSION	AGREEABLENESS	CONSCIENTIOUSNESS	NEUROTOCISM	OPENNESS	AUTHORITY	COMMITMENT	CONSENSUS	LIKING	RECIPROCITY	SCARCITY
Human-based											
Baiting		X			X					X	X
Pretexting		X			X	X			X		
Interpersonation	X	X		X	X	X			X		X
Dumpster Diving				X							X
Tailgating	X	X		X	X	X		X	X		
Shoulder Surfing	X	X							X		X
Eavesdropping	X	X			X						X
Division Theft	X	X		X	X			X	X	X	X
Reverse Social Engineering (RSE)	X	X		X	X	X			X	X	X
Off-Guard Hack	X	X		X	X	X			X	X	X
Honey Trap	X	X		X	X				X		X
Stealing Important Documents		X									X
Hybrid-based											
Reverse Social Engineering (RSE)	X	X		X	X	X			X	X	X
Watering hole		X		X	X						X
Online Social Engineering	X	X		X	X				X		

DEFENSE RECOMMENDATIONS

This section presents defense recommendations to enable organizations to fight back against threat actors. Risk and related cyber security threats cannnot be fully eliminated because humans will continue to be the weakest link (Mitnic, 2011; Nohberg & Kowalski, 2008; Mouton et al., 2014; Harley, 1998; and Laribee, 2006). Multiple measures are proposed to minimize the risk of social engineering attacks. The User Introspective Countermeasure Approach (UICA) characterizes attacks as a function of the following dimensions (1) SE engineering vectors, (2) personality categories, (3) persuasion principles, and (4) the attack classification by type. All dimensions were presented in this paper.

One recommendation to minimize the risk for social engineering attacks revolves around understanding individual strength as a dimension of personality and persuasion. In

this scenario, any organization would be in a better position to withstand a social engineering attack by understanding the individual operator of any given system. Figure 4 below illustrates a characterization for individual strength in very simple terms as "weak or strong." Individual strength is presented in this paper as the ability of the operator by any system to identify and resist any social engineering attack. The proposed UICA framework can be leveraged to understand and describe the strength of an individual & risk associated to personality and persuasion tactics. Additionally, the recommendation also examines systemic strength, and it is characterized as the position by any information system to resist a social engineering attack with no human interaction. Understanding these two components would serve as a strong line of defense for cyber-attacks. *Figure 3* presents the social engineering mapping for systemic strengths vs. individual strengths.

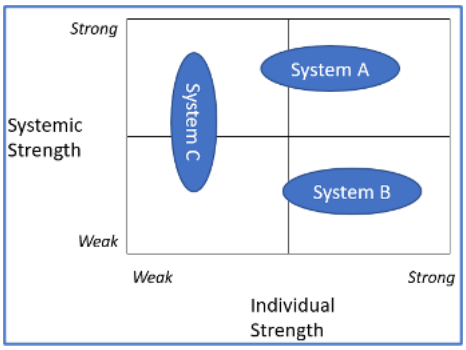

Figure 3: **Social Engineering Map – Systemic Vs. Individual Strengths**

Following is a non-exhaustive lit of recommendations to achieve an optimal social engineering mapping, as it is related to the systemic and individual strengths.

- Define data and information threats. This exercise will help the organization assess risks and target the more vulnerable areas.
- Assess the personality types within the organization. This will help understand and uncover specific traits that are related to individuals in the organization.
- Evaluate the strength of each individual. In this scenario, it is recommended to measure the ability to resist a social engineering -attack and the likelihood of persuasion. This exercise will provide the ability to develop a security profile for each role and individual. Keep in mind traditional security practices and appliances, including deploying firewalls, will provide a comprehensive protection mechanism.
- Classify multiple security mechanisms that are already deployed in the environment and document the protection levels provided. Having the protection levels well defined will help deal with risks associated with human vulnerabilities.
- Map the systems as recommended in Figure 4. The map provides a visual comparison for the different systems as a dimension of "systemic strength" and "individual strength."
- Testing is also recommended to validate the information presented as part of the map and related assessments.
- Develop an implementation plan to address all vulnerable systems and individuals.

Another recommendation to minimize the risk for social engineering attacks is focused on systemic protection mechanisms. Companies and organizations must train their employees on how to detect social engineering attacks and implement systemic protection mechanisms to counter them. There are a number of things that can be done to help protect both targeted people, the information, and the system. It would be a big mistake not to focus on security awareness training. This study suggests that it is much easier to hack humans than computers. However, effective defenses such as, but not limited to, access controls, information classification, security policy, company's privacy policy, firewall protection, keeping antivirus and antimalware up to date software are highly recommended. Keep in mind not only humans but weak systems are also susceptible to social engineering attacks. The study offers four examples of social engineering attacks to depict

best practices and preventive recommendations to spot attacks and protect systems, people, and information.

ATTACK ONE: VOICE PHISHING ATTACK

Vishing or Voice phishing is the fraudulent practice of using telephony and pretense to conduct phishing attacks by convincing victims to act quickly to trick them into surrendering private information. In this attack, the attacker uses automated text-to-speech systems or live callers posing as an employee of a genuine organization such as a bank to attempt to obtain the victim's bank account details or personal information. The attacker needs the following details to launch the attack:

- The name of the victim
- The bank that the victim is currently using
- The authentication details such as a personal identification number (PIN)

The UICA framework can be leveraged to highlight personality weaknesses to help individuals and organizations minimize the impact from Vishing or Voice Phishing attacks. UICA highlights specific personality weaknesses that could be transformed into vulnerabilities as follows.

- Agreeableness: specific human behavior to include: "believing," “naive,” “kind,” “generosity,” “forgiveness,” and “appreciate" are likely target to this type of attack.
- Conscientiousness: specific human behavior to include: "efficiency," "organized," reliable," and "responsible," are likely target to this type of attack.
- Neuroticism: specific human behavior to include: "anxiety," "self-pitying," "unstable," and "worrying" are likely target to this type of attack.
- Openness: specific human behavior to include: "artistic," "curiosity," and "ingenious" are likely target to this type of attack.

Additionally, the UICA framework, presented in Table 2, highlights the persuasion tactics used by the threat actor. Understanding of the specific tactics for the Vishing or Voice Phishing attacks would help individuals and organizations to detect the threat actor and minimize the impact of the attack. The UICA highlights the following persuasion tactics associated with the Vishing or Voice Phishing attacks.

- **Authority:** human behavior in favor of listening and obeying those in power.
- **Commitment:** human behavior to execute tasks as a result of verbal and written agreements.
- **Liking:** human behavior to execute tasks requested by someone they liked.
- **Scarcity:** human behavior in favor of unique, rare, and exceptional offerings.

Systemic improvements are presented next as part of the recommendations to minimize this type of SE attack risk.

- Two-factor authentication provides an additional layer of security each time the user logs into the account by verifying two different factors, such as a security token and a password.
- A straightforward method of phishing detection is the usage of blacklists.
- Authenticate callers
- Train employees on how to recognize phishing attacks, consequences, and prevention.

ATTACK TWO: TAILGATING OR PIGGYBACKING ATTACK

Tailgating is the act of following a person to get access to a restricted area. In this scenario, the attacker may give fake reasons to justify the access, including a misplaced or forgotten badge ID. In tailgating or piggybacking attacks, the attacker tries to trick employees by following them to gain unauthorized access into the company's restricted area and steal confidential information for malicious purposes. In this attack, attackers claim they have forgotten their

ID card and then ask the employee to hold the door for them. The attacker needs the following information to launch the attack:

- Employees with badges entering a building
- Conversations with employees while entering the building

The UICA framework can be used to understand the personality and related weaknesses to assess human vulnerabilities in order to minimize the impact from Tailgating or Piggybacking. UICA highlights specific personality weaknesses that could be transformed into vulnerabilities as follows.

- Extraversion (E): human behavior including "assertion", "talkative", "outgoing" and "energetic"
- Agreeableness: specific human behavior to include: "believing, naive, kind, generosity, forgiveness, and appreciate" are likely target to this type of attack.
- Neuroticism: specific human behavior to include: "anxiety," "self-pitying," "unstable," and "worrying" are likely target to this type of attack.
- Openness: specific human behavior to include: "artistic," "curiosity," and "ingenious" are likely target to this type of attack.

The UICA framework, presented in Table 2, also provides the persuasion strategies used by threat actors. Understanding such persuasion suggested strategies for Tailgating or Piggybacking attacks would help individuals and organizations to detect these threat actors, therefore minimize the impact of the threat. The UICA highlights the following persuasion strategies associated with the Tailgating or Piggybacking attacks.

- Authority: human behavior in favor of listening and obeying those in power.
- Consensus and Social Proof: human behavior to ask for opinions by others when dealing with risk and decision-making.
- Liking: human behavior to execute tasks requested by someone they like or admire.

Systemic improvements are presented next as part of the recommendations to reduce this type of SE attack risk.

- Conduct security awareness training
- Do not allow unauthorized employees to follow you behind
- Lock computer whenever away from the computer desk
- Deploy biometric scanners and access control turnstiles to prevent tailgating
- Train employees on how to recognize tailgating attacks, consequences, and prevention.

ATTACK THREE: EMAIL PHISHING ATTACK

Email Phishing is a fraudulent attempt to acquire sensitive information to compromise security. In this attack, the attacker sends a fraudulent email to trick the victim into revealing sensitive information or redirecting to a malicious website that exploits web browser vulnerabilities and installs malware like ransomware. The attacker usually pushes the victims into action by creating a sense of urgency or panic. The attacker needs the email address of the victim to launch the attack.

The UICA framework would help organizations by understanding personality and related weaknesses to assess human vulnerabilities. In turn, such understanding would help decrease the impact from Email Phishing Attacks.

UICA highlights specific personality weaknesses that could be transformed into vulnerabilities as follows.

- Agreeableness: specific human behavior to include: "believing," “naive,” “kind,” “generosity,” “forgiveness,” and “appreciate" are likely target to this type of attack.

- Openness: specific human behavior to include: "artistic," "curiosity," and "ingenious" are likely target to this type of attacks.

The UICA framework, presented in Table 2, depicts the persuasion tactics used by threat actors. The argument revolves around the understanding for such tactics as they would help to lessen the impact of the Email Phishing Attack. The UICA highlights the following persuasion strategies associated with the Email Phishing Attack.

- Authority: human behavior in favor of listening and obeying those in power.
- Liking: human behavior to execute tasks requested by someone they like or admire.

Systemic improvements are presented next as part of the recommendations to diminish this type of SE attack risk.

- Inspect links before clicking them.
- Always verify before taking actions
- Never trust any emails from unknown senders
- Use of two-factor authentication to access your online email account. This mechanism protects the account of the user and requires additional steps when accessing an online email account, adding an extra layer of security.
- Train employees on how to detect email phishing attacks, consequences, and prevention.

CONCLUSION AND FUTURE RESEARCH

This paper characterized social engineering attacks as a relevant challenge in the cyber security space. Furthermore, social engineering is presented as one of the most intriguing forms of cyber-attacks to manipulate human phycological weaknesses. The paper focused on human psychological considerations and related vulnerabilities as the weakest link for cyber-attacks (Uebelacker & Quiel, 2014). In this research, we learned about the different types of social engineering attacks and how they can be mitigated. Multiple taxonomies are reviewed in the paper to characterize social engineering attacks as a process linked to human psychology and related vulnerabilities (Krombholz et al., 2015; Heartfield & Loukas, 2015; Mouton et al., 2016). On the other hand, the methods reviewed revealed limitations and failed to depict the connection for humans as the weakest link (Mitnic, 2011; Nohberg & Kowalski, 2008; Mouton et al., 2014; Harley, 1998; and Laribee, 2006). The paper proposed a novel model to better understand SE attacks as a dimension of persuasion and personality by each individual. The User Introspective Countermeasure Approach (UICA) framework is presented as an alternative to help the community detect these SE attacks. Understanding personality traits will provide awareness to individuals about their weaknesses and strengths, preventing the likelihood of becoming a victim. The most common examples of phishing attacks are discussed in the paper to educate the community on coping with them. In addition, systemic improvements are proposed to help both organizations and their employees in minimizing risks and neutralize the attackers. Finally, the paper addresses general guidelines and best practices to help individuals to be in a better position to fight back against any SE attack. This paper proposed a novel framework to address SE attacks that can be leveraged for future research to understand the human dimension better and optimize SE countermeasures as cybercrime evolves.

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CIVIL WAR BY OTHER MEANS

Suri, Jeremi. (2022). *Civil War by Other Means: America's Long and Unfinished Fight for Democracy.* Public Affairs. ISBN 978-1541758544. 320 pp. Hardcover $21.99.

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The United States, from essentially its birth until now, is no stranger to division, tension, and violence. A nation founded upon liberty and equality has seen more than its fair share of exactly the opposite. Many historians have focused on perhaps the pinnacle of this internal strife: the American Civil War. In *Civil War by Other Means: America's Long and Unfinished Fight for Democracy*, author Jeremi Suri argues this fighting never fully ended.

Suri asserts that while many Republicans before and after the Civil War were committed to defeating the Confederacy, ending slavery, and ensuring racial equality, former Confederates and Southern Democrats repeatedly and emphatically dogged them at every turn. To Suri, white supremacy is the biggest threat to the United States, and people across the country have fought to preserve this horrid institution. While Suri does cite examples of Republican politicians and even sitting presidents who try to do good for the country, the bulk of the book centers on former Confederates, Southern Democrats, and even mobs of white Southerners who attempt to destroy everything the Union and Republicans set out to do in the Civil War.

Most of the research done by Suri is not extraordinary, but it serves well to introduce this topic to those unfamiliar with the subject. A good number of the sources he utilizes are famous speeches, private correspondence, and diary entries of figures like Abraham Lincoln, Ulysses S. Grant, and Andrew Johnson. Suri's analysis begins at the end of the Civil War and transports the audience into Ford's Theater. From there Suri presents all the information in his book in a chronological fashion, going from the end of the Civil War all the way to the end of the 19th century. Along the way, Suri includes example after example of white supremacists being lionized both in the South and at the national level and local white backlash against the Union and African Americans attempting to achieve equality. Many of the examples Suri consulted are not new to the conversation. His discussion on the Freedmen's Bureau, in particular, is remarkably ordinary; it emphasizes only local white backlash to Bureau workers and African Americans trying to obtain employment, education, and opportunity. Though it does work well in tandem with multiple other instances and examples in the book, many of Suri's assertions will not surprise anyone in his audience who has studied this topic.

This is not to suggest there is nothing of value in Suri's book. Quite the contrary; one of his early chapters sheds light on an often-undiscussed subject of post-Civil War history. Following the war, many Confederate military leaders were given the choice of staying in the U.S. to be

captured or flee. Suri discusses a large number of Confederates who went to Mexico. These Confederates, such as Matthew Maury, even offered their allegiance to the French who ruled Mexico at the time and to Emperor Maximilian I, in the hopes that they could reintroduce slavery and colonialism across Mexico. While this sojourn was brief (the Mexican people revolted, kicked out the French, and executed Maximilian), it does well to support Suri's thesis that many former Confederates stood by white supremacy to the very end.

Suri is successfully able to shock and anger his audience by explaining how many former Confederates were welcomed back into the U.S. with open arms, including some of the people he discusses who fled to Mexico. Dozens of Confederates avoided any real punishment after the war; many ended up local war heroes, and even politicians at the state and federal level. Some of them—unsurprisingly—used these new platforms to advocate for white supremacy throughout the country and did their best to stifle the efforts of the Union and African Americans towards equality. Perhaps the best example Suri gives is the Terrell Legislation Law, passed by a former Confederate of the same name, that restricted voting in Texas primary elections only to white voters. Suri then articulates this point by accentuating the long-lasting nature of white supremacy and its respective policies; the Terrell Legislation Law was not abolished until the 1950s.

Suri often strays from his point that white supremacy is ever apparent in American society. While Suri does include interesting ideas—the less-famous presidency of James Garfield is an interesting touch—many of them feel simply like the ideas other Civil War and Reconstruction historians assembled and transcribed into more accessible language for a wider audience. The example given about the Terrell Legislation Law is one of only a few instances where Suri sticks to his thesis. One real example Suri gives is the January 6, 2021, attack on the Capitol; the rest of history following the 1890s Suri presents is allusion to racial inequality and injustice. Simply put, the book would offer a much more prescient argument if Suri offered more examples of the legacy and continued attack of white supremacy on the United States and on equality. As such, those who are unfamiliar with the Civil War and Reconstruction will no doubt find this book illuminating, but many who know most of this story will be primarily interested in only a few chapters.

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OUR TROUBLED PATHS

McDermott, Michael. (2022). *Scars From Another Life: A Memoir.* Pauper Sky. https://michael-mcdermott.com/product/822636 285 pages. Softcover $40.00 online.

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Reviewer Note: Shawn Schumacher, PhD. Senior Professor English and Humanities at DeVry University, Addison, IL.

Michael McDermott is a Chicago-based singer-songwriter who knows full well the successes and challenges a rock and roll lifestyle can bring. McDermott has been living this harrowing life since he was just 19 years old, when his first album, *620 W. Surf*, was released in 1991. After a career which includes more than 25 album releases and spans three decades, McDermott, now 53, has published his long-anticipated memoir, *Scars From Another Life: A Memoir*, which details his often brilliant, sometimes painful, journey from the peaks of a beloved rock star to the depths of self-destruction through drugs and drink, and back to sobriety, redemption, and a new life filled with love and family.

Full disclosure: I am a Michael McDermott fan—have been since I heard his first harmonica note on *A Wall I Must Climb*, his hit single on *620 W. Surf*, more than 30 years ago. And I am grateful to him for the healing power of his words and music because as a younger, single man, I, too, had my fair share of self-destructive behaviors. On many, many occasions, McDermott's music was there to lift me, guide me, help me in becoming a better man. Through his lyrics and arrangements—which are a music lover's dream—McDermott has helped me find my own personal redemption.

McDermott's music is pure poetry; he uses tenacious metaphors, sarcastic similes, and lyrical alliteration profusely. More than anything though, McDermott is a master storyteller. His narrative lyrics rival Bob Dylan, Bruce Springsteen, and Joni Mitchell. To that point, last fall, McDermott was awarded the Tenco Award for Songwriting, founded in 1974 and named after the famous Italian singer-songwriter Luigi Tenco. It has previously been bestowed upon such celebrated singer-songwriters as Leonard Cohen, Tom Waits, Elvis Costello, Jackson Browne, and Sting.

McDermott's songwriting over the years has, in fact, gained national attention from *Rolling Stone*, *The New York Times*, and *The Wall Street Journal*, and perhaps even more significantly, after only his second album release, from best-selling horror writer Stephen King, who opined that McDermott is "possibly the greatest undiscovered rock and roll talent of the last twenty years." (King 1996) King, in fact, glowingly wrote in the liner notes of McDermott's third album, the self-titled, *Michael McDermott*:

My first listen to *Gethsemane* is one of the great events of my life as a rock music fan. It wasn't so much the record itself, good as it was, as was the man on the record. Not since I first heard Bruce Springsteen singing *Rosalita* had I heard someone who excited me so much as a listener, who turned my dials so high, who just made me feel so fucking happy to have ears. (King 1996)

Now, years later, McDermott's memoir has spellbindingly taken center stage, as it captivates the reader with his beautiful and tragic tales of his life in music, his inner demons satiated only with drugs and booze, his encounters with guns and jail, and a path of often self-inflicted pain and anguish. Through his absorbing stories, McDermott weaves a life-long image of one who knows tribulation, and in a recent interview I conducted with him, he explains that "as a writer, you spend a fair amount of time looking back and trying to make sense of it all…I needed to confront a lot of it." (Personal communication, June 13, 2023).

The chapters within his memoir, which typically are no longer than a few pages, lucidly describe his many trying moments battling substance abuse. McDermott never loses sight of where he's been nor of the depths to which he has sunk during these ghastly times; these include narratives from chapters titled "Broken From Birth," "There Was Blood Everywhere," "Got Myself a Gun," "Brett Favre and a Bag of Blow," and "Suicide Watch." McDermott's unsettling stories thoroughly and remarkably grab hold of the reader and shake him to the core, wishing for peace and calm to enter McDermott's tormented life.

During our interview, McDermott commented that writing these stories "was like drinking poison again…reliving and retraumatizing myself of all the shame I lived with." However, in hindsight, he believes the writing process was "a good thing to do…it became a sense of therapy for me." (Personal communication, June 13, 2023).

As resplendent as the narratives are in the memoir, the interchapters, which provide an alternative perspective to the main character's experience, are perhaps even more telling. McDermott, similar to John Steinbeck's style in his masterpiece *The Grapes of Wrath*, utilizes his interchapters to tell a true-to-life story of being lost and stranded in a field of strawberries in Sweden, trying to make his way back to London. In our interview, McDermott felt these interchapters were a sort of "beginning to a bad indie film." (Personal communication, June 13, 2023).

Here, in *Scars From Another Life*, we learn more of his innermost thoughts:

> My God, I'm an idiot. I have fucked things up all through my life, but this might be the quintessential blunder of all time…why am I like this? Have I always been this way? What broke me?...Why have I always gone out of the way to make things difficult for myself? (p. 55)

These interchapters shed light on McDermott's current understanding of his often cruel and selfish life choices.

McDermott's memoir, *Scars From Another Life*, is a poignant telling of his life and his troubles, leading to his redemptive present. In 2009, he married musician Heather Horton, and in July 2010, Heather gave birth to their daughter Rain, whom they call Willie. Through his family's love, understanding, and assistance, Michael has been clean and sober since 2014. He still works on his music daily and performs regularly; he and his family will be touring Italy this summer, where Willie will celebrate her 13th birthday.

McDermott concludes his final interchapter with these inward thoughts:

> I've been haunted by a lot of things. A lot of missteps, a lot of flawed decisions. We all have our crosses to bear. We all have our own reasons for carrying them….maybe it's time we put down those unnecessary crosses, stop telling those same stories to ourselves. How do our stories fit into the truth? Is there discomfort there? If so, is that discomfort growth? Remember that a lot of that baggage you, me, and all of us carry are just scars from another life (p. 281).

Michael McDermott writes of what he knows - in his music and in his memoir. It is his words, his music, and his passion that sustains him and carries him through, and when you read *Scars From Another Life*, they will help do the same for you. They most certainly have for me.

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M. McDermott, personal communication, June 13, 2023.

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