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McNAIR RESEARCH JOURNAL

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FOREWARD

Congratulations to the 2023 McNair Scholars on a wonderful summer of research... and congratulations to the McNair Program on a new, five year grant! It is amazing to realize that St. Mary's was first funded for a Ronald E. McNair Post-baccalaureate Achievement grant in 2007 and that this marks our fourth consecutive successful funding. I say it is amazing because it seems like only yesterday we were receiving the exciting news this wonderful program would be available to help St. Mary's students achieve their doctoral dreams. On the other hand, as I write this I reflect on the many scholars who have gone through the program and realize, it has been 16 years. Today, we can proudly say that the program is making a difference and that our scholars are entering and completing doctoral programs across the nation and pursuing careers in academia and industry. There is no bigger thrill than welcoming an alumnus back to campus with, "Welcome home, Dr." For many of these now accomplished individuals, the McNair summer research experience was the first step of their journey. It is now my pleasure to present the work of the 2023 McNair Scholars and I welcome you to join them in celebrating this auspicious start.

Jennifer Zwahr-Castro, PhD
Director

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Spiking frequency dependence on input current in correlation with the Leaky Integrate-and-fire neuron model



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ABSTRACT

When a neuron receives a stimulus, it will become depolarized and reach a specific threshold producing an action potential, which will fire, sending the electrical signal down the axon. In order to analyze the behavior of these neural systems and how they can be affected a model called Leaky Integrate-and-fire neuron model (LIF) was used. In this simple mathematical model, a simulation was run where the neuron's threshold was set to 4mV with a constant time interval of 500msec. A set of 7 input currents was established; (I.C.= 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7) and two different stimuli were sent from the alpha synapses, the first with a value of $\alpha=1$ and the second of $\alpha=0.5$ to the neuron. If an action potential is generated it will produce a peak above 4mv, which is counted and then divided by the time in milliseconds, this would be considered the firing rate. The firing rate (F.R.) for the first stimulus was (F.R.=0, 0, 0.016, 0.024, 0.032, 0.04, 0.048) respectively, while the second was (F.R.=0, 0, 0, 0, 0, 0.002, 0.006) respectively. The results demonstrate a clear correlation between firing rate and input current. This suggests that the action potential occurs more frequently if there is a higher input current and higher alpha synapses.

KEYWORDS

action potential, threshold, input current, firing rate, alpha synapse

The nervous system is a network of specialized, excitable cells and tissues that organizes coordinated reactions in response to sensory information. The most fundamental part of the nervous system is the neuron. Neurons are diverse in structure and function, containing a cell body, dendrites, and axons (Ludwig, et al., 2022). These electrically excitable cells receive and transmit electrical and chemical signals to target cells, tissue, and organs. This property enables them to produce and conduct electrical impulses known as action potentials in response to an input. The generation of action potentials aids in the transmission of neurological information to neighboring neurons, which is the foundation for all nerve communication.

An action potential (AP) is known as a rapid sequence of changes in the voltage across a membrane and it's an all-or-nothing event. This process has three main stages: depolarization, repolarization, and hyperpolarization. A rapid rise in potential makes the neuron depolarized by the opening of sodium ion channels within the plasma membrane. The return to resting potential is called repolarization and is mediated by the opening of potassium ion channels. The flow of potassium ions out of the cell results in a decrease in membrane potential towards the cell's resting voltage. In this state, the neuron is in a non-excited state and not receiving any synaptic

inputs, reaching around -70mV , which indicates the inside of the neuron is 70mV less than the outside. Lastly, the brief dip in the membrane potential below the normal resting voltage is called hyperpolarization (Grider et al., 2023). The threshold depends crucially on the shape of the sodium activation function near spike initiation (about -55 mV), while its parameters are adjusted near half-activation voltage (about -30 mV) (Platkiewicz & Brette, 2010). Another factor in the neuron's spiking frequency is the Alpha Synapse, which is a Transmitter released from presynaptic terminals and it binds to postsynaptic receptors typically causes a conductance increase for one or more ions. While the Membrane Time Constant (τ) describes the rate at which the membrane potential leaks or decays over time. This is determined by the capacitance of the neuron's membrane and the resistance of the leakage channels. A larger time constant results in slower decay. The value of that threshold sets the firing rate and determines the way neurons compute. The neuronal firing rate is defined as the number of spikes, divided by the duration of given spikes in a time interval (Tomar, 2019).

The Leaky integrated-and-fire model (LIF) is a simple mathematical model used to describe the behavior of neurons, as well as the membrane potential of a neuron in terms of the synaptic inputs and the injected current that it receives. This model helps to represent a neuron as an electrical circuit with a capacitor and a resistor. It integrates incoming synaptic currents and generates an output spike when the membrane potential reaches a certain threshold. Then, it resets to a reset potential value (V_{reset}) for a refractory period, which is a short period of time where the neuron is insensitive to input. After the refractory period, the membrane potential starts integrating incoming synaptic currents again until it reaches the threshold, and the process repeats (Tempesta, 2013).

The LIF model provides a practical and simplified framework for studying neuronal activity and network dynamics. By systematically varying the input current and measuring the corresponding firing rates, it would be possible to determine if there is a consistent relationship between the two variables. Statistical analysis could be performed to assess the significance of the relationship and to quantify the strength of the association.

Previous researchers have widely documented a broad range of methods and approaches used for estimating neural firing rates (Cunningham, 2009). Existing models briefly summarize the technical aspects of using the LIF model to explain questions such as spike-frequency adaptation and the correlations between pairs of excitatory or inhibitory inputs.

In this study we will dive deeper into the leaky integrate-and-fire model and action potentials, examining their dynamics and significance in neuronal communication and information processing. As well as comparing methods to obtain the most optimal firing rate.

Hypothesis 1: Higher α -value will produce a higher firing rate at a lower input current. A lower α -value will need a higher input current to produce a firing rate.

Hypothesis 2: The firing rate of neurons increases in a graded manner as the input current exceeds a specific threshold.

Method

Research Design

The programming system, MatLab, was used to test the research hypotheses. A range of variables were modified under different stimulation conditions, including: the input current and α -value. The study also systematically examined the interspike interval distributions generated by spiking neuron models receiving fluctuating inputs and adaptation

Procedure

Specific measurements and coding were used, as shown in Table 1. Each line in the code represented the functions of a neuron when generating an action potential. The established threshold for this study was 4mV with a time interval of 500msec, these represent the constant.

The first data set observed were in relation to two different α -values ($\alpha=1$ and 0.5), which represent the independent variable. The dependent variable was the input current (I.C.=0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.6, 0.7). The action potentials generated created a peak, each peak was counted and then divided by the time interval (500ms) to obtain the firing rate. This procedure was repeated twice, the first with $\alpha=1$ and the dependent input current values as shown in Table 2. The second with $\alpha=0.5$ and the dependent input current values, as shown in Table 3. However, due to the low firing rate results obtained from Table 3, this procedure was conducted again but with higher input currents (I.C.=0.8, 0.9, 1.0, 2.0, 3.0, 4.0, 5.0) and with $\alpha=0.5$, as shown in Table 4.

The next data set observed was in relation to two input currents (I.C.=0.4 and 0.8), which are the independent variables. The dependent variables are the alpha values ($\alpha=0.5, 0.6, 0.7, 0.8, 0.9, 1.0, 2.0$). The action potentials (peaks) produced by this simulation were counted and then divided by the time interval to obtain the firing rate. This procedure was repeated twice, first with I.C.=0.4 and the dependent alpha values, as shown in Table 5. The second with I.C.=0.8 and the dependent alpha values as shown in Table 6.

Results

Higher alpha synapse presented a higher probability for an action potential to be generated at a lower input current. In comparison, a lower alpha synapse needed a higher input current to produce an action potential. When comparing how much input current is needed for $\alpha=1$ and $\alpha=0.5$ to generate an action potential, Figure 1 shows $\alpha=1$ begins to generate an AP at the lowest input current of 0.3 and produces a firing rate of 0.016. While in Figure 2, $\alpha=0.5$ doesn't generate an AP until input current of 0.6 and produces a firing rate of 0.002. Therefore, another subset of higher input current values was used for $\alpha=0.5$, as shown in Table 4, in order to achieve similar firing rate values as $\alpha=1$. Figure 3 shows an $\alpha=0.5$ with higher a I.C. generates AP immediately.

Furthermore, in the second simulation conducted where the input current is a constant and the alpha values varied as shown in Table 5 and Table 6. The results obtained from both of these tables were compared in Figure 4, viewing the α -Values vs Firing Rate. The outcome indicates that as the α -values increase, so will the firing rate. However, the one with a higher input current will have a higher firing rate at a lower α -values.

Discussion

The relationship between firing rate and input current is crucial for unraveling the mechanisms underlying information processing in the brain. The purpose of the Leaky integrated-and-fire model (LIF) is to examine the level of input current required to trigger an action potential and produce a high firing rate.

The relationship between firing rate and input current initially begins with a small change in input current leading to a larger change in firing rate, which can be seen as a steep slope in Figure 1. As the input current continues to increase, the firing rate eventually saturates, reaching a maximum firing rate. Beyond this point, further increases in input current have minimal effect on the firing rate.

The data obtained supported the hypothesis, which demonstrates that with a lower α -value, neurons need to send a higher input current to produce an AP. However, having a high α -value will spike more AP at a higher rate and at a lower input current.

Limitations and Future Directions

These are a variety of limitations that are important to consider. For instance, when measuring firing rates, such as extracellular recordings, the results may not provide precise information about individual neuron firing rates and may be limited to studying a small number of neurons at a time. This can affect the accuracy and reliability of the obtained firing rate measurements. Neural circuits are very complex and do not work in isolation. The firing rate of a neuron is influenced by inputs from other neurons and the network dynamics. Studying firing rates in isolation may not capture the full complexity of neural circuit operations, including feedback loops, lateral interactions, and synaptic plasticity. Thus, focusing solely on firing rates may oversimplify the information processing occurring within neural networks.

Despite the limitations, studying firing rates remains a valuable approach for investigating neural activity and understanding aspects of information processing in the brain. Combining firing rate analyses with other techniques can help overcome some of these limitations and provide a more comprehensive understanding of neuronal dynamics and their functional significance.

Conclusion

The overall study examined the relationship between input current and firing rate, as well as how the influence of having a higher or lower alpha synapse can affect the generation of action potentials. The firing rate can be influenced by various factors, which indicates that by altering factors such as input current, alpha synapse, and even time interval, the firing rate of a neuron can be easily modulated to obtain a specific outcome wanted.

Understanding the mechanisms behind action potentials and their relationship with the leaky integrate-and-fire model provides valuable insights into the fundamental principles of neural computation and the functioning of neural networks. By studying the LIF model, to understand how neurons process and transmit information, can be explored, contributing to advancements in fields such as neuroscience, cognitive science, and artificial intelligence.

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How do Gender and Geographical Location Impact Sentencing Reform?



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ABSTRACT

Making a distinguishing line between individuals and how the law maintains it emphasizes a cognitive ideal of a preferable outcome in the Justice system. Polarizing appeals to the exterior and inner concept of the method that the Criminal System should genuinely implement. The primary idea that the Criminal Justice system in the U.S. targets it also depends on the location where offenses are committed and go based on the gender of the suspect. Earliest as the 1980s, it has been proven that the total average exonerating cases of individuals, most surrounding minority groups, that were wrongfully convicted under the U.S. judicial branch, 27,200+ of those cases were proven to have been misled. Addressing implementations of extraordinary progressive sentencing guidelines has depicted that more than half of the population cannot maintain blame for nonresponding policies that keep oppressing and neglecting both male and female groups.

Utilizing sources of two distinct sides of the U.S. that depict relatively high or low rates from 1984 - 2023. A comparative response was obtained throughout Southern and Western sources' incarceration and prison population rates. The Southern side depicts an increase in incarceration and population even when utilizing sentencing guidelines under the SRA, deferring from the Western side of the U.S., depicting a lower incarceration and population outcome when following an SRA guideline across prison facilities. Men and women could be affected differently by the system under the SRA policies that depend on the location that the Sentencing Reform Act has had over the decades upon the system, which was inferred after obtaining the information.

KEYWORDS

Sentencing Reform Act (SRA), geographical reference to southern and western states, gender impact on SRA

Introduction

What could the United States of America do to enhance more than the security of the people? To build more than regulations that have taken advantage of people and profoundly impact the system that has constantly betrayed American society. The Sentencing Reform Act (SRA) the act that began a new method within sentencing practices. Which primary purposes surround the establishment of comprehensive and coordinated regulated sentencing authority; it addresses unlawful sentencing disparity while enhancing crime control through a sentencing commission system in which sentencing guidelines are expected to be periodically updated. Lastly, the SRA created conditions for constructing data distributed within the sentencing commission that

coordinates the research that's done regarding sentencing and education that also provides constant advice to the state based on knowledge about criminal behavior (U.S. Sentencing Commission, 2See S. Rep. No. 225, 98th Cong., 1st Sess. 37-39, 65, 161-62, 1983). Through the information and innovation that the SRA has brought into the Criminal Justice system, many are still questioning what the act has genuinely brought into the U.S. and, if so, how does the reform truly changed American society, groups, and communities.

Gender conflicts are another focus of the SRA, which depends on the state that an offense issued is being recorded by the individual under the custody of the law/police. From the primary stages of the SRA, the overall ideal perception of introducing a new method of punishment and regulatory law policies was to "eliminate sentencing disparities and state explicitly that race, gender, ethnicity, and income should not affect the sentence length." (Mustard, 2001, pp. 285-286). Considering the newly incorporated sentencing guidelines of the SRA took implementation until 1984, when all federal offenses committed on or after November 1st, 1987, such guidelines were going to be applied. Following into current years, the knowledge that has been provided by earlier and recent studies concerning the SRA has opened up several research questions that lead to the questioning of whether or not the guidelines reduce sentencing differences (Racial, Ethnic, and Gender Disparities in Sentencing: Evidence from the U.S. Federal Courts, 2001). Maintaining an increasing rate of reports that involve the arrest of several individuals that are made under the superficial and generic appearance scope, and while that serves as a general identification aid for law enforcement, it also allows for unlawful arrests.

Location is another focus, whereas several guidelines are affected, scripted, and collected differently than they would usually be approached in areas many might be familiar with. Geographical locations utilize several factors that have been affecting or could worsen the stability of the states, with the notion of movements also helping when newly established policies expanded on the protection of ongoing societal issues (The Role of Gender in a Structured Sentencing System, 1994). Areas within the U.S. are governed by different political outlooks that usually influence the methods by which the overall system carries law guidelines. Depending on the area of focus, whether that is the Northern, Southern, Eastern, and or Western side of the U.S., each has their manner of listening and including procedures that react negatively or positively against a crime. Most notoriously known for their disagreement perspectives on lawful procedures, the Southern and the Western areas of the U.S. will be geographical locations that will be looked into in this study.

Literature Review

Looking into the effects that each factor, gender, and geographical effect, has on the SRA historical development and what the act has taken into effect. The study will be breaking down the articles used to contribute to the expansion of the study, where a historical background section will be devoted to the process of eth SRA at the beginning of this review. Directing the study into the geographical areas that will focus on the Southern and the Western states of the U.S. and detailing the difference in sentencing results for both areas. Moving onto gender, a detailed and profound description of how men and women both have different outcomes within

the system, explicitly under SRA-related guidelines, will be included by the statistical references related to the Southern and Western states of the U.S.

A. Earlier Stages of the SRA (1971-1984)

Reference as the SRA (short for Sentencing Reform Act) establishes the task of implementing sentencing policies and practices in two primary manners, by promulgating while regularly amending the federal sentencing guidelines and by releasing reports that will serve Congress with recommendations regarding possible changes that should be made in the Federal Legislation sentencing spectrum (U.S. Sentencing Commission, 2020). Tracking back to the beginning of the SRA, January 1971, an issue report was initiated by the Brown Commission voicing requests on recommendations that could potentially allow progression on the function of law implementation upon offenses and the severity that each offense should be carried by the law (U.S. Sentencing Commission, n.d.). From 1971-1974 the Senate Subcommittee on Criminal Laws and Procedures took into consideration the proposals submitted by the Brown Commission, progressing onto the subcommittee hearings that focused on two legislative proposals: the CJ Codification, Revision, and Reform Act (RA) and the Criminal Code RA of 1973(USSC, 1991). There was no mention of a sentencing commission or guidelines until May 14th, 1976, when the Parole Commission and Reorganization Act was validated (U.S. Sentencing Commission, n.d.). From the year 1977-1978, there were several drafts of sentencing guidelines proposed by Senator McClellan and Sen Kennedy, Senator and sponsor of Congress, that were reported to cause more issues within the attempt of re-codifying sentencing guidelines and were negated to uphold any further action (USSC, 1991).

In 1979-1980, the Criminal Code Reform Act was partitioned into the system, created a sentencing commission, and abolished parole while implementing the idea of supervised release. In 1980 The House Judiciary Committee passed a sentencing bill, bill H.R. 6915, which proposes the publication of guidelines; The Judicial Conference Committee on Sentencing goes against the promulgated guidelines causing the parole proposal to be retained (USSC, 1991). After the Committee approved a sentencing bill, a comprehensive criminal code report was revised by 1985, though no action was taken by the Senate (USSC, 1991). Come 1983 and until 1984, American Politician and representative of South Carolina, Storm Thurmond and Paul Laxalt, American attorney, politician, ex-governor of Nevada, and former U.S. senator, introduced the crime control legislation that contains the sentencing reform as Title II (U.S. Sentencing Commission, n.d.). Completing a cycle of constant dispute over the method to implement upon both men and women found guilty of unlawful actions. However, it would be up to the states to embody such revolutionary sentencing guidelines and other imprisonment care for the inmates.

SRA Taking Action in the 20th Century

Because of the SRA, in the earlier implementations of law guidelines within the U.S., the development to the adjustment of historically claimed "progressive lawful regulations" took and continuously maintained as a benign perception within sentencing procedures (America Bar Association, 2004). The United States v. Booker case is an example of the further development of the SRA guidelines, which were written based on proposals for guidelines surrounding the

mid/late 19th-century sentencing issues. Following the SRA procedures, the Federal Sentencing Guidelines handled the respondent Booker's drug case terribly, where the presented evidence at the official sentencing hearing was found to be more significant facts that added to the original verdict of Booker's case (543 U.S., 2005). Due to the additional facts that were later on released to the court, Freddie J. Booker's original verdict of submitting him to a 360-month and or life sentence difference punishment, the judge gave Booker a 30 years sentence rather than a 21-year sentence or a 10th-month sentence that could have been adequately imposed based of the additional facts that where later on brought to the jury beyond reasonable doubt evidence (543 U.S., 2005). Granting of varus other unreported cases that till this day have been affected negatively by the guidelines implemented by the passing of the SRA bill differs from the other side that of the positively impacted areas within the U.S that have utilized the guidelines to place progression within the prison system.

B. Geographical Areas

The United States has been historically known to provide American societies with multiple perspectives on how a state should care for the people. However, the ideal method always separates a unifying systematic unification within the Criminal Justice system. This section of the research will emphasize two particular areas in the United States, comparing the sentencing rates of the Southern and Western states, both areas notoriously recognized by their different political stands. Polarizing citizens' perspectives and reactions to guidelines affect the outcomes of specific SRA regulations within their implementation procedures.

Southern States impacted by the SRA

like TX, OK, AR, LA, MS, AL, TN, KY, WV, VA, DE, MD, DC, NC, SC, GA, and FL, are within the Southern hemisphere of the United States, were their imprisonment rates throughout the years 1980 to the 20th Century, especially up to the year 2020, depict extreme recordings within the prison population. With Texas and Florida depicting the primary scale representation of prison population within the recordings from 1980-2020, Texas held a rate of 29,892 prison population as in 1980, leading to the year 2022 reaching a 134,345 scale of the overall prison population (The Sentencing Project, 2020). Texas exceeds the rates of Florida, with an overall 20,211 prison population rate as of 1980 by the year 2020; Florida reaches 81,027 rates within their prison rates (The Sentencing Project, 2020). Utilizing only the views of Texas and Florida between 1980-2020 depicts an outline of development that the SRA played upon Southern U.S. states when the Supreme Court adopted the bill from 1984 to the 20th Century (Congressional et al., 2023). Implementations of the Sentencing Reform Act in several states across the Southern area of the U.S. can be seen in Table No. 1 in the Method and Procedure section.

Western States Impacted by the SRA

Western sites like NM, AZ, CO, UT, WY, MT, ID, NV, CA, OR, WA, AK, and HI represent another prison population rate recorded from 1980 to the 20th Century, explicitly interpreting 2020 rates. Portraying relatively minimized prison population rates leaves California with the only highly expressive population scale. From 1980 CA had a 23,284 rate, and as of

2020, the prison population scales stood at a 97,319 result (The Sentencing Project, 2020). Further inspecting the U.S. growth in mass incarceration rates, the primary reason behind the peaking results on the prison population, mainly focusing on the Southern and Western states, is due to the constant changes that there is in sentencing law and policy associated with the SRA (The Sentencing Project, 2020). Obtaining both simple statistical outcomes of the most high-ranking states across both Southern and Western areas of the U.S., a particular decision can be formatted out of the prison population trends that are also represented in Table No. 3 in the Method and Procedure section. Leading to the different outcomes of probably related trends in how men and women differ when being sentenced under the system, which also affects the contrasting rates of several prison facilities across the United States (Nagel, Johnson, 1994).

C. Role of Gender Disparities

Under sentencing guidelines, "A defendant's race, gender is considered an extralegal factor in decision making at the sentencing stage" (Doerner, Demuth, 2012,p.2). Many may differ on the subject of men and women being treated differently regarding sentencing outcomes or within judicial systemic concerns. The significant difference between how each gender role may be received under the system view is that in a societal matter, men and women are different in levels of responsibility (Doerner, Demuth, 2012). An increase in women in state and Federal prison records has begun to be depicted in recent years, mainly making a more remarkable appearance in 2005-2015 (The Sentencing Project, 2020). Were as the rate of men that were arrested between the late 90s to 20th Century has maintained a relatively higher percentage than the women in stats and federal prison rates, leaving most of the prison population to be 1,132,767 made up of male gender inmates as of 2020 (U.S. Department of Justice, 2021).

Further understanding the beginning stages of the Sentencing Reform Act, it is historical upbringing from intensive beginnings upon the currency of the systematical injustice, demonstrates the scope of guidelines for sentencing procedures across the United States. It affects the crime rates and implies the methods by which these guidelines are utilized and institutions within several prison facilities—raising the question of the reality of the Sentencing Reform Act regulations and the impact that such act has brought to different areas within the United States. Collectively inferring the differences in impact between two complex governing areas of the U.S., the Southern and Western locations, would depict a different scale within their incarceration and prison population rates.

Hypothesis

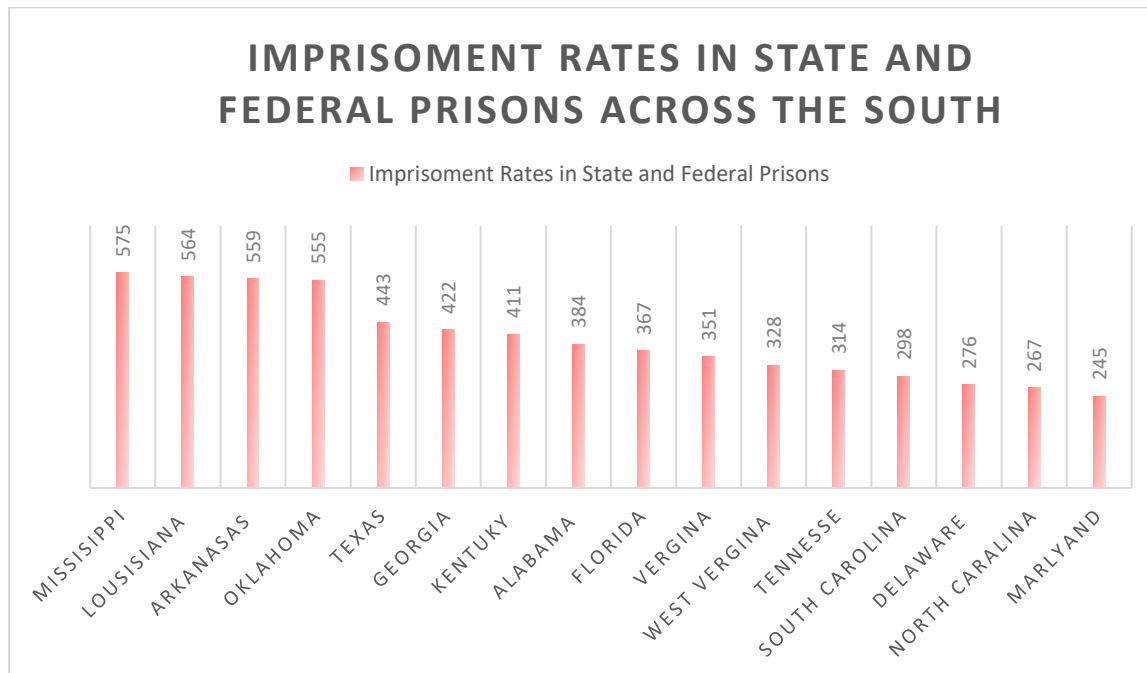
Because of the different scale rates that the USSC database provides under the implementation of the SRA regulation, the incarceration rates have had more of an increase than a decrease reaction to the SRA guidelines during the time of the sentence and after prison procedures. How do two predominantly democratic, being the western area, and republican, being the southern areas, sections of the U.S. react to the SRA guidelines within its begging stages to recent years? Meaning is there a difference in prison population rates across the U.S. Western V. Southern states acknowledging that both areas do take into consideration the reform

sentencing guidelines; if so, how do the disparities in gender complication impact the sentencing regulations? that are meant to prevent and decrease unlawful detainments and arrests.

Method and Procedure

Starting with a basic search on the Sentencing Reform Act, a more simplistic sample of the logistical timeline of the SRA contributions to the sentencing system was the beginning stages of finding a comparative variable. Leading to the finding of imprisonment rates between the southern and western areas that contribute to the geographical variable. Looking at the prison population between the geographical areas emphasized the Gender variable in this study. Thus, this study focuses on a comparative methodology utilizing existing records of past research regarding the imprisonment rates across the South and the Western states of the U.S. and the prison population records, also within Southern and Western states. By comparing each record between the southern and western outcomes of imprisonment and population rates, then depending on the area that had the least number of outcomes, it will lead to the conclusion of agreeing that the SRA does function, and gender and geographical areas do impact the way such sentencing guidelines are allowed to function to complete its purpose as a reformative act.

Graph 1

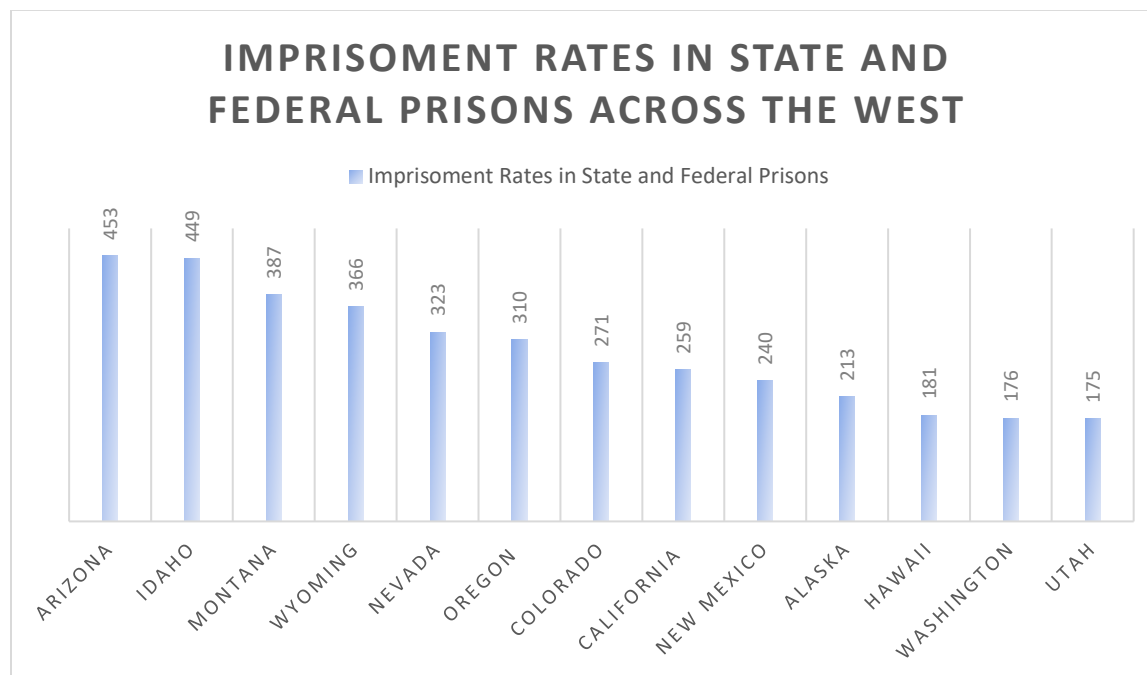


Note: Nellis (2023, p.6). Carson, E. A. (2022). Prisoners in 2021—Statistical tables. Bureau of Justice Statistics

Graph 1 depicts the outcomes of southern states that are mainly governed, by the majority, under a Republican umbrella. The information within this visual representation of imprisonment rates

in state and federal prisons states that the southern area of the U.S. does not adopt the SRA regulations as necessary to achieve a decreasing result in incarceration records. Rates have been updated from the 1920s to 2021, describing these states' need for adaptability regarding the SRA. Majorly speaking on states like MS, LA, AR, OK, TX, GA, and KY, with rates that almost surpass the 600 incarcerations of state and federal prisons rates, is another way to see the development to seek a better sentencing procedure that would involve both men and women. The southern area of the U.S. entails the outcome of a representation of a lacking effect upon the SRA sentencing regulations that could prevent higher rates of imprisonment and implement reformative goals for sentencing guidelines.

Graph 2



Note: Nellis (2023, p.6). Carson, E. A. (2022). Prisoners in 2021—Statistical tables. Bureau of Justice Statistics

Graph 2 utilizes the same database as Table 1 (Nellis, 2023). However, this research side focuses on Western states only, though the same objective remains the same as in Table 1. The imprisonment rates are relatively lower than the records originating from the southern states, utilizing CA and ID as the leading states with the highest rate of imprisonment records, only

reaching up to the 400s of imprisonment reports. Understanding the SRA representation across these states depicts the usage of the guidelines within the sentencing procedures allowing these states to see less of a pattern when it comes to imprisonment rates. Both men and women are equally as affected in these regions of the U.S. because there is less space for the judicial system to lack the beyond reasonable doubt evidence outcome producers, which could be proven by the fact in Tables 1 and 2. Recognizing that relatively democratically influenced states have been expressing more remarkable improvement in the rates of imprisonment within state and federal prison facilities, it entails a more significant usage of reformative regulations within these facilities, decreasing the rates of imprisonment and, at the same time, improving the system.

Table 3

Comparison Between Southern and Western Prison Populations Southern

| Southern | 1980-2020 | Western | 1980-2020 |
|----------|------------------|---------|----------------|
| TX | 29,892 – 134,345 | NM | 1,199 – 5,433 |
| OK | 4,796 – 22,309 | AZ | 4,360 – 37,101 |
| AR | 4,360 – 37,101 | CO | 2,609 – 16,168 |
| LA | 8,889 – 26,984 | UT | 928 – 5,441 |
| MS | 3,793 – 17,311 | WY | 534 – 2,087 |
| AL | 6,368 – 19,608 | MT | 738 – 3,927 |
| TN | 7,022 – 22,685 | ID | 817 – 7,343 |
| KY | 3,588 – 18,552 | NV | 1,839 – 11,422 |
| WV | 1,257 – 6,044 | CA | 3,264 – 97,319 |
| VA | 8,581 – 31,838 | OR | 3,172 – 12,747 |
| DE | 1,087 – 3,118 | WA | 4,399 – 15,689 |
| MD | 7,731 – 15,602 | AK | 624 – 2,740 |
| NC | 14,456 – 28,881 | HI | 624 – 2,740 |
| SC | 7,427 – 15,984 | | |
| GA | 11,922 – 46,574 | | |
| FL | 20,211 – 81,027 | | |

Note: The Sentencing Project (2020). The Sentencing Project (EIN 52-1472546) is a registered 501(c)(3) nonprofit organization.

Table 3 visually represents the comparison found between the rates of the South and West states prison population over the years 1980-the 20th Century, limiting to the year 2020, detailing both men and women that have been imprisoned and are currently part of the system under law. Utilizing the secondary primary source (The Sentencing Project,2020) allowed the research to expand on the knowledge of the SRA's impact on the prison population and how that variable also leads to the central question of whether or not geographical area influences and or impacts the SRA. Over the years 1980 to the year 2020, the rates in the southern area specifically possess the highest rate of the population within prison facilities already implementing sentencing guidelines under which most inmates were sentenced. Though as for the western areas, acknowledging that there are fewer states, the prison population is maintained as the lowest rate due to the procedure most western states utilize when sentencing an individual, leading to a more significant improvement in regulations for both sexes. Overall answering the

question of gender impact on SRA that would ultimately stand as equivalent to the matter of the importance of the geographical area.

Limitations and Recommendations

Finalizing the research on whether or not gender and geographical areas matter to the impact of the Sentencing Reform Act, overall, the procedure of obtaining such information was at times harsh due to the lack of specific acknowledgment of gender disparity issues within the prison system. Several bumps were found while gathering articles that emphasized the gender scope sentencing conflicts, with a narrowed view on the southern and western states of the United States alongside difficulties with gathering related articles. The variables that depended on the opposite context than the question being researched were another part of the limitations that came along the process, which complicated the exactitude of the records. However, the primary sources utilized for each of the graphs and table provided good plotting points to keep in mind when expanding the critical points of geography and gender, one being a political influence on how SRA regulations are received in other areas of the United States.

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Addressing Missingness in Longitudinal Data: Accommodating for Type I Error in Optimal T



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ABSTRACT

Missingness interferes with practitioners' ability to accurately interpret the results of their studies. This is especially true in within-subjects designs as a study with a sufficiently large original sample size might net a much smaller set of complete cases once missingness is taken into account. Contemporary solutions to dealing with missingness, such as regression and multiple imputation, have focused on replacing missing values. Methods such as these that replace missing values rather than delete cases altogether preserve sample size, but they also require a level of sophistication that far exceeds what practitioners can reasonably be expected to have.

Recent research has supported the use of between-subjects methods in within-subject scenarios as a means by which to manage missingness in a highly accessible manner. The present study builds on this earlier research by considering whether a new strategy, Optimal t, maintains statistical power in the face of missingness without artificially inflating alpha. Optimal t selects the better option between a paired samples and an independent samples t-test based on simulated trials. Initial research has supported the use of Optimal t, although there has been some concern about inflated Type I error rates (Sperling et al., 2023). In this study, a correction formula is introduced which adjusts p-values in proportion to sample size and compared the results against original Optimal t, paired samples t-test and independent samples t-test. Results suggest that original Optimal t outperforms all other options across conditions. Implications for practice and recommendations for further research are provided.

KEYWORDS

t-test, independent-sample t-test, paired-sample t-test, missing data

In practitioner settings, there are many variables that can influence the outcome of statistical tests meant to identify the progress of the participants throughout time. Missingness is a problem that has significant consequences for practitioners seeking to identify whether interventions have had an impact on targeted outcomes. For example, teachers who have changed some aspect of their pedagogy or curriculum may not be able to determine whether their students improved or worsened over time if a large share failed to contribute data at all measurement points.

The risk of missingness is not equally distributed across all situations, especially in educational settings. Students who are more prone to absenteeism are more likely to miss one or more measurement points, and since absenteeism correlates with student characteristics, such as social class and ability status, disparate impact cannot be ruled out. Addressing missingness is

thus a social justice issue that must be addressed to ensure that empirical findings are accurate and applicable to students without respect to social identities and intersectionalities.

In the present paper the statistical rationale for worrying about missingness is explained. Then it is also explained how missing data have been handled previously, as well as the limitations of different methods of managing the problem. One of those methods, Optimal t , has recently been presented as means of capitalizing on the advantages of the paired samples and the independent samples t -test to produce trustworthy results. An explanation of how Optimal t works, an examination of the downside of relying on it, and proposed correction formula to overcome that limitation are provided.

Popular Methods of Managing Missingness

The vast literature on missing data can be organized into three basic groups. The first can be considered “deletion methods” and focuses on retaining only those cases which are complete. Listwise deletion involves the extraction of cases in which one or more observations are missing. Many times, the decision to eliminate data in a listwise fashion is viable, other times the deletion of data causes the sample to become too small for proper analysis. The exclusion of a high proportion of the cases from the analysis can greatly reduce statistical power. It is most notable in longitudinal studies, an experimental design that that studies a variable or variables in the same case or from the same participants for a period of time (*APA Dictionary of Psychology*, n.d.), if the listwise deletion that is accounting for the missingness decrease the once sufficient sample to a much smaller pool. By contrast, pairwise deletion only eliminates cases in which the variable in question has missingness. Unfortunately, in longitudinal designs with a single dependent variable, pairwise deletion collapses into listwise deletion at the omnibus level.

The second group consists of “imputation methods.” These approaches use existing information to make educated guesses about what a missing score would have been had it been provided. Examples of imputation methods include mean substitution (all missing values are replaced with the group mean on the variable), regression methods (missing data are replaced based on a predicted score calculated differently for each case based on other existing scores on other variables), and multiple imputation (missing data are replaced using regression methods that build in variability across like cases). From these imputation methods, the current most popular method of dealing with missing data is multiple imputation (Sauro, 2015). The obvious advantage of imputation methods over deletion methods is the preservation of statistical power due to the inclusion of all available data. However, this is a very sophisticated way of dealing with missingness (Kang, 2013). However, there are all so cons associated with imputation methods, such as suppression of variance in the case of mean substitution and, to a certain extent regression, and the level of statistical sophistication necessary to use and interpret them in the case of multiple imputation. What’s more, imputation methods also require a leap of faith in the sense that subsequent analyses are performed on “fake” data—that is, imputed data are best estimates, but they were not actually contributed by research participants.

The third option can be referred to as “test-level” methods. Whereas deletion and imputation methods focus on how to handle missing values, test-level methods ignore individual cases and instead focus on the results of hypothesis testing. T-tests in statistical analysis is used to evaluate the difference between means of different populations in hypothesis testing (Glen, 2023). The original test-level method was introduced by (Sperling, Cruz, & Zwahr-Castro, 2017) and involved the use of an independent samples t -test, a statistical test used to compare the

means of two independent groups, for a within-subjects design. A similar approach extended the independent samples approach to situations in which there are three or more measurement points and involved the application of a one-way ANOVA rather than the more traditional repeated-measures ANOVA. The available research on test-level methods suggests that the independent samples t-test and one-way ANOVA are more powerful than the paired samples t-test and repeated-measures ANOVA in certain situations, such as when the correlation between time points is low and missingness is high.

Sperling et al (2023) attempted to improve on the use of the independent samples t-test in within-subjects scenarios through the use of Optimal t . The Optimal t test offers the decision based on the samples that are being compared. The principal motivating factor behind Optimal t has to do with the challenge of deciding when to use a traditional within-subjects approach, such as a paired-samples t-test, and when to use a between-subjects test, such as an independent samples t-test. In order to reap the benefits of the test-level approach, practitioners must calculate the correlation between measurement points and the proportion of missingness and then compare that information against a set of guidelines. It seems inconsistent with the original goal of Optimal t vis-à-vis imputation methods—that is, to improve accessibility—to require that practitioners take these extra steps.

Summary and Hypothesis

Missingness can have a profound impact on the accuracy of conclusions drawn from null hypothesis testing. This is especially common in within-subjects, longitudinal designs. In longitudinal studies, studies where a population is monitored for a long period of time, data is compared to previous data from the same population to see if there are correlations within the data and find possible cause-and-effect relationships. Since variables are not being manipulated during longitudinal studies, there is a reliance on continuous data coming from the subject(s) in the study. Longitudinal studies tend to be applied in research focusing on behaviors, thoughts, and emotions throughout the lifetime (Simkus, 2023), and because of this some missing data does not affect the results significantly. Once there is an increase in missingness of data then the statistical power of the test results as well as creating skewed and biased data (Kang, 2013).

Previous research on missing data in longitudinal studies mainly focuses on maximum likelihood methods of dealing with missingness and assumes that there is a normally distributed outcome (Ibrahim & Molenberghs, 2009). Existing methods of dealing with missingness have limitations that should not be overlooked. Deletion methods can result in small sample sizes and attenuated statistical power. Imputation methods rely on manufactured data and demand that practitioners have an advanced understanding of statistics in order to be used correctly. Newer methods that address missingness through approaches commonly associated with between-subjects scenarios can preserve sample size and statistical power, but they require that practitioners know when to use each type of test. An attempt to simplify the process, referred to as Optimal t , has been shown to maintain statistical power, but can also lead to inflated Type I error.

The present study compares deletion methods with Optimal t and Optimal t with an adjustment factor that corrects for bias related to sample size. Based on previous literature and the expected effect the correction formula will have, I have the following hypotheses:

H1: Adjusted Optimal t produces greater statistical power.

H2: Adjusted Optimal t has lower Type I error than Original Optimal t .

Method

To test the research hypothesis, the Monte Carlo simulation was conducted using the R statistical software. The sole independent variable was the type of t-test (independent, paired, original Optimal t , adjusted Optimal t) applied to input data across 81 different conditions that varied by mean difference, magnitude of correlation, and proportion of missingness.

Procedure

Data sets of 1000 (i.e., pretest and posttest) for each of 81 conditions were produced using the *mvrnorm* function in the MASS of R. Each dataset varied across sample size ($n = 30, 60, 90$), missingness (missingness = 0%, 15%, 30%), correlation ($r = 0, 0.15, 0.3$), and mean differences (mean difference = 0, 0.25 SD , 0.5 SD). All missingness was imputed using the *prdNA* function found in the *missForest* package of R and was specified to be missing completely at random (MCAR).

A paired sample t-test and an independent sample t-test was performed for each of the 1000 simulated datasets, then based on the observed results, the type of test (either independent samples or paired samples) that tallied the most rejections of the null hypothesis at $p = 0.05$ was then applied to the original data. The results from that t-test constitute Optimal t . To produce adjusted Optimal t , 90 was divided by the sample size multiplied by 1000 and added to the observed p from the original Optimal t .

Dependent Variables

There were two dependent variables of interest in this study: statistical power and Type I error. Statistical power is defined as the ability to correctly reject a false null hypothesis. Therefore, for the purposes of this study, it was possible to perfectly measure statistical power by counting the number of times a particular test produced a p -value less than 0.05 in conditions in which the known population mean was greater than 0.

Type I is the false rejection of a true null hypothesis. Like statistical power, it was possible to perfectly measure Type I error because the simulated sample data were drawn from populations with known parameters. Consequently, Type I error was evident when a particular test produced a p -value less than 0.05 when the simulated samples were drawn from the same population (i.e., mean difference = 0).

Results

Tables 1-3 contain the results of my simulation study separated by correlation level ($r = 0, 0.15, 0.30$). As expected, the original Optimal t resulted in the highest statistical power across all conditions followed by the independent samples t-test, adjusted Optimal t , and finally the paired samples t-test. More pertinent to my hypothesis, however, is that adjusted Optimal t failed to achieve the highest statistical power in any of the 81 conditions.

Table 1*Statistical power at Correlation = 0*

| Mean Difference | Missingness | n | Paired t test | Independent t test | Optimal t | Adjusted | |
|-----------------|-------------|----|---------------|--------------------|-----------|----------|--------|
| 0 SD | 0% | 30 | 0.0488 | 0.0483 | 0.0533** | 0.0501** | |
| | | 50 | 0.0464 | 0.0463 | 0.0497 | 0.0476 | |
| | | 90 | 0.0512** | 0.0513** | 0.0541** | 0.0523** | |
| | 15% | 30 | 0.0532** | 0.0528** | 0.0584** | 0.055** | |
| | | 50 | 0.0504** | 0.0503** | 0.0536** | 0.0504** | |
| | | 90 | 0.0514** | 0.0518** | 0.0541** | 0.0522** | |
| | 30% | 30 | 0.0472 | 0.0477 | 0.0539** | 0.047 | |
| | | 50 | 0.0449 | 0.0469 | 0.0493 | 0.0461 | |
| | | 90 | 0.0489 | 0.0494 | 0.0522** | 0.0506** | |
| | 0.25 SD | 0% | 30 | 0.1556 | 0.1655 | 0.1738* | 0.1591 |
| | | | 50 | 0.2275 | 0.2408 | 0.2456* | 0.2308 |
| | | | 90 | 0.3798 | 0.3932 | 0.3967* | 0.3819 |
| 15% | | 30 | 0.1186 | 0.1303 | 0.1373* | 0.1221 | |
| | | 50 | 0.174 | 0.1883 | 0.1949* | 0.1805 | |
| | | 90 | 0.2845 | 0.2982 | 0.3018* | 0.2864 | |
| 30% | | 30 | 0.0941 | 0.102 | 0.1128* | 0.0984 | |
| | | 50 | 0.1313 | 0.1418 | 0.149* | 0.1336 | |
| | | 90 | 0.2098 | 0.221 | 0.2269* | 0.2117 | |
| 0.5 SD | | 0% | 30 | 0.4729 | 0.5 | 0.5109* | 0.4887 |
| | | | 50 | 0.6881 | 0.7087 | 0.7143* | 0.6999 |
| | | | 90 | 0.911 | 0.9165 | 0.9179* | 0.9131 |
| | 15% | 30 | 0.3629 | 0.3871 | 0.4038* | 0.3763 | |
| | | 50 | 0.5373 | 0.5614 | 0.5697* | 0.5495 | |
| | | 90 | 0.7969 | 0.8102 | 0.8145* | 0.8028 | |
| | 30% | 30 | 0.2467 | 0.2681 | 0.2878* | 0.2589 | |
| | | 50 | 0.3835 | 0.4091 | 0.4206* | 0.3962 | |
| | | 90 | 0.6362 | 0.6574 | 0.664* | 0.6462 | |

*Note: paired t test, independent t test, original optimal t, and revised optimal t columns show the number of times the null hypothesis has been rejected out of 1000. * represents highest statistical power across all conditions, ** represents inflated type I error across all conditions.*

Table 2*Statistical power at Correlation = 0.15*

| Mean Difference | Missingness | n | Paired t test | Independent t test | Optimal t | Adjusted |
|-----------------|-------------|----|---------------|--------------------|-----------|----------|
| 0 | 0% | 30 | 0.0491 | 0.0332 | 0.0503** | 0.0462 |
| | | 50 | 0.0485 | 0.0344 | 0.049 | 0.048 |
| | | 90 | 0.0498 | 0.0327 | 0.0499 | 0.0484 |
| | 15% | 30 | 0.0484 | 0.0339 | 0.05 | 0.0458 |
| | | 50 | 0.0506** | 0.0343 | 0.0513** | 0.0491 |
| | | 90 | 0.0486 | 0.0315 | 0.0492 | 0.0477 |
| | 30% | 30 | 0.0514** | 0.0369 | 0.0542** | 0.0467 |
| | | 50 | 0.0489 | 0.0357 | 0.0503** | 0.0477 |
| | | 90 | 0.0479 | 0.0325 | 0.0488 | 0.0472 |
| 0.25 SD | 0% | 30 | 0.1694 | 0.1691 | 0.176* | 0.1345 |
| | | 50 | 0.2607 | 0.2598 | 0.2665* | 0.2148 |
| | | 90 | 0.4276 | 0.4252 | 0.4288* | 0.3668 |
| | 15% | 30 | 0.1427 | 0.1414 | 0.15* | 0.112 |
| | | 50 | 0.2025 | 0.2033 | 0.2088* | 0.1646 |
| | | 90 | 0.3293 | 0.328 | 0.3325* | 0.2764 |
| | 30% | 30 | 0.1025 | 0.1024 | 0.1131* | 0.0832 |
| | | 50 | 0.1499 | 0.1491 | 0.1589* | 0.1207 |
| | | 90 | 0.2387 | 0.2377 | 0.2431* | 0.1946 |
| 0.5 SD | 0% | 30 | 0.5228 | 0.5269 | 0.5385* | 0.4739 |
| | | 50 | 0.7601 | 0.7614 | 0.7658* | 0.7151 |
| | | 90 | 0.9515 | 0.9505 | 0.9521* | 0.933 |
| | 15% | 30 | 0.4114 | 0.4159 | 0.4289* | 0.3648 |
| | | 50 | 0.5993 | 0.5988 | 0.6071* | 0.5442 |
| | | 90 | 0.8556 | 0.8555 | 0.859* | 0.8241 |
| | 30% | 30 | 0.2796 | 0.2823 | 0.3006* | 0.2772 |
| | | 50 | 0.442 | 0.444 | 0.4579* | 0.3956 |
| | | 90 | 0.694 | 0.6955 | 0.7018* | 0.6462 |

*Note: paired t test, independent t test, original optimal t, and revised optimal t columns show the number of times the null hypothesis has been rejected out of 1000. * represents highest statistical power across all conditions, ** represents inflated type I error across all conditions.*

Table 3

Statistical power at Correlation = 0.3

| Mean Difference | Missingness | n | Paired t test | Independent t test | Optimal t | Adjusted | |
|-----------------|-------------|----|---------------|--------------------|-----------|----------|--------|
| 0 SD | 0% | 30 | 0.0511** | 0.0214 | 0.0515** | 0.0484 | |
| | | 50 | 0.0456 | 0.0191 | 0.0457 | 0.0439 | |
| | | 90 | 0.0491 | 0.0199 | 0.0491 | 0.0481 | |
| | 15% | 30 | 0.0521** | 0.0232 | 0.0528** | 0.0478 | |
| | | 50 | 0.0485 | 0.0199 | 0.0486 | 0.0461 | |
| | | 90 | 0.0492 | 0.0203 | 0.0492 | 0.0479 | |
| | 30% | 30 | 0.051** | 0.0219 | 0.0523** | 0.0455 | |
| | | 50 | 0.0516** | 0.021 | 0.0518** | 0.0479 | |
| | | 90 | 0.048 | 0.0185 | 0.048 | 0.0464 | |
| | 0.25 SD | 0% | 30 | 0.1992 | 0.1992 | 0.1927* | 0.1135 |
| | | | 50 | 0.3089 | 0.3089 | 0.3041* | 0.1988 |
| | | | 90 | 0.5025 | 0.5025 | 0.4996* | 0.3656 |
| 15% | | 30 | 0.1509 | 0.1509 | 0.1453* | 0.0826 | |
| | | 50 | 0.2268 | 0.2268 | 0.2211* | 0.1354 | |
| | | 90 | 0.3815 | 0.3815 | 0.377* | 0.2514 | |
| 30% | | 30 | 0.1135 | 0.1135 | 0.1048* | 0.0584 | |
| | | 50 | 0.173 | 0.173 | 0.1666* | 0.1002 | |
| | | 90 | 0.2746 | 0.2746 | 0.2693* | 0.1675 | |
| 0.5 SD | | 0% | 30 | 0.6113 | 0.6027 | 0.6136* | 0.4752 |
| | | | 50 | 0.8381 | 0.8342 | 0.8385* | 0.732 |
| | | | 90 | 0.9736 | 0.9732 | 0.9736* | 0.9452 |
| | 15% | 30 | 0.4792 | 0.4708 | 0.4853* | 0.3525 | |
| | | 50 | 0.6866 | 0.6805 | 0.6881* | 0.5554 | |
| | | 90 | 0.9133 | 0.9133 | 0.9153* | 0.8466 | |
| | 30% | 30 | 0.3146 | 0.3146 | 0.3373* | 0.2237 | |
| | | 50 | 0.5078 | 0.5078 | 0.5226* | 0.3872 | |
| | | 90 | 0.7774 | 0.7774 | 0.7829* | 0.6672 | |

Note: paired t test, independent t test, original optimal t, and revised optimal t columns show the number of times the null hypothesis has been rejected out of 1000. * represents highest statistical power across all conditions, ** represents inflated type I error across all conditions.

In contrast to Hypothesis 1, My second hypothesis was supported. Original Optimal t exhibited inflated Type I error across more conditions than any other approach (conditions = 15). Paired samples t-test was next with 10, followed by adjusted Optimal t (conditions = 6), and finally independent samples t-test (conditions = 4).

Discussion

The results of my Monte Carlo simulation study partially supported my research hypotheses. The formula used to adjust for inflated Type I error rates did reduce the number of conditions in which Optimal t 's empirical Type I error exceeded the nominal Type I error. It should be noted, however, that it did not eliminate inflated Type I error altogether as conditions in which the correlation between pretest and posttest was 0 was nearly identical to original Optimal t . Furthermore, even adjusted Optimal t did not present the least risk of inflated Type I error. Both the paired sample and independent samples t-tests outperformed Optimal t regardless of whether the adjustment was used. Therefore, the advantage of adjusted Optimal t with respect to limiting inflation of Type I error should be considered marginal at best.

With respect to statistical power, the adjustment to Optimal t proved costly. Whereas original Optimal t maintained the highest statistical power across all conditions, adjusted Optimal t lagged behind. Taken together, my results suggest that the small advantage over original Optimal t in terms of reducing the risk of inflated Type I error is outweighed by the loss of statistical power regardless of mean difference, sample size, correlation between measurement points, and proportion of missingness. As it stands, the biggest decision a practitioner would have is whether to take the small gain in statistical power associated with Optimal t and assume the risk of greater than nominal Type I error or run a traditional paired samples t-test.

Limitations

There are several limitations associated with my study that need to be taken into consideration when interpreting my results. One glaring factor is my status as a novice programmer of R code. It is entirely possible that the observed results are the product of mistakes in my coding as opposed to true differences between t-tests. Replications using a similar design would lend additional credibility to the findings reported here.

Similarly, my results are tied to a specific seed (1119). The benefit of setting seed is so other researchers can perfectly replicate the random data used in a particular study. That said, replications using different seeds would create more informative confidence intervals that would enrich our understanding of how each type of t-test performs.

The conditions I chose may also be more appropriate for certain situations than others. For example, my choice of using sample sizes of 30, 60, and 90 was intended to mirror what might be found in a classroom, a grade, or a school. The relationship between sample size and the dependent variables (i.e., statistical power and Type I error) needs to be more fully vetted in order to understand if and when a particular test is superior.

Likewise, the degree of correlation might be unrealistic, especially at the upper levels. A correlation of 0.3 might not happen often in applied settings, so specifying more common values between pretests and posttests would further inform our understanding of these phenomena. Missingness values might also need to be adjusted to more closely approximate real-life conditions.

Directions for Future Research

Although my hypotheses were only partially supported, there is much to be excited about in this line of research. For starters, better rationales for adjusting Optimal t are in order. My method was based only on eyeballing previous results and hoping that an adjustment based on a sample size of 90 would be sufficient to correct for inflated Type I error. While there was some improvement in alpha rates, the problem was not completely solved and had the unintended side effect of reducing statistical power to the point where Optimal t was no longer the highest performing strategy.

Optimal t , whether with an adjustment or not, also needs to be compared against other methods of handling missing data than just paired samples t-test with listwise deletion and independent samples t-test. Modern methods, such as regression and multiple imputation, may be more complex for statistical novices, but their performance is relevant to discussions about the efficacy of Optimal t . In fact, earlier research showed that a multilevel modeling approach outperformed both one-way ANOVA and repeated-measures ANOVA with three measurement points. It could be that a parallel approach might prevail as the best in terms of statistical power and control of Type I error in situations in which two measurements are collected.

In addition to replicating across different conditions, such as sample size, correlation, mean difference, and missingness, and including a wider variety of statistical tests, it is also important to consider violations of different assumptions. Results under different types of missing (i.e., missing completely at random, missing at random, and missing not at random) would also fill gaps in the existing knowledge base. Previous research comparing independent samples to paired samples and one-way ANOVA to repeated-measures ANOVA has taken on this challenge, and the results make a more compelling case than can be made by the present study.

Finally, some thought needs to be given to the premise of null hypothesis testing and statistical power, especially as it related to data that are MCAR. The general logic behind null hypothesis testing is that inferences can be made about whether two or more samples were drawn from the same parent population based on the ratio of differences in means to total variance. Statistical power is relevant to this determination because it is assumed that larger samples are more likely to be representative of the population than smaller samples due to there being less likelihood of sampling error influencing the results. Hinging statistical decision-making on this logic automatically rejects the possibility of MCAR, which of course, is a basic assumption built into hypothesis testing across statistical tests. Thought of differently, imagine a population of 1million research participants. If one were to take a sample of 1,000 participants, but only 100 produced data, there would be no difference in the likelihood of reaching a false conclusion so long as MCAR holds because the reduced sample of 100 would be defined as equally representative of the parent population as the aspirational sample of 1,000. On the other hand, if MCAR does not hold, the notion of statistical testing on a known biased sample seems misguided. Why would one engage in a test to make inferences about a population when one already knows that the sample one is using does not represent the parent population? The solution to this conundrum seems to be found in the application of Bayesian methods to most problems that are currently addressed using null hypothesis testing.

Conclusion

Missingness cannot be ignored unless one assumes that what is missing is completely at random and that statistical power can be disregarded. That seems like an unimaginable canon to achieve in our near future. Therefore, the search for better and more accessible methods of managing missing data ought to continue. The present study adds to the literature questioning the automatic reflex of using a paired samples t-test for within-subjects data measured at two points. Although there are some disadvantages of Optimal t , there is sufficient evidence to suggest that it should be investigated further to include but not limited to a wider range of conditions and violations of assumptions, as well as against other methods for addressing missing data. Given that not all members of our community are equally affected by misinterpretations of statistical testing and the conclusions drawn from those tests, it is imperative that we continue the journey toward a more robust method of overcoming this enduring problem.

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Does Religion Affect Intimate Partner Violence on PTSD? Exploring the Role of Divine Control on Those with PTSD as a Result of Partner Violence



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ABSTRACT

Intimate partner violence is an ongoing public health issue and accounts for 15% of all violent crimes. 1 in 4 women and 1 in 9 men experience severe intimate partner violence. This can lead to impacts such as injury, fearfulness, post-traumatic stress disorder, use of victim services, and contraction of sexually transmitted diseases. Research exploring the linkages between religion and PTSD has received limited attention. Data comes from the Nashville Stress and Health Study (2011–2014), a cross-sectional probability survey of black and white adults from Davidson County, Tennessee (n = 1,252). Results indicate that those with a high belief in divine control are expected to increase individual's PTSD score. This study provides a fresh perspective on the links between partner violence and PTSD by (a) considering multiple religious and divine control variables and (b) focusing on the association between divine control and PTSD.

Introduction

Despite increased social awareness, domestic violence (DV) and intimate partner violence (IPV) continue to be prevalent and ongoing issues. The most recent data from the National Intimate Partner and Sexual Violence Survey (based on data from 2016 and 2017) tells us that over half of both male and female victims that live in the United States have experienced rape by an intimate partner in their lifetime (Kramer & Finley, 2022). It is also vital to consider that many cases often go unreported. It can be hard to find an exact figure concerning the extent of this issue.

Intimate partner violence can best be defined as behavior by an intimate partner or ex-partner that causes harm, whether it be sexual, physical, or psychological, including physical aggression, sexual coercion, psychological abuse, and controlling behaviors (World Health Organization, 2021). Domestic violence has many definitions depending on whom you are asking. Domestic violence is defined as the pattern of behavior in any relationship used to gain control and power over an intimate partner (United Nations, et al.). Like intimate partner violence, crimes may include sexual assault, simple or aggravated assault, and homicide. The difference between domestic violence and intimate partner violence is that domestic violence can occur between two parties living in the same household. In contrast, intimate partner violence

only occurs between romantic partners who may or may not live together in the same household (Moorer, 2021). One area of research that is grossly understudied is the potential linkages between IPV and religion.

For this study, religion is defined as whatever system of practices unites several people into a single moral community, whether or not those practices involve belief in any unusual realities (Durkheim, 1912). Religion is often a talking point regarding it being the solving factor for intimate partner violence. Many believe that if you affiliate with a religion, you are less likely to commit sins, such as violence. Ellison and Anderson's (2001) results indicate that religious involvement diminishes the risk of abuse. However, more is needed to know how religious communities respond to victims and families affected by domestic violence (Ellison & Anderson, 2001). Some scholars have tried to understand partner violence and religion, but the results have been inconsistent.

More recently, Boyer et al. (2022) examined religious leaders' interpretation of gender roles during couples counseling courses to motivate men to share power and, as a result, reduce violence. In a religious household, they follow the patriarchal norm that places men as the head of the household. They are also told to perceive themselves with idealized male behavior (Novak, 2019).

Post-traumatic stress disorder (PTSD) is one of the most common mental health problems found in female victims of intimate partner violence, with 31% to 84.4% reported as meeting the criteria (Golding, 1999). According to the American Psychiatric Association (1980), PTSD first received notoriety after the Vietnam War and the resulting inclusion of the term into the DSM-III. This study examines the effect religion has on PTSD when it comes to victims of intimate partner violence, specifically the role of divine control.

Literature Review

Domestic Violence and Intimate Partner Violence

We define domestic violence and intimate partner violence as an individual who causes harm to someone living in the same household as them. While these can involve nonviolent actions such as emotional, financial, and psychological abuse, they predominantly involve the abuser causing physical violence upon the victim. The National Intimate Partner and Sexual Violence Survey conducted in 2010 found that 32.9% of women have experienced physical violence that includes slapping, punching, shoving, being beaten, burned, or choked by an intimate partner in their lifetime (Jung & Olsen, 2017). Moreover, while they are relatively frequent in the U.S. compared to other countries, they are nonetheless not common within the context of being reported. (Tjaden & Thoennes, 1998). Approximately 1.5 million women and 834,700 men are physically or sexually assaulted annually (Tjaden & Thoennes, 1998); they contrast in magnitude with 30% of female murder victims killed by intimate partners (Rennison & Welchans, 2002).

Religion and Domestic Violence

The United States is one of the most religious countries compared to other Western European countries. More than 50% of Americans view religion as important in their lives, while 22% of Spanish, 21% of German, 17% of British, and 13% of French respondents said so (Kohut, 2012). 89% of respondents said they believe in God, and 86% said religion is important

in their lives. As a result, individuals who view religion as important in their lives might be persuaded by religious norms and worldviews that endorse the purity of marriage and condemn intimate partner violence (Jung & Olson, 2017).

Previous researchers found religiosity is negatively associated between domestic violence and religion. One of the most prominent is Ellison and Anderson (2001). They analyzed data from Wave 1 of the National Survey of Families and Households (NSFH-1), which consisted of 13,017 men and women aged 18 and older in the United States. They hypothesized that religion decreases the likelihood of domestic violence because religious communities increase an individual's level of social integration. Religion is believed to discourage people away from domestic violence by assisting with coping, providing support, and increasing opportunities for emotional release. Additionally, religious communities like to develop deep connections with everyone in their community, limiting couples' isolation time and privacy. This can make it complicated for someone to conceal domestic violence. On average, regular churchgoers are more likely to identify their social networks as reliable and satisfying, and report having more social support than their nonreligious counterparts. Overall, the influence of religious communities reduces "rates and levels of partner violence, and in dealing with devastating consequences of this public health crisis" (Ellison & Anderson, 2001, p. 282).

In a follow-up study, Ellison and Anderson (2007) conducted a study that examined the effect of religious practices on the frequency of service attendance on domestic violence. They analyzed data from the first wave of the National Survey of Families and Households. The researchers found a negative relationship between the frequency of attendance at religious events and the likelihood of domestic violence. The likelihood of domestic violence fell by 5% for every one-unit increase in religious attendance. The protective aspect of religion was stronger for African Americans than for Hispanics and non-Hispanic whites (Ellison & Anderson, 2007). This is similar to what they found in an earlier study regarding a linkage between domestic violence and religion; however, they reported that men had the protective factor of religion only in weekly attendees.

Additionally, a study in Uganda found that religious leaders can be effective agents of change in reducing violence (Boyer et al, 2022). A representative sample of married couples in the US found that religion does not strongly or directly influence intimate partner violence (Cunradi et al, 2002). These studies run to similar conclusions as the previous studies. Although their claim can be beneficial in creating an argument that a link existed at one time, it can be difficult to imagine that link withstanding longer than a decade. Also, religion is conjoined to domestic violence via its effects on masculinity. Traditional beliefs about being male are detrimental to a man's health (Novak, 2019). Novak's findings highlighted the need to identify why married men push back their need for healthcare utilization to appear masculine (Novak, 2019).

Religious groups in domestic violence tend to endorse traditional gender roles where husbands are given authority to make official decisions for wives and children. These beliefs also encourage wives to be submissive and follow their husband's decisions, promoting that such beliefs authorize men's violence against women (Jung & Olsen, 2017). However, such ideology and behaviors may not be uniform globally.

Using the fifth wave of the World Values Surveys, Jung and Olsen (2017) attempted to determine whether personal religiosity raises or lowers the acceptability of wife-beating and how

the relationship between personal religiosity and attitudes toward wife-beating differs depending on the overall context of the country where a person lives. They found that people with high levels of religiosity are less likely to approve of domestic violence (Jung & Olsen, 2017). The current study is important because not much research has been done on this topic.

Post-Traumatic Stress Disorder

Post-Traumatic Stress Disorder, also known as PTSD, is defined as “a trauma and stress-related direct or indirect exposure to actual or threatened death, serious, injury, or sexual or emotional violence and characterized by persistent difficulties that negatively affect an individual’s social interactions, capacity to work or other areas of functioning.” (Piotrowski & Range, 2022) In other words, PTSD can occur after you have experienced a traumatic event. Although most people who go through a traumatic event will not develop PTSD, it is still a possibility. According to the U.S. Department of Veterans Affairs (2018), about 6 out of every 100 people will have PTSD at some point in their lives. When it comes to PTSD and intimate partner violence, these two variables are often seen together hand in hand.

Post-Traumatic Stress Disorder and Religion

After a traumatic experience, there have been increases and decreases in religious beliefs and activities recorded. This is because many individuals turn to religion to help cope with the distress and suffering that follows life-changing trauma. (Koenig et al. 2020). Religiosity could influence how individuals respond to early life adversity. A study conducted by Ter Kuile and Ehring (2014) suggests that religiosity may play an important role in post-trauma adaptation.

Researchers have found that in the United States, the majority of religious believers view God as a causal force involved in daily human life (Froese & Bader, 2010). Using data from the 2014 Nashville Stress and Health Study from the United States (NSSAHS), Upenieks and Ford-Robertson (2023) attempted to examine and consider how elements of religiosity, particularly divine control to explain why goal-striving stress takes a toll on self-esteem of individuals who experienced child abuse. They found that childhood abuse was positively associated with goal-striving stress and lower perceptions of divine control explain why goal-striving stress caused more damage for victims of childhood abuse (Upenieks & Ford-Robertson, 2023). The current study is important because this helped provide insight into divine control. To build on existing knowledge, the present study aims to identify if religion affects intimate partner violence in a sample of men and women who live in Tennessee.

Methods

Data

Data for this research comes from the Nashville Stress and Health Study (NSAHS). A cross-sectional probability sample of non-Hispanic African Americans and white men and women aged 22 to 69 who live in Davidson County, Tennessee. The NSAHS sample was collected using multistage stratified sampling techniques. Households were chosen based on 199 block groups stratified by the percentage of African Americans reported to live there, according to 2010 Census data. Trained interviewers conducted the survey and were matched with respondents based on race. Interviews were held either at respondents’ homes or at Vanderbilt University. Interviews lasted approximately three hours and were computer-assisted.

Participants were offered \$50 to participate in the survey interview. Data was collected between 2011 and 2014.

Measures

Post-Traumatic Stress Disorder

Post-Traumatic Stress Disorder (PTSD) was measured with survey items when thinking of a traumatic event. These some items were: (1) “Did you keep remembering (event) even when you didn’t want to”; (2) “Did you keep having bad dreams or nightmares about it”; (3) “Did you suddenly act or feel as though (event) was happening again even though it wasn’t”; (4) “Did you get very upset when you saw, heard or felt something that reminded you of it” and (5) “Did you sweat or did your heart beat fast or did you tremble when you were reminded of (event).” The items were summed to form an index ($\alpha = .83$) so that no = 0 and say yes = 1.

Partner Violence

For partner violence, respondents were asked, “Were you ever physically abused or injured by a spouse/boyfriend/girlfriend?” Responses categories were no = 0 to yes = 1.

Religious Service Attendance

Religious service attendance was measured by asking respondents, “Which of the following best describes how often you attend services at a church/temple/synagogue/mosque?” Response categories ranged from 0 = never to 3 = very often.

Prayer

Prayer was measured by a single-item question that asked respondents, “How often do you pray?” Response categories ranged from 0 = never to 5 = several times a day. As with the previous religious variables, prayer was dichotomized so that those who pray rarely = 0, weekly = 1, and daily = 2.

Religious Saliency

For religious saliency, respondents were asked, “How religious are you?” Response categories ranged from 0 = not at all religious to 3 = very religious.

Personal Belief in Divine Control

Schieman et al. (2005) measured perceived divine control with four survey items. These items were: (1) “I decide what to do without relying on God” (reverse-coded); (2) “When good or bad things happen. I see it as part of God’s plan for me”; (3) “God has decided what my life shall be”; and (4) “I depend on God for help and guidance.” Response categories range from 0 = strongly disagree to 3 = strongly agree. The items were summed to form an index ($\alpha = .83$) and subsequently dichotomized so that not having belief in divine control = 0 and having belief in divine control = 1. The variable was then split at the mean to gauge those with low beliefs in divine control and those with high beliefs in divine control.

Socio-Demographics

Additionally, this study controlled for age (in years), sex (female = 1, male = 0), race (white = 0, African American = 1), marital status (married = 1, not married = 0), education (less

than high school = 0, high school degree = 1, some college = 2, bachelors = 3, more than bachelors = 4), employment status (full-time = 2, part-time = 1, other = 0), and household income (under \$5000 = 0 to \$135000 and above = 14). Descriptive statistics are presented below in Table 1.

Table 1. Descriptive Statistics: NSAHS, 2011-2014.

| | Mean/ Proportion | SD | Range | N |
|----------------------------------|---------------------|-------|---------|-------|
| Focal Variables | | | | |
| PTSD | 10.44 | 3.68 | 3 - 17 | |
| Remembered event | .677 | | | 828 |
| Not remember event | .324 | | | 396 |
| Kept having nightmares | .318 | | | 387 |
| Not have nightmares | .682 | | | 831 |
| Felt event happening again | .254 | | | 311 |
| Not felt event happening again | .746 | | | 912 |
| Upset when reminded of event | .610 | | | 748 |
| Not upset when reminded of event | .390 | | | 478 |
| Sweat when reminded of event | .394 | | | 480 |
| Not sweat when reminded of event | .606 | | | 738 |
| Partner Violence | | | | |
| Experienced partner violence | .194 | | | 243 |
| Not experienced partner violence | .806 | | | 1,009 |
| Religious attendance | | | | |
| Attend very often | .387 | | | 484 |
| Attend sometimes | .170 | | | 212 |
| Attend rarely | .295 | | | 369 |
| Never attend | .149 | | | 186 |
| Often Pray | | | | |
| Daily | .642 | | | 802 |
| Weekly | .195 | | | 244 |
| Rarely | .163 | | | 204 |
| Religious Salience | | | | |
| Very religious | .242 | | | 301 |
| Moderately religious | .515 | | | 640 |
| Not too religious | .154 | | | 191 |
| Not at all religious | .089 | | | 111 |
| Belief in divine control | | | | |
| Has belief in divine control | .088 | | | 109 |
| No belief in divine control | .912 | | | 1124 |
| Covariates | | | | |
| Age | 46.0 | 11.52 | 22 - 69 | |
| Gender | | | | |
| Male | .470 | | | 589 |
| Female | .530 | | | 663 |
| Race | | | | |
| White | .499 | | | 625 |
| Black | .501 | | | 627 |
| Marital status | | | | |
| Not married | .554 | | | 693 |
| Married | .447 | | | 559 |
| Education | | | | |
| Less than high school | .137 | | | 172 |
| High school or more | .863 | | | 1,080 |
| Employment | | | | |
| Part/non-employed | .403 | | | 504 |
| Full-time | .597 | | | 748 |
| Household income | 7.98 | 4.16 | 0 - 15 | |

Notes : Statistics are derived from non-imputed and unweighted data. NSAHS = Nashville Stress and Health Study. SD = Standard deviation.

Analytic Strategy

Due to the variance of PTSD being greater than its mean, negative binomial regression was used for the analyses. For Table 2, Models 1 and 2 independently test the expected difference in log count between PTSD and partner violence and divine control, respectively. Model 3 included divine control along with other religious variables, religious attendance, prayer, and religious salience. Lastly, Model 4 included socio-demographic covariates to control the potential spuriousness of the previous models.

Results

Sociodemographic background information and unweighted descriptive statistics of study variables can be found in Table 1. Regarding partner violence, a little over 19.4% of the sample reports experienced partner violence. Looking at religious salience, and belief in divine control, less than a fifth of the sample reported moderately engaging or not believing in a religious dimension. However, a larger percentage of the sample report they attend services (38.7%) and often pray daily (64.2%).

Table 2 displays the results for each model generated through the negative binomial regression estimates of divine control and partner violence on PTSD. Models 1-4 include the coefficient counts and an indication for significant levels of divine control and partner violence on PTSD. In Model 1, for a one-unit change in the partner violence, the difference in the logs of expected counts of PTSD is expected to change by 0.13 (Coef: 0.13; $p < .01$). In model 2, for a one-unit change in the beliefs in divine control, the difference in the logs of expected counts of PTSD is expected to increase by 0.08 (Coef: 0.08; $p < .01$). In other words, if you have a higher belief in divine control, you are more likely to have a higher PTSD score. Model 3 included the other religious variables and found that for a one-unit change in the beliefs in divine control, the difference in the logs of expected counts of PTSD is expected to increase by 0.07 (Coef: 0.07; $p < .05$), holding all other covariates in the model constant. Substantively, indicating a high belief in divine control is expected to increase individual's PTSD score. When incorporating experienced partner violence and belief in divine control, all maintain a significant relationship to PTSD. Covariates significant to PTSD include gender, income, and employment.

Table 2. Coefficients from Negative Binomial Regression Estimates of Divine Control & Partner Violence on PTSD: NSAHS, 2011-2014 (n = 1,252).

| | <i>Model 1</i> | <i>Model 2</i> | <i>Model 3</i> | <i>Model 4</i> |
|------------------------------|----------------|----------------|----------------|----------------|
| Focal Variables | | | | |
| Experienced Partner Violence | 0.13 *** | | | 0.08 * |
| Belief in Divine Control | | 0.061 * | 0.04 | 0.01 |
| Religion Attendance | | | 0.00 | 0.00 |
| Pray | | | 0.04 | 0.01 |
| Religious Salience | | | -0.02 | -0.02 |
| Covariates | | | | |
| Age | | | | 0.00 |
| Gender | | | | 0.07 * |
| Race | | | | 0.03 |
| Education | | | | 0.00 |
| Income | | | | -0.02 *** |
| Marital Status | | | | 0.01 |
| Employed | | | | -0.04 * |

Notes: Odds ratios with 95% confidence intervals in parentheses. Estimates average over 30 imputed datasets, and adjust for post-stratification weighting and clustering by block group. NSAHS = Nashville Stress and Health Study.

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Discussion

The present study aimed to identify the role of divine control on those with PTSD as a result of partner violence. Several interesting findings were revealed in the results. The prevalence of belief in divine control (50.7%) was high at enrollment which is consistent with previous research (Golding, 1999). Overall, those with PTSD as a result of intimate partner violence reported having a high belief in divine control. Although our study makes a novel contribution to the PTSD-partner violence literature, we acknowledge several key limitations. First, the NSAHS data are cross-sectional and preclude temporal ordering among variables. This is especially important because we use a lifetime measure of PTSD, owing to extremely small cell sizes for 12-month measures. To be sure, other high-quality studies (e.g., Dokkedahl et al. 2022) have also relied upon lifetime measures of PTSD; nevertheless, this undercuts our ability to make causal arguments regarding the association between PTSD, divine control, and partner violence. These limitations notwithstanding, our study provides a fresh perspective on the links between divine control, PTSD, and intimate partner violence. There is little research that explores all three factors. Future research should explore the potential effects of additional religious variables on the relationship between partner violence and PTSD.

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Where Do I Belong? How Acculturative Stress and Discrimination Influences Hispanic/Latinx



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ABSTRACT

Past research has shown that cultural stressors are associated with increased symptoms of depression as well as alcohol and drug use and aggressive behavior among Hispanic/Latinx. Cultural stressors are defined as stressors rooted in navigating multiple cultural streams at once. Despite research documenting the detrimental impact of cultural stress, limited research has identified factors, such as acculturative strategies, biculturalism, and familismo, that may diminish experiences of cultural stress. Utilizing a subset of 1189 (74.5% female, $M_{age} = 20.43$ years, $SD = 3.858$ years) college students from the MUSIC survey, we looked to identify how specific cultural assets uniquely impact cultural stressors (i.e., pressure to acculturation, pressure against acculturation, and discrimination). Results indicated that greater Bicultural Identity Integration (BII) was associated with reduced pressure to acculturate, pressure against acculturation and whether these individuals will perceive higher levels of discrimination. In addition, Heritage and U.S. Cultural Endorsement had a positive association with heritage in pressure to acculturate, while Americanism had a negative association with pressure to acculturate. Finally, findings indicated familismo had a positive association with pressure to acculturate. Our findings emphasize that cultural stressors are heavily dependent on Hispanic/Latinx own acculturative configuration (i.e., endorsement of heritage and US cultures and familismo) as well as how they feel about their two identities. These results are discussed in relation to specific cultural stressors that Hispanic/Latinx face in the U.S. and the need for understanding the relationship these individuals faced with competing cultures.

Introduction

Hispanics/Latinx who have migrated to the United States (U.S.) have often faced challenges of navigating their own heritage as well as that of the host country (Romero & Roberts 2003). The struggles Hispanic/Latinx face such as legal status, minority status, and

language stress are a few factors that add additional stress (Cervantes & Cordova 2011). Past research has shown that cultural stress, or stress that indirectly/directly impacts individuals due to being from a different culture of the host country (Meca et al., 2021), has been associated with increased symptoms of depression as well as alcohol and drug use and aggressive behavior among Hispanic/Latinx (e.g., Cano et al., 2015; Meca et al., 2022; Schwartz et al., 2015). This is particularly true given that the current political climate further exacerbates the detrimental effects of cultural stress (Schwartz et al., 2015; Vos et al., 2021). Despite this, limited efforts have been made to understand key factors that contribute to the prevalence of these cultural stressors. Addressing this gap and drawing on cultural stress theory (Salas-Wright & Schwartz, 2018), which argues key cultural assets impacts the presence of cultural stressors, the current study sought to examine the unique association of heritage and U.S. cultural endorsement, bicultural identity integration, and familismo on cultural stress.

Cultural Stress Theory

Cultural stress theory is a multidimensional construct, that is composed of different culturally based stressors (Salas-Wright & Schwartz 2018), rooted in navigating multiple cultural streams as well as xenophobia and racism (Meca et al., 2022). Although cultural stress represents an umbrella term, prior research has tended to focus on three key cultural stressors: discrimination, bicultural stress, and negative context of reception (Salas-Wright & Schwartz 2018). *Perceived discrimination* is being attacked or taunted based on being a member of a certain cultural or social group (Schwartz et al., 2015). While the topic is debated due to the accuracy and construct of the term, perceived discrimination is reported by individual subjects (Pascoe & Richman 2009). Hispanics/Latinx are more likely to experience discrimination in forms of job employment (Sanchez & Brock 1996) and health care (Hausmann et al., 2008). *Bicultural stress* are perceived challenges that involve navigating one's identity through two competing cultures, such as cultural conflict with peers or family and pressure to be fluent in multiple languages (Piña-Watson et al 2019; Schwartz et al., 2015). Finally, *Negative context of reception* is how migrants will be received and presented with new opportunities in the host country (Salas-Wright & Schwartz 2018).

Individually, and collectively, an overwhelming number of studies have indicated cultural stress is associated with a variety of problematic outcomes. For example, a meta-analysis conducted by Lee & Ahn (2011), found strong correlations between discrimination against Latinos and increase in anxiety, depression, employment outcomes, psychological distress, and unhealthy behaviors. Higher acculturative stress, specifically higher levels of pressure against acculturation, has been linked to increased risky sexual patterns among Hispanic/Latinx young students (Fernandez et al., 2023). Focusing collectively on cultural stress, Schwartz, Waterman et al. (2022) found cultural stress was associated with greater symptoms of depression and anxiety. In addition, recent studies have highlighted that cultural stress undermines identity development, a key developmental milestone (e.g., Meca et al., 2022). Despite this, it is worth noting that cultural stress theory posits that certain cultural assets may buffer the deleterious causes. Indeed, in the introduction of cultural stress theory (Salas-Wright and Schwartz, 2018), indicated heritage and US cultural endorsement, bicultural identity integration, and familism may serve as key assets that provide a barrier in cultural stress.

Cultural Assets

Cultural assets are internal and external protective factors, largely rooted in the acculturative process itself, that lessen the harm on youth and family functioning (Salas-Wright & Schwartz 2018). Acculturative stress is the process in which migrants will choose to change to the new culture of the host country in terms of their beliefs, behaviors, and values (Telzer 2010). Acculturative strategies, or the degree to which individuals endorse their heritage and/or host culture, is an antecedent for mental health problems in adults (Cervantes et al., 1991), and have been differentially linked to add psychological and behavioral health to Hispanic/Latinx in complex ways (Meca et al., 2023). As conceptualized by Salas-Wright and Schwartz (2018), heritage and US cultural endorsement provides youth with necessary skills to navigate both cultural streams, thereby minimizing cultural stressors. At the same time, as individuals endorse both cultural streams, they are faced with the challenge of navigating their own culture and the pressure to acculturate to the U.S. leading to greater experiences of cultural stress.

Building on study of acculturation, research has explored in depth the notion of dual heritage and U.S. cultural endorsement or biculturalism (Benet-Martinez & Haritatos 2005), Chen et al., 2008, Ferrari et al., 2015). Although biculturalism is seen as a challenge that involves navigating one's identity through two competing cultures (Schwartz et al., 2015), dual cultural endorsement has been consistently associated with positive adjustment (Chen et al., 2008, Ferrari et al., 2015). However, recent research explored distinct dimensions of biculturalism, bicultural identity integration (BII) is investigating how much one person's dual culture intersects with each other as well as how oppositional they are (Benet-Martinez & Haritatos 2005). Individuals who measure high see themselves as a blend of both cultures, while those who measure low have a difficulty in incorporating both cultures to form "one" cohesive identity (Benet-Martinez & Haritatos 2005). Those individuals that view their cultures as in conflict and/or distant often feel the need to choose between one culture over the other, increasing likelihood for symptoms of depression and anxiety (Benet-Martinez & Haritatos 2005). Indeed, Cano et al., (2020), found higher levels of BII harmony were associated with lower levels of stress. This is to say that when Hispanic/Latinx view both cultures as compatible, cultural stress experience is lessened and they are more likely to be able to effectively navigate subsequent cultural stressors.

Familismo is prioritizing family beliefs and needs over individualism (Ovink & Kalogrides 2015). Familismo can be seen as obeying those in a position of authority such as parents, grandparents, and those who are older. Additionally, this promotes feeling of cohesiveness and unity in the family, adding an additional support and coping system Hispanic/Latinx individuals can use (Stein et al., 2013). A study done in 2019 examined how higher scores of familismo in Mexican descent adolescents decreased mental health issues (Piña-Watson et al., 2019). Moreover, higher level of familismo Latinx has been associated with decreased likelihood in witnessing community violence (Kennedy & Ceballos 2013). That said, past research has shown that familismo does not always function as a cultural asset. For example, Kuhlberg, Pena, and Zayas (2010) reported a study done on Latinas, where familismo was associated with higher levels of internalizing behaviors, putting them at a higher risk of suicide attempts.

Current Study

The purpose of this study was to examine how key cultural assets (i.e., heritage and U.S. cultural endorsement, BII conflict and distance, and familismo) influences cultural stress (i.e.,

pressure to acculturation, pressure against acculturation, and discrimination) among Hispanic/Latinx in college.

Hypothesis 1: consistent with broader literature on bicultural identity integration (e.g., Benet-Martinez & Haritatos 2005), bicultural identity-conflict will be positively associated with pressure to acculturate, pressure against acculturation, and perceived discrimination.

Hypothesis 2: Again, consistent with broader literature on bicultural identity integration (e.g., Benet-Martinez & Haritatos 2005), bicultural identity-distance will positively associate with pressure to acculturate and pressure against acculturation. However, I did not hypothesize that bicultural identity-distance would be associated with perceived discrimination. As two cultures become separated into their own entities, Hispanic/Latinx individuals may be better equipped to shift back and forth between distinct cultural scripts (Benet-Martinez & Haritatos 2005), in turn, becoming more apt at navigating distinct environments and minimizing likelihood for experiencing less discrimination.

Hypothesis 3: Heritage culture endorsement will be positively associated with pressure to acculturate and perceived discrimination but will not be associated with pressure against acculturation. As Hispanic/Latinx individuals in college embrace their native culture such as eating authentic food, dancing to music, and speaking their native language, they may increase the likelihood that they will feel pressure to acculturate and/or experiences of discrimination by the majority group by engaging in behaviors that deviate from typical “American” practices (Salas-Wright et al., 2014). In contrast, given these individuals engage in heritage cultural practices, they are unlikely to experience pressure against acculturation from their within group, as they are engaging in behaviors aligned with ones’ heritage culture.

Hypothesis 4: U.S. cultural endorsement will be negatively associated with pressure to acculturate and perceived discrimination but will be positively associated with pressure against acculturation. When Hispanic/Latinx engage in American cultural practices, they are less likely to feel pressure to acculturate as the majority accepts them for having their shared values and thus likely to be ostracized and experience discrimination for engaging in typical Hispanic/Latinx practices. At same time, engagement in American practices may increase likelihood for Hispanic/Latinx youth to feel pressures from members of the within group to reject the majority culture and align themselves more closely with ones’ heritage culture. Hypothesis 5: Familism will have a negative association with pressure against acculturation, pressure to acculturate, and perceived discrimination. Past research has supported theories that familismo serves as a protective factor in cultural stressors such as acculturative stress, therefor familismo will lessen pressure against acculturation.

Methods

Sample

A subset of the sample was taken using the Multi-Site University Study of Identity and Culture (MUSIC; Castillo & Schwartz, 2013). The sample size used for this study consisted of 1189 college students who identified as Hispanic/Latinx ($M_{\text{age}} = 20.43$ years, $SD = 3.858$ years). The sample was primarily composed of individuals that were born in the U.S. (72.2%) and the majority identified as female (74.5%). Of the sample population 40.2% lived with their parents and 36.9% had been in their first year of college.

Measures

Multidimensional Acculturative Stress Inventory. Pressure to Acculturate and Pressure Against Acculturation was assessed using the Multidimensional Acculturative Stress Inventory (MASI; Rodriguez et al., 2002). The 7-item scale was utilized to assess pressure to acculturate (sample item= "Because of my cultural background, I have a hard time fitting in with Whites"), while pressure against acculturation used a 4-item scale (sample item= "People look down upon me if I practice American customs"). Items were measuring a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree).

Perceived discrimination. The 9-item Perceived Discrimination subscale from the 32-item Scale of Ethnic Experience (Malcarne, Chavira, Fernandez, & Liu, 2006) was used to assess perceived racial/ethnic discrimination. Each item was rated on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Sample items include "My ethnic group has been treated well in American society" and "In my life, I have experienced prejudice because of my ethnicity."

Heritage and U.S. Cultural Endorsement. Heritage and U.S. cultural endorsement was assessed using a 32-item Stephenson Multigroup Acculturation Scale (SMAS; Stephenson, 2000) bidimensional acculturation scale that used a 4-point rating scale that ranged from 1 (false) to 4 (true). This assessment includes 17-items that assess heritage cultural endorsement (sample item = "I know how to read and write in my native languages") and 15-items that assess U.S. cultural endorsement (sample item = "I feel totally comfortable with (Anglo) American people").

Familism. Familismo was assessed using the 18-item Attitudinal Familism Scale (Lugo Steidel & Contreras, 2003) using a 5-point rating scale that ranged from 1 (*strongly disagree*) to 5 (*strongly agree*). The scale includes 14-items (sample item = "A person should rely on his or her family if the need arises").

Bicultural identity Integration. Bicultural identity Integration (BII) was measured using a 6-point Likert-scale ranging from 1 (*strongly disagree*) to 6 (strongly agree) (Benet-Martinez et al., 2002). This assessment includes 4-items that assess bicultural identity distance (sample item = "I keep my heritage and American cultures separate.") and 5-items that assess harmony versus conflict (sample item = "I feel caught between my heritage and American cultures").

Results

Using a linear regression model for each dependent variable, three separate tests were run. The independent variables that were used are: born in the U.S., Heritage and U.S. cultural endorsement, Familism, Bicultural identity Integration. Results indicated that these cultural assets accounted for a significant percent of the variance across all three cultural stressors.

The first linear regression focused on the impact of cultural assets, controlling for key covariates, on pressure to acculturate. These cultural assets predicted a significant amount of the variance in Hispanic/Latinx's pressure to acculturate; $F(9, 935) = 31.65, p < .001$, with an R^2 of .23. As seen in Table 1, Heritage Cultural Endorsement ($\beta = .158, p < .001$), Familism ($\beta = .161, p < .001$), BII distance ($\beta = .112, p < .001$), and BII conflict ($\beta = .258, p < .001$) were significantly and positively associated with pressure to acculturate. At same time, US cultural endorsement was negatively associated with pressure to acculturate ($\beta = -.184, p < .001$).

Table 1*Linear Regression of Pressure to Acculturate*

| Model | Standardized Coefficients | <i>p</i>-Value |
|-------------------------------------|----------------------------------|-----------------------|
| (Constant) | | .004 |
| Age | -.012 | .667 |
| Gender | .005 | .871 |
| Born in United States | -.066 | .035 |
| Residence | .010 | .739 |
| Heritage Endorsement | .158 | <.001 |
| U.S. Cultural Endorsement | -.184 | <.001 |
| Familismo | .161 | <.001 |
| Bicultural Identity-Distance | .112 | <.001 |
| Bicultural Identity-Conflict | .258 | <.001 |

The second linear regression focused on the impact of cultural assets, controlling for key covariates on pressure against acculturation. These cultural assets predicted a significant amount of variance in Hispanic/Latinx's pressure against acculturation; $F(9,934) = 12.35, p < .001$, with an R^2 of .11. As seen in Table 2, BII conflict ($\beta = .286, p < .001$) was positively associated with pressure against acculturation.

Table 2*Linear Regression of Pressure Against Acculturation*

| Model | Standardized Coefficients | <i>p</i>-Value |
|-------------------------------------|----------------------------------|-----------------------|
| (Constant) | | .035 |
| Age | .032 | .304 |
| Gender | -.058 | .062 |
| Born in United States | -.003 | .934 |
| Residence | .021 | .502 |
| Heritage Endorsement | -.052 | .137 |
| U.S. Cultural Endorsement | .006 | .872 |
| Familismo | -.015 | .661 |
| Bicultural Identity-Distance | .068 | .053 |
| Bicultural Identity-Conflict | .286 | <.001 |

Finally, the last linear regression focused on the impact of cultural assets, controlling for key covariates on perceived discrimination. These cultural assets predicted a significant amount of variance in Hispanic/Latinx's pressure on perceived discrimination; $F(9,937) = 7.01, p < .001$, with an R^2 of .06. As seen on Table 3, Born in United States ($\beta = -.138, p < .001$) was negatively associated with perceived discrimination, while BII conflict ($\beta = .196, p < .001$) was positively associated with perceived discrimination.

Table 3*Linear Regression of Perceived Discrimination*

| Model | Standardized Coefficients | p-Value |
|-------------------------------------|----------------------------------|-----------------|
| (Constant) | | <.001 |
| Age | .068 | .034 |
| Gender | .057 | .075 |
| Born in United States | -.138 | <.001 |
| Residence | .012 | .706 |
| Heritage Endorsement | .043 | .230 |
| U.S. Cultural Endorsement | -.047 | .178 |
| Familismo | .048 | .161 |
| Bicultural Identity-Distance | -.012 | .730 |
| Bicultural Identity-Conflict | .196 | <.001 |

Discussion

Guided by cultural stress theory (Salas-Wright & Schwarts, 2019), the purpose of the study was to examine how key cultural assets impacts impact cultural stressors such as acculturative stress and perceived discrimination among in Hispanic/Latinx college students. Specifically, in the current study, I sought to examine whether cultural endorsement, bicultural integration, and familismo are associated with decreased levels of cultural stressors, thereby serving as cultural assets as hypothesized by cultural stress theory.

Consistent with my initial hypothesis, bicultural identity-conflict, or a lack of BII harmony, was positively associated with pressure to acculturate, pressure against acculturation, and perceived discrimination. Put another way, the more conflict Hispanic/Latinx individuals face with understanding their two cultures, the more they will feel the stress to acculturate or become more American. Our results are aligned with past research indicating that perceived conflict between both cultures can lead to individuals feeling like they have to choose who they identify as (Schwartz et al., 2015). Hispanic/Latinx youth who perceive heritage and US culture to conflict are likely more impacted by changing demands of distinct cultural environments. In context marked by high Hispanic demands, they feel more pressure to be less American and more Hispanic. On the other hand, in environments with high American demands, Hispanic/Latinx will feel more pressure to acculturate. In essence, viewing cultural streams as in conflicts likely creates a sense of navigating a tightrope between two Hispanic and American

cultures. In contrast, those with minimal conflict are less likely to feel these cultural pressures as they are able to effectively switch between cultural scripts (Benet-Martinez & Haritatos 2005).

Our second hypothesis was partially supported. Specifically, although bicultural identity-distance was positively associated with pressure to acculturate, it was not significantly associated with pressure against acculturation. When Hispanic/Latinx keep their two cultures separate from each other, they are more likely to engage in cultural frame switching (Benet-Martinez & Haritatos 2005), where in school settings they adapt to more American norms, while at home they have strong Hispanic/Latinx identities. Although this may seem adaptive, the need to toggle between cultural scripts can be challenging overtime (Yim et al., 2019). In context of our findings, the differential association between pressure to acculturate and pressure against acculturation may be unique to college students, who may feel more pressure to behave more American in professional settings to advance their career. In contrast, the degree of distance may not impact heritage cultural pressures as these youth are able to more effectively navigate the cultural script requirements at home.

Consistent with hypothesis 3, heritage cultural endorsement was positively associated with pressure to acculturate. On the other end, our fourth hypothesis was only partially supported; a negative association was seen in pressure to acculturate. Taken together, these findings indicate that ones' cultural orientation is tied particularly to pressure to acculturate, which largely stems from the majority cultural group (Meca et al., 2021). In essence, the more you identify with your heritage culture, the more pressure they feel from majority group to appear more American. At same time, Hispanic/Latinx practicing American norms, such as eating typical American food and following more individualist views, experience less pressure to acculturate given they are already behaving in ways aligned with the majority culture. With Hispanic/Latinx steadily climbing in population and soon to become the majority in the ethnicity in the U.S., members of the traditional majority culture may begin to feel threatened (Hall & Krysan 2016) and further pressure Hispanic/Latinx to engage in practices aligned with "American culture".

Interesting enough, neither heritage nor US cultural endorsement were associated with pressure against acculturation, which largely stems from the within group. Thus, whereas the majority group is more likely to engage pressure Hispanic/Latinx emerging adults to confirm, based on their cultural orientation, findings indicate pressures against acculturation may not stem from ones' conflict between ones' cultural orientation and other Hispanic/Latinx groups. These findings contradict work on intragroup marginalization (Castillo 2009), that has reported how the more youth identified and felt confident with the majority culture, the more likely they feel pressure from members of their own cultural heritage against acculturation. Additionally, inconsistent with my hypothesis, there was no associations between either cultural orientation and perceived discrimination. As such, individuals are equally likely to experience discrimination regardless of their cultural orientation. A study done among Asian and Latino foreign-born, and U.S. born emphasized the impact that no matter if they identified themselves as American, they were still treated in a different manner along with identity denial (Armenta et al., 2013). Whether Hispanic/Latinx individuals form American cultures and values, discrimination remains at a steady rate.

Finally, our last hypothesis was not supported; familismo did not have a significant association with pressure against acculturation or discrimination. Moreover, in contrast to

conceptualizations of familismo as a cultural asset, familismo was positively associated with pressure to acculturate. It is possible that, with Hispanic/Latinx being raised in a more traditional family lifestyle, as adults, they may begin to evaluate how they grew up, and assess how they want to change, unknowingly proceeding to more American family values. Additionally, outside factors such as peers or the media, can influence them to have less traditional family roles. In turn, this would cause pressure to acculturate from external factors. Future research should explore this counterintuitive finding.

Limitations and Future Directions

Although these findings highlight the key connection between cultural assets and cultural stressors, emphasizing the critical role bicultural identity in particular plays in cultural stress, there are several limitations of note. First, familismo was designed to measure family relationships in Mexican Americans, as such, these results may not generalize to other Latinx groups. More research should be done in seeing if different Latino countries measure differently in familismo and whether this influences acculturation and perceived discrimination. Second, our study had limited measures of cultural stress. In other words, whether these findings generalize to other cultural stressors, remains an open question. Future research should further explore the links between these cultural assets and a broad spectrum of cultural stressors. For example, future research should look at language pressure and see how individuals that speak one or two languages measure differently in feeling pressure to acculturate. Third, although I examined the effects of bicultural identity integration, we did not see how dual cultural endorsement orientation directly impacted cultural stress. Future research should examine biculturalism more comprehensively. Fourth, the cross-sectional design of the study, limits our capacity to make statements regarding directionality. Equally possible, cultural stress can impact these cultural assets. Future longitudinal research is necessary.

Conclusion

The study explored the relationship identity holds with Hispanic/Latinx adolescence and whether they will experience pressure to acculturate to the U.S. culture and the more likely they are to perceive discrimination. As a whole, bicultural identity integration served as an important cultural asset, in particular the absence of conflict. This tells us that the way Hispanic/Latinx view their relationship with their culture of origin as well as the U.S. culture, will influence whether they will stick to their own culture and the amount of discrimination they will perceive. This research will contribute to the significance of Hispanic/Latinx studies that bring a new multidimensional understanding of how cultural assets contributes to acculturative stress and perceive discrimination, and hopefully, spurs future research to further examine factors that contribute to experiences of cultural stress among Hispanic/Latinx youth.

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EL Atrapasueño: Undergraduate Student CREA training at HSIs



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ABSTRACT

The Hispanic-serving Institution (HSI) designation is a test of character. Colleges and universities in which 25 percent or more of the student body self-identifies as “Hispanic” can qualify as HSIs. If a sufficient percentage are low-income, and if the institution has low core expenditures, it is also eligible to receive Title V funding. Remarkably, there are no mechanisms in place to ensure that Title V money is used to narrow gaps in the school’s opportunity and reward structures. The vacuous, undefined space that characterizes Title V functions as something of a projective test that reveals each HSI’s true values and assumptions about what counts as fairness and equity. Institutions that genuinely care about Latinx students intentionally center them in their grant applications; others assume that helping all students means helping at least some who identify as Latinx. This paper discusses the on-going failure of the US Department of Education to hold HSIs accountable for spending Title V funds in ways that are beneficial to Latinx students. In so doing, it critiques the neo-liberal metrics by which HSIs are judged and recommends new methods of assessing the impact of the designation and the use of Title V funds. It concludes by arguing that lessons learned from the vast literature on culturally responsive evaluation and assessment (CREA; Hood et. al., 2015) can be used to guide strategic planning in ways that shift power into the hands of the students whose identities made the funds possible.

KEYWORDS

Culturally Relevant Evaluation, Race & Racism, Critical Pedagogy, Hispanic Serving Institutions

Introduction

Hispanic serving institutions (HSIs) are legally defined as accredited, degree-granting public or not-for-profit institutions of higher education with 25% or more undergraduate Hispanic full-time equivalent student (FTE) enrollment (*Excelencia in Education*, 2022). HSIs only represent a small sector of higher education but continue to enroll majority of Latinx undergraduate students, at least 46% of enrolled students are Latinx (*Excelencia in Education*, 2022).

The HSI designation was ostensibly created to advance the academic interests of Latinx people. However, critics contend that it is a performative gesture that undermines progressive calls for radical change, protects elite colleges and universities from having to integrate and promote White interests. Latinx people, especially those in Texas, go along with this course of action because they desire assimilation, have a relatively low sense of entitlement when it comes

to education, believe the only reason someone goes to college is to get a job, fear student loans, and believe “something is better than nothing.”

Ladson-Billings refers to the benevolent racism of Latinx higher education as “you poor dear syndrome” (De Silva et. al., 2018). The deficit thinking she describes can be best defined as an ideology “that holds students from historically oppressed populations responsible for the challenges and inequalities that they face” (Davis & Museus, 2019). A great number of influential scholars that dedicate their career to analyzing and developing the HSI literature continue to label the Hispanic/Latino community as the “neediest” population (Garcia, 2017; 2019). When creating this harmful notion, it focuses on the individual and cultural deficiencies which in turn produce challenges for historically oppressed populations (Davis & Museus, 2019).

The lack of accountability towards oppressive structures, policies, and practices within educational settings affects the education given and creates problematic social norms. When manifesting these ideas, theories like the achievement gap are raised (Ladson-Billings, 2007). Along with these theories that are adopted and carried out, funding gaps are also one of the primary reasons why equitable outcomes are lacking. When academic scholars or policymakers who care about Black and Latino students beg and criticize the current system, many of the current leaders fail to see it as a piece of the bigger puzzle. Similarly, the population begins to see communities of color as beggars who only want handouts. It is hard to reason with closeminded individuals who are themselves being affected by the “modern/colonial capitalist/patriarchal western-centric/Christian-centric world system” (Grosfoguel, 2012).

When attending minority serving institutions (MSI) it is somewhat expected to have a form of cultural or agency expression. In effect, cultural centers, student activism, and Diversity, Equity, and Inclusion offices are salient in helping create equitable outcomes in the student body (Smith, 2018). Ethnic studies usually encompass various discussions depending on the material taught. Many students, faculty, administrators, parents, and policy makers believe it is useless due to the belief that race is an issue of the past (Gutiérrez et. al., 2012). Race is a variable that encompasses these courses, but overall suggesting that students should think of themselves, society, and the world critically, looking at race relations, patriarchal systems, resistance, and to finally, develop consciousness raising.

In this paper, I discuss the various problems with the ways HSIs are managed and prevailing how metrics of success contribute to these issues. I also consider the motivation behind these strategies, including why Mexican American students and their parents not only accept the way HSIs are run, but actually seek them out. I then propose a new way of thinking about HSIs followed by a theoretical perspective that could be referenced in designing an assessment plan that does a better job of capturing Latinx-servingness than is currently in place. I conclude by explaining why none of the recommendations are likely to be followed.

What is an HSI?

The HSI designation is conferred upon colleges and universities in which 25 percent or more of the student body self-identifies as “Hispanic.” If a sufficient proportion of students are low-income, and if core expenditures are also low, the school is also eligible to compete for Title V funding. Because HSIs tend to be under-resourced compared to Predominately White Institutions, the financial incentive to pursue these extra funds can be quite enticing.

In thinking about what could possibly be wrong with channeling money toward colleges and universities that serve Latinx students, it is informative to consider how the designation came to be. During the 1990s, an organization called Hispanic Association of Colleges and Universities (HACU; Calderon-Galdeano et. al., 2012) advocated for formally recognizing and rewarding schools that educated large percentages of college-going Latinx. What was their motivation? An inspection of HACU's mission statement reveals that their primary stakeholders are government, business, and industry, as well as Latinx students themselves (HACU, 2023). It can therefore be surmised that HACU was primarily interested in producing complicit capitalists who would fit in nicely into jobs in corporate America.

The impetus for creating the HSI designation did not necessarily have to determine its destiny, however (Aguilar-Smith 2021). It was and is still possible for individual colleges and universities to leverage the funds in ways that benefit Latinx students. This is especially true given that there are almost no requirements in place for how HSIs are expected to spend Title V funds. Within such an environment, any HSI could use federal dollars to bankroll a revolution if the project director of the grant chose to do so.

Unfortunately, that has not transpired. There is no evidence to suggest that Title V funds (Aguilar-Smith, 2021) have radically changed the landscape of Latinx higher education. Certainly, some HSIs are a little less poor because of the additional funds they receive, but we have yet to see fundamental changes in things like degree offerings, faculty representation, and politically active student organizations, and we definitely have not seen an uptick in campus activism surrounding Latinx education despite similar activity focused on Black lives and LGBTQ+ rights.

Why Not be a True HSI?

There are several reasons why we have yet to see meaningful progress at HSIs. For starters, it is not in the best interests of university administrators to tout the HSI designation. Cheryl Harris' (1993) concept of "Whiteness as property" goes a long way toward explaining why it is anything but accidental that administrators desire to keep Black and Brown students out of the view of passersby. The property value of Whiteness refers to the idea that Whiteness is valued over characteristics ascribed to other races (Donnor, 2021). For example, the perceived property value of one's home is negatively related to beliefs about the presence of Black and Latinx neighbors. On college campuses the same is true. Perceptions of prestige tend to be negatively related to Black and Brown enrollment. Therefore, if the goal of an institution is (if we are being honest with ourselves) to make as much money as possible, it behooves the administration to suppress images of Black and Brown students lest White students and economically privileged Black and Brown potential applicants take their money elsewhere.

There are also reasons why the HSI designation is desirable at the broader societal level as well. Former Supreme Court Justice Anton Scalia once defended his anti-affirmative action sentiment by claiming that Black students would feel more comfortable at less competitive institutions because they are not academically prepared for more elite schools and because they would be studying alongside their racial peers if they attended schools that elite White students typically avoid (Fulwood III, 2016). The same can be said of HSIs. A majority of HSIs are either two-year colleges or non-selective four-year colleges and universities. Having an open admissions policies does a lot for enrolling mass quantities of Latinx students, and although most are probably poor in terms of credentials and economic resources, something is better than

nothing if you are a low-prestige institution struggling to stay open so employees can keep their jobs (Vargas & Villa-Palomino, 2019).

Segregation has implications for the power elite as well. So long as very few Latinx people receive an education that is (and ought to be) taken seriously, it is easy to justify why the most powerful and financially lucrative positions go to White applicants. If the reasoning is that the “best” candidate should get the position as opposed to “giving a minority a chance,” then it is only obvious that the Ivy League graduate be offered the opportunity to prove their worth over a graduate of a middling HSI. And, these rules of meritocracy, sometimes spoken sometimes simply assumed, are held in place because the very people who would be most likely to challenge them never rise to positions where their voices can be heard, and those who do rise to those positions have been screened to make sure any revolutionary tendencies have been polished away.

Why do Latinx Students and Families Stand for It?

One might ask, “Even if all of the aforementioned were true, who cares?” After all, Latinx students continue to flood into HSIs, and very few of them have engaged in protest, at least not in the past 50 years. Their lack of resistance must be a sign that they are desiring of assimilation and have an affinity for second or third-rate education. Why fix something that isn’t broken?

Indeed, there does seem to be some truth to this assertion. However, to understand why Latinx students and their parents are not only tolerant, but are apparently advocates for cut rate higher education, one must take history and positionality into consideration. Mexican Americans, particularly those in Texas have a history that separates them from the most stigmatized racial groups. The racial duality in the US is such that all minoritized racial groups other than Blacks can pridefully accept the praise “at least you’re not Black” (Kim, 1998). History has also shown us that Mexican Americans and, to a certain degree Mestizo Latinx people from other nations, have benefitted socially, politically, and economically by passing themselves off as European and suppressing their Indian culture and ancestry (Garcia, 2018). One need not look far to hear a family praising the lightest skinned child and poking fun at the darkest, encouraging their daughters to marry a White man *para mejorar la raza*, or chiding a foolish person for being like “an Indian coming down from the hills” to witness the severity of White-loving, Indian-hating dogma. Opposing the decisions of Whites does little to sell the idea that one might actually be White, which is of course to say, fully human.

This point should not be minimized. As Nájera (2015) has pointed out, Mexican Americans in South Texas in the early 1900s were able to infiltrate White spaces through intermarriage. Essentially, Mexican American families would trade their daughters and property in exchange for White sons and the privilege that went along with being treated as a White person. The way to make it in early Texas was not to study hard and make something of yourself; it was to breed attractive Brown daughters and marry them off to willing White men. It is unclear how much time has changed that gameplan.

In contemporary times, economics play a role as well. Working class people regardless of race or ethnicity tend to see the purpose of college as a means by which to secure a job (Garcia, 2019). They do not go to college to be trained as a rabblouser, and they do not plan on becoming the next generation of faculty. Some programs, such as the Ronald E. McNair Scholars

Program do prepare working class and poor students for positions in academia, but even McNair programs vary in the extent to which they prepare students to make structural attributions for inequality as opposed to internalizing the racialized culture of the bourgeois professoriate.

The fixation on economics is exacerbated by dominant narratives concerning student loans that were pushed by former President Obama. Non-wealthy students of all racial/ethnic backgrounds have been led to believe that college is not worth the cost, that the social sciences and humanities are a waste of money, and that the second goal of college after getting a job is to be there for as little time as possible. Needless to say, these are not the conditions in which revolutions are born (Kornbluh et. al., 2022).

Once on campus, students are also subjected to the forces of coercive assimilation that pressure them to bury any activist tendencies they may have (Bell, 1993). Students who are visibly aware of racism and social stratification can easily be dismissed as thinking that the world is against them and cut off from the social capital needed to secure graduate school admission or their most preferred professional appointments. Given the real material costs associated with identifying too strongly with *mexicanidad* or questioning university politics, it is unsurprising that few opt to become vocal advocates for Latinx-servingness.

What Counts as Latinx-servingness?

Determining what counts as servingness requires looking toward Gina Ann Garcia who is widely regarded as the foremost expert on all things HSI despite her decision to work at a PWI. This should come as no surprise since the preceding “foremost expert” on HSIs, Anne Marie Núñez also left the University of Texas at San Antonio, an HSI, for The Ohio State University, a PWI. There is some irony in making claims about the equivalence of HSIs and PWIs while freely choosing to work at a more prestigious PWI when once one gets the chance.

Hypocrisy notwithstanding, Garcia has made many highly referenced contributions to the scholarly literature and continues to be a frequently invited guest speaker on HSI campuses. One of her better-known pieces is her typology that classifies HSIs into four categories (Garcia, 2019; Garcia et. al., 2019). One category, “Latinx-enrolling,” refers to institutions that have a higher Latinx representation, but do little to validate Latinx cultures. Those that graduate Latinx students, but ignore Latinx cultures are termed “Latinx-producing.” On the other side, schools that validate Latinx cultures, but do a poor job of graduating Latinx students are referred to as “Latinx-enhancing.” Finally, the select few that validate Latinx cultures and graduate Latinx students at a high rate are considered “Latinx-serving”.

The problem with Garcia’s typology is that it does what it is intended to do. That is, the two dimensions that are thought to be the most important are graduating Latinx students and affirming their cultures. The former is contingent upon two factors: non-selective admissions criteria and smooth pathways through the undergraduate degree. Non-selective, or “open,” admissions policies maximize the number of Latinx students who are able to attend college because it means that they were expected to learn practically nothing in their first 13-plus years of school. Smooth pathways through undergraduate majors means that very little should be expected of students lest they encounter some difficulty, including but not limited to actually learning the material, that could nudge them towards dropping out. The idea of “everyone gets a trophy” is extremely attractive to low prestige schools because it increases revenue via tuition

and has little cost since employers and graduate schools do not expect quality from these schools in the first place. Everybody wins.

The problem, of course, is that the status quo is maintained. Latinx students who have their identities affirmed as opposed to being challenged to develop a critical consciousness are duped into accepting an inferior education because they do not know any different. That they are also certified for positions in society, that although relatively powerless, do come with the hope of buying a home in the suburbs is yet another benefit. Trading one's integrity is a small price to pay when it leads to unfettered access to Whiteness, a pool, and the possibility of once and for all not being Indian.

What Should be Considered Servingness?

Poking fun at scholars of color who have found ways to make money by telling White administrators and "successful" Latinx faculty what they want to hear is entertaining, but it is mostly useless unless there is some alternative that would work better. In this case, the alternative seems to be applying lessons learned from culturally responsive evaluation (CRE) toward understanding what servingness should be all about. From a CRE perspective, Latinx students would be considered the primary stakeholders and their interests would be central to the evaluation. They would also play key roles throughout the evaluation process, including imagining what the metrics should be, identifying appropriate data sources, deciding on instrumentation, formulating a plan for data analysis, interpreting results, and having a say in how interpretations manifest in policy and other actions (Hood et. al., 2015).

CRE is also sensitive to power dynamics, which is of critical importance given the positionality of students relative to faculty, staff, and administrators, and even more profound given the omnipresent threat of coercive assimilation. Latinx students at many HSI's have learned that they should avoid "rocking the boat" or "poking the bear" for fear of the repercussions to them personally. In short, evaluators employing a CRE approach would have to ensure that students were protected from overt and covert forms of retaliation if there were to obtain valid data on which to base their work.

Evaluators would also have to resolve a debate in the field that revolves around the tension between honoring people's lived experiences and consciousness-raising (Collins & Hopson, 2014). Many evaluators argue that people are the leading experts on their own lives and it is the job of the evaluator to take them at their word and do their bidding. It is not only impolite for evaluators to impose their understandings of the world on stakeholders, it is contrary to the spirit of evaluation. On the other side are those who argue that people may very well be experts on their own lives, but simply living one's life does not make them experts on all aspects of psychological, social, and political theory (DeCuir-Gunby et. al., 2019; Hood et. al., 2015). If that were the case, it is unlikely that the mechanisms of control that are in place currently would persevere because the expert masses would see to it that they were destroyed in short order. Indeed, a significant portion of the field of political psychology is dedicated to understanding how people in positions of power not only dominate the masses, but dominate them so thoroughly and completely that the masses beg to be dominated even more (Bell, 1993).

Applying this logic to Latinx students, it is reasonable to expect that they, too, would be influenced by dominant ideologies that would constrain their thinking about what counts as a quality education. They likely have been taught that the sole purpose of going to college is to get

a job. They may also believe that there are no meaningful differences between Ivy League schools and HSIs and that students who attend Ivy League schools have been tricked into paying higher tuition for no appreciable gain. They may look up to White faculty and aspire to be them while casting aside Brown faculty who are invested in consciousness-raising as “whack jobs.” They might also have such a deep internalized hatred of all things Indian that they chase the bluest eyes no matter the cost to their mental health.

Taking all of this into consideration, true metrics of servingness should be based on the social, political, and economic advancement of Latinx peoples. At the national level, that means that institutions are integrated at all levels of prestige with respect to race, ethnicity, and social class. It also means that the power within the institutions is spread across races, ethnicities, and social classes so that decision-making is not in the hands of antagonistic Whites nor Whites who harbor a *pobrecito* mentality (De Silva et. al., 2018; Hernandez et. al., 2022; Smith, 2018). It also means that what warrants being called a worthwhile education goes beyond memorizing facts or learning to abide by a particular writing style and involves critical thinking and a commitment to the common good. In some ways, we already have this, but it is limited to spaces that Latinx students do not have access, such as elite private universities. At many HSIs, Latinx students are made to feel comfortable around similarly ill-prepared racial/ethnic peers who are thrilled to be passed through the system. Through this approach, the HSI is able to attract hordes of tuition-paying, minimally qualified Latinx students who are blissfully unaware of the psychological cost associated with getting assimilated and credentialed for a low-power job.

How Do We Get There?

The easy answer is “We can’t.” But, before we succumb to that cold reality, let us imagine what would need to happen for our dream of Latinx-servingness to become a reality (Arellano et. al., 2022). As mentioned before, we would need full integration across all levels of prestige in higher education. That would mean that White, Asian, and Asian American students would need to stop being over-represented at the schools that offer the education with the most market value. We would also need the administration of HSIs to be representative of their student body (Garcia, 2018). That, in turn, would probably mean moving away from the Indian school model of HSIs and closer to what goes on at Historically Black Colleges and Universities (HBCUs). We would also need a faculty that is culturally responsive and dedicated to consciousness-raising. The faculty probably should have the same Latinx representation as the student body, but it would be possible to have committed faculty of any race/ethnicity and still achieve the goal. What cannot happen is that liberal White faculty get selected for positions of power and influence because they are safer than “aggressive” Latinx faculty (Gutiérrez et. al., 2012).

None of what I write here should be surprising. There is a vast literature on ethnic studies that could be relied upon to guide thinking about how best to stir up Latinx students (Dee & Penner, 2017; Grant, 1992). Freire and others have also written about liberatory pedagogy, a process of educating for freedom and dignity. Even work in Black Studies on fugitive pedagogy or critical race theory could be used to stimulate thinking about how best to develop a cadre of activist Latinx students. These methods could be deployed, but they will not be because we value the wrong metrics and pursue the wrong goals.

What Lies Ahead?

Unfortunately, I do not see much hope for change because the system is working as it should. At the national level, the Supreme Court recently ruled that race can no longer be used as a factor in university admissions (Hurley, 2023). For HSIs, that means that even more Latinx students will be showing up on campus because they will be denied admissions to more elite schools. This will make administrators across the board happy because prestigious schools will increase their property value by reverting back to being almost exclusively White and Asian while HSIs will be receiving some well-heeled, but heartbroken Latinx students who were rejected by their schools of choice.

Within HSIs, faculty, the majority of whom are White at most HSIs, will not be asked to do anything any differently and coercive assimilation will prevail under the guise of teaching professionalism. Students will be reticent to oppose these processes and before too long accept that holding a real job means acting White (Gutiérrez et. al., 2012). They will continue to gain the documentation necessary to take on jobs that provide enough income to abandon their home neighborhoods and cultures, and perhaps even marry someone who offers them admission into proximal Whiteness.

Meanwhile, so-called advocates of HSIs will tour the country making Gucci money telling stories about how the system is fine the way it is and that, as one attendee at an AERA presentation on HSIs so succinctly put it, “something is better than nothing.” Anyone who dares speaks out against these system-justifying snake oil salesmen will be disinvited from Title V grant teams and other committees aimed at defining servingness. Those who do the disinviting will earn social capital by bullying the “whack job” and will have their own shortcomings ignored.

Although the future may seem bleak, it is not so bad. Ultimately, Latinx people have a decision to make about whether the value of Whiteness is greater than the cost of denying Indian ancestry and turning on Black people. To the extent that it is a win-win to be assimilated while earning a marginally significant college degree, there is no good reason to rock the boat.

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A Comparative Analysis of Pre- and Post-Pandemic Films – Trends in Genre and Plots in the Highest Grossing Movies: A Content Analysis of the Top 100 Grossing Films from 2017 - 2022



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ABSTRACT

During the Covid-19 pandemic, access to movie theaters was restricted, and online streaming became the primary way for movie consumption in the US. Moreover, the audience's mentality was seriously influenced by the drastic changes in their daily life. However, the impact of these changes on the audience's preferences for movies is underexplored. This study utilizes content analysis, a hybrid deductive and inductive coding approach to identify relationships between plot and genre in the highest-grossing films between the years 2017 - 2022. This study builds upon the idea that every story is told using one of the seven basic plots and genres as a means of classification for this set of films. By utilizing the seven basic plots, genre categorization, and the official descriptions released with each film this study investigates how the audience's preferences were affected by the 2020 covid-19 global pandemic. The results show notable changes in the types of films that were most consumed such as an increase in comedy and horror genre movies along with an increase in comedy and overcoming the monster storytelling plots.

Introduction

There have been many plot analysis studies done on singular films, but no plot percentage studies have been done. There is no current study about the effects on the preferred content of films during the pandemic. In recent years, there is no updated research on how the seven plots apply to modern films nor content analysis to see the percentage of films that fall under a specific plot. While every story can be told differently, every story has a central singular plot line that is followed. Plot gives the reasons and focuses a structure for the story, main characters, and audiences to follow, which is supported by (Egan, 1978). This paper uses Christopher Booker's book, 'The Seven Basic Plots,' which outlines the criteria and characteristics of the seven different plot lines and will be used as a basis for this story. Booker, C. (2004) work includes content and plot analysis of some of the age-old stories we know, such as Cinderella, Aladdin, and David and the Goliath, to identify the key elements that make up the seven basic plots. Genre is an umbrella term used to describe the different classifications that a story can fall under as supported by Harris, T. (1995). The genre influences the shaping and narrative presented to audiences about a story. Each story can also be categorized by the genre that they fall into. The genre of a story heavily influences how the tone of the story is presented. Genre is one of the

many elements that can influence how the same plot can be used to tell the same story in different ways. According to Carvalho, T., Krammer, F., & Iwasaki, A. (2023) On January 31st, 2020, The Secretary of the Department of Health and Human Services declared the Novel Coronavirus (Covid-19) a public health emergency in the United States. The declaration of the covid pandemic immediately interrupted the daily route from the basics of grocery shopping to utilizing public spaces and the type of media we consume was affected.

Various industries were affected by the Covid-19 pandemic including the film industry. During the global pandemic, how films were consumed and what types of films were being consumed have yet to be studied extensively. The film industry significantly contributes to the United States's and the global economy, creating billions of dollars of revenue every year. However, the global pandemic brought about significant changes in how films were consumed and what types of films were in demand. Like the United States other countries also experience in changes in the film industry as demonstrated by Changsong, W., Kerry, L., & Marta, R. F. (2021) study about the shift to VOD (video on demand) services during the pandemic in South East Asia. In 2020, the film industry experienced historically low box office revenue which the box office has yet to recover from (Table 1). To determine the extent of these changes, it is essential to analyze the consumption patterns during this unique period and identify the highest-grossing films as representative case studies. This analysis of the market's most consumed films will give insight to filmmakers, marketers, and researchers on the industries evolving view preferences and consumer habits.

Literary Review

Content Analysis

Daniel Riffe, Stephen Lacy, and Fredrick Fico are notable researchers in content analysis having multiple editions of their book, 'Analyzing Media Messages,' which give throughout approaches to the analysis of multimedia content. Jessica Allen, Sonia Livingstone, and Robert Reiner have focused on the changing locations of crime taking place in films. They use content analysis of said films to compose their findings in a sample of films from 1945 - 1991. The research conducted by Allen, Reiner, and Livingstone gives us insight into how they gathered data to conduct their research and findings of the industry changes involving a specific genre of movie.

Foundations of coding

Booker, C. (2004), lays out the foundation for the deductive coding method for this research paper's content analysis through his descriptions of the seven basic plot lines: overcoming the monster, voyage and return, rebirth, comedy, tragedy, and the quest. This study aims to analyze the individual movies in the top one-hundred-grossing list for the years of 2017 - 2022 utilizing the plot archetypes presented in Booker's literature. The data sets gathered for the top one-hundred grossing films domestically were compiled from, ("The Numbers," n.d.) These lists were chosen due to their nondiscriminatory inclusion of all films that were currently at the box office. In addition, ("Box Office Mojo," n.d.) and ("Rotten Tomatoes," n.d.), were used for their additional genre classifications in order to get the full scope of how these films were officially classified. The numbers, box office mojo, and rotten tomatoes are all sources of official descriptions. Each film was described, and genre categorizations were analyzed in order to determine the appropriate plot categorization.

Effects on Film Industry

The focus of previous research efforts has been on understanding the monetary effects of social distancing on the local film industries such as the decline in ticket sales and delayed or canceled movie releases in communities. Lothar Mikos has investigated the impact of the pandemic on film and television production and consumption in Germany. Wang Changsong, Lucyann Kerry, and Rustono Farady Marta have studied the distribution of films by video streaming platforms across Southeast Asia during the COVID-19 pandemic. Murat Akser wrote a paper investigating how the COVID-19 pandemic affected the production and release of specific films during 2020 such as Christophe Nolan's *Tenent*, *No Time to Die*, and *Wonder Woman 1984*. The Motion Picture Association releases an annual THEME REPORT cohesively synthesizing international and domestic box office revenue along with consumer demographic information. Their 2020 report noted the significant changes in audience numbers at in-person movie theaters and the rise to VOD (video-on-demand) service numbers during the pandemic.

Hypothesis

Due to the mass isolation, financial constraints, and public gathering restrictions placed during the Covid-19 pandemic, it can be hypothesized that these factors would influence a change in consumer behavior that reflects an increase in more serious, darker content. I hypothesize that the straining and stressful changes in the local and global environment would be reflected through the plots and genres of the top films during the pandemic.

Methodology

Sample Selection

The data sample for this research project was selected from ("The Numbers," n.d.). By using their list of, "Top Domestic Movie Chart for 2017 – 2022," a sample of one hundred of the highest-grossing films was taken from the years 2017 – 2022. Additional genre categorization data was gathered from ("Box Office Mojo," n.d.), ("Rotten Tomatoes," n.d.). By utilizing three major sources of film data, this study was able to use the more accurate descriptions made available of each film as all the websites listed above provide genre categorizations,

The research presented in this paper utilizes methodologies to perform a comparative analysis of consumer behavioral patterns before and after the pandemic. The methodologies used such as data collection and content analysis provide the framework of the comparative analysis as written about and utilized by (Stemler, 2015). The findings of this study will shed light on the impact of the covid-19 pandemic effects and alteration of consumer behavior on the film industry, providing valuable insights into the evolving landscape of audience preferences.

Content Analysis

Content analysis is a method used by researchers to categorize films based on their genre, plot, and predominant narratives conveyed in media. Researchers can utilize content analysis to identify the major points in a film to classify each film using the criteria for the seven basic plots. The coding utilized in this content analysis is a hybrid approach of inductive and deductive coding as in the research presented by (Vaismoradi, Jones, Turunen, & Snelgrove, 2016). Identifying which of the seven basic plots a movie falls under, in addition to its genre

classification. The coding approach allows us to utilize an objective analysis of the films in our sample and enables us to identify which of the seven basic plots along with genre audiences preferred. To effectively categorize the highest-grossing movies from 2017 to 2022, this study utilizes the seven basic plot points as a framework provided by Booker, C. (2004). By applying the foundations of the classification system, we evaluate storyline variations and identify any significant shifts in audience preferences over the specified time frame (Table 1).

The application of this framework will enable us to effectively categorize and analyze these movies. We can track the consumption patterns of this period to determine the highest-grossing films by measuring the top stories we picked between pre and post-pandemic. This research contributes to the existing body of knowledge by highlighting the importance of studying the impact of global current events on consumer choices and the film industry. It also explores the predominant popular stories during a specific period, categorizing them by storyline. By examining the cultural climate and its effects on the stories portrayed in films, this research aims to provide insights into the relevance of traditional plotlines in contemporary society.

Data

Significant Percentage Differences in Genre Findings

The most notable film genre percentages from 2017-2018 the Horror genre experienced a -13.82% change in popularity (Table 5). From 2018-2019 (Table 5) the Horror genre experienced an increase of 7.16% from the previous year. Despite the drastic loss in revenue for the industry the year 2020 stands out with substantial variations of percentage changes including Horror, Mystery, Sci-Fi, and Suspense/Thriller (Table 5). The Suspense/Thriller genre experienced a significant decline in popularity in 2018 – 2019 (Table 5). From 2019 – 2020 Suspense/Thriller saw a 1.98% increase in popularity from the previous year (Table 5). From 2019 to 2020, Drama witnessed a substantial surge of 35.10%, indicating a significant boost in popularity (Table 5)..

Trends in Genre

These findings demonstrate the variances in genre preferences with Horror, Suspense/Thriller, and Drama experiencing notable changes with consistent upward trends until a decline in 2022 (Table 6). The Horror genre experienced its biggest increase in the years 2018 - 2019 and then maintained a consistent level through 2021 – 2022 (Table 6). Drama demonstrated a consistent upward trend throughout the entirety of 2017 – 2022 (Table 6). The most significant increase was in 2020 - 2021. However, in the final year, from 2021 to 2022, Drama experienced a significant decline, indicating a potential shift in audience preferences away from this genre (Table 6).

Significant Percentage Differences in Plot

The most significant decrease in the percentage of films featuring the "Overcoming the Monster" plot type occurred between 2018 and 2022, with a decrease of 16.37 percentage points. Quest: The most significant increase in the percentage of films featuring the "Quest" plot type occurred between 2018 and 2022, with an increase of 15.24 percentage points (Table 3). These highlights showcase how the plot line "Quest" consistently has the highest percentage of the top one-hundred-grossing films (Table 3). The most significant changes in plot types between consecutive years are observed in the "Overcoming the Monster" and "Quest" categories. The percentage of films following the "Overcoming the Monster" plot type decreases notably from

2018 to 2022, while the percentage of films following the "Quest" plot type shows a significant increase during the same period. Other plot types, such as "Voyage and Return," "Rags to Riches," "Comedy," "Tragedy," and "Rebirth," exhibit fluctuations without significant differences from one year to the next.

The most notable percentage of the plot of every year, 2017: Quest (31.82%), 2018: Quest (43.72%), 2019: Rebirth (22.25%), 2020: Quest (45.62%), 2021: Quest (35.76%), 2022: Quest (58.96%).

Table 1: Criteria for Plot Classification

| | |
|-------------------------------|---|
| Overcoming the Monster | <ol style="list-style-type: none"> 1. Anticipation Stage: The Call <ul style="list-style-type: none"> • Hero is made aware of threat 2. Dream Stage: <ul style="list-style-type: none"> • Hero prepares for confrontation 3. Frustration Stage <ul style="list-style-type: none"> • The threat is presented as a great force against Hero 4. Nightmare Stage <ul style="list-style-type: none"> • Final confrontation 5. Escape <ul style="list-style-type: none"> • Hero defeats threat |
| Rags to Riches | <ol style="list-style-type: none"> 1. The Call: <ul style="list-style-type: none"> • Underdog hero with little or nothing 2. Out into the World: <ul style="list-style-type: none"> • gains of "Riches." 3. Central Crisis: <ul style="list-style-type: none"> • Hero loses everything "Riches," that have been gained 4. Independence and final ordeal: <ul style="list-style-type: none"> • This lose causes change and maturity in character usually 5. Final Union: <ul style="list-style-type: none"> • involes in the gain of those "Riches," back |

| | |
|--------------------------|---|
| Voyage and Return | <ol style="list-style-type: none"> 1. Anticipation Stage: <ul style="list-style-type: none"> • Hero in a broken state, lost, young, or naive 2. Initial Frustration Stage: <ul style="list-style-type: none"> • Introduction of the unexpected world, fun and unfamiliar 3. Frustration Stage: <ul style="list-style-type: none"> • Darkness creeps in, spoiling the initial fantastical dream stage 4. Nightmare Stage: <ul style="list-style-type: none"> • Threat/monster takes center stage 5. Thrilling Escape Stage: <ul style="list-style-type: none"> • Hero barely escapes with growth in character |
| Comedy | <ol style="list-style-type: none"> 1. Confusion of the world/story 2. The confusion gets worse 3. Coming to light, the story the whole picture/ story comes into fruition |
| Tragedy | <ol style="list-style-type: none"> 1. Anticipation Stage: <ul style="list-style-type: none"> • Hero is unfulfilled or incomplete 2. Dream Stage: <ul style="list-style-type: none"> • Hero dreams of higher aspiration, change their present course of action 3. Frustration Stage: <ul style="list-style-type: none"> • Things go wrong for hero 4. Nightmare Stage: <ul style="list-style-type: none"> • Hero is completely out of control of their situation 5. Death Stage: <ul style="list-style-type: none"> • Hero's death |

| | |
|------------------|--|
| Rebirth | <ol style="list-style-type: none"> 1. Hero falls to a dark force 2. Threat subsides 3. Confrontation is initiated again 4. Threat is finally triumphed 5. Hero has miraculous redemption |
| The Quest | <ol style="list-style-type: none"> 1. The Call: <ul style="list-style-type: none"> - Hero's community is threatened 2. The Journey: <ul style="list-style-type: none"> - Hero must journey away to save their community 3. Arrival and Frustration: <ul style="list-style-type: none"> - New threat, usually an minor overcoming the monster plot 4. Final Ordeals: <ul style="list-style-type: none"> - Hero overcomes final trials 5. Goal: <ul style="list-style-type: none"> - Thrilling escape |

Table 2: Total Revenue of Box Office Top 100 Domestic Grossing Films

| | |
|---------------------------|---------------------------|
| 2017 total revenue | \$9,961,215,860 |
| 2018 total revenue | \$10,675,846,119 |
| 2019 total revenue | \$10,304,021,761 |
| 2020 total revenue | \$1,944,030,583.00 |
| 2021 total revenue | \$4,433,954,292 |
| 2022 total revenue | \$7,229,533,078 |

Table 3: Plot Percentage Trends 2017 – 2022

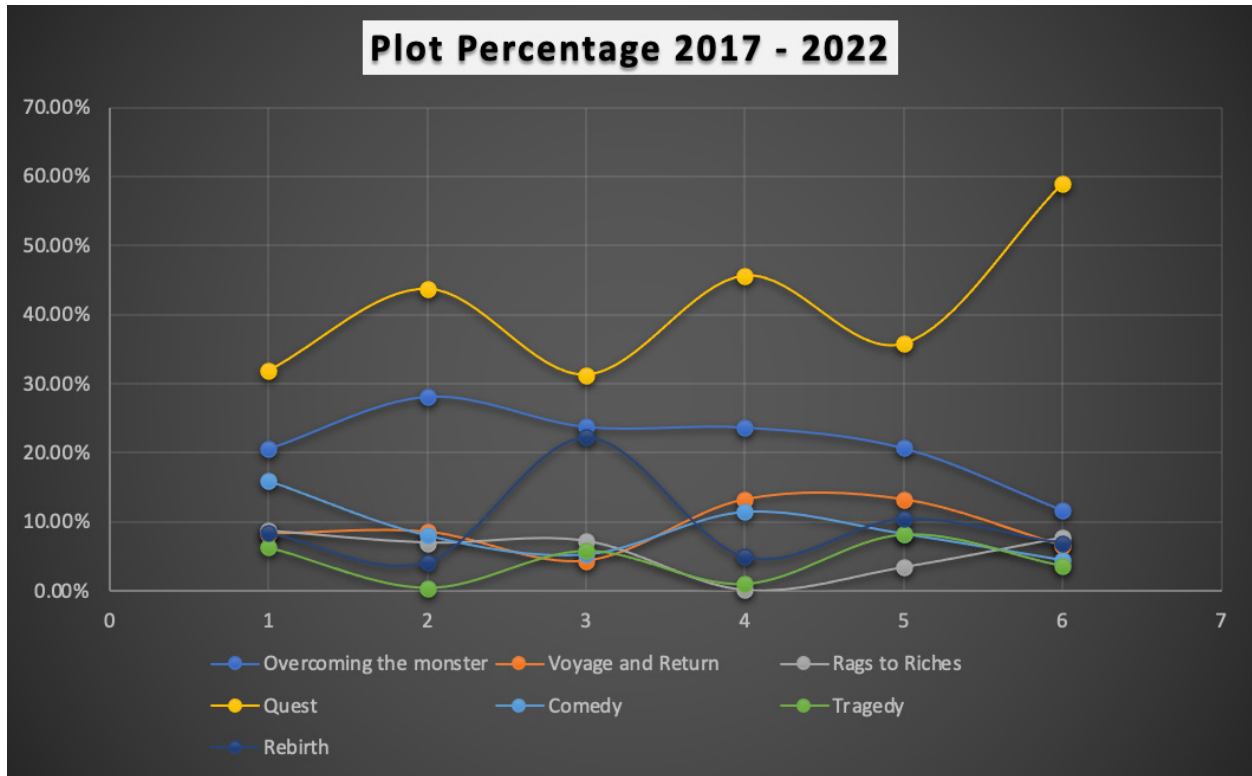


Table 4 : Yearly Plot Percentage of Box Office Top Grossing 100 Films

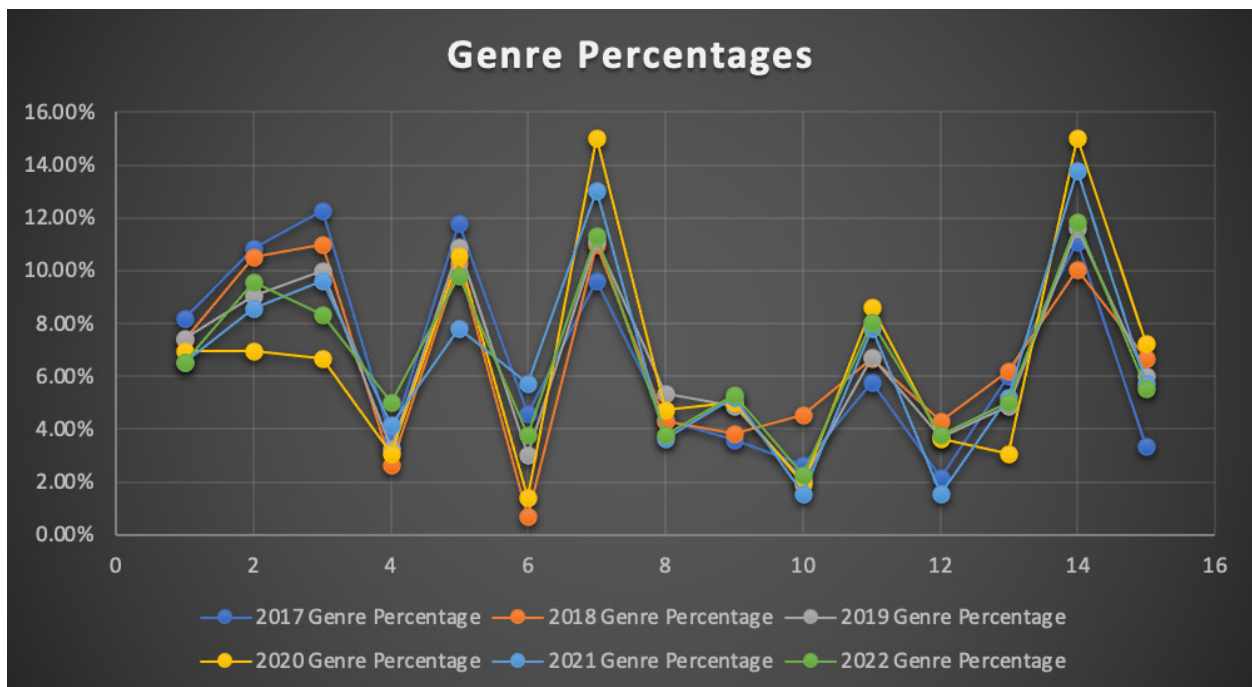
| | Final Plot Percentage | | | | | |
|------------------------|-----------------------|------|------|------|------|------|
| | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
| Overcoming the monster | 21% | 28% | 24% | 24% | 21% | 12% |
| Voyage and Return | 8% | 9% | 4% | 13% | 13% | 7% |
| Rags to Riches | 9% | 7% | 7% | 0% | 3% | 8% |
| Quest | 32% | 44% | 31% | 46% | 36% | 59% |
| Comedy | 16% | 8% | 5% | 11% | 8% | 5% |
| Tragedy | 6% | 0% | 6% | 1% | 8% | 4% |
| Rebirth | 8% | 4% | 22% | 5% | 10% | 7% |

Table 5: Genre Percentage Differences

| | Final Genre Percentage | | | | | |
|-------------------------|------------------------|------|------|------|------|------|
| | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
| Fantasy | 8% | 7% | 7% | 7% | 7% | 7% |
| Action | 11% | 11% | 9% | 7% | 9% | 10% |
| Adventure | 12% | 11% | 10% | 7% | 10% | 8% |
| Animation/anime | 4% | 3% | 3% | 3% | 4% | 5% |
| Comedy/Black comedy | 12% | 10% | 11% | 11% | 8% | 10% |
| Crime | 5% | 1% | 3% | 1% | 6% | 4% |
| Drama | 10% | 11% | 11% | 15% | 13% | 11% |
| Family | 4% | 4% | 5% | 5% | 4% | 4% |
| Horror | 4% | 4% | 5% | 5% | 5% | 5% |
| Musical/Music | 3% | 5% | 2% | 2% | 2% | 2% |
| Mystery | 6% | 7% | 7% | 9% | 8% | 8% |
| Romance/Romantic Comedy | 2% | 4% | 4% | 4% | 2% | 4% |
| Sci-Fi | 6% | 6% | 5% | 3% | 5% | 5% |
| Suspence/Thriller | 11% | 10% | 12% | 15% | 14% | 12% |
| Small Percentage Genre | 3% | 7% | 6% | 7% | 6% | 6% |

(The Suspence/Thriller genre has a significant increase from a 11.60% in 2020 to a 15.04% in 2021.)

Table 6 : Genre Percentage Trends 2017 - 2022



Discussion

The hypothesis proposed that the pandemic-related stress factors would lead to changes in consumer preferences for more serious and darker content. This study aimed to investigate the impact of the Covid-19 pandemic on consumer behavior and narrative preferences in the film industry. This research study sought to understand the changes in genre and plot preferences by analyzing and categorizing the highest-grossing films from 2017 - 2022. The findings of the study revealed several noteworthy insights. There were significant revenue impacts to the film industry such as the revenue provided by the top 100 grossing movies in 2020 was down 81.41% compared to the revenue brought in by the top 100 grossing movies in 2019. This is largely attributed to the social distancing measures implemented during the pandemic. The differences in genre and plot preferences showcase how the plot line "Quest" consistently has the highest percentage of the top one-hundred-grossing films (Table 3). The most significant changes in plot types between consecutive years are observed in the "Overcoming the Monster" and "Quest" categories. The findings provided valuable insights aiding in understanding the evolving landscapes of audience preferences in the face of major societal changes for filmmakers, marketers, and researchers to use.

Limitations of study

Content analysis can be debated due to its subjective nature. The genre classification of each film is open to interpretation. To be as objective as possible this study utilizes widely available and frequently sourced such as Box Office Mojo, Rotten Tomatoes, and The Numbers.

This study focuses on a finite sample of five-hundred movies over a specific time. The list is comprised of the top five-hundred grossing movies domestically. Domestically this study means the United States, Canada, Guam, and Puerto Rico.

Contributions

This research contributes to the existing body of knowledge by examining the impact of the Covid-19 pandemic on consumer behavior and narrative preferences in the film industry. It demonstrates the importance of studying global events and their influences on audience choices.

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Recognizing Bonds and Attachment Relations in One Beluga Whale (*Delphinapterus leucas*) Mother-Calf Pair



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ABSTRACT

John Bowlby's theory of attachment is found to be a way of explaining why bonds are important in being formed for both physiological and psychological needs to be met in human offspring. However, attachments also exist within and between species. This study examined 11.71 hours of video recordings of a beluga (*Delphinapterus leucas*) mother-calf pair housed at SeaWorld Texas over two years of the calf's life. It was expected that as the calf matured, mother-calf swims would decrease while solo swimming increased. of the duration of myriad behaviors were recorded and included mother-calf swims, solo swims, affiliative behaviors and agonistic behaviors. Although mother-calf swims stayed consistent across the first two years, solo swimming initiated increased. Evidence of secure base and safe haven use was observed between the calf and his mother as was maternal intervention and other caregiving behaviors by his mother. These different interactions suggest that the bond between the mother and calf could be described as an attachment e. Additional study of beluga mother-calf relationships could determine if belugas form specific types of secure or insecure attachments

KEYWORDS

Beluga whale,
attachment,
behavior, mother-
calf relationships

Similar to human animals, many large brain mammals have the capacity for complex social lives and behaviors. For many years, it was the initial belief that humans were the only animals capable of elaborate communication. Recent studies have shown that not only humans have attachments to each other but can form attachments across species, as well as non-human animals form attachments within their own species. The theory of attachment proposes to explain a catalog of caregiving and offspring behaviors as well as a classification of attachment relationships.

Theory of Attachment

Attachment in its most basic form is a relationship or bond that shows preference to a particular person. The person with an attachment exhibits proximity promoting behaviors to the attachment figure as well as being in significant stress when separated for a substantial period of time away from the preferred person (Cohen, 1974). Attachments were first recognized by psychologist John Bowlby (Bowlby, 1969). Bowlby attempted to explain how attachments form, the basic classification of secure and insecure attachments, and the consequences of the different

types of attachments. In Bowlby's work, humans form an attachment due to Secondary Drive, a theory that encompasses a number of physiological needs and psychological needs that should be met consistently to lead infants to develop a bond with their mother (Bowlby, 1969). Using specific behaviors, two broad styles of attachment have been identified: secure and insecure. Secure attachments are defined as a mutually beneficial relationship between two individuals in which most psychological needs are met. Psychological needs include depending and being emotionally close with each other. The other broad style includes insecure attachments in which the relationships between two individuals characterized by psychological needs being inconsistently met. For example, insecure attachment may be associated with high anxiety for the attachment figure, a failure to form an intimate bond, or unstable control of emotions. Attachment styles have been applied to both humans and non-human animals, with efforts to discriminate between different types of insecure attachment.

Human Attachment

Human attachment theory predicts that many of the first bonds made occur between infants and their caregivers. In many cases, the initial bond is the maternal parental figure since this individual typically provides food, shelter, and appropriate mental stimulation for the infant. If these needs are followed with a persistent and consistent schedule of care, it is likely that a strong secure attachment will form (Bowlby, 1969). Some of the first bonds can form in the first few months of life for a human child. Attachment may start during the latter stages of gestation and is strengthened during the first year of life. Bowlby hypothesized this attachment bond was formed due to the biological connection between the mother and offspring and the evidence that infants show preference for their mother based on odor, voice, and eventually facial recognition (Sullivan et. al, 2011). However, not all mothers bond with their offspring and infants can still form attachments with other caregivers following that period of time (Sullivan et al, 2011). Based on a series of studies by Harry Harlow, Bowlby concluded that attachments are critical in the beginning stages of life because without the bond there could be serious issues with development.

If physiological needs are met, infants typically follow motor and cognitive developmental trends, however meeting the psychological needs and attention of an infant are imperative to social and emotional development (Hong & Park, 2012). Lack of attention and preoccupied parents may lead a child to form an insecure attachment that can influence their behavior as adults. The temperaments of infants remain consistent through childhood and eventually become the personality of the adolescent and adult, thus the type of parenting received can either facilitate or regress different personality traits (Hong & Park, 2012).

Based on different types of interactions between attachment figures and offspring, four classifications of attachment have been identified: a secure attachment and three insecure attachments, avoidant attachment, ambivalent attachment and disorganized attachment. These attachment styles were identified by Mary Ainsworth when she created a standardized test to measure attachment (Hong & Park, 2012). The "Strange Situation" is a series of novel events combined with separations and reunions with the attachment figure tested with young children experiencing novel events (Hong & Park, 2012). Behaviors that are of key interest include

reaction to a new environment, reaction to the mother leaving, and reaction to a stranger in the new room when the mother was both not present and present. Based on the child's distress, curiosity and reactions to the new experiences, an attachment style could be determined. One key behavior is a secure base, which is defined as when a child explores or interacts with the environment will return to the caregiver for a short period of time and then leave again to return to exploring. A similar behavior, a safe haven, occurs when the offspring is in a distressing situation and returns to the caregiver to find protection from a threatening situation.

Using specific patterns of responses exhibited during a strange situation, Ainsworth and Bowlby broadened our understand of attachment styles. Secure attachments are characterized by the child showing a use of safe havens, secure bases, reunions and distress when the child's caretaker is away for a significant amount of time. An insecure attachment, avoidant attachment styles are when an individual has difficulty or the inability to form intimate bonds with another person. As children, avoidant styles are characterized by avoiding the caregiver or having no outward signs of stress or indifference to others around them. Children with ambivalent styles have moments where psychological needs are met by others, but then may refuse and avoid contact with those same people. Ambivalent styles may have the offspring exhibiting secure base use but may also show distress around the parent, if present. Lastly, a disorganized attachment style is where the child may react fearfully to their caretaker, strangers, and the current environment. Children with disorganized attachments rarely perform reunions or safe havens with caretakers or others. Reunions are when a child may return to their caretaker after an extended period of time to find comfort. Those with disorganized attachment style tend to show general distrust and avoid others to circumvent threatening situations.

Human to Animal

In addition to human-to-human attachments, it is important to note the ability of cross-species attachment. Cross-species attachments can be seen in many different animals and humans, but is most frequently involving pets. Dogs, in particular, appear to form attachments with their owners, including secure and insecure types of attachments. Dogs with close human attachment figures will use their humans as secure bases (Jalongo, 2015). Additionally, dogs with a separation related disorder (SRD) usually had higher stress levels than other dogs and were inferred to have an anxious attachment style (Konok et al., 2019). Much like human parent-offspring attachments, dogs find humans to be a comfort to them, and humans find comfort with their dogs as. People have reported their pets as safe havens (Rockett & Carr, 2014). Interestingly, it has been suggested that the owner's own attachment style, if insecure, could influence the chances of their dog developing an SRD, which could lead to an estranged relationship with the dog (Konok et.al, 2019). Given that attachments are formed when physiological and psychological needs are met as is the case for dogs and other pets with complex social behaviors, it is not surprising that attachment bonds can form with humans. Pets rely on the human to provide shelter and food, which is basic physiological care. However, when meeting the psychological needs through affection or play, it is more likely that a secure attachment will form.

Animal to Animal

Although it is slightly more difficult to assess the quality of a relationship or a bond within a non-human animal, patterns of attachment have been shown in animals. For non-human animals, it is especially important for a mother and offspring to form a bond in the early stages of life. This bond ensures that their physiological needs are being met by the mother, such as feeding or nursing them and living in a safe habitat. However, it is just as important, as it is in most cases of attachment, that psychological needs, such as attention from their mother or interacting with other offspring helps them mature socially. If an animal's caregiver gives them attention and meets the psychological needs, the offspring should engage in safe haven or secure base behavior. Additionally, an attached animal may engage in reunions with its mother even if not in a dangerous situation. Evidence for these expectations are supported by observations with non-human primates. For example, after about 8 months of age, gorilla infants usually are allowed to explore their area but will typically be aware of the mother's location in relation to them and opt to travel on the mother's backs (Bowlby, 1969). These behaviors occur almost naturally when the offspring is provided with proper and consistent care. Without proper care of the animal, as shown in primates, they may engage in abnormal behaviors socially or clear disturbance in their ability to form attachment that could be found in their offspring (O'Connor & Cameron, 2006).

Beluga Whale Behavior

The beluga (*Delphinapterus leucas*), or white whales, are described as complex social marine mammals similar to other cetaceans. They reside in Arctic locations and typically live in pods with other belugas (Hill, 2009). Beluga calves depend on their mothers for the first two to three years of life. In their first few years of life, beluga calves show high levels of social behavior, engaging in a variety of affiliative behaviors and sociosexual behaviors as they mature (Ham et al., 2022). In their first year of life, beluga calves spend a significant portion of their time with their mother, ranging between 50% to 60% of their time (Hill et al., 2013). Much of this time with their mothers involves different types of swim positions that alternate between echelon swims, which is swimming on top of the mother, infant swims, which is below the mother's mammary glands and often leads to the calf nursing, or side by side swimming. The mother also initiates and engages in behavior with the calf but less often than her calf. The behaviors that the mother engages in can include maternal interventions in which a mother calf will approach and "get" her calf away from another beluga or to get them away from a situation that is distressing to either the mother or calf. Mothers will also discipline their calves, although with different frequencies and rarely in most cases (Hill, 2009; Hill et al., 2013). Having maternal care is imperative in developing the social aspect of a beluga's life, especially due to how complex they are.

Based on observations with beluga calves in managed care and in natural habitats, calves spend less proximal time with their mothers as they mature (Krasnova et al., 2006; Lilley et al., 2020). As calves dissociate with their mothers, they engage in more solo swimming and different forms of play. Belugas engage in two forms of play, social play and non-social play. Belugas engage in social play with their mother in their first few months of life and then begin to include

other belugas of similar age in their social groups especially during a juvenile period of their life (Ham et al., 2023; Hill, 2009; Hill et al., 2013). These forms of play can include playing with objects in their environment or objects that have been provided to them by the training staff. Calves can also engage in affiliative behaviors such as mouth locking as early as two months, which is considered to be a friendly form of greeting one beluga to another (Ham et al., 2023). At around this same time, calves interact with one another through sociosexual play behaviors (Ham et al., 2021). These sociosexual play interactions often occur between males, although females have also been observed to display them. Non-social play includes playing with objects in their environment, such as objects provided by trainers and water. Many of these non-social interactions involve manipulating water or objects in novel and repeated movements (Ham et al., 2023; Hill & Ramirez, 2014).

Immature belugas do not as often show agonistic behaviors towards others, although mothers may perform agonistic displays in the forms of head jerks, open mouth threats, bubble bursts, or vocalizations to intervene or protect their calves. Agonistic behaviors become aggressive behaviors when an animal escalates the intensity of an agonistic display to create physical contact such as biting, raking, or slamming their bodies.

Purpose of Study

The purpose of the following study was to review the occurrence of certain behaviors linked to attachment. It is important for researchers to understand if other large brain mammals can have an attachment and to understand in broad terms which particular one. Additionally, due to the lifespan of belugas it was important to see how they engage with their mothers during this extended period of dependence. It is also important to see the frequency and duration of these behaviors over the period of dependence and see how the behaviors may change as a beluga matures.

Research Question

This study asked the following question: Could it be assumed, that based on the frequency and duration of attachment-related behaviors, that this mother-calf pair developed an attachment relationship with one another. If an attachment existed, then it was hypothesized that as TUL matured he would spend less time with LUN and would increase the duration in solo swimming. It was also predicted that TUL would exhibit secure base and safe haven use of his mother, exclusively, if an attachment had been formed.

Method

Subjects

The study conducted follows the behaviors of two white whales, a mother and calf pair. The mother subject, LUN, born in July 2000 is 22 years old and currently lives in Seaworld Texas. LUN has birthed four calves that reside at the same facilities as she does. The calves, from firstborn to most recent include ATL, a female at 12 years old, SAM, male and 9 years old, KEN, a male at 6 years old and TUL, a male at a year and 11 months. LUN's calves have been described as "independent" since a few days after birth. At birth, ATL did not regularly swim

with her mother and never formed a relationship with LUN. SAM, who was born three years after, was not cared for by LUN initially, which can be attributed to LUN's lack of maternal care experience of being a caretaker after her first calf. SAM was surrogated by another whale, until LUN began to care for SAM following the birth of another whale's calf that LUN observed. Three years later, KEN was born, and like SAM, did not bond initially with LUN. After a brief delay, LUN eventually became more attentive to KEN and bonded with him. TUL, the study's focus animal, was born July 25, 2021 and once again, LUN did not immediately bond with him. After about 2 weeks LUN began swimming with the calf and coming for him. He is currently a light gray and was weaned in February 2022, although he still swims with LUN and nurses occasionally. Both subjects are considered in good health, and live with 10 other belugas in a 2 million gallon habitat divided into a series of seven pools. Social groupings are varied by training staff across a day. Belugas also live with six Pacific white sided dolphins (*Lagenorhynchus obliquidens*) at the facility and occasionally housed socially with them.

Measures

The behaviors of interest were measured for duration (sec) and frequency. Attachment behaviors examined for the study included: Mother/Calf swims, solo swims, affiliative behaviors, and directed aggressive behaviors towards mother/calf and whether or not they were performed by mother-calf pair or individually. Mother/calf swims are important to the bond of the two whales since it shows proximity preference behavior. The animals are comfortable in being around one another and the calf considers the mother as a safe animal to be around. Solo swimming is important to consider in understanding an animal's preference if they want to be sociable or not. Secure base is defined as the offspring will perform a "check in", periodically going to with their caregiver while exploring their environment. Safe haven is defined as when an offspring is in a situation that distresses them, they will go to their caregivers for comfort and protection. These two behaviors are hallmarks of attachment bonds.

Procedure

Data Collection

Data collection occurred by researchers using a video camera to record any behavior or phenomena at the pools where the belugas were being kept. Videos would be taken between approximately 7:00 A.M to 5:00 P.M. Video recordings would begin with the date, the time, what type of recording protocol, identity of whales, and pools that were accessible. A concluding summary of video highlights was provided at the end. Data were either collected using a Focal Follow (FF) or a Scan Sample (SS) procedure. FF recording lengths typically ranged anywhere from 10-15 minutes of footage and primarily focused on LUN and TUL and their observable actions. The data used for the study included 39 FF. SS recording lengths were approximately 20 minutes and scanned all animals in a social grouping. Five of the selected video samples coded were SS.

Video Recording Selection

Video recordings were selected over a 22-month period. Two videos per month were selected randomly to best represent the overall behaviors between the mother and calf. Some months had limited video recordings and the end of the following months were selected. FF were the main source of video, however, if there were no FF for the allotted time, then a scan sample was used.

Video Coding

One research assistant coded all selected video recordings for the study. Video coding was conducted within Google Sheets. A recorded instance of the behavior would have: the video file name, the total video length, the start time of the behavior in minutes and seconds, the stop time of the behavior in minutes and seconds, the first animal's name, the second animal's name, what kind of behavior occurred, the initiator, the terminator, if a safe haven occurred, if a secure base occurred, if a mother intervention occurred, if a return occurred and any additional comments or notes. Behaviors were marked using the numbers 1-4. 1 indicated a Mother/Calf swim, 2 indicated a solo swim, 3 indicated any other affiliative behavior and 4 indicated any other aggressive behavior. Initiator and terminator portion was marked with numbers 1-4, 1 indicated the calf, 2 indicated the mother, 3 indicating any others and 4 indicating unknown. For safe haven, secure base, mother intervention, and returns a 1 is marked for the occurrence, if no behavior occurred it remained unmarked.

Statistical Planning

The coded videos on the spreadsheet were transferred to SPSS to perform statistical analyses. A comparative analysis was performed across quarters of TUL's life. A generalized linear mixed model (GLMM) was utilized to assess trends over time using a repeated measures model.

Results

A total of 42,155 seconds (11.71 hours) were coded across 44 video recordings of TUL and his mother, LUN. An overall activity budget was created for four categories of behavior collapsed across eight quarters: mother-calf swim, solo swimming, affiliative interactions, and agonistic interactions. The total duration of time spent in each category was divided by the total observation time and multiplied by 100. Additional analyses were conducted to determine if these behaviors changed over the course of the first two years of life. Finally, an assessment regarding attachment behaviors and a resulting bond between the calf and his mother was performed.

Mother-Calf Swim

From the observation time, TUL initiated 83 Mother-Calf swims for a total of 23,643 seconds, which constituted 56% percent of their time engaged in this activity. A linear regression with quarter as the predictor and mother-calf swim as the criterion indicated that time spent in mother-calf swims was stable over time ($\beta = -0.011$), $F(1,81) = 0.01$, $p = .92$ (Figure 1). This

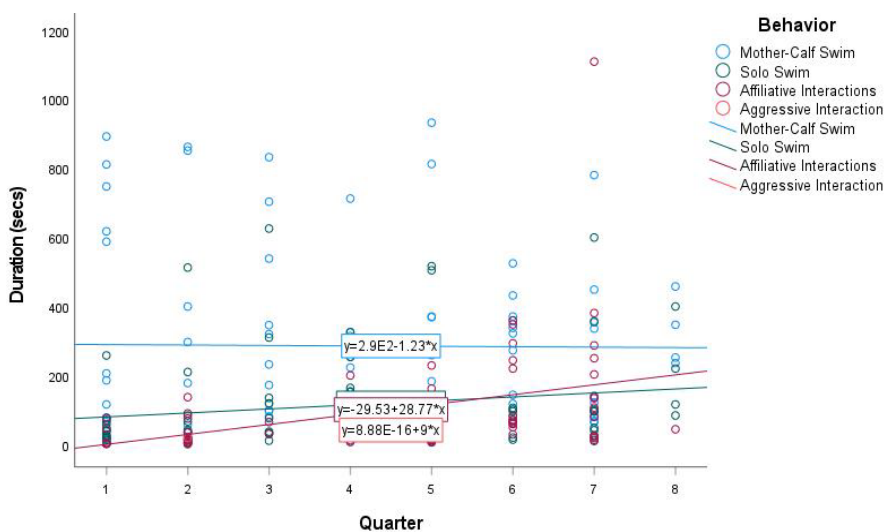
result did not support the expectation that mother-calf swim would decrease over time. While LUN initiated only one of the total 84 mother-calf swim events recorded, TUL initiated Mother-Calf swims with LUN about 7.09 times per hour.

Solo Swimming

Across the two years of life, TUL initiated 76 Solo Swim events. This solo swimming accounted for about 20.6% (8,695 seconds) of the total time recorded. LUN initiated two solo swims from TUL for a total of 1,585 seconds. Unexpectedly, the results of a linear regression to evaluate solo swim over time indicated that time spent in solo swims remained stable over the first two years of life ($\beta = 0.169$), $F(1,74) = 2.17$, $p = .15$ (Figure 1). TUL was more likely to initiate solo swimming than his mother given his observed rate of approximately 6.49 times per hour.

Figure 1

Regression Lines for All Behaviors of Interest for TUL



Affiliative Behaviors

TUL initiated and participated in 76 affiliative behavior interactions across multiple belugas for a total of 7,135 seconds. Approximately 2% (288 secs) of that time in affiliative behavior interactions involved his mother. In contrast, TUL spent approximately 11.8% (4,992 seconds) of his time engaged in affiliative behavior with calves. When combined with mother-calf swim, TUL initiated affiliative interactions with his mother at a rate of 8.37 per hour. TUL spent a minimal amount of time with other adult belugas, approximately 0.18% (76 seconds) with only one affiliative interaction observed across the two-year period. A linear regression confirmed that affiliative behavior interactions initiated by TUL increased over time ($\beta = 0.407$), $F(1,74) = 14.65$, $p < .001$, (Figure 1), with TUL initiating affiliative behavior interactions with

other calves approximately 3.07 times per hour. In terms of social interactions, LUN displayed similar levels over time, $F(1,3) = 0.96, p = .40$.

Agonistic Behaviors

Agonistic behaviors were observed rarely. TUL initiated a single agonistic behavior interaction for a duration of 18 seconds. LUN initiated two agonistic events for a total of 5 seconds. Due to a small number of agonistic events, no additional analyses were conducted. (Figure 1).

Secure Base and Safe Haven

As the two attachment indicator behaviors, TUL performed a total of 5 Secure Bases and 7 Safe havens across the eight quarters of his life. Secure bases occurred the most in the 5th quarter (13-15 months) with three events. Safe Haven behaviors were observed at least once across multiple quarters. TUL is consistent in using the Safe Haven behavior. TUL exhibited these attachment behaviors 1.02 times per hour.

Discussion

Based on previous research and the current findings, the calf examined in this study is following the developmental timeline and milestones observed in other beluga calves both in the care of humans and the wild (Hill, 2009; Hill et al., 2013). The bond demonstrated between the two subjects remained consistent over the two years of life recorded. Evidenced by more than half the time spent together in mother-calf swims or affiliative social interactions with each other, TUL and LUN showed a clear preference for each other versus any other animal available. When not with LUN, TUL spent much of his time engaged in solo swimming. However, he also engaged in different social interactions with other animals. Given that belugas have long life spans with a period of dependence that lasts two to five years, beluga calves take more time to mature sexually, socially, and ecologically (Hill et al., 2013). This extended developmental period enables a bond to be formed between the mother and calf and is evidenced by the percentage of time spent together (more than half of observed time) and the use of his mother during exploration and stressful events. In terms of secure base and safe haven usage, TUL did them consistently if rarely as they were only observed 1-2 times per quarter. Despite the seemingly low usage, it is important to consider the fact that these animals are in a controlled environment. Due to them being in a controlled environment the argument could be made that the environment is less stressful than a natural environment so there could be a difference in the usage of secure bases and safe havens.

Improvements that could occur with this study include the video coding. Due to video coding using the judgment of a single coder, the primary researcher, there could have been misinterpreted behaviors that would classify as different attachment behaviors. To fix this in future studies. It would be best to have another researcher review the footage for reliability. Furthermore, only visible actions were recorded, meaning that potentially there were behaviors occurring that were not seen. The number of videos reviewed per month should increase to obtain a more accurate representation of performed behavior.

With the research conducted in this longitudinal study, attachment theory goes beyond humans, but has a genuine role in animals and especially mammals (Jalongo, 2015; Konok et al., 2019). Attachment serves the purpose of not only basic physiological needs for survival, but provides the psychological safety needed for animals with complex social lives. Attachment in the case of most animals is imperative for survival due to their need for a caregiver. Caregivers in the case of living in managed care, could be the biological parent as well as trainers that work in the facility, much like dogs and their owners (Konok et al., 2019). With cross-species attachments existing, it is possible that a beluga could form a bond with a trainer as trainers provide food, attention, contact, and toys. However, it would be difficult to assess the quality of a human to beluga attachment because secure base and safe havens would not be able to be performed. Therefore, while theoretically possible, it would be difficult to classify what kind of broad term bond a human and beluga may have. The current inability to classify the cross-species attachment does not take away from the ability to class conspecific-to-conspecific attachment. It is important to inventory attachment behaviors that are seen in belugas so that future researchers can generate a profile for different attachments. Researchers could begin to understand which specific behaviors belugas engage in with their caregivers or calves and see why a specific attachment forms. So far what has been noted in the study of a mother-calf pair in human care have shown strong indications for attachment. The behavior demonstrated implies the possibility of a secure attachment, although that would require much more data collection on the future years of TUL and LUN's life. imilar levels over time, $F(1,3) = 0.96, p = .40$.

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“A Little Monster Music”: History, Future, and Analysis of Tuba-Euphonium Ensemble Music



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ABSTRACT

This research aims to provide analytical review that explains the history and prospects of the Tuba-Euphonium Ensemble with its repertoire, investigate the production, the recorded works, and composers for the Backburner Tuba-Euphonium Collective's debut album: “A Little Monster Music,” while also discussing the biography and objective of the Backburner Tuba-Euphonium Collective. This paper includes the oral and written history behind the Tuba-Euphonium Ensemble and the Backburner Tuba-Euphonium Collective; this paper provides two oral interviews with two professional Tuba-Euphonium players, named Dr. Clayton Maddox and Dr. Matthew Mireles. In these interviews, both Dr. Maddox and Dr. Mireles share their biography while also reviewing the general condition of Tuba-Euphonium ensembles and their motivations for Backburner. The approach to researching this topic involved an examination of all the recorded works and composers for the repertoire of the Backburner Tuba-Euphonium Collective, and then it was also required to collect the biographical data behind Backburner. After collecting data, it was instructed to communicate an analysis of the recorded works that are in the Backburner's debut album: “A Little Monster Music.” This interpretation is also referred to as creating “liner notes,” which essentially illustrate a listener's perspective of the portrayal and pervading theme or character of the piece. The contention for the reader was to explain why documenting the history and momentum of Tuba-Euphonium Ensembles is crucial to the continuity and respect for the instruments, while also inspiring a consensus to understanding and listening to the recorded works for Tuba-Euphonium Ensembles and Backburner.

Introduction

Definitions:

According to Christopher Lair, “the name ‘tuba-euphonium ensemble’ describes a musical group that mainly consists of several tuba and euphonium musicians” (Lair et al., 2009, p 1). In this kind of ensemble, there would usually be more than one person playing a given part. This is not entirely different from the tuba-euphonium chamber ensemble approach, which is only one player per part and consists of mainly trios, quartets, or quintets. However, the tuba-euphonium ensemble maintains its separate moniker and identity from the traditional chamber ensemble. To clarify again, Tuba-Euphonium Ensembles typically have more than a few players

to a part, possibly more than four at a given time. The tuba-euphonium ensemble was made popular through the work of Winston Morris, Professor of Tuba and Euphonium at Tennessee Tech University, and Constance “Connie” Weldon, Professor of Tuba at the University of Miami. Yet, Winston Morris was more associated with the direct works of corroborating the tuba-euphonium ensemble whereas Weldon’s endorsement relied heavily on the chamber ensemble approach.

This project would not be complete without the addition of “liner notes.” The term liner notes refer to the texts that are printed alongside the sleeve of a CD case or physical record album. Liner notes allow the researcher to present a concise biography of the composers and artists, provide a general and historical background behind the music, and then proceed to give a qualitative overview or description of the character of the music. The description is an interpretation in which one must illustrate the portrayal of the piece, conveying to the audience by the way it sounds.

Literature Review:

The two dissertations that are referred to in this paper are Christopher Lair’s, “*A Historical Overview of the Development of Collegiate and Professional Tuba-Euphonium Ensembles in the United States,*” and Richard Perry’s, “*The Tennessee Technological University Tuba Ensemble: A Short History and Summary of Original Contributions to Tuba-Euphonium Ensemble Literature,*” which are both used to provide a comprehensive analysis of the background, the foundation, the current condition, and the continuity of the tuba-euphonium ensemble. Christopher Lair’s dissertation communicates the extensive history, condition, and outlook of the tuba-euphonium ensemble in the United States. Lair’s dissertation also contains various oral interviews with several professional tuba-euphonium players: Winston Morris, Scott Watson, Harvey Phillips, Jerry Young, John Stevens, Joseph Skillen, Demondrae Thurman, and Skip Gray. Lair asks the following questions to the interviewees:

1. “*Can you describe the history and climate related to tuba ensembles in the 1960s?*”
2. “*Can you describe the history and climate related to tuba ensembles in the 1970s?*”
3. “*Can you describe the history and climate related to tuba ensembles in the 1980s?*”
4. “*Can you describe the history and climate related to tuba ensembles in the 1990s?*”
5. “*Why did you form the Tuba-Euphonium Ensemble with your studio?*”
6. “*What has been your overriding philosophy for the group?*”
7. “*Did you have any special influences?*”
8. “*Do you feel tuba ensembles are important to the university curriculum? Why?*”

9. “Can you describe the reception the group has received by the public over the years?”
10. “Do you feel professional tuba-euphonium ensembles are important to the development and continuity of the instrument? Why?”
11. “What have you witnessed in the evolution of tuba-euphonium quartets over the decades?”
12. “Do you think tuba-euphonium quartets will have a place as a traditional chamber ensemble?”

All of which provide substantial, corroborate evidence for the state and future of tuba-euphonium ensembles, and “*Symphonia*” (Lair et al., 2009, p 2). Some of these interview questions were also used to predicate certain responses in the interviews of this document.

Richard Perry’s article, which briefly mentions Winston Morris and his ambitions with the Tennessee Tech Tuba Ensemble, is mainly concerned with the history and prospects of the Tennessee Tech Tuba-Euphonium Ensemble itself. Although it supplies sufficient evidence for the specific nature of the Tennessee Tech Tuba-Euphonium Ensemble, it is not adequate for the comprehensive status that is given in Christopher Lair’s dissertation. However, Perry’s dissertation still enforces the main argument: how subsidiary or auxiliary ensembles promote the continuity and respect for the instruments and their players; and how it contributes to expanding repertoire and catalog for tuba-euphonium ensembles and their respective music.

The PDF document that is entitled, “*The Serpent’s Kiss*,” is an album for the collection of music for the chamber ensemble known as the “*Boreas Quartet*.” This album is used as a reference point to create proper liner notes for the Backburner Tuba-Euphonium Collective’s debut album: “*A Little Monster Music*.” The liner notes in “*The Serpent’s Kiss*” give a sufficient framework as to document each composer’s biography, the history behind the works, and incorporate a qualitative analysis of the music.

The sources and websites that contain the biographical data of the composers are then transferred into the liner notes for the debut album. The biography may contain information about the composer’s early life, current status, achievements and education, work and contributions, and other miscellaneous details. One of the sources is a full text book, referred to as the “*Guide to the Euphonium Repertoire: The Euphonium Source Book*.” This book gives information on composers John Stevens and Elizabeth Raum. Every other composer was found via program notes and websites.

There are also several performance videos found via YouTube. These performance videos are a reference to listen to the music behind the debut album: “*A Little Monster Music*,” and give an analysis of its pervading nature. This description will then be included in the liner notes for the piece. There are other sources that are PDF documents known as “program notes.” Essentially, these documents give more biographical data and background to the pieces, and are presented at live music performances. The information gained from these papers will also be used to display as liner notes for the music.

A BRIEF HISTORY OF TUBA-EUPHONIUM ENSEMBLES IN THE UNITED STATES

Early Development of the Tuba-Euphonium Ensemble:

Prior to the formation and respect of the Tuba-Euphonium ensemble, the “Hoffnung Festival” in 1956 portrayed the tuba in a humorous fashion. Around this time, the instruments were widely disregarded as a serious practice and more stigmatized as an amusing caricature, which did not present many opportunities for full-time Tuba-Euphonium professor/faculty positions, and disallowed much esteem for the instruments. Moreover, there was little to no original solo repertoire for Tuba-Euphoniums, and there were minimal tubists to play the solo music. However, Tuba-Euphoniums encountered substantial development in repertoire and performance opportunities as a result of its induction into the brass quintet, acknowledgement, or recognition of the tuba as a solo instrument, and its acceptance as playing a vital role in symphony orchestras during the “second half of the twentieth century” (Lair et al., 2009, p 6).

During the developmental years of the Tuba-Euphonium Ensemble, there were a series of major events that heralded the, which include the following: the making of the song “*Tubby the Tuba*” in 1945, which became an animated short in 1947; Rex Conner’s induction as the United States’ first-ever full-time Tuba professor at the University of Kentucky; the early works of Kenneth Cook, “*Introduction to Rondino*” in 1951, and Eric Ball, “*Friendly Giants and Quartet for Tubas*” in 1961; Roger Bobo’s first-ever tuba solo performance at Carnegie Hall in 1961; Constance Weldon’s development of the first Tuba-Euphonium Ensemble at the University of Miami in 1960; the formation of the Tubists Universal Brotherhood Association (T.U.B.A) in 1966, now referred to as I.T.E.A; and Winston Morris’ pervading pursuits and prospects to challenge the Tuba-Euphonium curriculum to advance the instruments’ capabilities. Another prominent accomplishment for the history of the tuba is Ralph Vaughn Williams’ first written concerto for Tuba, entitled “*Concerto for Bass Tuba*.”

After the introduction of the short film “*Tubby the Tuba*,” the tuba became known as a “viable melodic instrument” (Lair et al., 2009, p 6). Although the “Hoffnung Festival” humorously painted the tuba, it would then slowly be considered a serious form of musical expression and prowess, as well as incorporating and inventing new styles of music for the Tuba-Euphonium Ensemble. As Rex Conner applied for the United States’ first full-time tuba professor, it assembled the foundation for a new list of solo work and repertoire, as well as the formation of chamber ensembles and student interest. This enabled the formation of the first Tuba-Euphonium Ensemble at the University of Miami by Constance “Connie” Weldon. Constance created this ensemble to present the chance for her students to prosper as a musician by playing chamber music, meaning one player to a part which required copious amounts of refining and texture work for the students. Likewise, Roger Bobo’s performance at Carnegie Hall, in 1961, portrayed the tuba to be a practical solo instrument, painting it in a “serious artistic light” and inspiring more determined, solemn Tuba-Euphonium Ensemble performances (Lair et al., 2009, p 8).

The purpose of these ensembles, at least in the University curriculum, was to create an august atmosphere which reflected and demonstrated distinctive musical expertise for the

development of the students. However, the lack of repertoire at the time deterred the availability of the Tuba-Euphonium Ensemble in most universities across the United States. After Constance's formation of the first University Tuba-Euphonium Ensemble, the ensemble became an official course in the curriculum. According to Christopher Lair, the University of Miami's Tuba-Euphonium Ensemble was invited to perform for the Orchestra Clinic and Midwest in Chicago, Illinois in 1969. Alongside Constance's curriculum, William Bell, who accepted the position for tuba professor in 1961 at the University of Indiana, also had a tuba-euphonium ensemble but painted them in a less serious light. In other words, Bell's curriculum was rather insubstantial, meaning rehearsals were loose and infrequent, and the music themes were seen as a novelty. Winston Morris, a former student of professor William Bell, explained that the curriculum did not pursue esteemed-level performances, and it was more for the enjoyment and pleasure of playing rather than learning the pieces. After experiencing tenuous work with the ensemble, Winston Morris later claimed the title of a full-time tuba-euphonium professor at Tennessee Technological University in 1967. Morris' philosophy was to allow all his students to participate and play substantial music that challenges their current abilities.

The Origin and History of the Tennessee Tech Tuba-Euphonium Ensemble:

According to Christopher Lair's interview with Winston Morris, Morris states that after accepting the tuba position at Tennessee Tech University, he persuaded the administration to establish a tuba-euphonium ensemble curriculum which eventually became an officially accredited course. Morris' overriding philosophy was to provide more opportunities for ensemble performances as well as the advancement of students' musicality and technical expansion through challenging them with serious music. This motivation likely originated because the tuba was seen as a humorous novelty, which did not supply tuba students and instructors with career and performance avenues, or substantial repertoire.

Despite that, Morris' approach to challenging the students was different from "Connie" Weldon's, in which he instructed his studio through the means of a tuba choir, meaning more than one player for a part, while "Connie's" approach was through a chamber ensemble, only one player per part. Later, Morris explains the condition of tuba-euphonium players being that they have lesser opportunities as musicians compared to trombone and trumpet players, and did not have as much original repertoire to perform. However, over the years, the Tennessee Tech University tuba-euphonium ensemble has generated more than two hundred compositions through various sources, such as alumni, current students, composers, and commissioners that wish to catapult this new ensemble (Perry, 1996, p 1).

For the first two years, the ensemble struggled to accumulate relevant repertoire. The ensemble's first performance in 1968 contained pieces that were originally written for trombones or other instruments. Nevertheless, Morris and his ensemble were able to collect substantial music for the group, most of it being original pieces intended for the tuba-euphonium ensemble. In the ensembles' second performance in 1970, the program of pieces presented contained more works that were composed and written by members of the ensemble. According to Richard Perry, the "1970-71 academic year" consisted of various projects for the ensemble, and they even experienced another drastic increase in original music.

For example, the ensemble was credited to endorse its “first ever off-campus performance” at the Tennessee's Music Teachers Convention in November 1970. According to Morris, his idea was to inspire his students to perform well enough for the crowd, virtually eliminating the negative stereotype associated with the tuba. Thus, it would give them the respect as a “serious artistic medium.” Next, in January 1971, the ensemble held their first symposium at Tennessee Tech University, which included a variety of clinics, reading sessions, and rehearsals. This event garnered the attention of several tuba-euphonium players across the state and region. Additionally, one of the major contributors to this event was James A. Garrett, who graduated from Tech in 1959 and has produced a slew of compositions for the ensemble.

In October 1971, the Tennessee Tech Tuba-Euphonium Ensemble completed their second off-campus performance at “Phi Mu Alpha Sinfonia Fraternity Province Workshop” in Jefferson City (Perry, 1996, p 13). Later in the 1971-72 academic year, the ensemble performed two more on-campus shows in February and May of 1972. Thereafter, the ensemble gave another appearance in their third off-campus performance during the 1972-73 academic year. Around this time frame, the ensemble had become an established ensemble, gaining recognition across the state.

Afterward, this collection of works bolstered the reputation, numbers, and quality of the ensemble. As this was taking place, Winston Morris promoted the ensemble to perform at the national level through bestowing reports and compositions to the “NACWPI Journal and the Instrumentalist,” as well as participating in two major invitational performances in 1975. Afterward, the ensemble embarked on its first off-campus tour, where they visited and played for various high schools throughout Cleveland, Tennessee, and Cobb County, Georgia for approximately two days (Perry, 1996, p 9-14).

In March 1976, the ensemble had their first performance at Carnegie Recital Hall where they played their original repertoire and programs with nine years in the making. Morris states that he desired and encouraged the group to be prepared to play at Carnegie Recital Hall because he believed that the ensemble had been taken seriously enough at that point. Plus, at around this time, Morris had challenged various composers to commission original and challenging music for the ensemble, giving them a robust music library to perform with (Lair et al., 2009, p 55).

The Formation and Prospects of the Tuba-Euphonium Ensemble:

Throughout the 1970s, the comprehensive climate of tuba-euphonium ensembles experienced tremendous growth in terms of major events, music library, and notable contributors. Some of the largest contributors at this time were “Connie” Weldon, Winston Morris, and Harvey Phillips. All of which would propel the direction of the tuba-euphonium ensemble through commissioning newer repertoire and the inauguration of celebrations that are vital to the evolution and continuity of the instruments. Constance Weldon contributed many works and commissions for the tuba-euphonium ensemble, as well as assisting with production and performances for instructors at the University of Miami. Weldon’s ensemble, “*Brass Tracks*,” gained more traction and rose to popularity. Their performances were always highly praised and made at the highest quality. This ensemble gave her students the chance to refine

their skills from a chamber group approach. While “Connie” was working on her “*Brass Tracks*” tuba-euphonium ensemble, she was unaware of the work that Winston Morris was doing at Tennessee Tech. Although Weldon and Morris were pursuing a similar goal, (temper the student’s fundamental skills), Weldon endorsed a chamber music approach while Morris applied a tuba choir approach.

Predicating on Morris’ contributions to the Tennessee Tech Ensemble, he refused to play humorous music for the audience. Morris even incorporated jazz compositions to mellow the tone of the music, allowing his students to perform different styles. Morris and Weldon were significant contemporaries when it came to the overriding philosophy behind the tuba-euphonium ensemble, which is to cultivate a crucial learning environment that improves the skills of tuba-euphonium players. Lastly, Harvey Phillips was the commissioner for over one hundred written tuba solos. He was also responsible for initiating major celebratory events for tubas, these include “*Tuba Christmas, and Octubafest.*” These events would ultimately alter the tuba’s stereotype, giving players the foothold to prove and expand their musicality, and thus eradicating the comedy of the tuba (Lair et al., 2009, p 33-34).

Afterward, in the last two decades of the twentieth century, the tuba-euphonium ensemble continued to rapidly evolve and expand with introduction of Morris’ “*Symphonia*” in 1993, the US Army band Tuba-Euphonium conference in 1983, and the Armed Forces Tuba-Euphonium ensemble. The inaugural United States Army Band Tuba-Euphonium Conference was held in Washington D.C in 1983 for the discussion of how the absence of performance avenues for military tuba-euphonium musicians catalyzed workshops for the instruments. In these workshops, the military players would help aspiring musicians in a variety of playing aspects. Next, the Armed Forces Tuba-Euphonium Ensemble gravely contributed to the reputation of military bands after performing at the Midwest Band and Orchestra Clinic in Chicago, 1988. Thus, inspiring young musicians to perform at a professional level.

As T.U.B.A established in the 1970s and began to commission several works for the tuba-euphonium music library, it would slowly inspire the formation of a major professional tuba-euphonium ensemble, also known as “*Symphonia.*” This ensemble, formed by Winston Morris and Scott Watson, was aimed for the preparation of several professional players to perform at a superior level. “*Symphonia*” only consisted of professional tuba-euphonium players that were motivated to play virtuous music. The group accumulated three separate published recordings by 2008, and they usually performed at major tuba-euphonium conferences and events such as The Midwest Band and Orchestra Clinic and The Great American Brass Band Festival in Danville, Kentucky. According to Morris, the performances matched the great quality of their rehearsals. Watson would also add that these performances were crucial to the continuity of the instrument, as well as providing a paradigm for young tuba-euphonium musicians (Lair et al., 2009, p 37-39).

A BRIEF HISTORY AND BIOGRAPHY OF THE BACKBURNER TUBA-EUPHONIUM COLLECTIVE

Interview Questions:

1. Brief Greeting and Biography of Dr. Maddox and Dr. Mireles.
2. What is Backburner about and why did he start the group?
3. What is the mission of the group?
4. What is the overall momentum of the ensemble?
5. Where does he see this ensemble going?
6. Do you see another generation growing with another ensemble?
7. Do you think it will become a traditional chamber ensemble?
8. Do these ensembles influence the continuity of the instruments?
9. Do you feel Tuba ensembles are important to the University curriculum?
10. How can you describe the climate of the Tuba-Euphonium Ensemble right now?

Synopsis:

The interviews with Dr. Clayton Maddox and Dr. Matthew A. Mireles showcase brief biographical information, their shared experiences with response to the history, evolution, and prospects of the Tuba-Euphonium Ensemble, as well as their comprehensive and collaborative works with the Backburner Tuba-Euphonium Collective.

Dr. Clayton Maddox, originally from South Bay Florida, completed his Bachelor's degree at the University of Alabama and studied with Demondrae Thurman, a renowned euphonium player. Then he completed his Master's degree at the University of Memphis while studying under Dr. Kevin Sanders, and then he completed his Doctoral degree at Louisiana State University while studying under Dr. Joseph Skillen. Dr. Maddox also mentions that he regularly tours with the Alias Brass Quintet, which was formed back in 2014, and he notes that their debut albums are coming out soon.

Dr. Matthew Mireles, Chair of the Department of Music at St. Mary's University, Professor of Tuba-Euphonium, Associate-Dean in the College of Arts, Humanities, and Social Sciences, and the Director of Bands, earned his Bachelors of Arts degree with a Teacher Certification from St. Mary's University (2007), then he earned his Master's in Music degree in Euphonium Performance from the University of Alabama, and then he earned his Doctor of Musical Arts in Euphonium Performance from the University of Wisconsin-Madison. Dr. Mireles has won the Leonard-Falcone International Euphonium Competition and the International Tuba-Euphonium Association's Chamber Music Competition. After receiving his doctorate, he then worked as the Director of Bands at Cameron University in Lawton, Oklahoma, and then he was hired at St. Mary's University. He also has two notable music pursuits: his solo

album, entitled *Prometheus*, and his Chamber Music Album from the Boreas Quartet, entitled the *Serpent's Kiss*.

According to both Dr. Maddox and Dr. Mireles, the overall mission of the Backburner Tuba-Euphonium Collective is to create a professional model for the Tuba-Euphonium Ensemble. The purpose of this is to inspire younger audiences, specifically aspiring collegiate low-brass students, to perform difficult repertoire, advance the musicality of the performers, and bolster the continuity and reputation of the instruments.

ORAL INTERVIEW WITH DR. CLAYTON MADDOX (Transcript) – June 7th, 2023

Rodriguez: “Ok, I first want to say thank you so much for taking the time to do this interview. My name is Jacob Rodriguez, and I am a rising junior at St. Mary’s University, and I play both the trombone and guitar. I first want to start off with your biography, background, education, experience, and anything along those lines.”

Maddox: “Ok, so, I am originally from South Bay Florida, which is a small city in South Florida. I did my Undergraduate Studies at the University of Alabama, where I studied with Demondrae Thurman, who was a famous euphonium player and famous for his quartet that he played in which he inspired me to do what I do. I did my Master’s Degree at the University of Memphis with Dr. Kevin Sanders, who had, you know, their tuba ensembles. They had recorded a few albums, so they ended up in the same way as the Tennessee Tech Tuba Ensemble. I did my Doctoral Studies at Louisiana State University, where I studied with Joseph Skillen: and while he is not a tuba ensemble guy, he is a notable soloist and ‘master-teacher;’ and I play as a soloist throughout the country in different places; and I also perform and tour regularly with Alias Brass Quintet, which is a brass quintet that we formed in 2014. And all these groups I play in, we have debut albums coming out soon.”

Rodriguez: “That’s awesome!”

Rodriguez: “I guess the first question I can ask is: how did you start the group, Symphonia...”

Maddox: “You mean Backburner?”

Rodriguez: “Oh yeah, Backburner yes, I am sorry.”

Maddox: “Well, it is funny that you mention Symphonia because they were my inspiration. But Backburner began as a result of the Boreas Quartet, and not really being able to get together as often as I would like to. Since we were so spread out throughout the country, and there is four people, you know, you must depend on every single person. One member lives in Tokyo, Japan, so it became very difficult for us to get together. So, I was thinking: you know what? I can figure out a way for all of us to play together and get new people. So, we recorded an album and it was very successful, and that success generated a lot of interest in us as people and as artists. Also, because the album was so successful, I was able to approach anyone about being in that group. And they were like: yes, I would love to play in that group. And I knew Dr. Matthew Mireles, he was already conducting his stuff, but I was not really conducting yet. So, I thought he would be a good person, you know, it was like everything was ‘in-line’ for us to have him as conductor, and he sorted out a manager and stuff. But yeah, that is one of the big reasons how it was able to happen, but I was looking at it in this way:

‘Every school and most universities’ music departments are going to have a tuba ensemble, and Symphonia was not doing anything anymore. And so, I thought that it would be good for us to have a professional model for a tuba ensemble. And there was not one. This was not one at the time but I started this group so it could fill the void that Symphonia left, and so I thought it would be a good thing for students to be able to hear a professional version of a tuba ensemble. Since there were so many student groups, the

most notable one being the Tennessee Tech Tuba-Euphonium Ensemble. And so that's how Backburner came about. And it was Backburner, the name, because I was thinking that we would have the professional version of the Tuba ensemble, and they do not do any competitions for it. So, it seems as if they just got to put it on the Backburner. And I was thinking about the fact that we all sit in the back [of the wind ensemble, or orchestra]. We pride ourselves while sitting in the back and really kind of laying it down and tearing it up, like a Backburner, so I got wrapped up in that name. But the Backburner Tuba-Euphonium Collective because I basically went around collecting a bunch of Tuba-Euphonium artists. It is a collection of us and we are very versatile, we can do all euphoniums and all tubas. We could do a tuba-euphonium quartet if you want, so it is a cool thing like that, which is different from Symphonia.”

Rodriguez: “Wow, that is very interesting, very interesting. The next question I guess I could ask is: What's the primary mission of the group and where do you see this ensemble going soon?”

Maddox: “So, like I said a little bit ago, the mission is to provide a professional model of the Tuba ensemble with professionals instead of students. Most Tuba-Euphonium ensembles consist of students from their specific university, and sometimes you get Tuba ensembles formed at a conference, where they were putting a bunch of people together. Which is not always the best sound but it is nice to have it, and it is not the best sound because it is not as well-rehearsed as we are. So, I wanted to rehearse with a professional model of the Tuba ensemble, so that the Tuba ensemble can remain at the forefront of our thoughts. Once again, I felt like it was starting to get put on the Backburner, hence the name. But yeah, I wanted to just provide that professional model to perform at our conferences so that other professionals and students can hear us and hopefully be inspired by us. Which would keep their Tuba ensembles going.”

Rodriguez: “Ok, that is cool! I guess also predicating off Symphonia and how they influenced you guys as a group. Do you believe that the momentum is going to keep moving much stronger in the next few years? Or to put it simply: Would a newer generation form another ensemble that is like Backburner’s influence from Symphonia?”

Maddox: “Yes and no because... So, the Symphonia members were our teachers, and a lot of people in Backburner studied under the members of Symphonia. And we kind of... It is hard to fill... It is hard to have another Tuba-Euphonium Ensemble right now, probably. Because we kind of already have that Market Corner, I believe. I mean, I like to see it happen, but it seems like it could be such a difficult thing to do. And I think it will be like that for a long time. And I hope to step away whenever I get older and give it to a younger person so that they can learn it. I hope that Backburner can be around for the next one-hundred years, but it does not have to be me. Hopefully when I can group some people to take it over and I want it to be a Symphonia-type ensemble that stays. Not one that goes away when I go away because I just want it to be here forever.”

Rodriguez: “Yeah, that is cool and interesting! Another question that I found very interesting when reading these articles was this one: Do you think that Tuba-Euphonium quartets will have a

place as a traditional chamber ensemble? In the articles, there were various mixed responses where some of the interviewees said it could and then some were saying that it possibly could not be so.”

Maddox: “I believe that it could. I just think that we must play serious repertoire to where we would want people to hear us and other bright musicians to hear us. People whom I look up to are like great violinists and pianists. The music is so old and their professionals are most likely really seasoned, and so I was hoping that... Hold on... What was the question?”

Rodriguez: Its: “Do you think that...”

Maddox: “The Tuba quartet could become a serious ensemble Yeah, I was hoping that when they hear us, they can take us seriously. That is why I am not really into playing humorous repertoire. You know, I do not want... Tubas are already a sort of comical instrument if you notice in movies and TV shows, it is usually associated with a goofy person or something like that. So, you know I kind of want to get rid of that stigma and be taken seriously. And that is the reason why my quartet decided to record Bach and Mozart instead of people you may never hear of. And we were able to generate a lot of interest and respect from recording that string quartet. I think people sort of realized what was going on with Tuba and Euphonium after that, like wow, they can play that. Because we played it verbatim, obviously down an octave.”

Rodriguez: “Nice, that is impressive! Another question that I took from the dissertation is: Do you feel that professional Tuba-Euphonium Ensembles are important to the development and continuity of each of the instruments and why?”

Maddox: “Yeah, I feel like... I feel like because it gives the audiences and other music-lovers a chance to hear the Tuba and Euphonium in a different light. Because we sit in the back of the band, meaning we are considered background instruments. So, you do not really hear us and we do not get to play the beautiful melodies, we don't get to play what a majority of the others play which is sixteenth notes. You know, we just play whole notes, half notes, and eighth notes, or some outline of what they are playing. Because the composers do not believe in the ability in which the Tuba and Euphonium possess. So, yeah, I do think that it helps our instrument move forward. It helps artists move forward because they can get a chance to practice in different styles. It is cool. And it is funny because the Tuba and Euphonium... You know, when you are going through a beginner band, you play... You know, if everybody were playing Mary Had a Little Lamb, everybody would play that melody including the Tuba. But if we go and play a band piece called Variations on Mary Had a Little Lamb, then the Tuba and Euphonium would go back to playing whole notes and half notes. And so, I like what the Tuba-Euphonium Ensemble brings in terms of enhancing our artistry so we can play more notable music and art.”

Rodriguez: “So, a little bit of your overriding philosophy is to advance the technicality of the players?”

Maddox: “Yeah, the musicality. You know, I think it is very important.”

Rodriguez: “Let me see, I think there's only two more that I wanted to ask and then we'll be done...”

Maddox: “Ok.”

Rodriguez: “In a way I think that this question can be tied to the previous one, and its: Do you feel that the Tuba-Euphonium Ensembles are important to the University curriculum? How important is it?”

Maddox: “I do feel like they are important... So, for instance, I will give you a direct example:

‘My first teaching job, in the fall, that school had one band. But I will get a class of five to Tuba players. But we obviously could not play in that one band, which is the wind ensemble because it carries only two Tuba players. So, if it was not for the fact that that school let me start the first-ever Tuba-Euphonium Ensemble, then those students would have to sit out of an ensemble for another semester. Like they could not play in a band. They came to college because they love band and then they do not have a band to play in because the studio is too big and it is one band. So, I really became more serious about the Tuba Ensemble back then because I was thinking that this needs to be part of the curriculum. Because if not, then that means that the student comes out of high school and sits out of band for a semester, which is no good. So, I thought it was cool to bring students in and expose them to all the good stuff. I think that that is the value in how you find Tuba-Euphonium Ensembles as part of the curriculum. I think that it needs to be kept and nurtured.’”

Rodriguez: “I guess one more question and then we can be done. Another question from the dissertation: In this current time frame or context, how can you describe the climate of the Tuba-Euphonium Ensembles?”

Maddox: “I do not know; it is kind of like... I think it is a lot of, well... I just came back from the International Tuba-Euphonium Conference in Arizona, and there were probably fifteen college Tuba-Euphonium groups there, which is good. A lot of people came from long distances and they spent a lot of money. And not to be prideful, but I also recently started the first-ever International Tuba-Euphonium Ensemble Competition for ITEA. And that was a huge success and we had a lot of people that applied and participated. We anticipate having more in the future, but it was just a thing where you had quartet and solo and excerpt competitions. And I was thinking: Why don't we have a Tuba-Euphonium Ensemble Competition when we have Tuba-Euphonium Ensembles every year? That would be great for studios to be able to win that. So, they began to judge the first-ever Tuba-Euphonium Competition. I think it is the first in the world, and not just at that place. And I created that and I am proud of it because that is what really helps the climate of the Tuba-Euphonium Ensemble. It has a direct effect. It bolsters it.”

Rodriguez: “That is awesome! I asked all the necessary questions. Thank you!”

Maddox: “Thank you sir!”

ORAL INTERVIEW WITH DR. MATTHEW A. MIRELES (Transcript) – June 22nd, 2023

Mireles: “Testing...”

Rodriguez: “Alright, well... I want to say Dr. Mireles, thank you for making the time to schedule this interview with me, your student. And I just wanted to ask you if you could give a brief biography about your education, where you started, and how it led to where you are right now in your professional role.”

Mireles: “Sure, so, my name is Dr. Matthew Mireles, Chair of the Department of Music at St. Mary’s University, Professor of Tuba-Euphonium, and Associate-Dean in the College of Arts, Humanities, and Social Sciences, and the Director of Bands. I earned my Bachelors of Arts Degree with the Teacher Certification from St. Mary’s University in 2007. Then, I went to the University of Alabama for my Master’s in Music Degree in Euphonium Performance. After that, I went to the University of Wisconsin-Madison, where after my years there, I earned my Doctorate’s Degree in Euphonium Performance, also with an instrumental conducting minor cognate. So that’s sort of my background, education-wise. Playing-wise, I pretty much made a name for myself as one of the winners of the Leonard-Falcone International Euphonium Competition. As well as, winner of the International Tuba-Euphonium Association’s Chamber Music Competition. That is kind of how people started to know me and recognize me, which propelled me into my graduate degrees. Once I finished my Doctorate, I was hired at Cameron University, which is in Lawton, Oklahoma, my first job. And I was also the Director of Bands there for three years. And then, I was hired at St. Mary’s University where I am now, and I just finished my seventh year here. And along the way I have released my solo album which is entitled *Prometheus*, and released my Chamber Music’s Album, entitled the *Serpent’s Kiss*. That album won the Roger Bobo Award for Album of the Year at the International Tuba-Euphonium Association in 2016. And... Plenty more other things but that’s kind of more in the lines with my Tuba-Euphonium career. I studied with Professor John Stevens at the University of Wisconsin-Madison, who has become one of the main celebrated composers of the Tuba-Euphonium Ensemble. And while I was there, I was his teaching-assistant and my job was to conduct the Tuba-Euphonium Ensemble. So that was the first-time I had a group that I conducted independently, where I had set the program and set the rehearsal schedule. And that was the University of Wisconsin Tuba-Euphonium Ensemble. Working alongside that group is what sort of got me into the Tuba-Euphonium Ensemble Music through John Stevens, who is the pioneer of this type of ensemble.”

Rodriguez: “Wow, that is incredible! That is so much information! Well, the first set of questions I can ask is in regards to the Tuba-Euphonium Backburner Collective. What is Backburner about, exactly? How did it originate, why did you start the group, and what is the significance of the name, Backburner?”

Mireles: “Oh yeah, well the name itself, Clayton Maddox came up with that title. Mainly just an homage to Tubas and Euphoniums playing in the Wind Ensembles or the Symphony Orchestras in the back row. Burning it up! And we are just trying to find more ways to keep advancing our instruments, advancing our skills, and producing recordings like this that inspire other students to

do more with the instruments. John Stevens himself came to our premiere concert. And he said that in all his years as he started the Tuba-Euphonium Ensemble genre, he never envisioned how far it would go and how far we took it with our group. I am happy that we are making him proud by sort of advancing our instruments. And this group is intended to inspire the next generation to take it even further. But, but, but... The main way it started:

‘So, Clayton Maddox and I play in the Boreas Quartet, and we have recorded an album and there is another that is about to be released as well. It is him, myself, another Tuba player named Derek Fenstermacher, and another Euphonium player from Japan named Kyohei Ando. In 2017, the Boreas Quartet, invited to perform at the South-Central Regional Tuba-Euphonium Conference in UTRGV. And we took the quartet down there. And at the same time, there is a Euphonium quartet that was also sort of gaining some notoriety called the North Texas Euphonium Quartet. So, we were both going to the conference to perform at the final concert. We had separate performances. And so, I knew all those guys in there: Danny Chapa, Chris McGinty, Vince McKinney, and Takahiro... I cannot pronounce his last name. I was thinking, well, it is y’all four and us four, so let us at least do one or two tunes at the end where we combine to have an Octet. It would be a killer-Octet. So essentially, six Euphoniums and two Tubas. And at the time, at the conference, there were these two other guest artists, one from Portugal named Sérgio Carolino, one from Brazil named Fernando Deddos. They were both there to perform at the conference, and I invited them to also join us at the end. So, we were going to combine the Boreas and North Texas Euphonium Quartet, plus Sérgio Carolino and Fernando Deddos. And that was the first time we put together a larger professional-quality ensemble, playing it there. It was meant to be a combination to have one tune at the end. We did a Trombone Shorty tune that I arranged called *Suburbia*. You might want to check that piece out.’”

Rodriguez: “Yeah, I’ll take a look at it!”

Mireles: “So that was kind of the first time we had a group like that. Fast forward to the next conference, which was at Florida State University in 2018, there was a conference at Tallahassee Florida State University. And we were like, you know, this worked well at the end and people liked that final concert. So, let’s put together a group to give a big performance at the next conference in Florida State. And that was the premiere of Backburner, at Florida State’s Southeast Regional Tuba-Euphonium Conference. But the one in UTRGV where we first had the get-together was cool. So, we expanded on it and performed the final concert at Florida State where we had... The first one had ten people, and during the Florida State one, there were at least twenty of us or maybe more. That was the debut performance. We had a drummer from St. Mary’s University came with us, her name is Analina Devora.”

Rodriguez: “She sounds familiar.”

Mireles: “She graduated in 2020, so a couple of years before you got here. I brought her up with me, and then she became the drummer for Backburner’s first show. I cannot remember what we did there or why we needed a drummer, but there was something that required it. But we did a

full concert. So, the first performance we did one to two pieces, but this concert was a full hour-long concert. And this was the premiere of Backburner at Florida State University. That is how it started.”

Rodriguez: “That is great! Well, I asked this question to Dr. Maddox last time, and I asked him about the overall mission of Backburner. He had mentioned, or I guess you stated it already, a professional Tuba-Euphonium Ensemble made only of professionals. Is there a way you could expand on that notion a little bit more?”

Mireles: “Yeah, absolutely. So... Around the country... Most kind of larger music schools around the country, Universities. They will have a Tuba-Euphonium Ensemble that the Tuba-Euphonium Professor conducts as part of the studio. And those groups are always really, good. But that sort of the peak of that type of music because when they graduate, they may choose to go onto other things. So, we wanted to form a group that... Instead of that being the peak, we then have professional Tuba-Euphonium musicians and performers get together to make that peak higher. Obviously, because we are more experienced performers. So, one, just to bulk the quality of the performance and capabilities of the ensemble.”

Rodriguez: “Oh, ok.”

Mireles: “But then also to give those college students and high school students an example to really strive for as far as what is capable on their instruments. Because that is what inspired me, which is hearing ‘Symphonia.’ I think we have talked about the group Symphonia. When I got their CD’s when I was in college, I was like, I did not know that Tuba and Euphoniums could even do this. This is amazing! And so, we are trying to take what they built and expand further.”

Rodriguez: “Yeah, that has always been very intriguing to me because I was also wondering... This is going into the next question I suppose... So, I know that you were mentioning to me the momentum of your ensemble, or it sounds like it is going strong. How far do you still see this ensemble going? For example, do you still see it going many more years or decades into the future? If you could possibly map that out. And then also do you see another younger generation of musicians forming another ensemble like Symphonia and Backburner?”

Mireles: “So, the momentum we have now is that we have recorded this album, its set to release, it is close to... The edits are done finally. So, it is releasing soon. And, we have always played at every international conference since 2017. So, I mean you must be invited to those things. Meaning people know us now. People know that Backburner is going to play and that our concerts are always packed because Backburner is going to be the best Tuba-Euphonium Ensemble. Because there are other Universities that play, but Backburner usually places at the top of the heap, meaning we have that reputation now. Once we release the album, then we will carry even more momentum because we will release the recordings that people can finally listen to outside of the conferences. And then, once we have that album released, then we talked about looking at proposals at other conferences outside of the Tuba-Euphonium Association. So, the International Tuba-Euphonium Association is great! They love us! They let us play at all the conferences. But, as far as Texas is concerned, there’s Texas Music Educators Association (TMEA), which we could apply for, or the Texas Bandmasters Association (TBA), which we

could also apply for in July, or even the Midwest Conference, which is in Chicago every year. So, once we have this recording, then we can showcase it around to other conferences outside of Tuba-Euphonium groups. Because what we want to do is show band directors, middle and high school directors, what the capabilities are of Tuba-Euphonium ensembles. Because they will be able to help their students see beyond the whole-notes, half-notes, or quarter-notes that they are playing in the band and repertoire. If they can play more stuff as younger students, then they are going to be better performers and musicians as they get older. However, the only way to make that happen is if their teacher knows that there is something that they can show the students what the capabilities are. So, I think that is where we can go next. And as far as another Backburner coming after us... Right now, all of us that are in Backburner are in our thirties to early forties, as far as our age is concerned. So, we are kind of the ones now that were recently hired at universities..."

Rodriguez: "You guys are carrying the torch?"

Mireles: "Well, we are the ones that are starting out our careers. There are still the senior members of the Tuba-Euphonium academic profession. But we are 'that' next generation currently. Once we have more recordings and get older, maybe in another ten years another one could originate. The reason I think that is because our quartet, the Boreas Quartet, our album is called the '*Serpent's Kiss*...' We have, I can say at least one to four or all the tracks on that album are virtually unplayable by anyone else. That is what we wanted to do. We wanted to record something that was 'so-beyond' what a Tuba-Euphonium Quartet could do. We thought we could do it ourselves. And we pushed ourselves to showcase something that is beyond what anyone could believe as possible. And we also published those arrangements so others could buy and perform them. Just last week, (laughs), we released that album in 2014. Just last week, I had a student come up to me, he is a sophomore student at Texas Tech University in Lubbock, and he came up to me at this camp I was doing and said:

'Dr. Mireles, you do not know this but I have been a big fan of the Boreas Quartet for a while, and I wanted you to know that my quartet performed the *Serpent's Kiss* this year.'

I was thinking to myself, really? It is hard! He was saying it was hard. But that was the first time that anyone ever told me that they had bought that piece, rehearsed it, and performed it. I talked to his teacher, and I asked him if he had coached the quartet on the '*Serpent's Kiss*?' He was like, 'Oh yeah man! That is tough! But they worked on it and they sounded great on it!' I said that that was impressive. So, I then talked to the student again and asked him for a recording of it. 'I'd love to hear it!' I told him. Then, I told him that I had never heard anyone else play it or even attempt it. And I have sent this piece to people. So, some people asked me if I could send them the '*Serpent's Kiss*,' and I would send it to them so they could try it out. However, they do not end up doing it. But this group finally did! They finally did! They sounded good on it! So, then I texted all the other guys in the quartet saying, 'Hey man! You guys should check out this group because we have never heard anybody else do it.' So, ten years later, the group finally performed what we had done. A college-aged group! When we did it ten years prior, we were already in our professional playing careers, trying to do something that has never been done before. This is like a 'quantum leap' in increasing the difficulty. Once again, ten years later, there

is this group at Texas Tech University that finally did it! Man, it was so awesome! So, if we keep doing that same thing with Backburner, pushing the limits so to speak, then that will inspire everybody to hear and play it. And five to ten years from now, those college Tuba-Euphonium Ensembles can be playing some of that hard stuff that we played. That's the mission. I have seen it already occur in the Boreas Quartet. So, that is where I can see as far as where the next generation is going."

Rodriguez: "That is incredible! Yeah, it would be interesting to see another ensemble like you guys come about. I am interested to see how crazy they could potentially get with all the music."

Mireles: "Exactly."

Rodriguez: "Well, since you did mention the Boreas Quartet, I'm assuming that that's a chamber ensemble, correct?" Could you elaborate on that more in terms of Tuba-Euphonium becoming a traditional chamber ensemble? Could there be more sprouting up or starting?"

Mireles: "Yes, there is more sprouting up, but it is more of a niche kind of thing. It is something that is mainly enjoyed by low-brass players. I am not saying that people outside of that notion would not enjoy it. However, now, it is typically enjoyed by low-brass musicians and music educators. The music educators might think that this kind of ensemble is cool or applicable to their students. So, as far as popping up, in high school, you can go to State solo and ensemble with a Tuba-Euphonium quartet. And... Our entire album, the '*Serpent's Kiss*,' is entirely comprised of new arrangements, meaning we arranged all of it. Nothing was original for Tuba-Euphonium Ensemble, or quartet. The idea was then where this thing could go. So, then high school students can be inspired to play that type of music also. So, the groups then, as far as listening to Backburner, they can then be inspired to play their instrument and Tuba-Euphonium playing. That is what it is about. We want to inspire and excite students to become a low-brass performer. When you are in middle school or high school, the band directors are prioritizing the flutes, the clarinets, and the trumpets because they have the melody. They typically have a lot of responsibility for the melody and the notes. We, the low-brass, provide the texture, the bottom-end, the support, and the foundation of the sound. So, for a high school or middle school kid, it may be a little more difficult for them to be excited about that. Rather, if we have people performing in an ensemble like this, Tuba-Euphonium Ensemble, you are the featured voice and you have the responsibility of the melodies. That then gets you excited about playing your instrument, as a Tuba-Euphonium player. So, that is what we are trying to do."

Rodriguez: "Yeah, I honestly do think that you basically already answered the next two questions that I have. They are how the Tuba-Euphonium Ensembles affect the continuity of the instruments. In other words, 'How do these ensembles help with the continuity of Tubas and Euphoniums?' And, 'How important do you think that these ensembles are to the university curriculum?' I know you mentioned that middle-school kids would not typically be excited about playing only whole-notes, half-notes, and what-not. How can these ensembles especially inspire younger generations to launch their musical aspirations into their college career?"

Mireles: "So, we talked about this a little bit already, as far as giving them an example of the capabilities. Essentially, a trumpet player can just search up a trumpet solo or band to find things

that the trumpet can do. A ton of artists or features of that instrument can show the implications of what the trumpet can do. And so, we are trying to build off on the library of recordings of our instruments. A lot of us have our own solo albums out. For example, Dr. Clayton Maddox is about to release his solo album, and then I am going to release mine. The guys that play in the North Texas Quartet still play with us. They have two albums out now. And I am blanking out on the other ones right now but... Essentially, there is a lot of us that have our own recordings out. So, we are just trying to add to the recording library for our instruments so that anybody at any time can hear something that can inspire them about the instrument's capabilities. And then at the same time, inspiring others, composers, so that they can know what our instruments are capable of in order to write out music for it. Some of us in our ensemble, Matt Hightower is a good example, compose music while the rest of us perform and collaborate with composers. So, the more repertoire there is, the more arrangements there are, the more recordings there are, then the more opportunities there are in order to consume that sound of music by the younger generations on the same instruments. And then, as you are playing that type of music in a smaller setting, (maybe one or two to a part), you begin to learn faster about all the things you need to do to become a successful musician. This pedagogy pertains to intonation, rhythm, time, matching, tone, articulation, sound, and flexibility. You can really grow very quickly being a part of a group like this. As opposed to being in a full ensemble because there is so many people that you could just fit inside the texture. However, if you are in a group that's eight or even four members in capacity, you'll have more responsibility put on you. You will get the experience of everyone depending on your part as opposed to trying to fit it. You must lead from your playing, which is a really good experience for students, at any level, to progress faster."

Rodriguez: "This kind of reminds me of the Jazz ensemble."

Mireles: "Oh yeah, absolutely!"

Rodriguez: "Yeah, it reminds me of the same thing because I usually think to myself that the jazz musicians are more advanced than some of the people that play in just the wind ensemble."

Mireles: "Sure. But even just our wind ensemble here at St. Mary's University. We are basically just one to a part. But you are that part, meaning no one can cover for you. For example, the first person plays measures one to twenty the best, or the next person plays the next part the best. So, essentially, one person must play that part, all of it. But not only play it, but play it well in context with everyone else. So, it is a similar thing, as opposed to a large concert band of one hundred plus people, you can just sit back there. "

Rodriguez: "Like, slack off a little bit?"

Mireles: "Not necessarily slack off but to just kind of fit in and sit there. However, if you are the one playing one part, then you have the role of being the one to move your part forward."

Rodriguez: "Nice! The last question I have is this: 'Can you describe the climate of the Tuba-Euphonium Ensemble right now, across the board?'"

Mireles: “Across the board? I would say that the Tuba-Euphonium Ensemble is one of those things that plenty of people have never heard of. Like, you probably never heard of this until I gave it to you, right?”

Rodriguez: “Yes, exactly.”

Mireles: “Yeah, and that is fine. But once again, it is one of those things when you hear it live you get impressed like, ‘Oh wow! I never heard that before but it sounds amazing!’ Nobody is going to hear it and say that it is not anything. So, it is one of those things that people are introduced to unless they play their instrument. But at the same time, it has its strengths and weaknesses as far as a full concert goes. There are certain genres that sound best for it, or perhaps certain ways to compose the music that sound better. For example, if you have ten euphoniums and ten tubas, those ten euphoniums may play four to five different parts. They are in the same octave to two octave range. And the same thing goes for the tubas. As opposed to the wind ensemble, you have the piccolo flute, which is the highest voice, down to the tubas, which is the lowest voice. This gives you a very wide octave spectrum. So, the Tuba-Euphonium Ensemble has a smaller range than the wind ensemble. There are just strengths to that and weaknesses to that as well. We typically try to highlight the things that the instruments are best at: for example, loud, powerful, blended music, fast-playing in the euphoniums, and even jazz tunes or pop tunes where the sound is entertaining to the audience.

Rodriguez: “You can catch the groove essentially.”

Mireles: “Yeah, you can catch the groove. So, the climate is close to a hidden-gem but not really. People know about it, especially band directors and university professors, they know about Tuba-Euphonium Ensembles. However, there is still plenty that do not, and when they hear it, they may think it is very entertaining.”

Rodriguez: “So, it is like a ‘culture-shock?’

Mireles: “Yeah, you can use that term. That is a good term for it.”

Rodriguez: “Alright that is basically all I must ask. That is all the questions I needed to ask, and thank you so much Dr. Mireles!”

Mireles: “Thank you sir!”

RECORDING REPERTOIRE AND COMPOSER'S BIOGRAPHY

Composer John Stevens:

John Stevens became a faculty member of the "University of Wisconsin-Madison School of Music in 1985, following four years as the tuba/euphonium professor at the University of Miami (Florida) School of Music." For several years, Stevens was a "freelancer, composer and performer" in New York City, performing with a variety of prominent orchestras in New York state. Later in his career, Stevens "toured and recorded" alongside the Chuck Mangione Orchestra and the American Brass Quintet. Stevens is also known for being a former member of the following groups: "New York Tuba Quartet, Aspen Festival Orchestra, Philharmonic Orchestra of Florida, and the Greater Miami Opera Orchestra" (Bone et al., 2007, p 479). He also performed as the tuba soloist on the "original Broadway production of *Barnum*."

Although Stevens' compositions are world-renowned for brass performances, much of his publications have also become the "standard repertoire" for ensembles worldwide. Several esteemed brass soloists and ensembles have also "commissioned and recorded Stevens' works." The amalgamation of his talent as a performer and composer was embedded into his peculiar record album, entitled "Power," which is available on "Mark Records." His honorable credentials of being on the "board of directors for T.U.B.A.," Tuba Universal Brotherhood Association, and the preceding director of the "UW-Madison School of Music" has made him one of the most distinguishable tuba and euphonium instructors, composers, conductors, and performers in the world. Stevens was also a member of Symphonia, "America's premiere professional tuba/euphonium ensemble." Additionally, he also continued his projects as a persistent "soloist, clinician, and conductor for brass ensembles," as well as continuing his efforts to perform with Wisconsin Brass Quintet (Bone et al., 2007, p 479).

Liner-Notes for Adagio:

"*Adagio*," composed by John Stevens and commissioned by T.U.B.A. (Tuba Universal Brotherhood Association), is a piece which is inspired by various "beautiful adagios" for the orchestral repository (Tubist's, 1991). According to John Stevens, the piece was "originally composed in 1991" and then later "revised in 2009." The primary purpose of "*Adagio*" was intended to be a tribute to the "memory of Rayburn Wright," a former instructor of Stevens, who taught Jazz Studies at the Eastman School of Music, "shortly after his death." Prof. Wright proved himself to become a major and monumental inspiration to him, which influenced Stevens to "launch his own career as a composer." Stevens also expressed that "the music is meant to convey both the sense of loss at his passing and an uplifting remembrance of his life and our friendship" (Editions, 2023; Stevens, 2010). In addition to Steven's account, after its commission by T.U.B.A., it was designed to be "premiered by the International College All-Star Ensemble at the 1992 International Tuba-Euphonium Conference in Lexington, Kentucky."

The opening theme is quite calm yet capricious, as the modulations offer a sense of moving characters and moods, from asking questions, which represent dissonance and color-notes, to receiving the answers, representing consonance and diatonic. The character of "*Adagio*"

appears to pick up momentum and shift through more themes as the music progresses; the various ritardando offer a heap of clarity as to ascertain the listener to its tranquilizing nature.

Towards the middle of the piece, the modulations begin to sound like the compositions of the opening section. The character finally gets revealed as the euphonium soloist serves as a soaring eagle which graciously glides through the various wastelands and landscapes. Conclusively, the eagle, euphonium solo, conjoins back to its flock or familiar sound, continuing to soar through the air until it reaches its destination.

Composer Elizabeth Raum:

Elizabeth Raum, an active oboist, and composer, earned her bachelor's degree of musical performance with the oboe from the "Eastman School of Music in 1966," then earned her master's in music composition from the "University of Regina, Saskatchewan, Canada, in 1985." Raum was also awarded an "honorary doctorate in humane letters from Mt. St. Vincent University in Halifax, Nova Scotia." Raum also performed as the principal oboist in the Atlantic Symphony Orchestra in Halifax, Nova Scotia, for approximately seven years prior to her arrival in Regina in 1975, and now performing as the principal oboist in the Regina Symphony (Bone et al., 2007, p 474).

According to Bone and Paull, "Elizabeth Raum's works have been heard throughout North America, Europe, South America, China, Japan, and Russia, and have been broadcast extensively on the CBC." Moreover, Raum has also written various films and videos, and received awards for the repertoire found in the following documentaries: "*Saskatchewan River and Like Mother; Like Daughter* and the feature length film *Sparkle*." Additionally, Raum also produced "Canada's first classical video, entitled *Evolution: A Theme with Variations*, which premiered at a gala event at the CBC in 1986. Other film collaborations include *Preclude to Parting*, *The Green Man Ballet*, and *Symphony of Youth*, all broadcast on national television" (Bone et al., 2007, p 474).

Furthermore, Raum was featured in several articles and served in an array of juries: "New Grove's Dictionary of Music and Musicians, the New Grove's Dictionary of Opera, the New Grove's dictionary of Women Composers, Opera Canada, the Encyclopedia of Music in Canada, the T.U.B.A Journal, Music Scene, and Prairie Sounds, Canada Council, the Saskatchewan Arts Board, the Manitoba Arts Council, the Ontario Arts Council, the CBC, and the Canadian Music Centre," according to Bone and Paull.

Liner-notes for A Little Monster Music:

According to Elizabeth Raum, "*A Little Monster Music*" (2000) and approximately twelve minutes long, was "commissioned by tubist, Roger Bobo, for his tuba ensemble, *Stuba*." There are four distinctive movements which are composed of eight separate portions entitled: "*Hydra, Nessie, Fafner, and St. George and the Dragon*." Raum's "*A Little Monster Music*" debuted at the International Tuba-Euphonium Conference, ITEC – 2000, in Regina (Raum, 2000).

“*Hydra*” begins with a bizarre and suspenseful opening followed by the foreboding crescendo of the ensemble which intends to create an apprehensive atmosphere, leaving the audience hanging off the edge of their seats as the “*Hydra*” creeps up on their victims. The various *diminuendos* allow the “*Hydra*” to properly stalk its prey, and it slowly retreats into its dark abyss as the music ends in a gradual decrescendo.

“*Nessie*” opens with a remarkable and happy theme as the euphonium “*soli*” represents a graceful tread among the water whereas the bass lines portray the calming depths of the ocean and heights of the wind. The melodies lodged within the groove of the piece are virtually distinctive of “*Nessie*’s” large size as it treads among the waters. As the piece runs its closure, the treading waters slowly vanish as if it had never been manipulated; thus, “*Nessie*” has become evanescent to the observer and the waves come to a slow demise with the *fermata*.

“*Fafner*” begins with a bombastic and much more sinister and dastardlier, angry sound. The effective and glorious dissonance illustrates “*Fafner*’s” displeasure and strength as it devours anything it sees. The tension and mixture of major and minor keys offers a level of confusion to the listener, who tries to grasp where “*Fafner*” is going but their attempts are ultimately futile as the music comes to a subtle closure.

“*St. George and the Dragon*” opens with a subtle increase in range in the top parts. This sound showcases a tone of familiarity and righteousness, seemingly to bring some comfort to the audience. As the piece progresses, it exhibits some deep agitation and anticipation for a dramatic increase in dynamic contrast. For example, at the *Allegro* section, the full instrumentation evokes a strong, muscular presence and the modulations convey the tension between “*St. George and the Dragon*.” As the two belligerents rage against each other, the battle resolves to the dragon’s debacle and St. George’s victory, depicted by the bass lines cascading range and syncopation between the top parts.

Composer Kevin Day:

Kevin Day, a prominent composer, conductor, and pianist, has received worldwide acclaim for his vast genre of musical compositions, which often intercede each other; Day’s musical spectrum ranges from the following genres: “jazz, minimalism, Latin music, fusion, and contemporary classical idioms.” Day also “serves as the Vice President of the Millennium Composers Initiative,” an international collaboration of more than “120 composers from several countries” (Day).

Day has composed a collection of more than 200 works, and he has also played in countless performances in several countries, such as “United States, Russia, Austria, Australia, Taiwan, South Africa, and Japan.” According to Kevin Day, his compositions became predicated arrangements for numerous sophisticated collegiate wind ensembles, as well as grand American symphony orchestras, which include the cities of San Francisco, Houston, Detroit, Indianapolis, Boston, and many others. His arrangements fulfilled many performances in honorable locations: “Carnegie Hall, Rachmaninov Hall (Russia), The Midwest Clinic, and other major venues, and

recently he had his Carnegie Hall Conducting Debut at the 2022 New York International Music Festival.” Day is also the beneficiary of an array of awards: “a winner of the BMI Student Composer Award, a three-time finalist for the ASCAP Morton Gould Young Composer Award, and considered for the 2022 Pulitzer Prize for his Concerto for Wind Ensemble” (Day).

In addition to his accolades, Day’s collaborations with several chamber ensembles, Hiram Diaz, James Markey, and many others, showcases his distinguished level of achievement to perform with infamous names in their respective instruments. Day currently serves as the Assistant Professor of Composition at Wilfrid Laurier University, and he is also striving for his D.M.A in Music Composition from the University of Miami Frost School of Music. Professor Day possesses a Master’s of Music Composition from the University of Georgia, and he also holds a Bachelor’s in Musical Performance from Texas Christian University.

Liner-notes for Ignition:

The term “ignition,” noun, is defined as the following: “the action of setting something on fire;” and the process for initiating fuel combustion in an engine. The piece was written in 2019 and was originally commissioned by Dr. James Jackson III for “The Hartt School Tuba-Euphonium Ensemble at the University of Hartford, Connecticut.” Day’s opportunity to create arduous music for tuba-euphonium players is quite astounding (Kevin, 2019).

According to Kevin Day, “*Ignition*” serves as his “second tuba-euphonium ensemble piece ever written.” The piece is conveyed as a driving, passionate, dynamic composition, featuring several instances of divine musicianship, lyrical lines, and technical runs to showcase the esteemed genius behind low brass playing. Day’s illustration of the music portrays an accelerated race car attempting to secure the victory despite numerous obstacles, which it must maneuver.

Right away the piece begins with vigorous and fast lines, exhibiting the backburner of the race car taking off towards race. As the piece progresses, the race car digresses into the rest of the race; the melodic lines and lyrical contrasts represent the car’s successful maneuvers to escape the various obstacles that lie in its midst, it enters a blissful cruise control then slowly accelerates as the race proceeds into more intensity. As the piece reaches its dramatic closure, the modulation of a minor mode then changes to a major mode, seemingly showing the race car’s victory and abrupt stop as it passes the finish line.

Composer Jonathan Oliver:

Jonathan Oliver, born in 1974, currently serves as the Director of Bands for the Ohio County Middle School band in Hartford, Kentucky. Oliver creates compositions and arrangements for several distinct genres of ensembles: chamber ensembles, marching bands, concert bands, and mainly Tuba-Euphonium ensembles. Oliver obtained his bachelor’s degree from Tennessee Tech University, operating under Winston Morris, and then later receiving his master’s degree from Western Kentucky University, operating under the vision of Joe Sites and Jeff Hodapp (Smith, 2016, p 6).

Liner-notes for The Seventh Degree:

According to Jonathan Oliver, “*The Seventh Degree*” presented itself as an inspiration for the collection, (Tuba Quartet no. 1), and was derived from his daughter, Cadence, who was naturally inquisitive about every subject matter (Oliver, 2017). After its premiere, Oliver chose to innovate two additional compositions which honored his other family members.

Initially, “*The Seventh Degree*” conveys a blizzard of runs from the euphoniums and buoyant splashes from the tubas, which could illustrate Oliver’s daughter’s natural curiosity. In other words, the daughter’s inquisitions are frequently flooding her mind, and thus revealing her questions, being that the minor mode leaves the natural person unanswered. After asking about a thousand unanswered questions, the ascending minor scale lines and elastic bass pops reach their abrupt conclusion, like a cliffhanger.

Composer Frank Lynn Payne:

Frank Lynn Payne, born in Asheville (North Carolina), “attended Little Rock Central High School in Arkansas” and then later became a professor at Oklahoma City University (Wilhelm, 2015, p 3). After serving thirty-five years as the Oklahoma City University Professor of Music and Graduate Studies Coordinator, he honorably retired in 2002 (Potenza, 2023a; UNT, 1961).

Liner-notes for Quartet for Tubas:

Payne composed “*Quartet for Tubas*,” which was originally considered by its former name and purpose: “tuba quartet (4 tubas).” However, it was judiciously altered to its current name: “*Quartet for Tubas*” (Wilhelm, 2015, p 3).

Movement one begins with a variation and cluster of rhythms and chords, which sporadically alter as the piece continues; this may very well illustrate the pandemonium between the contrasting lines, offering a sense of confusion and resolution in a large tonal amalgamation. As the character shifts through several themes and modulating chords, it concludes with a cliffhanger, which then leads into the second movement.

In the beginning of the second movement, the character’s desultory nature is subdued as it finally embraces its lyrical qualities, singing through varying keys once more but creating a tranquilizing atmosphere. There are several instances where the tubas obtain full harmony and syncopation, which is remarkable in its ever-flowing nature, keeping the audience uncertain as to what may occur next.

The third and final movement transfers back to an arbitrary gallop, which slowly leads to manipulate the audience with its captivating triplet licks. The deception behind this contrasting essence, as dissonance battles with consonance, offers little climactic resolution even as it suddenly draws its end.

Composer Matt Hightower:

Matt Hightower, Assistant Professor of Tuba, and Euphonium at Florida State University, is an accomplished tubist whose performances balance a myriad of solo, chamber, and orchestra repertoire. Hightower is also a “prizewinner” of various global solo competitions and presents a plethora of tuba-euphonium masterclasses to prospective students and aspiring colleagues.

Having earned his Bachelor’s Degree in Music Education (Murray State University), his Master’s in Musical Performance for Tuba (Indiana University), and his Doctorate in Musical Arts (University of Texas at Austin), Matt Hightower also possesses an ever expanding catalog of “solo residencies,” some of which include the following: “Baylor University; Vanderbilt University; University of Tennessee; the 2019 International Tuba/Euphonium Conference; the 2017 & 2018 South Central Regional Tuba/Euphonium Conferences; the United States Army Band Tuba/Euphonium Workshop in Arlington, VA; and many more” (Hightower, 2022)

According to Matthew Hightower, he also performs as the tubist for various chamber ensembles: “University of Kentucky Faculty Brass Quintet and has also performed with the Corpus Christi Brass Quintet, the Kingsville Brass Quintet, and various others.” In addition to his chamber ensemble work and performances, Hightower also expresses himself to be an esteemed tubist amongst the larger ensembles or symphony orchestras: “Bloomington Camerata Orchestra, The Columbus (IN) Symphony, The Evansville Philharmonic, The Iceland Symphony Orchestra, The Louisville Ballet, The Jackson Symphony, just to name a few” (Hightower, 2022).

Moreover, Hightower relentlessly persists in his solo pursuits, which are quite remarkable amongst the world of tuba and euphonium players: his debut album “Re(in)spiration, released in 2019, underscores his mark as a finalist in the ‘2021 ITEA Roger Bobo Award for Excellence in Recording.’” As reported by Matt Hightower, the album advertises Hightower’s immense musical prowess as a music creator and executant, which all demonstrate his technicality, consistency with fundamentals, and maneuverability throughout the various spectrums of the horn.

Hightower also stands as an “award-winning composer” for the “2010 KMEA Intercollegiate Composition Contest and the 2021 ITEA Winston Morris Award for Tuba Ensemble Composition,” whose works have been incorporated in premiere performances at several International Tuba Conferences, and they have also been published through “Potenza Music and Absolute Brass Publishing.” He studied under various instructors such as “Ray Conklin, Daniel Perantoni, among other professionals” (Hightower, 2022).

Liner-notes for IET Fanfare:

The International Euphonium-Tuba Festival commissioned Dr. Matthew Hightower to compose “*IET Fanfare*” for the 2020 virtual IET Festival. The piece then won the 2021 “ITEA Winston Morris Award for Tuba Ensemble Composition” (Bombardinos, 2021; Potenza, 2023b; Renshaw-James, 2023). The music utilizes the fortitude and power of “4 tubas and 4

euphoniums” in order to achieve maximum potential, creating an exhilarating atmosphere for a substantial Tuba-Euphonium ensemble (Hightower; Pinnacle, 2023)

From the initial impression of the music, the enigmatic mysteries from previous pieces have now been dissolved and invigorated into vitality, tenacity, and an ever-present zeal that is steadfast throughout the shifting contour. The judicious personality of this piece remains in the joyous pursuit of amenities that serve as the object of its affection; this is self-evident as the oscillating solos of the high waves and brawny bass lines of the ocean’s depths maintain their relentless approach to navigating a wayward ship to shore.

Composer Giuseppe Verdi:

Giuseppe Verdi, (born in Roncole, Italy, October 9th 1813; died in Milan, Italy, January 27th 1901), became an influential “Italian musical dramatist” throughout the 19th century, and he served as a successor to “Rossini Bellini, and Donizetti.” As a contemporary composer to Wagner, Verdi played a crucial part as being an opera composer of his time, receiving countless notoriety across the nation and the world because of his invigorating compositions (English, 2023). Verdi derived much of his knowledge from his efforts to incorporate the likes of “Dumas, Hugo, Schiller, and Shakespeare” in his works. He also collaborated with two dignified “librettists,” Piave and Boito (English, 2023).

Verdi's Musical Style

Verdi’s earliest musical styles were vastly expansive and polished to fit a widely elegant mannerism. According to the English National Opera, Verdi’s faithfulness to “well-established musical structures” from the derivatives of early Italian composers, as stated before. Moreover, much of these substantial musical motifs were transformed by Verdi’s stylistic perspective. Later in his career, the rudiment of bel canto composers still prevailed while the “distinct forms” music thawed out. Additionally, as Verdi advanced his compositions, his “harmonic language” remained steadfast in its simplicity and sincerity, gradually evolving into a nuanced, exciting, and enticing language. This is clear in his music whenever Verdi appears to highlight the vocal passages and underscores his thematic thesis in the piece.

Verdi's Life

Much of Verdi’s early life and influence can be summarized through the origin of his parents. His parents originated from “landowner and trader” families which is thought to have affected Verdi’s excellent entrepreneurship and business endeavors. This later sprouted up his substantial “music career and administration of a landed estate.” Verdi began as a humble church organist around seven years of age, and then he received his “formal musical training” at twelve years of age. In addition to this, Verdi wrote numerous operatic music shortly after his studies in the city of Milan.

According to the English National Opera, during the 1850s, there were three popular operas that hardly dwindled: “Rigoletto (1851), based on ‘Le Roi S’amuse’ by Victor Hugo; Il

trovatore (1853), based on a text by the Spaniard Gutiérrez; and *La traviata* (1853), based on Dumas's story of a courtesan's love affair with a respectable young man." Moreover, Verdi continued his work and his latter compositions received massive respect as "major cultural events." Although Verdi's concentration was primarily "lyric theater," at times he would transcribe to different genres; some of these works may include the infamous "Requiem (1874) and the Four Sacred Pieces (1887–96) for soloists, chorus and orchestra" (English, 2023).

Arranger Vikentios Gionanidis:

Vikentios Gionanidis, (Born in Corfu, Greece), is a Greek arranger for brass music and a proficient tubist who started his musical aspirations with the wind ensemble named "Mantzaros" in 1998. Mantzaros incorporated various instruments such as percussion instruments, the euphonium, and the tuba, while also utilizing a plethora of music theory. Afterwards, Gionanidis "studied at the Corfu Conservatory of Music, and then he began his education at the Hochschule für Musik, Theater und Medien in Hannover, Germany," where he later joined Professor Jens Bjørn-Larsen's tuba class in October 2007 (Gionanidis, 2022). Gionanidis then received his degree in February 2013, in which he also had participated in several solo recitals and chamber ensembles. Vikentios did all this alongside his "orchestral training."

In addition to his education, Vikentios has obtained various accolades and acclaim: Vikentios has made his appearance as the soloist of several orchestras which include the "Folkwang Kammerorchester, Essen, the Orchestra of the Plauen-Zwickau Theater, the Göttinger Symphoniker, the Düsseldorfer Symphoniker, the Gdansk Academy Orchestra." According to Vikentios, he has also received numerous prizes in a couple of reputable brass competitions which include the "International Aeolus Competition in Düsseldorf in 2010, the special prize for contemporary music and the audience award, competing against other brass instruments, the first prize of the International Instrumental Competition in Markneukirchen in 2012, various awards from the National Music Academy Competition in Lübeck in 2011, and prizes from the International Brass Competition in Gdansk in 2012" (Gionanidis, 2022).

Additionally, Vikentios performs in a series of large orchestras and chamber ensembles and has taught in many institutions and masterclasses. According to Vikentios, he has performed alongside large orchestras with the likes of "the Berlin Philharmonic, the Bavarian State Orchestra, the Frankfurt Radio Symphony, the Orchestre de la Suisse Romande, the Staatsoper Hamburg, the Rundfunk-Sinfonieorchester Berlin, the Deutsches Symphonie-Orchester Berlin, the Gewandhausorchester in Leipzig, the Staatsorchester Stuttgart, the Komische Oper Berlin, the Konzerthaus-Orchestra Berlin." He also performed with several chamber ensembles that include "the Ensemble Modern, which specializes in contemporary music, the German Opera Brass (brass ensemble of the Deutsche Oper Berlin), the Salaputia Brass." Furthermore, his teaching and masterclass experience of solo and orchestra repertoire is noted in "the Hochschule für Musik, Theater und Medien, Hannover, and his masterclasses have been proposed in many countries, including Greece, Germany, Sweden and the USA" (Gionanidis, 2022).

In Vikentios' work as a brass music arranger, his orchestrations were performed and published throughout the world; "his primary etude book for tuba and trombone, 29 *Bel Canto*

Studies,” turned out to be sensational, and it is widely used by various low brass players and students in the world, ranging from the trombone, euphonium, and tuba (Gionanidis, 2022). In addition to his arrangements and publications, Vikentios is also a “Buffet Crampon artist” and he performs as the principal tubist in the Berlin Deutsche Oper Orchestra.

Liner-notes for La Forza del Destino:

Verdi’s “libretto,” (*La Forza Del Destino: The Force of Destiny*), was written in congruence with one of Verdi’s primary collaborators, Francisco Maria Piave, who positioned the “four-act libretto on the 1835 Spanish play, *Don Alvaro, o La fuerza del sino*, by Angel di Saavedra (1791–1865), and influenced by Victor Hugo” (Newman, 2018). Moreover, Verdi incorporated a visual from “*Wallenstein’s Camp*,” by Friedrich Schiller (1759-1805), where he was influenced to use it for the piece. In November 1861, the commission of “*La Forza Del Destino*” was finally completed despite the excluded arrangement. Verdi later finalized the piece which made his prototype one of his most innovative and convoluted operatic projects (Newman, 2018).

According to Newman, Verdi initially planned the premiere to be in the “1861-1862 season,” but the creation was delayed as a result. Thus, the premiere took place on November 10th, 1862, in which Verdi’s work was rather insufficient, according to him. Therefore, he improved his program and performed the edited version at the “Teatro alla Scala in Milan on February 27th, 1869.”

Verdi and Piave convey the following thematic message: several characters gather as a result of a coincidence; Melitone and Preziosilla are novelty characters whereas Don Carlo, Don Alvaro, and Donna Leonara express lamenting personalities. Furthermore, the big distinction between the 1862 and 1869 designs is the “overture.” According to Lori Newman, “the first version appears to be a concise prelude, and then an elaborated copy that contains various operatic melodies, the ‘fate’ motif, and ascending ‘four-note’ scales.” There is another drastic difference between the prototype and the revised version, and the change involves the closing acts. As the original act ends, Carlo is murdered by Alvaro in a duel but with his purging energy, ends up stabbing Leonora to death, leading Alvaro in a state of suicide as he leaps off the mountaintop. In the redrafted version, “Carlo’s stabbing of Leonora and duel with Alvaro take place backstage,” and then the mood modulates from a minor to major mode as Alvaro receives his redemption, meaning he did not commit suicide (Newman, 2018).

Giuseppe Verdi’s overture, (*La Forza Del Destino: The Force of Destiny*), has become an entity and an eminent piece in the high-quality, Orchestral repertoire, which is often played as the “opening piece” in various performances. As the score opens with “the opera’s ‘Fate’ motif,” there are a series of three foreboding unison notes in the brass sections. This specific low brass configuration, by arranger Vikentios Giananidis, was particularly organized for a tuba quartet, but the parts can be used interchangeably with euphonium instrumentations: for example, the instruments that are required include four tubas, (tuba one, tuba two, tuba three, and tuba four). However, the top two parts can also be exchanged with the top two euphonium parts -- euphonium one and euphonium two (Gionanidis, 2021).

The piece has a dramatic and blaring opening as an initiation to the audience into the nimble runs. As the piece gains momentum with its blistering tornado of tumultuous ascending lines and scales, it then reaches its first peak in full fortissimo dynamics, which is identical to the beginning. After the first peak, the play then transitions itself into a sweet, warm, and smooth *dolce* section, which carries the speed of an *andante mosso* as it modulates and alternates between distinct keys, reaching yet another peak with an ascending scale pattern. The principal instrument, part one, then enters the *allegro brillante* section, in which it sings alongside various counterpoints in the low brass section, then repeating the same theme throughout the piece (smooth transitions to a crescendo into brawny brass moments – peaks). Throughout the music, the counterpoint is indicative as the minor and major modes build tension and fight with each other, which basically simulates the duel between Alvaro and Carlo. The piece appears to be fixated on the modern version of the opera because it concludes with a major mode, meaning Alvaro sealed his victory and has received his redemption.

Composer Kevin McKenzie:

Kevin McKenzie, Assistant Director of Bands at the University of Memphis, works alongside the “Mighty Sound of the South Marching and Pep Band.” Prior to his teaching experience at the University of Memphis, McKenzie worked, for five years, as the Director of Bands for “North Point High School in Southaven, Mississippi.” McKenzie carries a bachelor’s degree in Music Education from the University of Memphis, where he has also “competed with a Tuba-Euphonium Quartet.” McKenzie became the President of the Tuba-Euphonium Studio for four consecutive years, where he innovated three CD’s and served as the principal euphoniumist for Albert Nguyen’s Wind Orchestra. He has also received the “Clement Santi Memorial Scholarship,” which acknowledges him as a virtuous brass student. Afterwards, he served as the drum major for the University's Marching Band in his last year of school (University, 2019).

Kevin also prides himself as being a Music City Drum Corps charter member, in which he marched alongside Phantom Regiment Drum Corps in 2012. Later in 2013 and 2014, he became a member of the “Memphis Grizzlies Drumline,” playing at a majority of the “NBA team's home games.” Coincidentally, he typically taught music for the Phantom Regiment and Music City Drum Corps. Additionally, Kevin is also the composer for the “The Hollywood Warm Up” book that has grown with popularity, and he has also received various awards: “ITEA's Excellence in Composition Award with ‘Axis’ in 2016, and the U.S. Army Band Composition Contest with ‘Whirlwind’ in 2017” (University, 2019).

Liner-notes for Contra Victus:

“*Contra Victus*” became one of Kevin McKenzie’s greatest compositions, leading him to receive a Nobel award. In the ITEA Competition of 2019, the piece, “*Contra Victus*,” allowed McKenzie to obtain the “Runner-Up for ITEA’s Excellence in Composition Award” (UM, 2022, p 26).

The piece begins as a delicate and intimate carol which sings in a flattering manner, seeming to relax and tame the listener. However, the listener is then met with a drastic and instantaneous transition, resembling a sort of sprint and high dynamic volume as the instruments rush to a fortissimo sound.

The top parts sing alone and with each other over the sporadic bass lines. The principal euphonium resembles the sound of a trumpet playing with an authentic Spanish sound, (vigorous vibrato; powerful, brassy, and soaring belting tones). The piece winds down as it interludes to the middle passage, which then introduces the euphonium solo: it sings beautifully and wonderfully and then it comes to a brief stop. Afterward, the texture of the music continues to expand where it left off. Then, the bass lines convey bouncy bell-tones which pick up the momentum of the music, leaving the euphoniums to quickly follow thereafter, and finishing the piece with a triumphant and robust conclusion.

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Depression and Anxiety: Outcomes of Traumatic Experience in Relation with Drug Abuse



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ABSTRACT

Depression and anxiety are major public health concerns as they affect over a million Americans every year and have numerous adverse outcomes. Research exploring the linkages between depression and anxiety with drug abuse has remained minimal. Results derive from the Nashville Stress and Health Study (n = 1,252), a study that ascertained the stress and health status of predominantly African Americans and White Americans from Davidson County. Results indicated a significant relationship between depression and violent crime (rape), as well as depression and drug abuse. Similarly, a significant relationship was identified between anxiety and violent crime (rape and physical assault), as well as anxiety and drug use. This study provides insight into the prevalence of drug abuse in relation to depression and anxiety that developed due to traumatic experiences via violent crime victimization.

Introduction

Victimization due to violent crime is a traumatic experience that may have many consequences for the victim. One such consequence would be the decline of the victim's mental health. This decline is often measured by the increased symptoms or presence of mental disorders like depression and anxiety. For example, research has indicated that sexual assault victimization is related to a higher prevalence of depressive disorders (Dworkin, 2018). Such mental disorders affect 8% to 19% of American adults per year (Comer et al., 2021). Additionally, mental health is a leading factor in multiple adverse health behaviors and outcomes like suicide. Prior research indicated that 60% of suicide attempters were afflicted by depression (Balázs, 2006). High-risk suicide attempters are also more likely to be afflicted with comorbid mental disorders like depression, anxiety, PTSD, OCD, and substance abuse disorders (Park, 2018).

Depression is a mental disorder exhibited by individuals from all backgrounds, regardless of age, race, gender, or socioeconomic status. Depression is a disorder that could heavily hinder a person's daily functioning in that they can become influenced by feelings of unhappiness, discontent, and extreme sadness. Sadness is generally seen as the biggest symptom accompanying depression. Still, depression is much more extensive than that, and its symptoms

can affect people's functioning in terms of emotion, motivation, behavior, cognition, and physicality (Comer et al., 2021).

Similar to, and often in accompaniment to depression, generalized anxiety disorder, is another common mental health diagnosis that a large population of the U.S. contends with, an estimated 19% of US adults in a year (Comer et al., 2021). Generalized anxiety disorder hinders a person's daily functioning in that they become influenced and overcome by uncontrollable feelings of anxiety for an extended period of time (Stein & Sareen, 2015). The persistent nature of this anxiety typically results in high irritability, limited concentration, fatigue, and trouble sleeping. Like depression, the symptoms of anxiety are extensive enough to impact a person's daily functioning in terms of emotion, motivation, behavior, cognition, and physicality (Comer et al., 2021).

Drug abuse is the process of being exposed to a drug over time until a person gets addicted to the drug (Becker, 2008). Most drug abusers are individuals from a vulnerable position, it is also known that men have a higher susceptibility than women to become a victim of drug abuse (Becker, 2008). Drug abuse often involves the use of substances like alcohol, marijuana, cocaine, heroin, methamphetamine, and opiates. Drug abuse is also associated with various negative health risks such as bronchitis, cancer, liver disease, higher mortality rates, and decreased life expectancy (Fox, 2013). As more exposure occurs, it becomes harder to break an addiction due to the body formulating a dependence on the drug (Fox, 2013).

In the context of violent crime, depression and anxiety are important factors to understand regarding the victim. This study aims to further the literature on this important health and traumatic experiences relationship and how drug use and abuse may affect this health association. Understanding how victims respond to victimization is important in learning how to support them better and prevent further decline in their mental health.

Literature Review

A study of violent crimes like sexual assault and aggravated assault has indicated that victims of violent crimes are more susceptible to negative psychological impacts when compared to victims of non-violent crimes (Tan et al., 2016). These psychological impacts include depression, anxiety symptoms, and various other mental disorders and behavioral changes (Tan et al., 2016). Other scholars have also found that an individual's environment (e.g., neighborhood) increases susceptibility to depression and anxiety if crime is common (Baranyi et al., 2021). Additionally, studies examined the association between violent crime hotspots and mental health, with one finding that individuals living in violent crime hotspots are more susceptible to depression by 19% (Weisburd et al., 2018). In contrast, areas where crime is not as prevalent have been found to have significantly lower rates of mental disorders (Weisburd et al., 2018).

Depression and anxiety can emerge due to a variety of factors. A common catalyst for depression and anxiety to emerge in individuals is victimization via violent crime. One such increasingly concerning example, sexual assault, occurs so frequently that it has been stated that 1 in 6 women and 1 in 33 men from the US will be a victim of sexual assault during their life

(Choudhary et al., 2012). Prior research has indicated that victims of sexual assault have a greater susceptibility to a wide variety of mental disorders, including depression and anxiety (Dworkin, 2018). In their study, Dworkin (2018) compared two groups, one consisting of sexual assault victims and one consisting of individuals not victimized by sexual assault over their lifetime and past-year depression and anxiety, with findings indicating that sexual assault victims experienced higher percentage rates of being afflicted by both conditions. A similar study also indicated that victims of sexual assault are significantly more likely than non-victimized individuals to experience rates of depression, anxiety, or both (Choudhary et al., 2012). Furthermore, this higher prevalence was consistent for both men and women that were sexually assaulted over those that were not (Choudhary et al., 2012). These self-reports resulted in sexual assault victims reporting a significantly greater number of days where they experienced depressive and anxiety symptoms than non-victimized individuals (Choudhary et al., 2012).

Additionally, depression and anxiety as a whole are relevant and immensely important topics to study or factor into studies because the symptoms accompanying these disorders can have detrimental consequences in various ways. Statistically speaking, 20% of all adults have experienced some form of depression throughout their life, and 6% of people will be afflicted by generalized anxiety disorder (Comer et al., 2021). Studies have indicated that in the United States, 10%-25% of women and 5%-10% of men will experience a depressive disorder in their life (Comer et al., 2021). This statistic involves millions of people who are a part of society, which has led to societal consequences (e.g., suicide). Indeed, mental disorders have led many to commit suicide; estimates have been made that this has equated the consequence of suicide to a \$12 billion financial loss in terms of productivity (Pincus et al., 2001). As a whole, depression alone has financially cost society between \$40 and \$50 billion in regard to healthcare, workplace practices, etc. (Pincus et al., 2001).

As stated, depression and anxiety are mental disorders that negatively affect the behavior of individuals, whether that be physically, emotionally, or cognitively. An impact that these disorders have upon society is the significant financial losses that occur as a result of their linkage with drug use and abuse, especially when accounting for the strain placed on the healthcare and judicial systems.

Additionally, it is known that drug abuse is often used as a coping mechanism for depression and anxiety; researchers have indicated a strong association between drug abuse, depression, and anxiety (Fooladi et al., 2014). Furthermore, research has indicated a link between depression, drug abuse, and comorbid disorders that result from victimization via violent crime (Kilpatrick et al., 2003). Regarding rape, it has been indicated that victims have a 6 times greater likelihood to use a drug like cocaine and a 10.1 times greater likelihood to abuse harder drugs (Kilpatrick et al., 2003). General research on victimization has also indicated that victims have a higher susceptibility to abuse hard drugs (Ruback, 2013).

Another study related to sexual assault focused on differences between victimized groups and non-victimized groups in terms of lifetime and past-year drug abuse (Dworkin, 2018). The results of this study indicated that sexual assault victims experienced a significantly greater amount of both lifetime and past-year drug abuse when compared to the non-victimized group

(Dworkin, 2018). Additional research has also indicated that active drug abuse increases the chances of victimization to occur (Kilpatrick et al., 2003). This increased chance for victimization to occur relates to why victims turn to drugs, a theorized explanation for that would be that after victimization, victims turn to drugs as a way to cope and alleviate their feelings of anxiety and depression (Ruback, 2013). Since victims seek out drugs to consume, there would be a willingness to put themselves in an unsafe setting in order to obtain drugs, and this unsafe setting could result in re-victimization (Ruback, 2013).

Methods

Data

The data derives from the Nashville Stress and Health Study, which consists of a sample size of 1,252 people from Davidson County, Tennessee. The study aimed to ascertain the population's stress and health status through variables such as mental health and drug use. The sample size was comprised primarily of African Americans and White Americans, ranging from age 22 to 69; numerous variables were utilized to gain an understanding of how health differs across a Davidson County sample. These variables include differences among factors such as sex, race, education, and income. This data was gathered through the use of interviewing techniques throughout a 3-year period. Interviewing techniques included interviewers being assigned to a respondent based on the respondent's race. Interviews typically lasted 3 hours and were conducted at the respondent's home or Vanderbilt University. Data was collected between 2011 and 2014.

Measures

Depression

Depression was gauged by asking respondents how well certain statements applied to them; these statements were derived from the Center of Epidemiological Studies Depression Scale (Radloff, 1977). Some of these statements included, but were not limited to, "You did not feel like eating," "You had trouble keeping your mind on what you were doing," "You felt depressed," "You thought your life had been a failure," and "You had crying spells." Respondents were given answer choices pertaining to the applicability of each of these statements. These answer choices were dichotomized as (0 = "No," and 1 = "Yes"). A 20-item index was constructed ($\alpha = .80$) to capture this self-rated depression.

Anxiety

To measure anxiety, a 5-item index was constructed ($\alpha = .82$). These statements included "I felt worried over possible misfortunes," "I felt over-excited," "I felt tense," "I felt anxious," and "I felt nervous." Respondents were given answer choices pertaining to the applicability of each of these statements. These answer choices were dichotomized as (0 = "No," and 1 = "Yes").

Rape

The variable of rape was gauged by asking respondents a one-item question. The question was asked, "Did you ever have sexual intercourse when you didn't want to because someone

forced you or threatened to harm you if you didn't?" Respondents were given two answer choices for this question (0 = "No," and 1 = "Yes"). Additional information inquiring about the frequency, the first age of being a victim of rape, and the last age of being a victim of rape were also collected; however, this additional information, while useful, was not used for the purpose of this study.

Physical Assault

Similarly, to measure physical assault, a one-item question was used. The question asked was, "Have you ever been physically assaulted or mugged?" Respondents were given two answer choices for this question (0 = "No," and 1 = "Yes"). Additional information inquiring about the frequency, the first age of being a victim of physical assault, and the last age of being a victim of physical assault were also collected; however, this additional information, while useful, was not used for the purpose of this study.

Drug Abuse

Drug abuse was ascertained by asking respondents key questions. These questions included "Have you ever used cocaine in any form, including powder, crack, freebase, coca leaves, or paste?" "Have you ever used heroin, opium, or other opiate drugs even once?" and "Have you ever used ecstasy, even once?" Respondents were given answer choices that pertained to the applicability of these questions. These answer choices included 0 = "No" and 1 = "Yes".

Socio-Demographics

Additionally, this study controlled for age (in years), gender (female = 1, male = 0), race (black = 1, non-Hispanic white = 0), marital status (1 = married, 0 = not married), education (0 = less than high school to 4 = more than bachelors), employment status (2 = full-time, 1 = part-time, 0 = other), and household income (ordinal, 0 = under \$5000 or less to 14 = \$135,000 and higher). Descriptive statistics are presented below in Table 1.

Analytic Strategy

Due to the variance of both CESD and anxiety being greater than their respective means, negative binomial regression was used for the analyses. For Table 2, Models 1 and 2 independently tested the expected difference in log count between CESD and rape and physical assault, respectively. Model 3 measured the use of hard drugs. Lastly, Model 4 included socio-demographic covariates to control for the potential spuriousness of the previous models in addition to rape, physical assault, and drug abuse. Models 5-8 followed the same format as Models 1-4 but with the dependent variable anxiety measured instead of CESD. RStudio was used for data analyses; measures of depression, anxiety, and hard drugs were coded into a composite variable.

Table 1. Descriptive Statistics: NSAHS, 2011-2014.

| | Mean/ Proportion | SD | Range | N |
|------------------------|---------------------|-------|---------|-------|
| Focal Variables | | | | |
| CESD-20 | 0.15 | 0.20 | 0 - 1 | 1252 |
| Anxiety | 1.010 | 1.44 | 0 - 5 | 1251 |
| Rape | .170 | 0.37 | 0 - 1 | 1250 |
| Physical Assault | .200 | 0.4 | 0 - 1 | 1252 |
| Drug Abuse | .620 | 0.49 | 0 - 1 | 1252 |
| Covariates | | | | |
| Age | 46.04 | 11.52 | 22 - 69 | 1252 |
| Gender | | | | |
| Male | .470 | | | 589 |
| Female | .530 | | | 663 |
| Race | | | | |
| White | .499 | | | 625 |
| Black | .501 | | | 627 |
| Marital Status | | | | |
| Not married | .554 | | | 693 |
| Married | .447 | | | 559 |
| Education | | | | |
| Less than high school | .137 | | | 172 |
| High school or more | .863 | | | 1,080 |
| Employment | | | | |
| Part/non-employed | .403 | | | 504 |
| Full-time | .597 | | | 748 |
| Household Income | 7.00 | 4.12 | 0 - 14 | 1221 |

Notes: Statistics are derived from non-imputed and unweighted data. NSAHS = Nashville Stress and Health Study. SD = Standard deviation.

Results

Table 2 displays the results for each model generated through the negative binomial regression model. Results include the coefficient counts and an indication of significance levels. Models 1-4 pertain to CESD. In Model 1, for a one-unit change in rape, the difference in expected log counts of CESD is expected to increase significantly by 0.70 (Coef: 0.70; $p < .001$). Model 2 saw that a one-unit change in physical assault increased expected log counts of CESD by 0.30 at a nonsignificant level (Coef: 0.30). Model 3 indicates for a one-unit change in drug abuse, the difference in expected log counts of CESD is expected to increase significantly by 0.45 (Coef: 0.45; $p < .01$). Lastly, in Model 4, when incorporating rape, physical assault, drug abuse, and controlling for covariates, rape and drug abuse maintained a significant relationship to CESD. Covariates significant to CESD included only household income.

Model 5 of Table 2 shows that for a one-unit change in rape, the difference in expected log counts of anxiety is expected to increase significantly by 0.67 (Coef: 0.67; $p < .001$). In Model 6, for a one-unit change in physical assault, the difference in expected log counts of anxiety is

expected to increase significantly by 0.36 (Coef: 0.36; $p < .05$). Model 7 indicates for a one-unit change in drug abuse, the difference in expected log counts of anxiety is expected to increase significantly by 0.29 (Coef: 0.29; $p < .05$). Lastly, in Model 8, when incorporating rape, physical assault, drug abuse, and covariates; only rape maintained a significant relationship to anxiety. Covariates significant to anxiety included age and race.

Table 2. Coefficients from Negative Binomial Regression Estimates of (CESD & Anxiety): NSAHS, 2011-2014 (n = 1,252).

| | CESD: Models 1-4 | | | | Anxiety: Models 5-8 | | | |
|------------------------|------------------|---------|---------|---------|---------------------|---------|---------|-----------|
| | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 | Model 6 | Model 7 | Model 8 |
| Focal Variables | | | | | | | | |
| Rape | 0.70 *** | | | 0.39 * | 0.67 *** | | | 0.48 *** |
| Physical Assault | | 0.30 | | 0.14 | | 0.36 * | | 0.24 |
| Drug Abuse | | | 0.45 ** | 0.35 * | | | 0.29 * | 0.21 |
| Covariates | | | | | | | | |
| Age | | | | -0.01 | | | | -0.02 *** |
| Gender | | | | 0.13 | | | | 0.15 |
| Race | | | | -0.24 | | | | -0.37 *** |
| Marital Status | | | | -0.09 | | | | -0.08 |
| Education | | | | -0.13 | | | | 0.06 |
| Employment | | | | -0.18 | | | | -0.13 |
| Household Income | | | | -0.06 * | | | | -0.03 |

Notes: NSAHS = Nashville Stress and Health Study. Models 1-4 logs CESD. Models 5-8 logs anxiety.

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Discussion and Conclusion

As stated, the goal of this study was to investigate the relationship between victimization, drug abuse, and mental health. Negative binomial regression models were ran to test the relationship of violent crimes and drug abuse to mental health. Through these analyses, it was determined that significant relationships exist between violent crime and mental health, as well as drug abuse and mental health.

These findings support previous research that indicated that victims of sexual assault have a greater susceptibility to mental disorders, including depression and anxiety (Dworkin, 2018). Additional research also indicated that general violent crime negatively impacts victims by increasing their likelihood of suffering from a mental disorder. In terms of rape and physical assault, this study determined that there are significant relationships between depression and rape, anxiety and rape, as well as anxiety and physical assault. Future variations of this study could further investigate the relationship between mental disorders and violent crime by investigating additional mental disorders. This is achievable through the current Nashville Stress and Health Study dataset as it takes into account additional mental disorders like social phobia, ADHD, PTSD, and conduct disorder. Additional forms of crime could also be investigated in tandem with these additional mental disorders.

Additional research that this data supports is the indication strong association between drug abuse, depression, and anxiety (Fooladi et al., 2014). In terms of drug abuse, this study determined that there is a significant relationship between depression and anxiety. Due to drug abuse and violent crime sharing a significant relationship with mental health, additional research should investigate the relationship between violent crime and drug abuse. Future variations of

this study should utilize additional variables measuring violent crime and mental health in order to attain a better understanding of how these variables relate to drug abuse.

Some limitations of this study would be the fact that the cross-sectional nature of the Nashville Stress and Health Study which entails that there is no clear way to establish causal direction. Other limitations include violent crime being measured by 2 variables. Additionally, this data is solely derived from a specific county. This fact would make it difficult to make generalizations since there could be unaccounted factors in the community that may not be present in other parts of the nation.

Despite these limitations, this study provides novel findings. Future research should investigate the relationship between the covariate variables with drug abuse, violent crime, and mental health since some covariate variables indicated significance with mental health. One example of this would be income having a significant relationship with depression. Future research could investigate this relationship while also accounting for how drug abuse and violent crime could be related, such as investigating how different income levels influence rates of depression and susceptibility to drug abuse after victimization.

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Neuropenitentiary: The Mind's Tragic Autonomic Sacrifice of Free Will in the Battle Against Trauma



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ABSTRACT

“Neuropenitentiary” utilizes the naturalist-compatibilist interpretation of free will presented by Daniel C. Dennett in “Freedom Evolves” (2003) to argue for the brain’s tragically natural fallibility in preserving autonomous agency when afflicted with trauma (PTSD, developmental trauma, etc.). When juxtaposed with the naturalistic framework provided by Dennett, Bessel Van Der Kolk’s recent (2014) in-depth medical and academic accounts of trauma (whether in the context of PTSD, intergenerational trauma, or developmental trauma) elucidated in “The Body Keeps the Score” present necessary and sufficient conditions for the loss or obstruction of autonomous agency on a physiological level – in that humans’ evolutionarily developed sense of rationality, made possible by the neurophysiological functions of the brain in an attempt to maintain homeostasis through hormonal regulation and conceptual recollection, is jeopardized by the overwhelming stressors of a traumatic event. Finally, this paper ties these points together to elucidate the loss of individual autonomy at the hands of trauma itself and provides an explanation for free will as an evolutionary development, contingent upon the efficiency of neurophysiological function. As an example, “Neuropenitentiary” encourages the continued study of naturalistic free will for the advancement of its ancillary application to other similarly concerned interdisciplinary fields.

Introduction

Developments in neuroscience, regardless of the time of their prominence, have proven to explain, predict, evaluate, and even heal the human mind. It is thanks to these developments that psychology, economics, medicine, law, and even arts/literature can be better understood in the context of their relation to the human story. As the brain takes in information through biological sense-perception, it begins to associate certain bits of information with others and draws from experiences to assist in the solution of a yet-to-be-encountered issue. This biochemical computer forever locked behind the human skull is highly advanced and has been evolutionarily refined to efficient, non-detrimental day-to-day operation. As with most computers, the brain experiences quite a few programming issues when on the receiving end of data, information, or experiences that present as either subjectively or universally overwhelming. It is this manifestation of issues in the face of trauma that gives rise to a life-altering question; are you still free? Freedom, as it

relates to the individual and their abilities, however, must be accurately understood as many evolutionarily developed biochemical processes in the brain that grant the ability to evaluate, decide, and act - generating multiple issues when juxtaposed with the history of the study of free will and non-Darwinian understandings of volition. Given that human behavior might be solely attributed to a kind of cerebral homeostasis, the very idea of freedom itself is put into question and oftentimes disregarded through the individual subscription to determinism. This occurrence also furthers demonstrates the importance of intellectually and professionally developing a universal understanding of the necessary and sufficient conditions of freedom and how it pertains to medicine, education, industry, and most obviously, the law. A specific application of naturalist free will operates under the correlation between philosophy and psychiatry, where trauma presents issue in the development of a naturalist proof for free will. The neurological effects surrounding trauma (such as those related to PTSD¹ – blackouts, amnesia, dissociation, etc.) It is important to emphasize the dichotomous relationship present in any system of thought, with an aim to influence human understanding or method in a particular context, between theory and praxis. This conceptual dichotomy, while imperative for distinguishing the necessary means to form method or praxis out of theory, presents a roadblock in efficiently establishing the steps necessary for the further development of or research in socially necessary goods, services, and ideas. The difficulties in developing practical compartmentalization of the steps necessary to achieve a result predicted in the formulation of any theory ought only to be circumvented by the construction or adoption of a logically tried model in which the background information and framework of said model efficiently and accurately satisfy conceptual, ethical, or practical issues that arise at the notion of practical application. “Neuropenitentiary” takes this dichotomy into consideration while positing a direct connection between trauma and autonomy indicative of free will’s contingent existence in a psychiatric context (which can be modified, emphasized, or further developed to establish further connection between problems in both philosophy and psychiatry. These conditions are qualitatively met in this paper through the adoption of Dennett’s naturalistic framework to assess the effect that trauma has (if any) on individual human autonomy. To properly witness, attribute causes to, and understand the complexities of human behavior as it relates to individual freedom, a naturalist (evolutionary) account of autonomy effectively becomes necessary in satisfying the needed compartmentalization of the facts and possibilities present in the dichotomous relationship between a philosophical theory of human volition and the practical psychiatric treatment of trauma. It should be noted that this conceptual conditions of free will recently found as (through the increase in modern-day psychological and neurological study) contingent upon efficient neurological function. Consequentially, the argument yielded from this framework-construction process, in an attempt to explain agency and its fragility in light of trauma, then becomes; Through the framework provided by Dennett’s “Freedom Evolves,” the application of Bessel Van Der Kolk’s in-depth classification of trauma and its physiological effects to a naturalistically compatibilist definition of free will presents the implication of a physical loss of individual autonomy (the biological manifestation of symptoms

¹ Symptoms as mentioned by Van Der Kolk: A., Van der Kolk Bessel. *The Body Keeps the Score: Brain, Mind, and Body in the Healing of Trauma*. Penguin Books, 2015.

resulting from trauma that obstruct or remove autonomy) when neurologically afflicted by trauma in general.

Freedom/Free Will

Before applying the naturalist conception of free will in a psychiatric or neuroscientific context, one must understand the keywords and/or phrases surrounding the currently recognized facets of free will as a topic, and the conceptual evolution of free will resulting from various philosophical, religious, and scientific interactivity.

3 Dominant Positions:

- I. Determinism: History (actions in the past) in juxtaposition with the collective knowledge of the laws of nature will accurately and unavoidably cause the future. (We are not in control of our actions, whether they are cosmically influential or not). It is also important to note that acceptance of this determinism would require a holistic understanding of the cooperative, collaborative, and conflicting laws of nature in any known position(s) in space – as a person would, by then, make accurate predictions of the future. Determinism also presents the problem of the human’s effectual pre-disposition to be at the mercy of forces greater than themselves (physics, chemistry, etc.) This idea is excellently portrayed by Dennett in his reference to an omnipotent being as one in complete understanding the laws of physics², so can therefore manipulate them in the process of evaluation or prediction. In short, how can humans be considered free if both themselves and their reality are made of determinant matter?
- II. Libertarianism: The currently socially dominant view of freedom concerned with attributing actions of human agency as a product of spontaneous will over evolutionarily causal nature. This presents issue in explaining natural phenomena independent of agency, as the simultaneous acceptance of both the order of nature and spontaneity of agency is contradictory³. This problem is circumvented in the naturalist understanding of free will through Dennett’s adherence to a Darwinist explanation of evolutionary volition, in that the acceptance of freedom as an evolutionarily gained human presupposition proves compatible with determinism, preserves autonomous rationality (i.e., the decision(s) made from sense-perception and/or prior knowledge between the possible futures caused by natural law)⁴.
- III. Compatibilism: Although some occurrences are determinant and therefore, out of human ‘control,’ conceptual determinism fails in providing a platform for the construction of an ethical system grounded in moral and social responsibility. Compatibilism is a sort of “soft

² Dennett, Daniel Clement. *Freedom Evolves*. Penguin Books, 2004. (pg. 65)

³ Statement considering both SEP - O’Connor, Timothy and Christopher Franklin, "Free Will", *The Stanford Encyclopedia of Philosophy* (Winter 2022 Edition), Edward N. Zalta & Uri Nodelman (eds.), - and discussion with Dr. Culverhouse (University of the Incarnate Word) of “Indeterminism’s central concern.”

⁴ Holistic definition of naturalistic (evolutionarily justified) autonomy; Dennett’s “Human Freedom is Fragile” (Pg. 305) - Dennett, Daniel Clement. *Freedom Evolves*. Penguin Books, 2004.

determinism” – in that certain actions are of free will and ought to be judged for their moral content, as they are sole of the agent and their internal considerations (desires, fears, etc.)⁵.

In addition to recognizing these three dominant understandings of the mechanics of free will, one must understand the differences between theories associated with or contingent upon conflicting concepts or ideas. Theories concerned with providing explanations of free will and their justifications often presuppose truths imperative to their explanation that disregard the presupposed truths of equally conflicting theories. One such distinction is the difference between “naturalist” (where the necessary and sufficient conditions of free will are grounded in a biological or evolutionary framework – “naturalist”) and “non-naturalist” (where the volitional theory in question relies upon a framework grounded in facets other than nature) accounts of free will. It is in this distinction that the grounds for assessing the status of an individual’s autonomy through a framework grounded in a naturalist understanding of free will in an evolutionary or biomedical context are effectively established and justified.

The Problem of Free Will:

When discussing individual agency in any context, it is imperative to address what is known as the “problem of free will.” Notably debated through the modern and early 20th-century periods in philosophy, the problem of free will references the difficulties in providing a compatibilist model to both explain individual agency without predication on any religious deity and identify the degree to which one is morally responsible for their actions, the effects of their actions, or the actions of others.

A common issue that presents while developing a model to explain free will is the amount of historical contingency placed upon attributing free will to God or other transcendent, omnipotent beings. While the notion that freedom is the result of some holy beneficence out of regard for human life is satisfying and truthful to many, it fails to offer a functional framework to be used in assessing the degree to which autonomy is present, lost, or earned in any related context. This is not to say that theological explanation of free will would be plausible in application of this context, but at this time could only be used in coalition with a scientific argument. Of course, this issue, for proper circumvention, would require that we humans definitively know the nature of the universe, who or what the cause is for our existence, and if there is an afterlife that is both conceivable and achievable to us. Unfortunately, one cannot rationally place well-founded confidence in the eventual circumvention of this issue in a purely theological context and must devise an alternative system for understanding free will, contingent upon knowledge at complete human disposal.

Secondly, free will as a concept must be believed to directly address (and make sense of) the issue of moral responsibility. If an individual or community were to abandon the idea of free will altogether, an individual loses the responsibility of moral action. In an assessment of both recent and ancient sociological/political history, one notices that world leaders, monarchs, or factions have demonstrated to have acted against the concept of universal free will. For example,

⁵ Free Will", *The Stanford Encyclopedia of Philosophy* (Winter 2022 Edition), Edward N. Zalta & Uri Nodelman (eds.)

slavery, Nazism, and violent conquest (Genghis Kahn, Alexander the Great, Viking Pillaging, Christian/Catholic Crusades, etc.) have all operated under the presupposition that free will is a gift of the select few, and therefore can fail to be recognized in other human groups. Whether genocidal atrocity or a simple lie, the disregard for individual agency seems to primarily lead to the destruction of a person's status as a human and therefore classifies them as property, lower class beings, or (considering historical pillaging and conquest) not even worthy of being alive.

The problem of free will also highlights the complexities found in the context of determinism as a solution. Of course, determinism presents a huge issue to the conceptualization of free will by suggesting that our actions are not of our own accord, to begin with, but that actions are the product of outside stimuli that govern a biological reaction to said stimuli. The determinist argument is also been known to be applied in a theological context, where a god or gods have determined whether a person is good or bad, or whether that person has a place in the afterlife (predestination). These ideas surrounding determinism and its relation to human agency are quite old and find their arguments grounded in assumption overall (of course). The determinist argument, although, arguably, the most logical of the three main schools of thought surrounding free will (Determinism, Libertarianism, Compatibilism), continues to fail when juxtaposed with phenomena like variable choice or individual (artistic) creativity. However, determinism becomes primarily interesting in the free will debate when considering the advent of modern behavioral science. The final and arguably most convincing argument for determinism posing a problem in the free will debate is the question of the human brain's condition and status as a vessel of will. The argument that the brain is physiologically unfit to contain free will (and therefore cannot) due to its evolutionarily and generationally increasing fragility, is a difficult argument to address – as the brain's reactions to certain stimuli or “overwhelming” events often cause it to form undesirable psychiatric/neurological conditions that demonstrate a measurable loss of autonomy and/or basic human agency (schizophrenia, ‘phobias,’ etc.). One condition, with its growing research and expanding methods of treatment, demonstrates this idea efficiently and provides insight into how conditions like it ought to be addressed in the context of limiting one's agency over their body and right to well-being.

PTSD (post-traumatic stress disorder) is one of the most researched and treated disorders in the United States. The ways in which it can affect an agent's brain both physiologically and psychologically demonstrate its almost tyrannical ability to circumvent the wishes of its victim at the neurological level, temporarily or permanently stripping them of their autonomy.

In order to properly assess the issues that arise in the conceptualization of a neuro-contingent free will, one must develop a sort of case study concerning a particular disorder or condition that interferes with the human understanding of autonomy and attempt to circumvent the logical, ethical, and practical issues that arise in the application of volitional theory to physiological study. This is effectively accomplished in the application of Dennett's successfully explanatory, naturalistic framework of free will to Bessel Van Der Kolk's in-depth psychiatric and neurological account of trauma and its physical effects on the brain to demonstrate the potential loss of individual autonomy.

Naturalist vs. Non-Naturalist Theory:

Having provided a background for the context in which free will is referenced when assessing the condition of its presence in the face of trauma, the question of how a ‘naturalist’ definition differs from other interpretations of free will becomes relevant in explaining the particularly beneficial utility of Dennett’s naturalist account and how other interpretations, as influential as they are in investigating free will and its contents, fail to provide the framework necessary to assess free will’s presence both biologically (evolutionarily, to be precise) and neuro-physiologically. The most effective means of indicating the distinction between naturalist interpretations of free will and the other historically influential theories of human volition would be to engage with available and conceptually relevant naturalist and non-naturalist explanations of will itself. However, it becomes apparent in elucidation of this concept that these accounts fall short in their explanations of freedom in a neuropsychiatric context, indicating the necessity for Dennett’s understanding of free will in said application.

Prior Naturalist Accounts – Lucretius and Nietzsche

Lucretius (94 BC. – 54 BC.) posited an early construction of reality contingent upon small, indivisible elements and their natural behavior labeled “atomism” in his seminal philosophical poem, “On the Nature of Things” (1st century BC). While far from the modern conceptualization of atomic physics, this idea operates on a strikingly similar premise, in that the sense-perceptible reality in which humans reside and engage is constructed of ‘indivisible’ elements in constant movement within a “void” (spaces between atoms) in straight lines, yielding the composition of palpable/perceptible matter through the interaction of multiple atoms at a particular distance (i.e., a solid would have tightly packed, non-distanced lines on atoms, whereas a liquid would not). Furthermore, Lucretius elucidates a state of universal atomism, where even the soul and consciousness are nothing more than atoms moving in a horizontal or vertical fashion within the void. It is precisely this movement that leads to the development of a purely physical (therefore, naturalist) understanding of free will. Book II of “On the Nature of Things” introduces the concept of atomic flux, where unpredictable, non-external causes can swerve an atom in different directions – causing molecular structure formation and/or the physical/geographical movement of atoms and their position. This concept, he explains, provides sufficient evidence for explaining the biological phenomenon that is human volition. Lucretius writes “their movement on, from which our power of free will arises, as nothing can emerge from nothingness⁶” (Lucretius, II). Just as a person can voluntarily cause affect and/or movement (the movement of matter at will), it may be that the very atoms composing that person have their own sense of agency. This early contention, while intensely interesting and impressive, looks to have fostered the development of the normative standard to which people would build upon in their own useful philosophies – not in respect to the argument of atomism itself, but in the context of conceptual agency derived from purely physical reasoning.

Nietzsche’s account of free will is interesting, in that his naturalist account, while align with the traditionally evolutionary-based Darwinism used by Dennett in his own account, does

⁶ Carus, Titus Lucretius, and A. E. Stallings. *Lucretius: The Nature of Things*. Penguin, 2007.

not argue nature's necessity to understanding free will per-se, but rather uses nature as a justification for his conceptualization of the "the will to power." This is the last of his conceptually evolving accounts given throughout his writings regarding free will, leaving one to believe this explanation as the final drafted account of free will. However, to avoid using a singular interpretation in representation of Nietzsche's account of free will, Walter Kaufmann's "Nietzsche: Philosopher, Psychologist, Antichrist" provides a useful explanation of Nietzsche's Darwinist account of free will in writing, "A privation of power gives rise to both fear and the will to power: fear is the negative motive which would make us avoid something: the will to power is the positive motive which would make us strive for something" (Kaufmann, 190). This loose framework for defining the origins of human volition as simply the neuro-sympathetic reaction to either action-encouraging or discouraging stimulus, while naturalist in the context of a Darwinist understanding of the origins of free will, does not satisfy the needs for a naturalist theory of free will intended for ancillary or neuropsychiatric application.

Non-naturalist Theory – Plato and Kant

An arguably plausible and heavily seminal interpretation of human volition can be found in Book V⁷ of *The Republic*, where Plato describes free will as "Mastery of the Self." This simple delineation of free will as an intra-personal responsibility is grounded in the justification for which Plato believes all human freedom (as it relates to autonomy) to adhere to. The three "characteristics," or "separations" of the soul that Plato delineates are identified as; "spirit," "appetite," and "reason."⁸ Each of the separations account for the soul's cause to behavior. The nature of the soul, as a three-part collective, explains human behavior and the application of autonomy through a balance of the primal/biological needs and/or wants of the body ("Appetite"), the drive or motivation responsible for the quality of a person's actions ("Spirit"), and the rational aspect of the soul that engages with reason concurrently in the deliberation of action or inaction in a given context (most especially in individual deliberation of acting out of edacity or incentive). With the introduction of this required balance for the conceptualization of freedom in a practical sense, such a system in explanation of human behavior, volition, and experience is complex without a doctrine to which one adheres to in the study of a metaphysically fractioned being responsible for its behavior and consequences. The preservation of moral responsibility is then ensured by a necessary "mastery of the self" through "Wisdom, Courage, and Temperance" in the construction of one's character (personality, eccentricities, archetype, virtues, vices etc.). This individualistic approach to understanding free will, while seemingly very useful in the full development of virtue-based ethics, does not explain much about the nature of free will itself.

It must be recognized that there exists a sense of parallelism between the construction of the soul and the construction of the city – in that the two rely on the balanced interaction of each of their components to efficiently operate in an unbiased fashion. However, this explanation fails to satisfy a purely natural understanding of the mechanics of freedom required for its application

⁷ Plato, et al. *The Republic*. Penguin Books, 2007.

⁸ Lorenz, Hendrik, "Ancient Theories of Soul", *The Stanford Encyclopedia of Philosophy* (Summer 2009 Edition), Edward N. Zalta (ed.)

in an industrial or medical setting and instead relies on the presupposed existence on an unnatural soul. Plato's interpretation of freedom, in totality, due to its grounding in the non-rational components of the soul and the emphasis on self-discipline as a justification for free will's existence, would essentially be deemed non-naturalistic – and therefore (like many others) not particularly useful in the assessment of free will in a bio-medical or psychiatric context.

Immanuel Kant's account of freedom, elucidated concurrently with the causal reality of nature in the Critique of Pure Reason's third "Antinomy" – Third Conflict of the Transcendental Ideas.⁹ (the standard to which Kant believed the universe operated) - (and thereby, strictly determinist) is particularly interesting and worth mentioning in the discussion of ancillary application of a naturalist account of free will. Kant's account of nature as proof for only the "noumenal" conceptualization of free will in a transcendent application – as not to undermine his account of nature as objectively¹⁰ determinist.¹¹ In the *Critique of Pure Reason, Groundwork for the Metaphysics of Morals, and Critique of Practical Reason*, Kant describes a "noumenal" (regardless of human perception) reality in which "transcendental freedom" exists¹². The awareness or human contact with noumenal freedom however, must be through the application of rationality within the confines of the "Categorical Imperative" (a system in which a person is treated as an end in themselves and thereby prohibits the undermining or circumvention of another's action or condition grounded in rationality), as Kant believes that to act morally, or in alignment with the categorical imperative, that one is free - simply in the choice of not doing x, y, or z in favor of a, b, or c.

In the latter part of the "Critique of Pure Reason," entitled; "Solution of the Cosmological Ideas," Kant continues the discussion surrounding the dichotomous relationship between the "noumenal" (transcendent) and practical (objective) realms in which nature and freedom reside,¹³ with the intention of displaying the counter-productive destruction they cause each other in the congruent application of either both or just freedom. Firstly, the Antinomy (Kant, 405).¹⁴ This interesting composition of conflicting arguments, both in support of and negating the existence of free will in a context of transcendent and secular application. In a brief explanation, the understanding of the noumenal reality is simply a reality in which the ideas that humans craft as justification for action (namely good actions), exist outside the realm of a causal law of nature.

⁹ Kant, Immanuel, and Marcus Weigelt. *Critique of Pure Reason*. Penguin, 2007.

¹⁰ Objective, in this section, is in reference to Kant's distinction between the sense-perceptible reality (objective) and the non-sense perceptible reality (transcendental ideal).

¹¹ Rohlf, Michael, "Immanuel Kant", *The Stanford Encyclopedia of Philosophy* (Fall 2020 Edition), Edward N. Zalta (ed.) – collective paraphrasing of nature in sense-perceptible reality, as topics of the transcendent (such as – according to Kant - freedom) reality, in which humans can only draw from conceptually, not practically.

¹² Rohlf, Michael, "Immanuel Kant", *The Stanford Encyclopedia of Philosophy* (Fall 2020 Edition), Edward N. Zalta (ed.) – collective paraphrase of section, titled: "Freedom."

¹³ Kant, Immanuel, and Marcus Weigelt. *Critique of Pure Reason*. Penguin, 2007. – paraphrased from

¹⁴ Kant, Immanuel, and Marcus Weigelt. *Critique of Pure Reason*. Penguin, 2007 – paraphrased pg. 404

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| <p>Thesis:</p> <p>Causality according to the laws of nature is not the only causality from which all the appearances of the world can be derived.</p> <p>-----</p> <p>Proof:</p> <p>Practical Freedom, as a cause of spontaneity, must be admitted, as those causes thereon proceed according to the laws of nature.</p> | <p>Antithesis:</p> <p>There is no freedom, but everything in the world takes place solely according to the laws of nature.</p> <p>-----</p> <p>Proof:</p> <p>Transcendental Freedom, as a cause of spontaneity, cannot coexist with nature, as this coexistence, as spontaneity cannot give an origin of events, and therefore no objective cause</p> |
|--|---|

Figure 1: Immanuel Kant: Critique of Pure Reason, 1781 Antinomy III of Transcendental Dialect - Third Conflict of the Transcendental Ideas

These distinctions, while both thorough in their proofs of a necessary or prohibited practical free will, can convolute the true opinion of Kant on these matters. Between the varying specifications of freedom and the arguments consisting of their logical conceptualization in accordance with nature, the following synopsis¹⁵ on Kant's view of freedom provides (if not an accurate account of Kant's volitional viewpoints), the most useful account in understanding where Kant falls short in a unifying theory of free will for interdisciplinary (namely, psychiatric) application;

Kant believed that the faculties in which humans govern themselves are of the product of both nature and transcendent reality. It is through both the "thoroughgoing" objective experience of the restrictions of natural law and the acceptance of a transcendent reality that lay the foundation for understanding humans as autonomous, moral agents without tangible freedom. By acting in accordance with ideals like the *Categorical Imperative*,¹⁶ human engage in their collective duty to act morally and, consequently, in accordance with moral law. The separation of freedom from nature is necessary for this distinction, however and, despite having a strong foundation in the fundamentals of the operations of nature, fails to provide the background necessary for applying a naturalistic account of freedom as an explanation to any objective reality.

Having made the necessary distinction between naturalist and non-naturalist conceptualizations of free will, the final step in ensuring efficient engagement with prior

¹⁵ Rohlf, Michael, "Immanuel Kant", *The Stanford Encyclopedia of Philosophy* (Fall 2020 Edition), Edward N. Zalta (ed.) – collective paraphrase of section, titled: "Freedom."

¹⁶ Kant's understanding of moral law as made manifest to humanity – in that the freedom to adhere or not to our "duty" to act in accordance with moral (and therefore natural) law: Rohlf, Michael, "Immanuel Kant", *The Stanford Encyclopedia of Philosophy* (Fall 2020 Edition), Edward N. Zalta (ed.) – collective paraphrase of section, titled: "Freedom."

scholarship surrounding freedom is addressing “The Problem of Free Will.” It is imperative that any theory concerning an evaluative model of understanding free will (in any context) successfully addresses the issues long debated in the pursuit of a holistic understanding and explanation of human agency. Here-on, it is important to establish that the view that will be most favored is Dennett’s naturalistic account of free will, as it is the most useful theory in alignment with the naturalist explanations for neuroactivity and psychiatric condition.

“Freedom Evolves” – Daniel Dennett

Dennett’s well-explained naturalistic account of compatibilist free will holds as the primary work this paper aims to draw from and apply in the demonstration of a necessary naturalist theory to explain free will in a neuro-psychiatric context in which free will itself presents to be biologically jeopardized. Dennett begins his influential work by clarifying the reason for producing this naturalist account in the first place. Previous conceptions of free will independent of natural law fail to develop a useful, compatibilist framework to explain the ancillary applications of autonomous agency present in any interdisciplinary study concerning the inner scientific workings of human volition.¹⁷ Furthermore, an understanding of the self, grounded in science presents the opportunity to “put our moral lives on a new and better foundation” (Dennett, 1). It will be this Darwinist account of free will that provides the means for individual agency’s conceptual protection and future academic, medical, or professional development. Dennett then proceeds to explain determinism through the lens of atomic physics, where at the atomic level, these machines concerned with self-construction act as (in themselves) independent rational beings that also experience Darwinist evolution through the development of denser and larger structures that “suffer damages” as a “revision of structure, a loss or gain of material” for matter’s “improved” and “less vulnerable” status against future “dissolution” (Dennett, 40). Dennett then begins to outline the complexities of the views held surrounding Darwinist natural selection, where he describes natural selection as the cause of natural species-specific biological and socio-cultural phenomena to “speed up evolution” (Dennett, 53). This view is significant, considering the widely held view that determinism (outside a naturalist context), popularized “inevitability.” Dennett, however, explains the development of human agency and rationality as a means of “informed guidance,” where, through rational evaluation of the environment and possible futures, “evitability is possible” (Dennett, 62). This is largely significant in Dennett’s framework, as the rational, cultural, or environmental evaluation of one’s surroundings and possible futures is directly applicable to the individual’s sense of rational agency, subjectively. Dennett claims that evolution designed us to be able to consume this kind of information. As “informavores” we utilize our evolutionarily gained sense of reasoning to make better decisions concerning, not just the well-being of ourselves, but our sense of moral responsibility. Before elaborating on the conclusion of moral responsibility out of rational autonomous agency, a clearer picture as to what Dennett believes other figures (creatures) in nature experience in the context of freedom ought to be established for a holistic understanding of free will pertinence to nature. Dennett explains the freedom of the bird as “a distinct

¹⁷ Dennett, Daniel Clement. *Freedom Evolves*. Penguin Books, 2004. – (Pg 1): Dennett’s positing of the mind’s dynamic nature as one found in the same “physics” as “the rest of nature.”

improvement on the freedom of the jellyfish,” as the bird has increased the bounds to which it can willfully travel, whereas the jellyfish continues to find itself confined to the water and its current (Dennett, 143). What is going on at the physical level of human freedom? Dennett explains the dynamic application of human freedom as one of decision-making between the logically and physically developed “configurations of systems,” that on which one needn’t to execute the physical calculations for, but rather utilize the skills of a “Life Hacker.”¹⁸ Why is this important? The distinctions between the types of evolution experienced by various species are significant for understanding the different strides made in different types of evolution. In the same section, Dennett discusses human language as a culturally revolutionary social evolution in which humans transcend the rest of nature through the formulation of “dimensions utterly inaccessible to birds.” This is to say that evolution manifests in different ways specific to the currently held abilities of those animals.¹⁹ For example, the realization that a salmon is biologically predisposed to swim upstream, simply due to the lack of imaginative ability in favor of an alternative, speaks to the level at which human evolution was at, both in the time of Darwin’s conception of “The Origin of Species” and in the modern-day. This holds the foundation for Dennett’s view of human evolution, as humans are uniquely social, morally significant creatures in need of a socio-cultural system in which to communicate and develop ideas. Returning, for a moment to the distinction between the human experience and animal experience of naturalistic freedom, it is imperative that one discusses the realization that through a naturalistic framework, distinctions can be made on the degrees to which certain species are free in relation to their current evolutionary status of freedom.²⁰ It is this communicatively developed sense of universal knowledge, as a product of communication, in fact, that presents the opportunity for the human to rationally become aware or “conscious” of any directly concerning truth (health status, social status, safety status) and alter their behavior in pursuit of a more beneficial system through the application of that consciousness in action. Dennett writes that the consciousness of illness or disease “postpones symptoms indefinitely by being educated” about its circumvention (Dennett, 156). It is this aspect of human nature that Dennett draws upon the most, not just in the context of illness, but as a holistic explanation for evolutionarily developed, rational human day-to-day function. The human brain acts as the database to which humans’ reference, when confronted with decisions and/or significant social situations. Dennett views the brain as “a bank of sensory inputs and motor outputs” (Dennett, 162), in that the brain acts as the means by which humans are to experience reality and draw predictions of the future grounded in past sensory experience. It is this very bank of information that gives way to arguably one of the most significant developments in human history. The concept of “doubt” manifested in humans out of the concern for a proclivity to know exactly when, where, how, and

¹⁸ A term proposed by Dennett in “*Freedom Evolves*” to explain the actions of a person operating in the context of their free will through the development of the ability to predict phenomena out of configurations or systems of configurations found in nature, freedom, and the degrees to which your preservation of it fluctuates is determined by your actions. In a naturalist context, one must operate through volition as a means of achieving the most foreseeable futures - Dennett, Daniel Clement. *Freedom Evolves*. Penguin Books, 2004.

¹⁹ Dependent on degree of autonomous evolution through anatomical, physical, or cultural communicative ability

²⁰ Not freedom in the way that humans experience it, as humans have the most evolutionarily developed brain to process free will – an “original” inference from Dennett, Daniel Clement. *Freedom Evolves*. Penguin Books, 2004 (pg. 179)

at what time significant or communal events are going to happen. To circumvent this widespread intellectual anonymity, “we invented culture” (Dennett, 165). It was the social evolution of this human culture that provided a means by which a collective could evaluate and make sense of the environment, its status, and the current standing of people’s needs and responsibilities. While this may present the notion that culture and biological/genetic forms of evolution are each proportionately responsible for the current standing of human ecosystems, Dennett discusses an idea that put into question how influential genes are in the development of a functioning human collective. Culture, as seen in today’s media, fashion, and advertising, spreads like wildfire (including before the age of readily accessible technology). Dennett ominously states both that, “customs and habits will go extinct unless something keeps them around,” and that changes in culture “that happen overnight send ripples” throughout the environment that “speed up evolution, often in directions that we come to regret” (Dennett, 181). While discussing free will in a Darwinist context, Dennett finds it particularly important to stress that Darwinism is not a reference to any biological or biochemical evolution specifically, rather he holds that “Darwinian algorithms of evolution are substrate-neutral”– in that Darwinism is concerned with “differential replication with mutation, wherever it occurs” (Dennett, 188). This becomes primarily important both in an understanding of the practical Darwinian application of evolution as an explanation for free will, and in providing the groundwork required for explaining evolutionarily developed human autonomy as the medium through which the potential for moral responsibility can be recognized. Dennett holds that the moral responsibility to which humans ought to adhere through the application of reason and autonomy is “distributed in both space and time in the brain” (Dennett, 225). Solidifying the evolution of and grounds for moral responsibility as a kind of neuro-contingent, natural reality is integral to this paper’s application of Dennett’s framework to trauma as it is understood by Van Der Kolk. It is the very fact that Dennett’s account of volition and its evolutionary origin reside in the brain as a collective, anatomical structure in which our moral agency and capacity for responsibility develop that presents the direct, ancillary application of free will to trauma in the first place. The collective account of Dennett’s Darwinist theory of free will as an explanation for the biological, cultural, and moral evolution of humanity is directly concerned with the loss of said free will through any naturalistic means – particularly in the context of concern for both the preservation of agency and the elimination of harmful neurological stimuli.

“The Body Keeps the Score” – Bessel Van der Kolk:

Having provided a thorough background of various naturalist and non-naturalist accounts, defined the meaning of freedom as an evolutionarily formed characteristic of human anatomy, and addressed the concerns associated with developing holistic accounts of free will in an interdisciplinary context, the application of Dennett’s account of freedom to Bessel Van Der Kolk’s “*The Body Keeps the Score*” presents as the most apt theory of naturalistic free will for identifying how exposure to trauma and its neurological manifestation of symptoms diminished autonomy.

Trauma's Current Classification

²¹Though an apt and scientifically useful understanding of trauma from a neuro-psychological and behavioral science standpoint (as expected of the APA), this wide-held definition of trauma fails to identify what trauma is on a directly neurological standpoint. Of course, as established, the unpredictable nature of trauma makes it a hard subject of study. However, if articulated thoroughly through a both scientific and social (cultural),²² account with specific examples of trauma's harm to autonomous agency, a scientific account of trauma would reveal the inverse relationship between the negative neuro-psychiatric effects of trauma and the individual exercise of day-to-day volitional activity.

Before delving into a specific account of trauma from Dr. Van Der Kolk, it would be useful to give a basic account for the objective definitions in which institutions charged with classifying and treating trauma operate. The two purely objective accounts for these classifications must come from the DSM (Diagnostic and Statistical Manual of Mental Health Disorders) and the more conceptually general, APA (American Psychological Association) public dictionary.

Trauma: *American Psychological Association*

1. any disturbing experience that results in significant fear, helplessness, dissociation, confusion, or other disruptive feelings intense enough to have a long-lasting negative effect on a person's attitudes, behavior, and other aspects of functioning. Traumatic events include those caused by human behavior (e.g., rape, war, industrial accidents) as well as by nature (e.g., earthquakes) and often challenge an individual's view of the world as a just, safe, and predictable place.
2. any serious physical injury, such as a widespread burn or a blow to the head. —traumatic *adj*

Figure 2: American Psychological Association: Definition of Trauma (Courtesy of <https://dictionary.apa.org/trauma>)

The DSM's classifications from III-V have varied in diagnostic qualification over the years, as the development from the World-War-I coining of the term "shell-shock" to the modern research in recently discovered subfields of trauma (PTSD, Developmental, Acute, etc.) have proven to be an ever-progressing development in the collective goal to heal neurological trauma. However, these definitions and qualifications in question are on scales of objective measurement, leaving psychiatrists like Van der Kolk to identify the cures and causes for these neurological phenomena. As the newly developed classifications for trauma have not yet been adopted by the DSM to assist in the treatment of these trauma-related variants, the scale to which "Neuropenitentiary" will be assessing the conceptual definition of trauma will be through a representational proxy of "PTSD," (Post-Traumatic Stress Disorder), which in the context of this

²¹ In reference to APA definition "1" of trauma.

²² Reference to "cultural" evolution proposed by Dennett.

paper especially, is permissible considering the focus on PTSD in “The Body Keeps the Score,” and Dr. Van Der Kolk’s psychiatric specialization in PTSD.

The evolution of the DSM’s diagnostic criteria for PTSD, of course, has somewhat improved since the original publication of the DSM III. Trauma, because of its variance in presentation, symptom variance, and the difficulty associated with healing, considering the manifestation of anti-social and currently non-precisely measurable symptoms (fatigue, dissociation, avoidance, amnesia, etc.) has proven difficult to treat. Van Der Kolk relays in his account that there “is no one-size-fits-all approach to trauma,²³” perhaps (inadvertently) providing the reason for why variational additions to the classification, diagnosis, and treatment of trauma are considered under great scrutiny, oftentimes with little-to-no avail. These strict evaluations seem to hold true in the evaluation of PTSD’s diagnosis criteria²⁴:

DSM III: Symptoms following psychologically traumatic event generally outside the range of usual human experience”

- The explanation of PTSD criteria for official diagnosis continues to elaborate “Associate Features” – (depression or depressive disorder, aggressive behavior, failing memory, impulsive behavior, emotional lability, and autonomous lability)
 - While outdated and in current disregard for psychiatric and therapeutic practices, it is interesting to note that the DSM III mentions “autonomous lability.” – Perhaps as a generalization to explain the general loss of cognitive function, but leaves an interesting implication to be explored.²⁵
- The specifications of PTSD end with the direct criteria for diagnosis²⁶:
 - The experience of an event that would evoke a response from “almost everyone”
 - Reexperiencing: recollection, dreams, or images produced intrusively or in response to outside stimulus
 - Detachment and/or disinterest in individually significant people, events, or activities
 - “At least two of the following symptoms that were not present before the trauma:”
 - (1) hyperalertness or exaggerated startle response
 - (2) sleep disturbance
 - (3) guilt about surviving when others have not, or about behavior required for survival
 - (4) memory impairment or trouble concentrating
 - (5) avoidance of activities that arouse recollection of the traumatic event
 - (6) intensification of symptoms by exposure to events that symbolize or resemble the traumatic event

²³ A., Van der Kolk Bessel. *The Body Keeps the Score: Brain, Mind, and Body in the Healing of Trauma*. Penguin Books, 2015.

²⁴ DSM paperwork citation from Dr. Culverhouse

²⁵ A side note, significant only in the respect of the direct identification of a loss of autonomy

²⁶ “At least” through “(delayed)” are direct citations from [Dr. Culverhouse DSM citation]

- Post-traumatic Stress Disorder,
- Acute
 - (1) Onset of symptoms within six months of the trauma.
 - (2) Duration of symptoms less than six months.
- Post-traumatic Stress Disorder, Chronic or Delayed Either of the following, or both:
 - (1) duration of symptoms six months or more (chronic)
 - (2) onset of symptoms at least six months after the trauma (delayed)

DSM IV: (Revised, 2009)

- PTSD:
 - Traumatic event was experienced, witnessed, or was confronted with an event or events that involved actual or threatened death, or serious injury.

This is the first example of a “fine-tuned” definition of the constituents of trauma, whereas DSM III was concerned with the events deviation from the standard “usual human experience,” the DSM IV directly links the situational gravity necessary for determining the causes of a patient’s mental dysfunction “PTSD.”

The DSM IV also broadens the criteria for a “reexperience” of a traumatic event, whereas the DSM III was concerned with recollection of traumatic memory through outer stimulus or dreams, the DSM IV found primary concern in the reaction toward symbolic or environmental representation of the traumatic event. This is specified in criteria 6 and 7 of the “reexperience” section, where the elaboration of such distinctions (between symbols and environment) mentions a physiological manifestation of behavior in response to symbolic stimuli.

The DSM IV also finds significant contrast from DSM III in the identification of “persistent” symptoms of both withdrawal (avoidance) and “increased arousal:”²⁷

Persistent avoidance of stimuli associated with the trauma and numbing of general responsiveness (not present before the trauma), as indicated by three (or more) of the following:

- (8) Efforts to avoid thoughts, feelings, or conversations associated with the trauma
- (9) Efforts to avoid activities, places, or people that arouse recollections of the trauma
- (10) Inability to recall an important aspect of the trauma
- (11) Markedly diminished interest or participation in significant activities
- (12) Feeling of detachment or estrangement from others
- (13) Restricted range of affect (e.g., unable to have loving feelings)
- (14) Sense of a foreshortened future (e.g., does not expect to have a career, marriage, children, or a normal lifespan)

²⁷ Dr. Culverhouse’s citation for DSM documents, - a direct listing from the DSM IV of the updated symptoms of persistence

Persistent symptoms of increased arousal (not present before the trauma), as indicated by two (or more) of the following:

- (1) Difficulty falling or staying asleep
- (2) Irritability or outbursts of anger
- (3) Difficulty concentrating
- (4) Hypervigilance
- (5) Exaggerated startle response

Interestingly, the subtypes of PTSD (Acute, Chronic, and Delayed) have not changed in their definition as ongoing traumatic experience past one, three, and six months, respectively.

- DSM-V

Though many of the psychological processes outlined in the DSM-V share that of the qualifications laid out (though in broader terms) in both DSM-IV and DSM-III, the DSM-V has a significant difference in the diagnosis criteria for PTSD as a whole.

The DSM-V was the first introduction to age-specific criteria (6 and younger), as well as the first DSM to adjust the concluding specifications for acute, chronic, and delayed, with characteristics of related psychological disorders. Namely, the significant developments of the DSM-V (as compared to the criteria outline in DSM-III and IV) are as follows:

- The development of a child-specific definition of PTSD
 - Though most symptoms remain similar to that of those that manifest in an adult with PTSD, there are nuanced difference in the background of the situations in which stimuli cause a reaction (i.e., a traumatic event happened to a parent or loved one, in a learning or otherwise “safe” environment, etc.)
- The outline of the surrounding causes manifestations of PTSD in children
 - Pre-traumatic, peritraumatic, and posttraumatic events:
 - Environmental and temperamental behavior recognition (6 and younger)
 - Gender-related Diagnostic Issues
 - Suicide Risk
 - Functional Consequences of PTSD
- Differential Diagnosis
 - The addition of the following:
 - Conversion disorder
 - Psychotic Disorders
 - Traumatic Brain Injury

While the nuanced differences in the definitions for and qualifications of specific terms and understandings have also changed, the focus of the section of this paper is to give a functional account of the evolution of the DSM as a standard of the treatment of trauma. Having been under the guise of the DSM-V since 2013, it goes without saying that the work currently being done and that has been done in the last ten years has gone unnoticed or deemed unfit for psychiatric and therapeutic application. It is here that the application of the study of free will becomes integral in expanding the understanding of trauma as it relates to its inherently negative

relationship with autonomy.

In recent years, the universal understanding surrounding trauma and its effects has grown through the continued development of scientific standards by which certain symptoms resulting from trauma can be treated in a variety of ways. Some of these non-DSM recognized accounts of traumatic rehabilitation can be found in application by trauma-specializing psychiatrist, Dr. Bessel Van der Kolk. However, it is not these accounts of others that the application of a naturalistic account of free will is necessary for the understanding of trauma and its relationship to free will, rather it is Van der Kolk's account of trauma thorough, a grounding in Darwinist understanding of trauma's direct neurological affect that lays the foundation for applying naturalistic accounts of free will, not only in effort to prove the value in considering free will as faculty of human evolution, but in effort to demonstrate the yielded value in the interdisciplinary study of philosophy and psychiatry – as both surround issues of the human psyche and its vulnerability to its physical and cultural environments.

Van der Kolk's Fight for Autonomy:

As seen through evaluation of the DSM and APA's sufficient conditions of trauma, there are a variety of symptoms (dissociation, interrupted recollection, hyperactivity, etc.) that remain consistent throughout the evolution of our understanding of trauma. These scientific accounts also seem to be primarily focused on the nature of the event, the environment in which the event took place, and the type of person that was involved with the traumatic event. While these conditions in the evaluation of trauma are important for the identification of currently available methods of treatment in the time of the event and thereafter, it is important to recognize that there are characteristics recognized by others that constitute what it means to have experienced "trauma." One such account is Van Der Kolk's "The Body Keeps the Score."

Van Der Kolk begins the book with a background of trauma in the context of PTSD in the chapter entitled, "Learning from Vietnam Veterans." In discussing the specific reasons as to why it is important that there be a continued study into the different treatment methods of trauma and what other forms of human behavior could be the result of trauma, Van der Kolk states, "We have learned that trauma is not just an event that took place sometime in the past; it is also the imprint left by that experience on the mind, brain, and body" (Van Der Kolk, 21). This is significant for the qualifications necessary for trauma, where the event in question (without specific mediums in which the experience must be for an APA or DSM diagnosis), leaves psychological and physiological damage post-occurrence. He then provides a full definition for his experientially based account of trauma, where he states "Trauma results in the fundamental reorganization of the way the mind and brain manage perceptions. It changes not only how we think and what we think about, but also our very capacity to think" (Van der Kolk, 21). The last piece of that statement, "the capacity to think," provides an account of trauma in recognition of the danger human autonomy is in, while under the influence of the effects of trauma. This sets up for the juxtaposition of Dennett's evolutionary theory of free will with Van Der Kolk's explanation of trauma, as his account specifically considers the altered capacity of the mind to experience the act of volition itself. Hereafter, this portion will feature a brief summary of Van Der Kolk's significant factors of trauma (whether in the context symptoms or treatment) that can be directly attributed to a loss in autonomy.

The first example that Van Der Kolk gives of an 'autonomic,' physiological manifestation of trauma in direct violation of autonomy is his account of a schoolteacher,

Marsha. While pregnant, Marsha was in car accident and unfortunately lost the baby. Marsha began to experience everyday difficulty in coping with the traumatic event and seeks psychiatric help, where Van Dr Kolk attempts a re-exposure to the stimulus of her traumatic effect to identify the specific physiological manifestations of a traumatic episode. When playing a tape recorder of related sounds and scripts, Van der Kolk recognizes, “The moment we turned on the tape recorder, her heart started to race, and her blood pressure jumped” (Van der Kolk, 41). This is significantly important for understanding the conditions for the loss of intrapersonal autonomy, in that the unwanted physiological manifestations are forced upon the individual and (without the proper treatment) cannot be introspectively disregarded or circumvented. Marsha’s case becomes especially interesting when Van Der Kolk mentions that these physiological processes of hyperactivity were occurring, despite Marsha’s full awareness that “she was resting quietly in the scanner” (Van Der Kolk, 43). Van der Kolk continues to explain that the manifestations of these events are a product of “the emotional brain” – or limbic system – particularly in the amygdala. This is a significant realization to consider in the application of Dennett’s evolutionarily-based theory of free will, as the attribution of trauma-related symptoms relate to the specific, highly evolved anatomy and physiology of the brain itself. With this one case study, Van Der Kolk provides the most efficient context in which the evaluation of autonomy’s status regarding a traumatic event or disorder can be completed.

Before discussing the specific neuro-anatomical justifications for the trauma-induced loss of autonomy, it is useful to recognize the simple responsibilities of the brain in “ensuring” or survival despite environmental condition. Van der Kolk outlines the responsibilities of the brain as follows; to generate “internal signals that register” the needs of the body (food, rest, sex, protection, shelter, etc.), to “create a map” of the locations that satisfy those needs, “generate the necessary energy to satisfy” those needs, “warn us the dangers along the way,” and “adjust our actions based on the requirements of the moment.”²⁸ These responsibilities, while established and understood by many, outline one specific area in which Dennett’s account becomes primarily applicable. The final responsibility of the brain to “adjust our actions” aligns directly with Dennett’s justification of the naturalistic justification for compatibility with free will, in that the direct altering of action considering new sense-perceptible information, is essentially exercising freedom. Dennett’s explanation of the human ability to identify sense-perceptible information and make decisions based on that information is deliberately undermined in this context when an individual experiences an overwhelming, traumatic experience. The circumvention of this ability would, by definition, be the obstruction of autonomy.

Van Der Kolk also gives an account of applying a Darwinist form of thinking to trauma. In the chapter titled, “Body-Brain Connections,” Van Der Kolk explains Darwin’s account of an evolutionarily gained state of “viscera,” where the excitement of the brain leads to the desperate can be, and has been, satisfied in a variety of ways – as the need for satisfaction is powerful enough to cause violence, addiction, and even self-harm.²⁹ From this, he concludes that in the acceptance of this Darwinist model (which in the application of Dennett’s theory, one must), “the solution requires finding ways to help people alter the inner-sensory landscape of their bodies” (Van der Kolk, 76), just as Van der Kolk does with patients like Marsha in the application of

²⁸ Van der Kolk inserts a footnote in reference to, R. R. Linas, “I of the vortex: From Neurons To Self”

²⁹ : A., Van der Kolk Bessel. *The Body Keeps the Score: Brain, Mind, and Body in the Healing of Trauma*. Penguin Books, 2015. (pg. 76)

experiential recreation and psychotherapeutic processing of the event's occurrence.

In the chapter titled "Agency," Van der Kolk explains agency as "the technical term for the feeling of being in charge of your life" (Van der Kolk, 97). While (for this paper) this is essentially established considering the attempt at demonstrating the existence of a "neuropenitentiary," he continues to state that the scientific definition of agency begins specifically with "what scientists call interception" (Van der Kolk, 97). Essentially, he defines the key characteristic to agency as the individual consciousness of what we feel and why we feel that way, which is important in the application of naturalist volition, namely in that the necessary condition for agency is a sensory-confirmed truth of one's bodily status in totality. It is important to note that Dennett, being the Darwinist-naturalist scholar of free will, would likely agree with the premise of this account of agency - in that Dennett's view aligns with Van Der Kolk's specification of a need to make sense of sense-perceptible reality. Trauma directly circumvents this need, as the difficulty posed by trauma causes the loss of essential components in determining situational well-being (issues in recollection, dissociation, hyperactivity, etc.).

Conclusion

In arguing the existence of a "neuropenitentiary" through the application of a naturalist theory of free will, the necessity for the integral study of philosophy and psychiatry is made apparent. Through the philosophical study of autonomy, the necessary and sufficient conditions of executing an action or decision in conscious, intentional volition can be found to align with the necessary and sufficient conditions for individual neuro-psychiatric help. Having demonstrated a direct correlation between trauma and its infringement upon individual autonomy through both the DSM and APA's specified symptom manifestations and Van der Kolk's experiential and neuroscientific account of trauma, the brain can be considered an evolutionarily developed "neuropenitentiary" through its unwanted, autonomic manifestations of symptoms that directly undermine exercising individual free will. It should be noted that this correlation between trauma and autonomy is more than likely one among many, indicating the necessity of developing a mass interdisciplinary study between philosophy and psychiatry - as the many premises concerning the mind and brain present in both fields align with each other in a naturalistic context (as proven), but could be found to align in other philosophical contexts as well; opening a door to the possibility of a new psychiatric database that explains both the mind and brain as more than an anatomy and physiology.

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Translating Custom Language to Assembly: A Python-Based Parser, Lexer, and Compiler



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ABSTRACT

This paper presents a Python-based toolset for translating custom language code into assembly language for a virtual machine. The toolset includes a lexer module for tokenizing the code, a parser module for generating an abstract syntax tree (AST), and a compiler or semantic analyzer module for translating the AST into assembly language instructions. The research focuses on the design and implementation of these components, utilizing top-down recursive parsing. Extensive testing ensures accurate translation and execution of custom language code. The toolset's flexibility enables future enhancements and support for diverse virtual machine architectures. The results demonstrate successful translation, highlighting the power and versatility of the developed toolset. This research advances language processing and compiler design, facilitating the seamless execution of domain-specific languages on virtual hardware platforms.

KEYWORDS

language processing, custom language, parser, lexer, semantic analyzer, virtual machine

I. INTRODUCTION

A. *Research Topic and Background*

Computer programming languages are essential tools in the field of software development. They enable programmers to develop a wide range of systems and applications that are used in our daily lives. These languages have allowed innovators to communicate their ideas to machines in a human-readable format. However, computers can only understand instructions in a specific format known as machine code or machine language. Machine code is a low-level language that computers can directly understand and execute and can be exhibited in diverse variations consisting of but not limited to binary, assembly language, hexadecimal, and octal.

B. *Research Objective and Significance*

The research objective is to develop a comprehensive toolset for translating code written in the custom language into assembly language for a virtual machine. By designing and implementing a robust parser, lexer, and compiler for a general-purpose custom language, this research aims to enable seamless execution of programs on virtual hardware platforms. This toolset will empower developers to efficiently create and execute specialized applications, expanding the possibilities of application development and enhancing software performance. The

significance of this research lies in its potential to bridge the gap between high-level custom languages and low-level machine code, offering a practical solution for efficient code translation and execution. By addressing this challenge, this research contributes to the advancement of language processing and compiler design, facilitating the development of domain-specific languages and their seamless execution on virtual hardware platforms.

C. *Research Approach and Methodology*

The project follows a systematic approach to designing and implementing a comprehensive toolset for translating code written in a custom general-purpose language into assembly language using Python. The methodology involves several key steps. Firstly, the project begins with the design phase, where the lexer module is specified to identify meaningful tokens based on the predefined grammar rules and regular expressions. Once the lexer was developed, a parser module was implemented to generate an abstract syntax tree (AST), representing the hierarchical structure of the code according to the grammar defined in Backus-Naur Form (BNF). Next, the compiler or semantic analyzer module is implemented to traverse and translate the AST into assembly language instructions specific to a virtual machine. Extensive testing is conducted using a comprehensive set of test cases that cover various grammar and semantic aspects of the custom language. The testing phase ensures accurate translation and execution of custom language code into assembly language, validating the effectiveness and reliability of the parser, lexer, and compiler modules. By following this project approach and methodology, a robust and efficient toolset is created for seamless code translation and execution using Python, specifically tailored for the custom language developed.

II. LITERATURE REVIEW

A. *Language Design and Parsing*

In the process of designing a programming language, a crucial aspect to consider is the language's grammar. The grammar, often defined using a formal notation such as Backus-Naur Form (BNF), dictates the set of rules that determine syntactically valid programs in that language [1]. These rules provide the structured blueprint that a parser will use to interpret the code.

```

<assignment> ::= <type> <identifier> "=" <value>
<type> ::= "STRING" | "INT" | "FLOAT"
<identifier> ::= [a-zA-Z_]w*
<value> ::= <string> | <number>
<string> ::= "<text>"
<number> ::= <integer> | <float>
<integer> ::= \d+

```

Fig 1. This figure shows the BNF rules that consist of variable assignment statements and value representation, including STRING, INT, FLOAT types, identifiers, strings, and numbers specific to the project.

Parsing is a fundamental component of a compiler or interpreter, It's the stage that comes after lexical analysis (or 'lexing'), where the input code is divided into meaningful tokens. The parser takes these tokens and, using the language's grammar constructs an Abstract Syntax Tree (AST). The AST represents the hierarchical structure of the program, and this tree-like representation is used in the subsequent stages of the compilation or interpretation process [2].

There are various parsing techniques that can be employed, often categorized as either top-down or bottom-up approaches. Top-down parsers, like Recursive Descent parsers, start at the root of the AST and work their way down, while bottom-up parsers, like shift-reduce parsers, start at the leaves and work their way up [3]. The choice of parsing technique can depend on factors such as the complexity of the language's grammar and the desired efficiency of the parser.

Significant prior work in the field of parsing includes the development of parsing algorithms like Earley's algorithm, and tools like YACC (Yet ANother Compiler-Compiler) or ANTLR (Another Tool for Language Recognition), which are parser generators [4]. These works have contributed to shaping the current landscape of compiler design and have informed the methods used in this project, as discussed in subsequent sections.

B. Lexical Analysis

Lexical analysis, also known as lexing, is an integral part of the compilation process, acting as the first phase of translating code. It takes raw source code as input and breaks it into meaningful chunks or tokens. These tokens can include various types such as identifiers, keywords, separators, literals, and operators, among others [5].

One of the primary tools used in the lexing process is regular expressions. Regular expressions provide a means to describe patterns in text, making them ideally suited for identifying the different types of tokens in source code based on their patterns. Lexers often implement finite automata, deterministic or non-deterministic, as a mechanism to recognize these patterns and categorize the input text into the corresponding tokens [5].

There exist numerous tools and techniques for performing lexical analysis, with some of the most prevalent being tools like Lex, Flex, or JLex. These are known as lexer or scanner generators, taking as input a file containing regular expressions and corresponding actions, and outputting code for a lexer that performs the specified actions when it encounters matches for the expressions [6].

Significant work in the field of lexical analysis has provided various strategies and methodologies for tokenizing code. These range from techniques for handling ambiguous token definitions to ways of dealing with language-specific quirks in the lexing process [6]. This existing body of knowledge has significantly shaped the approach taken in this project, as will be discussed in later sections.

C. Semantic Analysis and Code Generation in Compiler Design and Optimization

The process of compiler design is an intricate one, involving several stages to transform high-level source code into machine-readable instructions. A compiler takes the tokens generated

by the lexical analyzer and, through syntax and semantic analysis, generates an intermediate representation of the code. This intermediate representation is then optimized and finally transformed into machine code [5]. Each stage of the compiler plays a crucial role in generating efficient and correct machine code. Among these stages, the semantic analyzer and code generation stand out for their roles in improving the performance of the resulting program. The semantic analyzer ensures the correct interpretation of the code and performs static checks, while the code generator transforms the intermediate representation into machine code [5]. Compiler optimizations aim to enhance the runtime speed, reduce binary size, or decrease power consumption, all while maintaining the program's original functionality. These optimizations can happen at various levels, including the intermediate code level and the machine code level, and can involve techniques such as dead code elimination, loop optimization, and instruction scheduling [5]. There exist numerous techniques and tools for compiler design, including widely used compilers like GCC, LLVM, and Java compiler. These tools have shaped the field of compiler design and provided robust, efficient mechanisms for translating high-level languages into machine code [5]. Significant prior work in compiler design has led to the development of various methodologies for managing the complexity of translating high-level code into efficient machine code. This research project builds upon these existing techniques to create a compiler tailored to the custom language developed.

D. Python in Compiler Design

Python, a high-level, interpreted programming language, is renowned for its simplicity and wide usage. Its straightforward syntax and semantics make it an excellent choice for a myriad of applications, particularly in fields that require rapid development and testing of complex algorithms [7].

A major advantage of Python is its vast array of libraries and tools that facilitate various aspects of programming. For tasks related to language processing, Python provides several built-in libraries for string processing, regular expressions, and file I/O. These tools greatly simplify the process of reading source code, identifying tokens, and writing output files.

Python's capabilities make it particularly well-suited to tasks related to language processing. Its powerful string manipulation features and pattern-matching capabilities simplify the implementation of complex language processing algorithms. Additionally, Python's clear and concise syntax promotes readable and maintainable code, a significant advantage when designing and implementing the complex structures often found in compilers.

In this project, Python was utilized to design and implement the parser, lexer, and compiler for the custom language. The simplicity of Python allowed for rapid prototyping and testing of different language features and compiler designs. Python's rich set of libraries simplified many aspects of the project, from reading and tokenizing the source code to writing the generated assembly code. Furthermore, the readability of Python code greatly facilitated the process of debugging and refining the compiler or semantic analyzer [7].

III. DESIGN AND IMPLEMENTATION

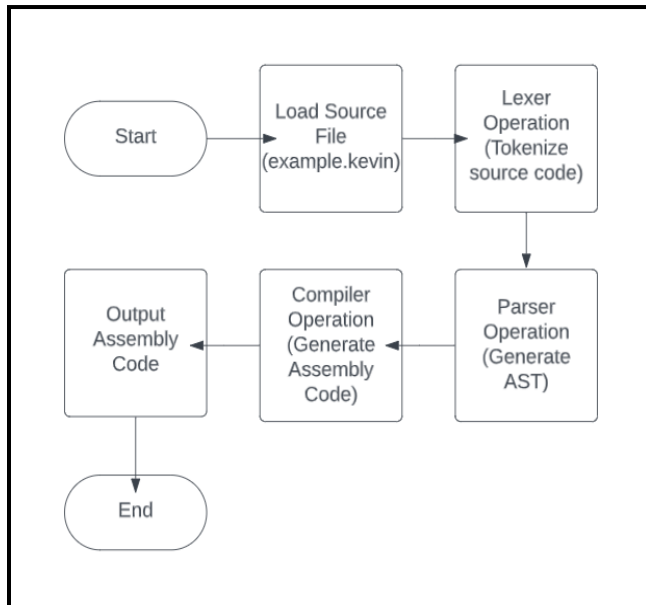


Fig. 2. Flowchart depicting the translation process. The source code from the 'example.kevin' file undergoes lexing, parsing, and compiling, resulting in the output of assembly language.

A. *Lexer Design and Implementation*

The initial step in translating the custom language into assembly language involved designing and implementing a lexer. The lexer, alternatively referred to as a tokenizer or scanner, is responsible for partitioning the input sequence into token strings. The significance of this component cannot be overstated, as it enables the subsequent elements of the compiler, namely the parser and the code generator, to handle the code in a structured and manageable fashion.

The custom language was read from a file with the extension ".kevin". Each line of code was read individually to ensure that each statement was handled separately, which helped maintain the order of execution of the code.

The first task of the lexer was to split the input line into individual words or components. This was accomplished by slicing the string at each whitespace character and storing the resulting substrings in a list. This method enabled me to separate individual elements of the code like keywords, identifiers, operators, and values, each of which plays a crucial role in the meaning of the code.

Following the initial splitting of the input line, each item in the list was then tokenized. Tokenization involved categorizing each substring into a type that could be understood by the subsequent stages of the semantic analyzer. For instance, keywords like "if", "else", and "while" were recognized and classified, and identifiers were separated from their associated values.

The design and implementation of the lexer were not without their challenges. One of the primary challenges was ensuring that the lexer accurately recognized all components of the code, especially with respect to more complex constructs like multi-character operators or identifiers

with special characters. Resolving this issue required thorough testing and fine-tuning of the regular expressions used for tokenization.

Another challenge was handling errors in the input code. While the lexer aimed to be robust and handle as many scenarios as possible, there were cases where the input code did not conform to the expected structure. This necessitated the design of error-handling mechanisms to inform the user about the nature of the error and where it occurred in the code [5].

Despite these challenges, the successful implementation of the lexer provided a solid foundation for the rest of the compiler. The lexer served as a bridge, translating the free-form structure of the custom language into a more rigid and easily processed format that could be used by the next stages of the compiler.

B. Parser Design and Implementation

After lexing, the next step in translating the custom language into assembly language was to parse the tokenized output. The parser's primary role is to check the code for syntactic correctness and generate an abstract syntax tree (AST) to capture the hierarchical relationship between different parts of the code.

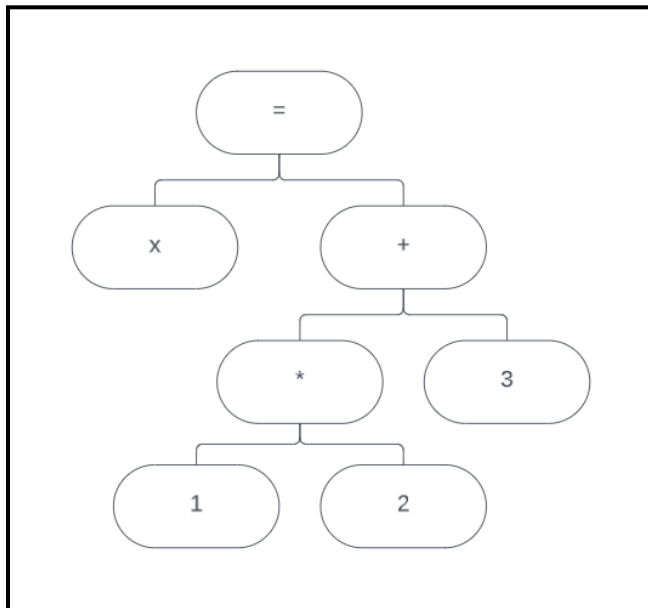


Fig. 3. Example of a simple Abstract Syntax Tree (AST) for a simple math expression "1 * 2 + 3". The AST illustrates the hierarchical structure of the expression, demonstrating the multiplication and addition operations along with their corresponding values.

In the context of the project, a top-down parsing technique known as Recursive Descent Parsing was implemented, as mentioned earlier. The parser takes the list of tokens produced by the lexer as input and recursively matches the tokens against the grammar rules of the custom language. Each token is examined to determine its type (e.g., keyword, operator, identifier), and a corresponding node is created in the AST. The parser ensures that the tokens comply with the grammar rules, thereby confirming the syntactic correctness of the input code [5].

The creation of the AST was a crucial part of the parsing process. This tree-like data structure allowed me to capture the hierarchical relationship between different parts of the code. For instance, in an assignment statement, the variable being assigned a value would be a parent node, with the assigned value or expression being a child node.

The design and implementation of the parser were not without challenges. Handling syntax errors in the input code was a significant challenge. Unclosed brackets or missing semicolons could disrupt the parsing process and lead to an incorrect AST. To address this, error-handling mechanisms were implemented in the parser to detect syntax errors and report them to the user, indicating the type and location of the error in the code [5].

Another challenge was ensuring that the AST correctly represented the hierarchical structure of the code, especially for complex constructs like nested if-else statements or complex expressions. However, through careful design and extensive testing, it was ensured that the parser correctly built the Abstract Syntax Tree (AST) for a wide range of code constructs.

The successful design and implementation of the parser using Recursive Descent Parsing represented a significant milestone in the project. With the Abstract Syntax Tree (AST) in place, the next stage of the process, the compiler, could be initiated.

C. Compiler Design and Implementation

The last crucial component in the translation pipeline of the custom language is the compiler. Its role was to translate the abstract syntax tree (AST) generated by the parser into assembly language instructions that could be executed by the target virtual machine.

The design of the compiler was intimately tied to the specifics of both the source language (the custom language) and the target language (the assembly language for the virtual machine). For each type of node in the Abstract Syntax Tree (AST), a corresponding rule was defined in the compiler to govern its translation into assembly code [8].

The compiler was implemented in Python and worked by traversing the AST generated by the parser. For each node encountered during this traversal, the compiler produced the corresponding assembly code according to the translation rules defined.

The process of implementing the compiler posed several challenges. One major challenge was dealing with language constructs that have no direct equivalent in the target assembly language. For instance, high-level control structures (like loops or conditional branches) had to be translated into sequences of low-level jumps and comparisons.

Another challenge was managing the allocation and deallocation of memory on the virtual machine. A strategy had to be devised to efficiently handle memory management and ensure the correct execution of the generated assembly code.

Despite these challenges, the implementation of a compiler capable of translating a wide range of custom language constructs into assembly language was successfully achieved. This marked the final step in the process of translating code written in the custom language into a

form that could be executed by a virtual machine, thus fulfilling the main objective of this research project.

IV. TESTING AND RESULTS

A. Testing Procedures

A thorough testing process is indispensable in the development of any language processing tool, and this project was no exception. The objective of this testing phase was to authenticate the functionality of the toolset and identify potential areas for improvement.

The custom language was put through a rigorous set of test cases to check its syntax and semantics. The test cases varied from simple programs that evaluated individual language features to complex programs that integrated multiple features.

During the testing of the lexer, each generated token was printed out. This allowed for a detailed visual verification process, ensuring that the tokenized output adhered to the syntax of the custom language.

Similarly, for the parser, tests were executed to confirm that it could build an accurate AST from a range of code constructs and accurately identify syntax errors.

The compiler, which translates the AST into assembly language instructions, underwent a similarly exhaustive testing procedure. The generated assembly code was executed on the target virtual machine, and the output was then compared with the expected results to verify the translation process's accuracy.

B. Results

Although the custom language is smaller in scale compared to full-fledged programming languages, the testing phase yielded promising results, reaffirming the toolset's effectiveness in translating code into assembly language.

Both the lexer and parser exhibited resilience and accuracy across diverse code constructs, successfully identifying and reporting errors.

The compiler effectively translated the Abstract Syntax Tree (AST) into assembly language instructions, producing expected results when executed on the target virtual machine. While these outcomes highlight the successful translation process, testing also identified areas for further enhancements. Certain complex programs revealed discrepancies in the execution of the assembly code, indicating potential improvement areas in the compiler's design.

In summary, the testing phase confirmed the efficacy of the lexer, parser, and compiler in translating the custom language into assembly language. Despite the smaller scale of the project, the results provide a solid foundation for potential future expansions and refinements to the toolset.

V. DISCUSSION

A. *Interpretation of Results*

The results from the testing phase provided several insights into the functionality and performance of the lexer, parser, and compiler. Notably, the toolset demonstrated promising capabilities in translating the custom language into assembly language, despite operating on a smaller scale compared to full-fledged programming languages. This could be indicative of Python's robustness in building language processing tools and its potential in the development of domain-specific languages.

Compared to existing research or applications, this project reinforces the utility of using high-level languages like Python to construct language processing tools, especially for smaller, custom languages. The efficiency and readability of Python code played a key role in the successful implementation and testing of the toolset.

B. *Advantages and Disadvantages*

One significant advantage of this system is its specificity to the custom language, enabling seamless translation and execution without the need for extensive modifications or adjustments typically associated with standard compilers.

However, this specificity poses a challenge as the toolset's efficiency is limited to the custom language, lacking the universality of traditional compilers. Adapting it to other languages or more complex programming constructs will require significant future development efforts.

C. *Potential Applications*

Despite being developed on a smaller scale, the toolset has potential applications in educational and research settings. It can be used as a practical teaching tool for students learning about language processing, compilers, and assembly language. It also opens avenues for further research into language design, potentially sparking the development of other custom languages with unique features.

VI. CONCLUSION AND FUTURE WORK

A. *Testing Procedures*

This research aimed to explore the design and implementation of a custom programming language and its translation toolset, which includes a lexer, parser, and code generator. The language processing pipeline was developed using Python's robust capabilities to enable the translation of the custom language into assembly language. Through rigorous testing, the system's effectiveness and reliability were verified. Despite operating on a smaller scale compared to full-fledged programming languages, the encouraging results established a strong foundation for future enhancements.

B. Implications

The successful implementation of this project contributes to our understanding of language processing tools and their development. It shows the potential for creating custom, domain-specific languages, and emphasizes Python's utility in this domain. Moreover, the upshot from this research might provide insights for future efforts in the design and implementation of programming languages and their respective compilers.

C. Testing Procedures

A thorough testing process is indispensable in the development of any language processing tool, and this project was no exception. The objective of this testing phase was to authenticate the functionality of the toolset and identify potential areas for improvements.

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