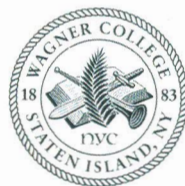# WAGNER COLLEGE

FORUM FOR UNDERGRADUATE RESEARCH

EDITOR'S INTRODUCTION

The Wagner Forum for Undergraduate Research is an interdisciplinary journal which provides an arena where students can publish their research. Papers are reviewed with respect to their intellectual merit and scope of contribution to a given field. To enhance readability the journal is subdivided into three sections entitled *The Natural Sciences and Quantitative Analysis*, *The Social Sciences* and *Critical Essays*. The first two of these sections are limited to papers and abstracts dealing with scientific research, clinical investigations and complex mathematical/statistical modeling. The third section is reserved for speculative papers based on the scholarly review and critical examination of previous works. As has become a tradition, the fall edition commences with a reprint of the abstracts of papers and posters presented at the Eastern Colleges Science Conference.

Read on and enjoy!

Gregory J. Falabella, Ph.D.
Editor-in-Chief

Editorial Board
Dr. Donald E. Stearns, Biological Sciences
Dr. Amy Eshleman, Psychology
Dr. Lori Weintrob, History
Prof. Josephine Marcantonio, Nursing

Section I: Eastern Colleges Science Conference[1]

Abstracts

Section II: The Natural Sciences & Quantitative Analysis

Full Length Papers

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[1] Papers and posters presented at the 77th Annual Eastern Colleges Science Conference held in Fairfield, CT on April 1, 2023.

Section III: Critical Essays

Full Length Papers

Section I: Eastern Colleges Science Conference

Behavioral Response of the Zooplankter *Daphnia magna* to the Chemical Presence of a Visual Predator (the Zebrafish *Danio rerio*)[1]

Bridget Damon (Biopsychology and Environmental Studies) and Donald Stearns (Wagner College faculty mentor)

Diel vertical migration (DVM) is a behavioral mechanism used by fish-food organisms to avoid visual detection by predatory fish by remaining in deeper water during daylight hours, then rising to feed on phytoplankton at night, when visual detection is minimized. Diel et al. (2020) showed that the freshwater crustacean *Daphnia magna* displays DVM in lakes and ponds when fish predators are present but not when visual predators are removed, indicating predator detection and behavioral response in real time. To test for chemical detection of fish and behavioral response, 46 *D. magna* were pipetted individually into the middle sections of 50-ml test tubes containing store-bought spring water. In contrast, 44 were similarly tested using aquarium water from a holding tank containing several freshwater zebrafish. The tubes were positioned under fluorescent lights (≈ 0.55 μEm-2s-1) and vertically divided into four equally-sized sections. Every three minutes for 15 minutes, the vertical location of each zooplankter was recorded. Chi-square analysis showed *Daphnia* vertical distribution to be highly significantly ($p < 0.005$) skewed towards the bottom in the presence of fish chemicals compared with those tested in their absence. Results indicate that *D. magna* can chemodetect fish presence and behaviorally respond quickly.

Calcium-mediated Modulation of Fibroblast Growth Factor Homologous Factor Induced Voltage-gated Sodium Channel Long-term Inactivation[2]

Gabriella Goldschmidt (Biology), Christopher Marra, Ph.D. (Wagner College faculty mentor), Nomon Mohammad, M.S. (Hunter College), and Mitchell Goldfarb, Ph.D. (Hunter College)

Fibroblast growth factor homologous factors (FHFs) are accessory proteins expressed throughout the central nervous system (CNS). FHFs bind directly to the c-terminal domain of voltage-gated sodium channels (Nav) and modulate gating properties. There are four FHFs and each has an a-type isoform (AFHFs). AFHFs can induce what is called long-term inactivation (LTI). In hippocampal pyramidal CA1 neurons (HipN), LTI alters the cell's firing pattern described as spike frequency accommodation/adaptation (SFA).

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[1] Received an excellence award for best poster presentation in behavior.
[2] Received an excellence award for nest platform presentation in biochemistry and molecular biology.

SFA is presumed to play a role in learning and memory, but there are other LTI influencers outside of AFHF-induced LTI and the degree of SFA in cells varies. AFHFs have a calmodulin binding site. We seek to determine if this site serves in calcium-dependent modulation of AFHF induced LTI, suggesting that calcium levels modulate firing properties. We aim to determine if LTI is altered in CA1 HipN via whole-cell patch clamp via extracellular chelation of calcium. Overall, calcium chelation by extracellular addition of EGTA significantly increased observable LTI in CA1HipN, exhibiting a potential modulatory mechanism of LTI and SFA. The blockade of calcium channels via cadmium showed significant modulation of LTI. Therefore, calcium-mediated modulation of LTI could be a product of calcium influx through partially calcium permeable Nav.

The Effects of Chronic Ethanol Exposure on Seizure Susceptibility in Planaria[3]

Hasan Ibrahim (Biopsychology) and Sara Guariglia, Ph.D. (Wagner College faculty mentor)

Alcohol use disorder is a widespread and significant public health problem associated with various physical and mental health complications. In particular, chronic alcohol exposure has been linked to an increased risk for seizures. Exposure to ethanol (EtOH) in animal models has been widely used as a model for studying the effects of alcoholism in humans. Chronic EtOH exposure has been shown to produce several changes in the brain and behavior of animals. For example, chronic EtOH exposure has been shown to alter the function of various neurotransmitter systems, including the glutamatergic, GABAergic, dopaminergic, and serotonergic systems. For these studies, we selected to determine if chronic alcohol exposure would induce enhanced seizure susceptibility using bicuculine, an inhibitor of the GABAa receptor. Inhibition of GABAa results in a shift in excitatory/inhibitory balance; the brain is less inhibited and more excited since activation of the GABAa receptor initiates inhibitor activity. To test for seizure susceptibility, we were chronically exposed to 0.1% EtOH for seven days and then tracked their movements when exposed to a range of bicuculine concentrations to determine if and when the animal developed epileptic-like activity. We found that chronic EtOH exposure did not cause any increased susceptibility to seizure-like movements in the planarians, which suggests that the chronic alcoholism mechanism of susceptibility to seizures is likely driven by other means, such as glutamatergic neurotransmission.

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[3] Received an excellence award for best platform presentation in behavioral neuroscience.

Online vs In-Person Learning: Self-Efficacy, Self-Regulation, and Motivation in College Students

Gia Pecorella (Biopsychology) and Jessica W. England, Ph.D. (Wagner College faculty mentor)

As a result of the COVID-19 pandemic, college students experienced significant academic and psychological challenges as they struggled with the stressors of the pandemic while shifting to all online courses. Students reported difficulty staying academically motivated, decreased self-regulation, concerns about their academic performance, and increased struggles with mental health (Kecojevic et al., 2020; Son et al., 2020; Usher et al., 2021). As the world continues to shift out of the pandemic, it is important to investigate the potential ripple effects on the success and well-being of college students and explore their current experiences with different learning formats, especially students most impacted by the pandemic. The current study explores potential differences between college student experiences in online versus in-person learning environments. More specifically, researchers will examine how self-efficacy, career adaptability, and self-regulation impact student motivation across learning environments in order to investigate students' current academic functioning following the pandemic. Researchers surveyed both first-generation and continuing-generation students to investigate potential differences. College initiatives aimed at the recruitment and retention of college students are vital to the success of students who may be continuing to struggle academically following the pandemic. Additional qualitative responses will be analyzed, and implications for best educational practices will be discussed.

Light and Immunogold Transmission Electron Microscopy Analysis of Mast Cells in Adult Zebrafish Optic Tectum Upon Traumatic Brain Injury

Robert J. Tipaldi (Chemistry), Christopher P. Corbo, Ph.D. (Wagner College faculty mentor) and Susan Briffa-Mirabella, Ph.D. (Wagner College faculty mentor)

Previous light and scanning electron microscopy analyses of injured adult zebrafish optic tectum revealed a high abundance of cells with mast cell-like morphology in proximity to highly organized regenerative structures. Here, we employ immunogold transmission electron microscopy of tectal explants labeled with the mast cell-specific marker carboxypeptidase A5 to attempt to confirm these cells as mast cells. To assess the reliability and specificity of the selected mast cell marker, both light and transmission

electron microscopy analyses were performed on the adult zebrafish liver, where the presence of mast cells have been previously established.

Section II: The Natural Sciences & Quantitative Analysis

Behavioral Response of the Zooplankter *Daphnia magna* to the Chemical Presence of a Visual Predator (the Zebrafish *Danio rerio*)

Bridget Yvette Damon (Biopsychology and Environmental Studies)[1]

Diel vertical migration (DVM) is a behavioral mechanism used by fish-food organisms to avoid visual detection by predatory fish by remaining in deeper water during daylight hours, then rising to feed on phytoplankton at night, when visual detection is minimized. Freshwater crustacean Daphnia magna displays DVM in lakes and ponds when fish predators are present but not when visual predators are removed, indicating predator detection and quick behavioral response. To test for chemical detection of fish and behavioral response, D. magna were pipetted individually into the middle sections of 50-ml test tubes containing store-bought spring water or aquarium water from a holding tank containing several freshwater zebrafish. The tubes were positioned under fluorescent lights ($\approx 0.55 \ \mu Em^{-2}s^{-1}$) or in a dark room and vertically divided into four equally-sized sections. Every three minutes for 15 minutes, the vertical location of each zooplankter was recorded. Chi-square analysis of the light treatment showed Daphnia vertical distribution to be highly significantly ($p<0.005$) skewed towards the bottom in the presence of fish chemicals compared with those tested in their absence. The results of the dark treatment displayed the potential influence of light, whether the daphnids were exposed to the fish cue or not. Results indicate that D. magna can chemodetect the presence of a visual predator and behaviorally respond quickly, and are potentially influenced by the presence of light.

I. Introduction

Predator-prey relationships

To increase one's fitness and thus survival, prey must adapt. The interaction between predator and prey largely shapes the ecology and trophic balance of nearly every ecosystem, including aquatic (Werner and Peacor, 2003; Hahn et al., 2019). The primary mechanism for increased prey survival is phenotypic plasticity affecting species interactions (Ebert, 2022; Werner and Peacor, 2003). This plasticity has been seen in various animal and plant taxa, combined with life history, morphology, and physiology,

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[1] Written under the direction of Dr. Donald Stearns in partial fulfillment of the Senior Program requirements.

that improve their anti-predator mechanisms (risk effect) (Moll et al., 2017; Werner and Peacor, 2003). Life history is reducing the impact of predation by prey adaptations that interfere with the feeding strategy of predators or offset population losses (Diel et al., 2020). Morphology is physical changes to the prey that interfere with the catching or feeding behavior of the predator (Diel et al., 2020). Physiological changes are body changes that assist in prey fight or flight response, like increased heart rate. The other way predators influence their prey is through direct killing (lethal effect). However, recent research has shown that risk effects, compared to lethal effects, may significantly influence prey distribution, behavior, and demography (Moll et al., 2017; Werner and Peacor, 2003).

One fundamental way prey species display plastic traits is through predator detection systems. Standard detection methods include vision, physical contact, and chemical cues. Systems that rely on aqueous chemical cues are particularly advantageous due to their broad temporal and spatial scales, given the water solubility of many detection cues prey rely on (Kalff, 2002). Additionally, chemical cues benefit prey that lacks high escape velocity, direct defense abilities, or does not live in low-light environments (Kalff, 2002). These chemical cues have begun to be identified to more adequately understand predator-prey interactions (Hahn et al., 2019; Pijanowska et al., 2020).

<u>*Daphnia magna* to study anti-predator behavior</u>

The genus *Daphnia* is taxonomically classified as follows: domain Eukarya, kingdom Animalia, phylum Arthropoda, subphylum Crustacea, class Branchipoda, superorder Cladocera, order Anomopoda, family Daphniidae, genus *Daphnia* (Ebert, 2022). There are over 100 described *Daphnia* species over a vast geographical area. These species typically share similar body structures with a large head, one compound eye, and a chitinous bivalve carapace or shell (Ebert, 2022). Specifically, their compound eye has a multichromatic photoreceptor system that includes UV sensitivity (Smith and Macagno, 1990). It has also been found that *Daphnia* use this system to initiate negative phototaxis as a response to higher amounts of UV radiation (Storz and Paul, 1998). Additionally, most species share a transparent body to limit detection from visual predators like planktivorous fish (Ebert, 2022). However, their transparency can be a hindrance as the green pigment of the phytoplankton they consume can be seen in their gut. Commonly *Daphnia* are known as "water fleas" due to the hop-like motion their two large antennae (Figure 1) create when moving upwards through an aquatic environment (Kalff, 2002).
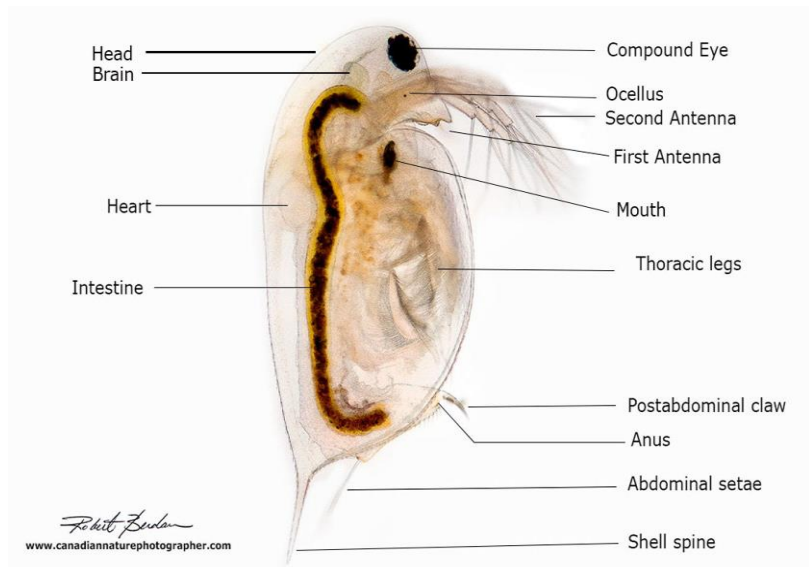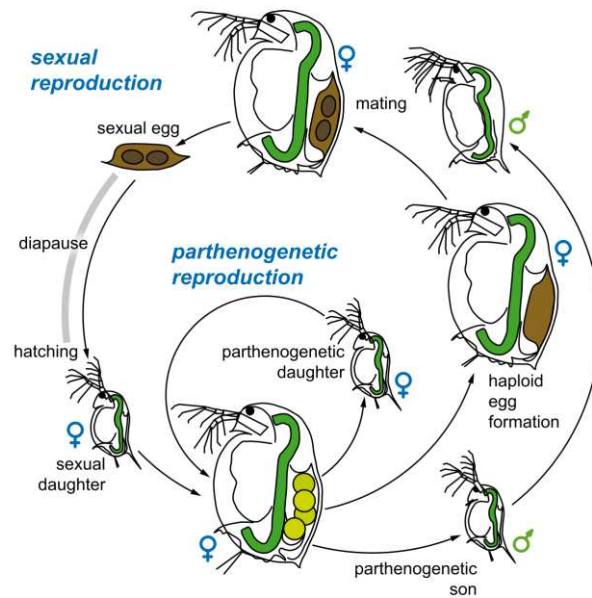
Figure 1: Diagrammatic representation of the typical body structure of the cladoceran _Daphnia._ _Daphnia_ species possess a hard chitinous transparent carapace and are commonly called "water fleas" due to their two large antennae. (Image taken by Dr. Robert Berdan).

In the wild, cladocerans are the main filter feeder in lakes and ponds, feeding on phytoplankton and protists. They significantly influence community production structure in their ecosystems, making them keystone species (Ebert, 2022; Kalff, 2002; Schmitt, 1965). Additionally, their large populations serve as the primary food supply for many planktivorous fish. The superorder Cladocera encompasses chiefly freshwater _Daphnia_ species, with _Daphnia magna_ and _Daphnia pulex_ being the most well-known and used for scientific research (Kalff, 2002; Ebert, 2022). Specifically, _Daphnia magna_ is the larger _Daphnia_ species, measuring between 2-to-5 mm, and can be seen with the naked eye, increasing their research value. Additionally, most species can live to 100 days in predator-free environments while still being able to reproduce quickly.

Daphnia's research value is further increased due to their ability to reproduce asexually and sexually (Figure 2) (Ebert, 2022; Kalff, 2002; Schmitt, 1965). They typically reproduce asexually through amictic parthenogenesis or diploid eggs that do not require fertilization. These eggs hatch from adult females' brood chambers into miniature female adults that mature in three to six weeks (Kalff, 2002). This asexual reproduction means all offspring are clones of the mother, adding to _Daphnia's_ genetic research value.

Under favorable conditions, this asexual reproduction can continue for several years, with the new generation of eggs producing the next in only a few weeks (Ebert, 2022; Kalff, 2002). This quick asexual reproduction is advantageous for scientific research and helps explain *Daphnia's* common usage as a model organism.

Figure 2: Diagrammatic representation of the life cycle of *Daphnia*. Individuals can alternate between parthenogenetic and sexual reproduction. (Figure taken from Wikipedia, drawing by Dita Vizoso).

Sexual reproduction is usually only performed in unfavorable conditions, such as many predators or deteriorating environmental conditions. Interestingly when unfavorable conditions present themselves, many cladoceran species can begin to produce more males to assist with fertilization (Kalff, 2002). Adult females can switch between the two reproductive processes (Figure 2). When females switch to sexual reproduction, they produce haploid eggs that require fertilization from a male. Once fertilized, the females will drop the eggs from their brood chamber in an egg case called the ephippium made from her carapace and let them settle into the bottom sediment of the aquatic environment (Ebert, 2022; Kalff, 2002). The eggs undergo diapause or resting until favorable conditions return, where they hatch into females. This is why there is often a dramatic increase in population in the spring or when rain fills bodies of water. Interestingly, some species of *Daphnia* can

undergo the resting state entirely asexually (Ebert, 2022). However, it is essential to note that the life cycle described could differ in any ecological aspect considering the wide variety and several species in the *Daphnia* genus (Ebert, 2022).

     Daphnia use in research is expanding as more advanced technologies and ideas evolve. In the early beginnings, over 100 years ago, their diel vertical migration (DVM) behavior concerning predator avoidance was of high interest especially related to phenotypic plasticity (Ebert, 2022; Moll et al., 2017; Werner and Peacor, 2003). Due to their long history in ecological and related research fields, they are one the best-studied organisms and remain a prime model for various topics. Recently, their use has expanded to host-parasite interactions, genetics, community ecology, and, pressingly, climate change ecology (Ebert, 2022). Climate change is heavily disrupting the ecology of nearly all ecosystems. *Daphnia* are keystone species, filter feeders, and the main food source for higher trophic levels. Therefore, exposure to toxins, like microplastics and other environmental contaminants, or increasing water temperatures have made them useful models to see how freshwater food webs will be affected by climate change (Ebert, 2022).

<div align="center">Diel vertical migration (DVM)- a model of anti-predator behavior</div>

     DVM of zooplankton is one of the largest migration movements regarding biomass that happens selectively in aquatic environments. It has been of interest for nearly a century and continues to be an area of anti-predator research (Kalff, 2002). There have been many hypotheses about what drives the behavior, but the most influential agreed upon are predator avoidance of planktivorous fish and exposure to ultraviolet (UV) and visible light.

     Lakes and ponds are divided into stratified sections: the epilimnion, metalimnion, and hypolimnion. These sections play a significant role in DVM behavior. During the day, the zooplankton stay low in the water column (hypolimnion), where it is dark and difficult for predators to visually perceive them (Figure 3). At night, they will move upwards in the water column (epilimnion) to more safely feed on food sources, like phytoplankton, and to reduce the costs of staying in the colder, deeper layer as the nighttime temperature decreases (Kalff, 2002). This migration benefits and increases the fitness of the zooplankton and puts their predators at a foraging disadvantage. Due to this, the prey significantly impacts many ecosystem processes, like trophic distribution of the food web (Ebert, 2022; Kalff, 2002).

     In freshwater environments, like lakes and ponds, DVM is similarly influenced by light intensity and predator-released chemical cues or info chemicals (Kalff, 2002). Info chemicals that specifically influence migration are known as kairomones. They are
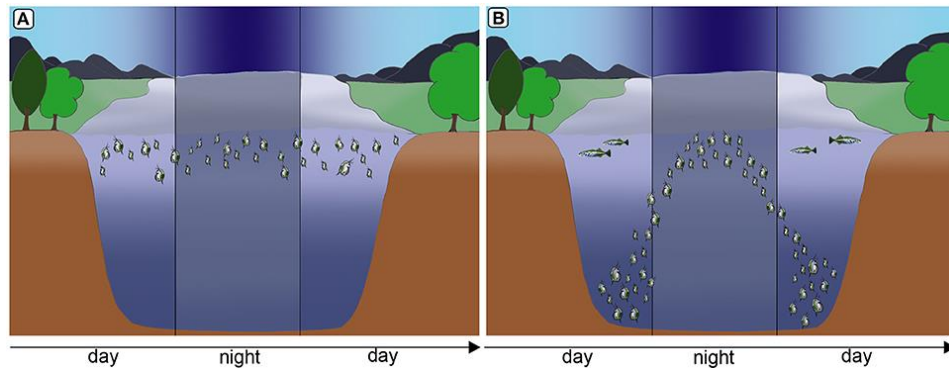
Figure 3: Visual representation of fish-induced diel vertical migration. DVM is a prey behavioral defense in *Daphnia* to counter planktivorous fish predation. Without fish predation, *Daphnia* remain in warmer surface waters where their main food sources are (A). Under predation, *Daphnia* migrate to greater depths during the day, minimizing visual predation. At night, they migrate to surface waters for feeding (B). (Image from Weiss, 2019).

characterized as providing advantageous information to the prey or receiving organism while disadvantageous to the predator or the producer of the chemical cue (Kalff, 2002). Alarm substances that provide cues about injured or attacked prey organisms of the same species may also affect the migration of *Daphnia,* yet this is not the focus of the current study.

Based on previous research, a reduction in mortality from predation is the main reason for DVM (Kalff, 2002; Ebert, 2022). DVM is related to predator abundance; if more planktivorous fish are present, it is beneficial for the zooplankton to migrate deeper into the water strata. Hence, phenotypic plasticity is involved, as prior literature has found that DVM behavior increases in environments with long-established fish populations (Gilwicz, 1986). Additionally, the clarity of the water and, thus, increased visibility of *Daphnia* also affect how directionally strong the DVM behavior is (Dodson, 1990). However, they need a reliable cue or a kairomone to conserve energy and accurately know when a predator is or is not present. Kairomones are quickly released by fish regardless of nutritional state and are readily degraded by bacteria in the surrounding water, hence why it is an accurate indicator for prey (Kalff, 2002).

Isolating the specific kairomones that predatory fish release has been a main focus of research to quantitatively measure kairomone concentration to better manipulate and understand DVM behavior. Due to the use of the zooplankton *Daphnia magna* in the current study, the isolated kairomone *Daphnia* utilized for DVM will be focused on. Hahn et al. (2019) used a bioassay-guided approach where fish incubation water from cyprinids

was extracted in a lipophilic solid phase separated by high–performance liquid chromatography. Its fractions were individually examined to see which fractions induced DVM. Kairomones are anions; thus, they isolated the kairomone with this as the framework and further testing. It was identified as a known fish bile salt alpha-cyprionol sulfate (CPS). It was the only compound in sufficiently high enough concentration in the fish incubation water to be considered biologically active or inducing a physiological change. When tested, it triggered DVM in the *Daphnia*.

Alpha-CPS is a bile salt, or in vertebrates, a metabolite of cholesterol that emulsifies dietary fats and facilitates intestinal absorption (Hagey et al., 2010; Hoffmann et al., 2010). Fish excrete these bile salts through the urinary tract, intestines, and gills, and they are relatively stable compounds considering their ability to pass through the digestive tract (Hagey et al., 2010; Hoffmann et al., 2010). Additionally, they are often conjugated with taurine if a bile acid or sulfate if a bile alcohol, making them highly water soluble. Furthermore, a comprehensive comparative study by Pijanowska et al. (2020) supported that fish bile or selected bile acids/salts could be responsible for providing biological activity to kairomones that *Daphnia* would be able to identify. Alpha-CPS was one of the bile salts they examined, and it adequately resulted in *Daphnia* remaining significantly deeper in the water column than the control during the daytime. The evolutionary process of *Daphnia* sensitizing to this compound as an info chemical or kairomone makes evolutionary sense. They possess a well-developed set of gustatory receptors to help detect these compounds (Ebert, 2022). Hahn et al. (2019) display that bile salt was still released by starved fish and did not require them to be successful in foraging for prey before they induced DVM. Bile salts are a key process in the metabolism of fish, and why they have been unable to stop releasing this kairomone despite its evolutionary disadvantage to their fitness (Hahn et al., 2019).

Not all orders of fish share this bile salt. However, it seems the production of bile salt alpha-CPS is the ancestral pattern from which more recent bile salt patterns have deviated through enzymatic modifications (Hagey et al., 2010; Hoffmann et al., 2010). Findings suggest *Daphnia* evolved a stable acute sensitivity to the ancestral fish bile salt to adequately identify fish from differing orders that have developed variations of the alpha-CPS bile salt (Hagey et al., 2010). This acute sensitivity would lower the metabolic costs of *Daphnia* as having a reliable cue would reduce unnecessary and costly adenosine triphosphate (ATP) use. Nevertheless, research still does not have enough evidence to understand how *Daphnia* developed this plasticity and the molecular pathways they utilize to detect the kairomone (Weiss, 2019).

Despite the clear influential role of kairomones in DVM, light exposure also plays a significant role, with some literature even arguing a greater one. A study by Effertz

and Elert (2014) suggested that light exposure was the modulating factor that induced DVM, while kairomones determined the depth the *Daphnia* would reach. Furthermore, other studies have shown that moonlight can be enough light intensity to alter DVM behavior. Dodson (1990) found that full moonlight seemed to reduce the ascent of *Daphnia* by 2 m. Overall, the cyclical nature of daytime versus nighttime is critical for *Daphnia*'s reproduction. They prefer 12 hours of daylight and 12 hours of nighttime (Ebert, 2022). Thus, light exposure seems to play a significant role in many biological processes, including DVM.

<u>Attempted experimental methods</u>

The current study was the first performed by an undergraduate student at Wagner College. Thus much of the research involved creatively designing and testing various methods to determine the most suitable for studying DVM behavior in *Daphnia magna* related to kairomones and light exposure. Hahn et al. (2019) stated that the specific kairomone is not commercially available or easily accessible; thus, creative solutions had to be found.

Dr. Juice® super concentrate scents

First was Dr. Juice® super concentrate scents in bass scent. It is a fish attractant for fishers to attract larger fish. The ingredients were vague but stated it included water-soluble ingredients like fear pheromones from injured baitfish to attract predator fish, sex pheromones to trigger aggressive behavior, schooling pheromones from baitfish, and special amino acids and fish extracts to stimulate a strike (Dr. Juice® USA, 2023). However, Dr. Juice® presented several problems. It was oily, possessed a deep yellow color, had an extreme odor, and was difficult to work with overall. There was concern about its volatility entering the air and affecting the *Daphnia* culture enclosure as testing and housing of the specimen occurred in the same room. Furthermore, it did not seem to work when used directly on the water surface of a test tube or when diluted with water before application. Additionally, it was unknown if it possessed a kairomone that the *Daphnia* would respond to and introduced too many other variables to continue its usage.

Zebrafish (Dario rerio)

Zebrafish (*Dario rerio*) holding tank water was collected instead in the hope of receiving the specific kairomone diluted in the tank water (Figure 4). Fish tank water seemed reliable, as prior literature used similar methods (Loose and Dawidowicz, 1994). Furthermore, Hahn et al. (2019) tested a fish species in the same family (Cyprinidae), supporting the possibility that zebrafish would adequately release alpha-CPS bile salt or

another kairomone in high enough concentrations into the holding tank water to use for experimentation.

Figure 4: Image of zebrafish (*Dario rerio*). Example of male and female zebrafish that tank water was collected from for experimentation. (Image taken from Teame et al., 2019).

Zebrafish originate from the freshwater source of the Ganges River in India (Teame et al., 2019). Their diet in the wild includes zooplankton, like *Daphnia*. They, too, are an increasingly popular model organism related to various fields, but most importantly in development, genetics, immunity, behavior, nutrition, and physiology (Teame et al., 2019). For the purpose of the study, they were easily accessible freshwater, visually predatory fish that were being housed in another lab at Wagner College.

Light exposure

Additionally, issues related to the amount of light exposure involved several revisions. Initially, a turned-on overhead fluorescent glow light used for plant growth approximately 1 m from the top of the test tubes was used as the light condition. Whereas turned off with the normal overhead lights in the laboratory room were used as low light. The grow lights and overhead ceiling lights emitted primarily light within the visible spectrum. However, it was decided that the light exposure from the turned-on grow lights introduced too much reflection in the test tubes. The light was reflecting off the bottom concave surface of the test tube, leading to a bright spot. Black velvet was laid underneath to minimize the reflection but did not greatly reduce it. The reflection was potentially leading the *Daphnia* to be unable to determine the direction of the light source, thus interfering with their DVM behavior. The grow lights were turned off for future trials. Furthermore, a dark room was added to test if light was needed for the daphnids to move downward in response to the chemical cues during the daytime phase of the daphnids' activity cycle.

Timing

Timing issues were also present as the *Daphnia* had to be quickly observed using scan sampling. Thus, the appropriate timing and number of subjects had to be found, which led to the least error and allowed quick, efficient scanning. The final number of subjects became 10-to-12 per trial, using 10-to-12 test tubes with only one experimental daphnid in each test tube. Each trial lasted 15 minutes, with a recorded observation every 3 minutes.

II. Objectives

The main objective of this thesis research project was to determine the effects of planktivorous fish kairomone and the presence of light on the DVM behavior of the zooplankton *Daphnia magna.* The subjects were exposed to either bottled spring water or to water collected from a holding tank containing several zebrafish (*Danio rerio*) for at least one week, and each subject's vertical distribution was observed over a period of 15 minutes. Additionally, lighting conditions were varied in combination with the control and fish-treated water to see if a difference in behavior was apparent, considering the supposed modulating influence light has on DVM behavior. It was hypothesized that there would be observational and statistically significant changes in the vertical distribution of *Daphnia magna* indicative of DVM behavior in the presence of fish chemicals such as kairomones, compared with their vertical distribution in the absence of such chemicals. It was also hypothesized that there would be observational and statistically significant changes in the vertical distribution of *Daphnia magna* in the presence of light, compared with their vertical distribution in the absence of light.

III. Materials and Methods

Maintenance and handling of *Daphnia magna*

The cultures of *Daphnia magna* used in this experiment were received from Carolina Biological Supply Company© in North Carolina. The *Daphnia* cultures arrived in 30 mL glass culture bottles that housed approximately 30 adults. The cap was loosened for gas exchange and set to equilibrate to room temperature (22ºC). Once equilibrated, the culture was slowly poured into an approximate 5.68 L plastic tank filled ¾ of the way with Poland Spring® bottled spring water. Spring water was used to reduce exposure to potential contaminants from tap water sources. The tank was covered with a lid with air holes to allow gas exchange. A second identical tank was used to rotate as new cultures were needed. The tanks were kept in the same area of the laboratory on an elevated counter. The lighting conditions remained the same throughout the experiment, with all

overhead lights in the room on, minimal outside light, and two fluorescent plant growth lights approximately 1 m away. When needed, the *Daphnia* cultures were fed a yeast pellet from Carolina Biological Supply Company©.

       The cultures typically survived and could reproduce for several weeks before a replacement culture was required. To maintain appropriate conditions, the tanks were cleaned once a week. During cleaning, 1000 mL of the dirty water was removed using a 500 mL glass beaker. Equal amounts of clean Poland Spring® bottled spring water replaced the removed water. A small mesh filter attached to a section of PVC pipe was placed a few centimeters beneath the surface of the tank water, and the new water was poured through to minimize air bubble formation. Carolina Biological Supply Company© warned that sudden air bubble formation could be lethal to the *Daphnia* if the air becomes trapped under their carapaces.

<u>Experimental design</u>

       To set up the experiment, two test tube racks that hold 8 test tubes, respectively, across their length, were placed next to each other (Figure 5). 10-to-12 identical 50 mL test tubes that were 2 cm in diameter were placed in the test tube racks in spaces that did not have visually impairing pieces of plastic as part of the test tube rack design. They were labeled 1-12 with a marker to assist in quick identification during trials. They were filled with approximately 48 mL of Poland Spring® bottled spring water for the controls and zebrafish tank water for the fish treatment trials. In the light condition, the test tubes were placed on a shelf with black-felt lining its bottom surface to minimize reflection or light coming from underneath. The test tubes were graduated into four sections of approximately 5 cm depth. A string was tied to the two poles on either side of the shelf, separating the top two sections.

       Next, approximately 10-to-12 adult *Daphnia* were collected from the *Daphnia* supply reservoir using a pipette. Adults were chosen, as previous studies have shown that younger and smaller daphnids may be less vulnerable to fish predation and will remain higher in the water column during the day (Hannson & Highlander, 2009). The pipette was cut to have a larger opening for the *Daphnia* to reduce harm as they were suctioned. They were placed in a 250 mL beaker with a small amount of spring water for transfer. At the start of each trial, the daphnid was placed in the center depth of the test tube and allowed to acclimate for approximately two minutes before experimentation. Each trial ran for 15 minutes, with the vertical distribution of each animal (using the four sections) recorded every three minutes.

Figure 5: **Experimental setup of test tubes.** The arrangement of test tubes in the rack maximized the *Daphnia* visibility. Additionally, it displays the four 5 cm sections for recording vertical distribution.

Four treatments were performed during the study (Table 1). First was light control which used the normal lighting of the laboratory with Poland Spring® bottled spring water. The approximate light intensities ($\mu Em^{-2}s^{-1}$) based on the light sensor's orientation and the test tubes' location were 0.55 straight up, 0.13 straight down, 0.20 towards the back wall, and 0.10 towards the remainder of the room. The second was the light fish treatment which used the same lighting conditions with fish tank water. Third was the dark control which used spring water in the dark room. The fourth was dark fish treatment, the fish tank water in a dark room. It is important to note that the same set of animals would often be used for the respective dark and light treatments with the same type of water to save on the high usage of the animals.

Table 1: Treatment groups used for experimentation

Groups:	Treatments:
1	Light and spring water (control)
2	Light and fish water
3	Dark and spring water (control)
4	Dark and fish water

The subjects were moved from the laboratory room in their test tubes to the dark room for the dark trials. They were placed on a flat surface, and all possible light was blocked out. The subjects were allowed to dark adapt for approximately five minutes before experimentation began. A LED flashlight with the lowest brightness was used to determine the depth in the dark. The light was filtered through a dark red filter that suppressed wavelengths less than 690 nm. *Daphnia* are minimally sensitive to visible red light (Stearns, 1975). A timekeeper sat on the other side of the blackout curtain to minimize light exposure to the subjects. They communicated to the recorder when each 3-minute mark was approaching during the 15-minute trial.

<center>*Dario rerio* tank water collection</center>

The fish tank water was collected from an onsite laboratory that housed zebrafish (*Dario rerio*) for research (Figure 6). Fish water was collected from the zebrafish holding tank, which held approximately 37.85 L of water. The tank held approximately 20 zebrafish. Surface tank water was collected using a one-gallon (3.79 L) Poland Spring® plastic bottle. An approximately equal amount of bottled spring water was added to the fish tank to keep the total volume the same. Fresh tank water was collected each time when needed for experimental trials. Once the *Daphnia* had been exposed to fish water, they would be discarded due to contamination. They were poured directly into a sink in the laboratory. Furthermore, test tubes exposed to fish chemicals were not utilized again for future trials to avoid the possibility of residual kairomones potentially affecting *Daphnia* behavior in later trials.

Figure 6: Zebrafish holding tank. The image depicts the individual zebrafish and the environment in which their water was collected for the experiment. The tank was housed in another laboratory on the Wagner College campus.

The total number of individual responses for the exposure to fish chemicals in the light treatment was summed to determine the number of daphnids found in each of the four sections. A chi-square test for goodness of fit was used to compare the resulting observed vertical frequency distribution in the presence of fish chemicals in the light (treatment group) with the vertical distribution pattern that would have been expected in the absence of fish chemicals (the control group). To find the expected frequency distribution had these daphnids not been exposed to fish chemicals, the proportion of tested daphnids found in each of the four sections without exposure to fish chemicals was found and multiplied by the total number of experimental daphnids exposed to fish chemicals. Vertical distribution patterns under dark conditions using a much smaller total sample size (n=22) did not meet conditions for a chi-square test for goodness of fit.

IV. Results

Light (fish treatment vs spring water)

A chi-square analysis of the daphnids exposed to the zebrafish tank water for 15 minutes under the experimental lighting conditions displayed a significantly ($p < 0.005$) higher than expected frequency of individuals in the lower two sections (3rd and bottom) of the test tube compared with the expected frequency distribution had the same number of daphnids been tested without exposure to fish chemicals under the same lighting conditions (Table 2, Figure 7).

Table 2: Chi-square testing comparing the observed vertical distribution of *Daphnia magna* in the presence of fish chemicals with the expected distribution in the absence of chemicals after 15 minutes of testing under light conditions. Expected frequencies were based on proportions calculated from observed frequencies of the vertical distribution of *Daphnia magna* in the absence of fish chemicals.

Category (Depth in Water Column)	Observed Frequencies With Fish Chemicals	Expected Frequencies Without the Effect of Fish Chemicals	Chi-Square Values
Top (0-5 cm deep)	5	16.261	7.798
2 (5-10 cm deep)	3	7.652	2.828
3 (10-15 cm deep)	6	6.696	0.072

Category (Depth in Water Column)	Observed Frequencies With Fish Chemicals	Expected Frequencies Without the Effect of Fish Chemicals	Chi-Square Values
Bottom (15-20 cm)	30	13.031	22.097
Totals:	**44**	**≈ 44**	**32.795*** **(p < 0.005)**
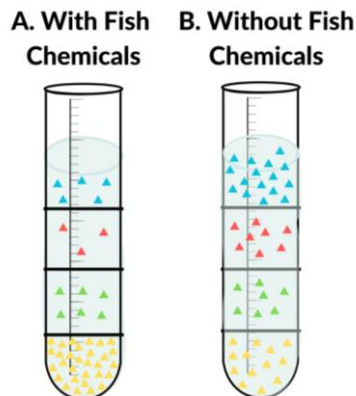
Figure 7: Visual representation of Table 2 data. The colors denote the total number of individuals found in each test tube section after 15 minutes for the light treatment. In the presence of fish chemicals, a majority of daphnids were found in the bottom section (A). In the absence of fish chemicals, they were more evenly disturbed through the test tube (B).

All three-minute time intervals from 3 minutes to 15 minutes displayed significant p-values less than 0.005 (Table 3). After only 3 minutes, the vertical distribution of the daphnids had already significantly (p < 0.005) shifted downwards in the presence of fish chemicals. Furthermore, the 3-minute time interval had the second highest calculated chi-square value of 34.940, displaying that fish water effectively induced DVM behavior within 3 minutes of exposure. Between 9 and 12 minutes, there was a drop in the calculated chi-square value to 17.427 and 14.300, respectively. This increased back to 32.795 for the 15-minute calculation (Table 3). For the full data set of the vertical distribution for light treatment, refer to Table 4.

Table 3: Calculated chi-square values comparing observed distribution in fish water with distribution expected if no fish chemicals in light

Time Frame	Calculated Chi-Square Values
After 3 minutes	34.940*
After 6 minutes	39.357*
After 9 minutes	17.427*
After 12 minutes	14.300*
After 15 minutes	32.795*

Table 4: Comparison of the vertical distribution of daphnids exposed to fish chemicals (WF) and their distribution without fish (WoF) in the light every 3 minutes during the 15 minute trials using only one daphnid per test tube

Category (Depth in Water Column)	3 min (WF)	3 min (WoF)	6 min (WF)	6 min (WoF)	9 min (WF)	9 min (WoF)	12 min (WF)	12 min (WoF)	15 min (WF)	15 min (WoF)
Top (0-5 cm deep)	1	17	2	15	8	18	6	15	5	17
2 (5-10 cm deep)	6	9	4	7	1	5	2	6	3	8
3 (10-15 cm deep)	8	6	9	4	5	5	8	7	6	7
Bottom (15-20 cm)	29	14	29	20	30	18	28	18	30	14

<u>Dark (fish treatment vs spring water)</u>

A complete chi-square analysis for the daphnids exposed to the zebrafish tank water under the experimental dark room conditions for 15 minutes compared to the controls exposed to spring water under the same lighting conditions was unable to be calculated. According to Baldi and Moore (2012), no more than 20 percent of the expected

counts in an expected frequency distribution should be less than 5. All individual expected frequency distribution counts should be 1 or greater. One or both of these conditions were not met for the experimental comparisons made in the dark room without light for any time trials. Table 5, showed that the observed distributions after 3, 6, and 9 minutes included sections with no daphnids; expected distributions after 12 and 15 minutes violated the 20 percent condition. This led to the inability to calculate the total chi-square value for each 3-minute time distribution.
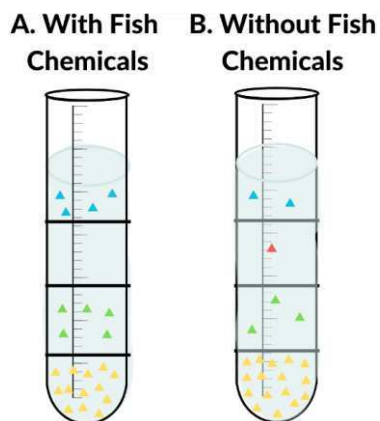
Table 5: Comparison of the vertical distribution of daphnids exposed to fish chemicals (WF) and their distribution without fish (WoF) in the dark every 3 minutes during the 15 minute trials using only one daphnid per test tube

Category (Depth in Water Column)	3 min (WF)	3 min (WoF)	6 min (WF)	6 min (WoF)	9 min (WF)	9 min (WoF)	12 min (WF)	12 min (WoF)	15 min (WF)	15 min (WoF)
Top (0-5 cm deep)	0	0	1	0	1	3	2	2	4	2
2 (5-10 cm deep)	0	1	3	4	1	0	4	2	0	1
3 (10-15 cm deep)	5	2	4	3	4	3	6	3	5	3
Bottom (15-20 cm)	17	19	14	15	16	16	9	15	13	16

Although chi-square testing could not be performed for the experimentation done in darkness, Table 6 and Figure 8 provide a visual comparison of the observed vertical distributions of the daphnids exposed to fish chemicals and daphnids not exposed to fish chemicals. In both cases, the vertical distribution patterns appear similar, with most daphnids moving downward in the dark room during external daylight conditions. Additional trials were not conducted because it was concluded that more trials would not have changed the observed pattern of behavior in the darkness. All 3-minute time intervals had at least 60% of 22 individuals in the bottom section for the control and experimental conditions.

Table 6: Comparison of the observed vertical distributions of the daphnids exposed to fish chemicals and daphnids not exposed to fish chemicals after 15 minutes under dark conditions

Category (Depth in Water Column)	Observed Frequencies With Fish Chemicals	Observed Frequencies Without Fish Chemicals
Top (0-5 cm deep)	4	2
2 (5-10 cm deep)	0	1
3 (10-15 cm deep)	5	3
Bottom (15-20 cm)	13	16
Totals:	**22**	**22**

Figure 8: Visual representation of Table 6 data. The colors denote the total number of individuals found in each test tube section after 15 minutes for the dark treatment. In the presence of fish chemicals, a majority of daphnids were found in the bottom section (A). They were also found in the bottom section (B) in the absence of fish chemicals.

V. Discussion

Light treatment

These experimental results suggest that *Daphnia* can detect the chemical presence of visual predators such as zebrafish and behaviorally respond quickly. Using a fish species in the same Cyprinidae family as zebrafish, Hahn et al. (2019) identified a kairomone that induced DVM in *Daphnia magna*. The daphnids in the current research using zebrafish tank water responded within 3 minutes (or less) by moving downward in the test tube, indicating the chemical detection of the presence of a visual predator quickly. The *Daphnia,* even after a short window of 3 minutes, could identify the kairomone in the water and adequately respond by moving deeper in the test tube or the artificial water column.

Often most individuals during experimentation would move immediately to the bottom and stay there for most of the experiment, further supporting their ability to identify a predator's chemical presence quickly. Within 3 minutes, they established a bottom-skewed distribution which was maintained throughout the 15-minute interval. Approximately 82% (36 of 44) of the treatment individuals were found in the bottom of the test tube after 15 minutes. Whereas for the control, 14-20 individuals were consistently found in the bottom section. This supported the hypothesis that there would be observational and statistically significant changes in the vertical distribution of *Daphnia magna* indicative of DVM behavior in the presence of fish chemicals such as kairomones, compared with their vertical distribution in the absence of such chemicals.

Furthermore, the current experiment supported that DVM behavior is induced by fish tank water from the visual planktivorous zebrafish predator even when the individual *Daphnia* were never exposed to the actual predator. This finding supports previous studies that found *Daphnia* display DVM behavior even when never exposed to a visual predator (Ebert, 2022). As far as the researcher knows, the *Daphnia* utilized were cultured and raised from the acquired facility without predators displaying the innate trait of identifying predatory kairomones.

Dark treatment

The dark treatment did not share the same clear difference in behavior between the control and treatment groups as the light condition. During daylight hours, the experimental daphnids under experimental light conditions showed a vertical distribution pattern that showed higher numbers near the top and bottom of the tube than the middle two sections. By contrast, the experimental daphnids in darkness showed a generally bottom-skewed distribution during daylight hours. However, the two groups had no substantial difference across the 15-minute intervals. Approximately 82-86% of the

daphnids remained in the bottom half of the test tube in both the dark control and treatment group. Adding fish chemicals under these lab conditions did not seem to change anything distribution-wise in the dark experiments since the cladocerans without exposure to fish chemicals may not have known where "up" is and/or sink at a faster rate than they swim without the light stimulus around to stimulate the hop response. Thus, the bottom-skewed distribution occurs with or without fish chemicals in the dark. A majority of daphnids remained at the bottom of the test tube for both conditions, providing potential evidence for light intensity influencing DVM.

If more dark sampling had been performed, the larger sample sizes would likely have shown similar patterns, thus further supporting that the presence or absence of light is a factor in determining the vertical distribution pattern of daphnids in the wild, at least when fish chemicals are not around. For experimental daphnids exposed to fish chemicals, a comparison of vertical distribution patterns under light and dark conditions showed 81.8% of the daphnids in the bottom half of the water column after 15 minutes (Table 4; Table 5). For those not exposed to fish chemicals, only 46.2 % were found in the bottom half of the test tube in the light, compared to 86.3% in darkness (Table 4; Table 5). These results indicate that experimental light conditions may have affected vertical distribution patterns. These results support the conclusion that the downward shift in vertical distribution of the experiment daphnids occurs in the presence of light. Field studies support this finding that daytime deeper depths are maintained by daphnids when visual predators are present (Diel et al., 2020).

This is in line with previous research that found *Daphnia* seem to cease DVM behavior when all light is blocked out, even in the presence of fish chemicals (Loose, 1993). Specifically, Loose (1993) found that when exposed to complete darkness, the daphnids ceased their DVM behavior immediately. However, bottom skewed distribution in the dark during the day hours in the lab may be due to endogenous rhythms (Young and Watt, 1993). Whether or not endogenous rhythms also play a role in DVM in daphnids is still valid and worth considering. Other researchers have found evidence that some daphnids do display rhythms in their phototactic reactions (Young and Watt, 1993). Therefore, potentially there is variation in populations of *Daphnia* regarding what they rely on for the induction of their DVM behavior (Loose, 1993).

Several issues with the dark treatment could have influenced the described results. First was the smaller sample size of n=22 for both the control and experimental groups. However, it is likely that the clear pattern of most individuals going to the bottom would stay the same with a larger sample size. Second, the culture of *Daphnia* in the holding tank did not experience true 12-hour days and 12-hour nights. The holding tank was in the same room as testing occurred, where the overhead lights were never turned off.

Considering the importance of having consistent exposure to day vs. night light conditions, this could have affected their DVM behavior, especially when exposed to the extremely dark conditions in a dark room designed to eliminate light leaks (Ebert, 2022). Furthermore, typically in the wild, they never experience true darkness as the moon and other ambient light enter the top section of the lake or pond, making the dark room potentially even more jarring. Before testing began, they were given 5 minutes to adjust to the dark room. They may have needed more time to dark adjust adequately.

<u>Suggestions for future studies</u>

This was the first study conducted at Wagner College with the model organism *Daphnia magna* and DVM behavior. Therefore, many improvements and future interests could be made and studied. Considering the induction of DVM behavior within the first 3 minutes for the light and fish treatment, focusing on those first 3 minutes could be interesting. For instance, a camera could be used to record the actual depth change of the individual *Daphnia* as they are exposed to the fish water. This could attempt to answer the question of how quickly *Daphnia* recognize the presence of the fish cue in the water. Additionally, a future study could utilize different dilutions of the fish water to see in what approximate concentration from the fish tank water it takes for the *Daphnia* to recognize the cue. Nevertheless, it could be difficult to isolate outside variables, as it is extremely difficult to isolate the alpha-CPS bile salt, which is not yet available commercially for dosage testing using measured concentrations (Hanes et al., 2019).

Another idea could be replicating aspects of Hannson and Hylander's (2009) study. Their methods inspired much of the current research; however, adding fish predators could benefit future studies. They utilized a fish predator in a net above a cylinder with *Daphnia* present within. This allowed active, natural secretion from a predatory fish of the bile salt that is thought to be the main kairomone that induces DVM. This could allow for more of a natural behavioral response from the *Daphnia*. Additionally, the study's main finding was that DVM behavior and predator response seem to be size-dependent (Hannson and Hylander, 2009). They found that the predatory fish preferred to eat larger individual daphnids, thus allowing the smaller individuals to stay closer to the surface in the presence of a predator during the day. This complete disregard for typical DVM behavior makes sense evolutionarily for the smaller *Daphnia*. Hannson and Hylander (2009) tested this size dependence by allowing two fish predators to feed for 60 minutes on a sample of *Daphnia* pre-measured into size classes. Then the surviving *Daphnia* were measured again, and the difference was compared. This could be replicated in future studies at Wagner College. Furthermore, the study's experimental

setup of their cylinders and light filters could inspire a future study examining the effects of light on DVM and the potential intersection of the two more closely.

Related to light exposure, a future study could examine when daphnids are able to detect light and what specific level of light induces DVM. This would be particularly interesting since the current study found that when daphnids were placed in the dark room they maintained a lower depth, and seem to show no indication of DVM. In nature, they rarely live in complete darkness, even at night. Furthermore, DVM is suggested to be a phototactic behavior, as they respond to the amount of light coming into the water to maintain their potential rhythm. Thus, it may be worth investigating this rhythm more closely to obtain a more precise answer of what role light plays in DVM versus kairomones. Also, research could be done comparing daphnids who had prior exposure to the physical presence of a visual predator versus those who had not. Their individual reaction times could be compared to see the influence of prior experience and how that shapes the daphnids' behavioral response rate.

From a different perspective, the temperature is also suggested to play a role in shaping DVM (Weiss, 2019; Ebert, 2022). This makes sense, because when the daphnids approach the water's surface at night, they feed and escape the colder, deeper water. It could be worth examining that role in future studies to see if there is a difference in behavior. Additionally, climate change is altering ecosystems and making bodies of water warmer. It would be intriguing to look at how DVM behavior is altered with bodies of water increasing in temperature, as well as the resilience of *Daphnia* to increasing temperatures considering their role as critical keystone species in their ecosystems (Ebert, 2022; Kalff, 2002; Schmitt, 1965). Not only are they an important food resource for planktivorous predators, but they are also filter feeders. Thus, if they cannot adapt to higher temperatures, bodies of water may suffer dirtier water.

A last suggestion for further research is potentially looking further into the physiological mechanisms and molecular pathways *Daphnia* utilizes to detect kairomones. This is becoming a growing focus of current research (Weiss, 2019). One way to examine this is with gene expression. One could modify a select group of daphnids with knockout genes that are hypothesized to be involved in the induction of DVM behavior. This could help target which gene or genes are involved.

<center>Summary and Conclusion</center>

In conclusion, the current research tested explicitly for changes in the vertical distribution of *Daphnia magna* indicative of DVM behavior in the presence of fish chemicals such as kairomones, compared with their vertical distribution in the absence of such chemicals in both the light and dark. This was done by exposing the daphnids to

bottled spring water or zebrafish (*Danio rerio*) tank water. Additionally, lighting conditions were varied in combination with the control and fish-treated water to see if a difference in behavior was apparent, considering the supposed modulating influence light has on DVM behavior. Then each subject's vertical distribution was observed over a period of 15 minutes.

Chi-square analysis showed *Daphnia* vertical distribution to be highly significantly ($p < 0.005$) skewed towards the bottom in the presence of fish chemicals compared with those tested in their absence when experiments took place under lighted conditions. The daphnids in the current research using zebrafish tank water responded within 3 minutes (or less) by moving downward in the test tube, indicating the chemical detection of the presence of a visual predator quickly. The light experiments displayed that *Daphnia* stayed lower in the water column during daylight hours than they would if they detected the chemical presence of visual predators such as fish. When there were no fish chemicals and was exposed to light, the *Daphnia* showed a different vertical distribution pattern in the water column. They may use light and their compound eye as a directional guide to orient up from down. Removing the light cues during daylight hours (the dark experiments) affected the vertical distribution of the cladoceran, perhaps by removing a directional cue that the daphnid could have used for orientation purposes and possibly removing a light-stimulated timing cue to direct their movement. Thus, the bottom-skewed distribution occurs with or without fish chemicals in the dark. Future research should continue to explore the several hypothesized factors that influence DVM and how they may interact to produce the final observed behavior.

VI. Acknowledgments

VII. References

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The Effect of Rising Interest Rates During High Inflation on the Lower Socioeconomic Class

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The current economy of the United States in the past 3 years has been in a volatile state with inflation on the rise. Due to the rise in prices, the Federal Reserve has responded by raising the federal funds interest rate to combat the high inflation. The rise in inflation and the federal funds can influence the spending of everyone. Previously, the spike in interest rates has more dominantly affected the spending of the lower socio-economic class whereas the upper socio-economic class did not change spending habits as intensely. The current rise in interest rates is less aggressive than in earlier years and effecting the different socioeconomic classes differently than it formerly did.

I. Introduction

The inflation in the United States and how the Federal Reserve responds with the federal funds interest rate are both very prevalent in the everyday life of an American. This paper will analyze how the rise in the federal funds interest rate during high inflation affects the different socioeconomic classes within the United States and, more specifically, how it negatively impacts the lower socioeconomic class. Over the past 20 years, the federal funds interest rate and inflation have fluctuated and affected how people spend their money, which can be seen in the data presented.

To represent the disparity in spending of socioeconomic classes when interest rates rise during high inflation, charts, and tables will be provided to give visual aid. The charts and tables will also provide analytical data on the change in the consumer price index, the federal funds interest rate, and the spending of the lower, middle, and upper socioeconomic classes. The tables will focus on the data presented on the variables. The charts will focus on the relationship between the variables. The variables will contribute to analyzing how the rise in interest rates during high inflation affects the socioeconomic classes. The rise and fall in spending by the different socioeconomic classes will portray if the lower socioeconomic class is most negatively affected by the rise in interest rates during high inflation. The spending that will be analyzed in the charts and graphs includes

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[1] Written under the direction of Dr. Shani Carter in partial fulfillment of the Senior Program requirements.

the largest segments of spending which includes food, housing, clothes, transportation, and entertainment. These segments are the largest portion of all socioeconomic classes' spending and portray an accurate comparison of each socioeconomic class.

All the variables will be assessed to determine if the lower socioeconomic class is the most negatively affected by the rise in interest rates during high inflation. The results of the analysis will show the disparity among the socioeconomic classes within the United States. The gap in income and spending will be highlighted in years of financial hardship for the country that includes high inflation, which in turn presents higher federal funds interest rates. The federal funds interest rate most dominantly affects loans from banks as the interest rises with the rates, making it more expensive to get loans. The spike in interest rates will become less affordable to those who are lower income and will overall affect their spending. As a graduate going into the banking sector, I find it important to identify the disparities between people with different incomes and eventually be able to provide solutions for people who are most negatively impacted by the economy in the United States.

II. Literature Review

Modern Money Theory

Modern money theory focuses on how government expenditures and taxation affect the economy (Hans, 2023). It implies that governments can and should manage their economies through fiscal policy, such as taxation and expenditure (Hans, 2023). The foundation of modern money theory is the idea that governments should be free to use spending and taxation as a means of achieving their objectives (Hans, 2023). This contrasts with conventional fiscal policy, which is predicated on the notion that governments should only spend money and impose taxes when essential to achieve budgetary balance (Hans, 2023). According to modern money theory, fiscal policy should be used by governments to attain full employment and price stability (Hans, 2023). It also contends that if they control the money supply and maintain a low inflation rate, governments can print money to finance spending without producing inflation (Hans, 2023).

Factors of spending money

Many factors affect the decisions of how people spend their money. Emotions can have a major effect on spending habits (Edwards, 2020). Stress in life is one of the main emotions that trigger spending. People tend to associate relief and happiness with new things, so to alleviate stress, people spend (Edwards, 2020). Tiredness and jealousy also increase spending (Edwards, 2020). When a person is tired, they tend not to think

about negative consequences, so when spending money, it does not process that it may be a bad decision (Edwards, 2020). People also can be very jealous by nature, so to try and compete with others, people spend more money (Edwards, 2020). People also tend to spend more money when they have the extra money to spend. Conversely, people also spend more money when they do not have spare money. All of these are factors that affect the human mind when deciding to spend money.

Variable expenses

Variable expenses are payments that vary from month to month and are not generally planned out but rather are impromptu expenses. (Lake, 2022). Variable expenses can include things such as gas, groceries, dining out, clothing, healthcare, and entertainment.

Fixed expenses

Fixed expenses are payments that are required each month and go along with general life. Examples of fixed expenses would be things such as rent, a mortgage, car payments, subscriptions, etc. (Lake, 2022). These expenses generally are the same amount each month. Fixed expenses are typically things that are non-negotiable when it comes to budgeting (Lake, 2022). For families and individuals, these are bills that are going to be sustainable such as housing and cars.

Money Spent

American citizens choose to spend their money on various things depending on their needs and financial standing (U.S. Bureau of Labor Statistics, 2023). People who have higher incomes will spend more money on extracurricular activities, whereas people with lower incomes will spend most of their money on necessities (U.S. Bureau of Labor Statistics, 2023). The income of people also influences how much money they spend on things such as houses, transportation, and clothing (U.S. Bureau of Labor Statistics, 2023).

Money spent on necessities

Money spent on necessities is similar to fixed expenses. The necessities of a person are things such as food and housing. Necessities can vary from person to person (Lake, 2022). Things such as cars can be a necessity for one person where it is not for another. One person may also require medical assistance or healthcare that is a necessity that another person may not require. These necessities are the most important when spending money and are a must when budgeting.

Budget for extracurricular activities

Depending on a household's income, most people will attempt to budget for extracurricular activities. These expenses come after a person has met all of the payments for their necessities. If a person spends on extracurricular activities without budgeting for the necessities, they will be in trouble (Lake, 2022).

<u>Socioeconomic status</u>

The term "socioeconomic status" refers to a person's or a group's place on the socioeconomic scale. This position is based on a variety of social and economic factors, including income, the level and type of education, the type and prestige of occupation, the location of residence, and, in some societies or segments of society, ethnic origin or religious background (Socioeconomic status). In the United States, socioeconomic status varies greatly and there is a large inequality within our country (Akhand & Liu, 2002). There have been arguments about the inequality of the wealthy continuing to become wealthier while those in poverty suffer and become poorer (2013). People have called for legislation to be proposed on aspects such as taxes to lower the inequality among the socioeconomic classes within our country (Akhand & Liu, 2002). Reducing inequality is one of the 17 Sustainable Development Goals of the United Nations. The US should consider this one of their goals in many aspects but especially in the disparity of wealth among the socioeconomic classes.

Income

The difference in income in the United States is drastic when looking at income in terms of socioeconomic class. The median income of the lower class is $25,624, whereas the middle class is $78,442 and the upper class is $187,872 (Elkins, 2019). Income affects the spending habits of people and other aspects of their life such as housing, transportation, and extracurricular activities (U.S. Bureau of Labor Statistics, 2023). The income of a family or person is highly dependent on their occupation and other forms of work (Elkins, 2019).

Housing

The income of families and individuals in the US has a large impact on the housing that they can afford (Jayashankar, Murphy, 2023). Ultra-wealthy individuals can afford multiple homes across the country, whereas low-income households are often in need of assistance from the government to afford housing (Cororaton, 2022). There is homelessness in the U.S., which can be observed in large cities such as Los Angeles and

New York. Many of those individuals go without housing at all and live on the streets in poverty (Jayashankar, Murphy, 2023).

Occupation

  The occupation of a person contributes immensely to their socioeconomic status due to the prestige and income their occupation provides (Fujishiro et al., 2010). People with high school degrees or less are more likely to be working in blue-collar jobs that pay less money status (Akhand & Liu, 2002). Those with college degrees are more likely to be in occupations that make more money and are considered middle-class status (Akhand & Liu, 2002). Further education such as master's, medical degrees, or law degrees tends to see people in higher-paying professions such as doctors, lawyers, and leaders within their companies (Akhand & Liu, 2002).

<center>Interest Rates</center>

  Federal funds Interest rates are set by the Federal Reserve (Basha, Zhang & Hart, 2021). The interest rates are based on the current economy of the country and rise and fall based on how the Federal Reserve views the current situation within the country (Basha, Zhang &Hart, 2021). When inflation is high, The Federal Reserve will raise the interest rates to reduce spending (Curry, 2023). By increasing the interest rates, the Federal Reserve predicts people are less inclined to borrow money because it will cost them more (Curry, 2023). When people are not borrowing money, they have less money to spend. This, in theory, is supposed to help combat inflation.

  When the economy is not doing well and spending is low, such as during the pandemic, the Federal Reserve will decrease interest rates to influence people to borrow more money and in turn, spend more money.

  The interest rates allow the Federal Reserve to control the economy in a sense and attempt to keep it from going into a recession (Basha, Zhang & Hart, 2021).

  Central banks can also influence the structure of interest rates (Deleidi & Levrero, 2021). By changing the amount of money available, central banks modify monetary policy. Typically, they do this by buying or selling securities on the open market. Short-term interest rates are impacted by open market operations, which in turn affect longer-term rates and the economy (Deleidi & Levrero, 2021). Monetary policy has a lasting impact on long-term interest rates (Monetary policy and central banking 2023).

Inflation

  Inflation is the overall increase in the price of goods and services across the whole economy (Jahromi, Mihai & Tongyang, 2023). Inflation affects the purchasing power of both consumers and businesses (2022).

Inflation can have a very large impact on an economy. When inflation rises, it becomes more difficult for people to buy goods and services (Jahromi, Mihai & Tongyang, 2023). The rise in the price of goods and services erodes the purchasing power of people and businesses (2020). The loss of purchasing power then negatively affects the economy because not as much money is being spent.

To fight inflation, the Federal Reserve will raise interest rates and make it more expensive to borrow money because the interest to borrow is higher. This encourages people to stop spending as much money and will cause the demand for goods and services to go down. When the demand for goods and services goes down, the prices also go down, thus, combatting inflation (Jahromi, Mihai & Tongyang, 2023).

The effect of COVID on inflation

During the pandemic, there were historic drops in output in almost all major economies. When the economy opened back up and the interest rates were low, people began to spend their money more. Demand for products was so low during the pandemic that when the demand rose after restrictions were lifted, businesses were not able to meet the demand of people, which caused the prices to rise. This caused the overall rise of inflation in the economy.

III. Hypothesis

H1: People in lower socioeconomic classes will be most negatively impacted by the rise in interest rates during high inflation.

IV. Method

<div align="center">Subjects</div>

Households across the United States who participated in the U.S. Bureau of Labor Statistics survey of consumer expenditures and income will be the subjects. Specifically, families who are considered in the upper socio-economic status, middle socio-economic status, and lower socio-economic status. I have chosen these subjects because they are all within the same country and subject to the same expenses represented on the survey.

Upper Class

The upper class in the United States economy is considered a family whose yearly income is greater than or equal to $156,600 annually (Social class in the United States 2016). People in the upper class are defined as adults whose annual household income is more than double the national median (Elkins, 2019). People who fall into the

upper-class category are typically college educated and many have advanced degrees such as master's, doctors, or lawyers (Elkins, 2019). People in the upper class are also those who hold leadership roles within American society (Elkins, 2019).

Lower Class

The lower class in the United States economy is considered a family whose yearly income is equal to or less than $52,200 a year (Social class in the United States 2016). People who fall into the lower class typically have jobs that require little prior skill or knowledge to do the tasks of their jobs (Social Class in the United States 2016). These jobs also rarely offer benefits such as healthcare and retirement planning (Social Class in the United States 2016). Most lower-class jobs pay the minimum wage, which in NYC is currently $15/hr. If an individual works 40 hours a week for 52 weeks of the year, their annual income before tax is $31,200.

<u>Variables and Instruments</u>

Variables

Variable 1: Federal Funds interest rate

This variable is used to show the differences in interest rates throughout the years and directly correlates to how people spend their money during the interest rates.

Variable 2: Spending of socioeconomic classes

The total expenses of each socio-economic class are measured through their spending on food, housing, clothing, transportation, and entertainment.

Variable 3: Inflation

Inflation is measured through the consumer price index provided by the U.S. Bureau of Labor and shows the fluctuation of prices in consumer goods.

Table 1: Hypothesis, Variables, and Statistical Analysis

Hypothesis	Variables			Hypotheses & Variable Relationships	Statistical Tests
	INTEREST RATE (IR)	SPENDING OF SOCIOECONOMIC CLASSES (S)	INFLATION (I)		
H1	(IR)	(S)	(I)	I=IR=S	correlation; regression; line charts
Adapted from: Rudestam, K.E. & Newton, R.R. (1992). Surviving Your Dissertation. Newbury Park, California: Sage Publications, Inc. page 138.					

Table 2: Detail About Variables

Data	Variables		
	INTEREST RATE (IR)	SPENDING OF SOCIOECONOMIC CLASSES (S)	INFLATION (I)
Instrument / Survey	Average Federal Funds Interest Rate	Consumer Expenditure Survey	12-month percentage change, Consumer Price Index, selected categories
Author / Publisher	U.S. Bureau of Labor Statistics	U.S. Bureau of Labor Statistics	U.S. Bureau of Labor Statistics
Type of data	Quantitative	Quantitative	Quantitative
Range of scores	0.08-5.02	0-100%	-4.2-8.02
Adapted from: Rudestam, K.E. & Newton, R.R. (1992). Surviving Your Dissertation. Newbury Park, California: Sage Publications, Inc. page 140.			

Procedure

Procedure to Locate Journal Articles and Data

As of February 2023, all information was gathered from the Business Source Premier database. I utilized search terms like inflation, interest rates, socioeconomic classes, and income by class to find and compile my data. I only displayed peer-reviewed literature from the past 20 years in my search results.

I selected peer-reviewed studies published over the previous 20 years to acquire precise and up-to-date information about socioeconomic classes and the impact of interest rates. The articles I selected demonstrate the connections between all three variables and will aid in addressing both hypotheses. To draw conclusions, I will also be able to assess how inflation, socioeconomic spending, and interest rate fluctuations all connect to my theory.

I acquired additional information from more recent papers published within the last five years in addition to the peer-reviewed sources I found in the databases. I selected these articles so that I could obtain precise data on the income of socioeconomic classes. The interest rate fluctuations are also covered in certain publications by reliable sites like US Labor Department. I found these sources using Google Scholar, and I used the same search criteria as I used for the database search.

Statistical Methods to Present and Analyze the Data

I will produce graphs and line charts to show the correlations between inflation and interest rate fluctuations and how that affects socioeconomic class's spending after I have finished my analysis of the data that has been provided.

V. Results

<div align="center">Inflation</div>

Table 1 contains data on the average CPI from the years 2003 to 2022. For example, in the
year 2003, the inflation percentage was 2.25%.

<div align="center">

Table 1: Yearly average

Year	Yearly % Increase in Inflation
2003	2.25
2004	2.68
2005	3.38
2006	3.23
2007	2.86
2008	3.85
2009	-4.20
2010	1.63
2011	3.16
2012	2.08
2013	1.48
2014	1.66
2015	0.13
2016	1.26
2017	2.12
2018	2.45
2019	1.82
2020	1.23
2021	4.70
2022	8.02

Source: U.S. Bureau of Labor Statistics

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<div align="center">Federal Funds Interest Rate</div>

Table 2 contains data on the average Federal Reserve interest rate by year from 2003 to
2022. For example, in 2003, the average Federal Funds interest rate was 1.13.

<div align="center">

Table 2: Average Federal Funds interest rate 2003-2022

Year	Average rate
2003	1.13
2004	1.35

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2005	3.21
2006	4.96
2007	5.02
2008	1.93
2009	0.16
2010	0.18
2011	0.10
2012	0.14
2013	0.11
2014	0.09
2015	0.13
2016	0.40
2017	1.00
2018	1.83
2019	2.16
2020	0.38
2021	0.08
2022	1.68

Source: U.S. Bureau of Labor Statistics

<u>Socioeconomic Class Spending</u>

Table 3 contains data on the percentage of total expenses by each socioeconomic class in the categories of food, housing, clothes, transportation, and entertainment. For example, of the total expenses in 2004, the lower class accounted for 20%, the middle class accounted for 35%, and the upper class accounted for 45%.

Table 3: Percent of total expenses by socio-economic class 2004 -2021

Year	Lower	Middle	Upper
2004	20	35	45
2005	18	33	48
2006	16	32	51
2007	17	32	51
2008	18	31	51
2009	18	32	50
2010	18	32	50
2011	18	31	51
2012	18	30	52
2013	19	30	51
2014	18	29	53

2015	17	27	55
2016	17	28	56
2017	16	27	58
2018	15	26	59
2019	14	26	60
2020	14	25	61
2021	14	24	62

Sources: U.S. Bureau of Labor Statistics

Figures 1 and 2 show the relationship between the Federal funds interest rates and inflation from the years 2003 to 2022. For example, in 2003 inflation was at 2.25% while the interest rates were at 1.13%. Figure 3 shows the relationship between the socioeconomic class's expenses percentage and the rise in the Federal Funds interest rate. For example, in 2004, the interest rate was at 1.35 and the lower-class percentage of expenses was 20%, the middle class was 35%, and the upper class was 45%.
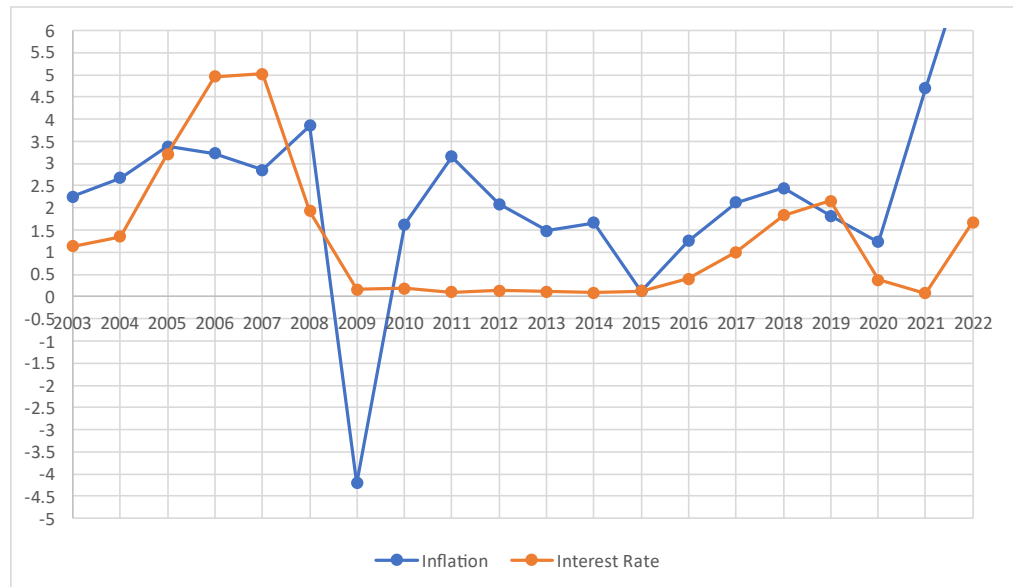

Figure 1 Correlation between inflation and interest rate percentages line chart
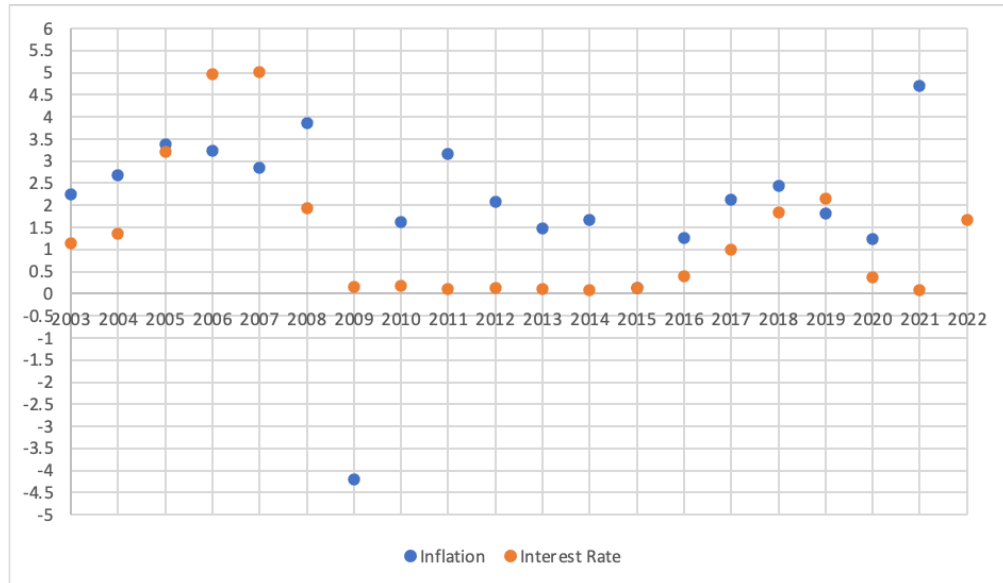Source: U.S. Bureau of Labor Statistics

Figure 2 Correlation between inflation and interest rate percentages scatter chart

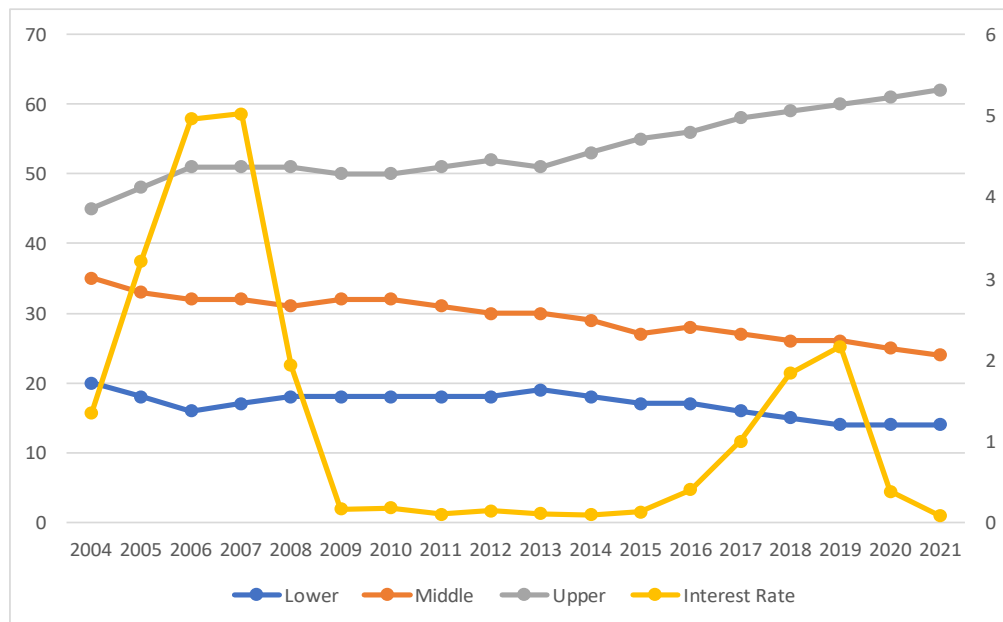Source: U.S. Bureau of Labor Statistics

Figure 3 Correlation between interest rate and socioeconomic class expenses

Source: U.S. Bureau of Labor Statistics

VI. Discussion

        In my hypothesis, the spending of socioeconomic classes, inflation, and the federal funds interest rates were analyzed to determine if the rise in the federal funds interest rate during high inflation negatively impacted the lower socioeconomic class. In table 1, the yearly average percentage change in the consumer price index is shown for the years 2003 to 2022. This table is used to show the change in inflation through the represented years and depict the years when inflation was high. Table 2 contains data depicting the federal funds interest rate through the years 2003 to 2022. This data was used to show the fluctuation in the federal funds interest rate throughout the represented years. Figure 1 was then used to show the relationship between inflation and the federal funds interest rate. When looking at figure 1, when inflation rises the interest rate soon follows with a rise apart from 2012 to 2015 when the interest rate remained low, and inflation rose slightly to between 1.5 and 3. It is evident in figure 1 that inflation directly affects the federal funds interest rate. For example, in 2005 when the inflation rose to 3.5 and eventually to 4 in 2008, the interest rate rose with it most notably in 2005 and 2006 when it went up to 5 and remained there until 2007. Conversely, when inflation dropped significantly in 2009 the interest rate also followed at nearly 0 and remained there for multiple years. The data in table 1 and table 2 along with figure 1 directly show the relationship between the rise in inflation and the federal funds interest rate.

        Table 3 shows data collected from the U.S. Bureau of Labor Statistics on the expenses of the socioeconomic classes. The expenses are a culmination of food, housing, clothes, and transportation. The table represents the percentage that each class spent on total expenses. For example, in 2004, of the total expenses between all the classes, the lower class accounted for 20% of the expenses, the middle class was 35%, and the upper class was 45%. This table was used to represent the spending of each socioeconomic class through the years 2004 to 2021. The data seen in table 3 was then used to show the relationship between socioeconomic class spending and the rise in the federal funds interest rate in figure 2.

        In figure 2, the left y-axis depicts the percentage of total expenses of each socioeconomic class whereas the right y-axis shows the federal funds interest rate. Both sets of data are from the years 2004 to 2021. This figure was used to determine if there was a relationship between how each socioeconomic class spends their money based on what the federal funds interest rate was. The hypothesis states that the lower class is most negatively affected by the rise in interest rates, but the data does not completely represent that. In 2006, the data shows that when interest rates hiked close to 5%, the lower class's spending did drop slightly from 18% to 16% from 2005 to 2006. Conversely, from 2005 to 2006 when the rates spiked, the upper class's spending rose from 48% to 51%. These data

points are supportive of the hypothesis as it is evident that overall, the lower class's spending dropped due to affordability whereas the upper class began to spend more money because they have accessible extra money to afford the rise in prices. The next hike in interest rates can be seen from 2017 to 2019 when they rose from nearly 0 up to close to 2. This is where the discrepancy in spending is not as evident. There is not a noticeable change in the pattern of spending between any of the classes during this rise in interest rates. All of the socioeconomic classes follow the same pattern in which they had been previously during times of low-interest rates. The upper class continues to slightly increase spending and the middle and lower class remain on a very gradual slope of less spending. During these years, it is not a large enough change in spending habits to determine that the rise in interest rate from 0% to 2% affected one class more than it did another. The discrepancy in the years 2016 to 2019 compared to 2006 and 2007 could be due to the smaller change in interest rates. In 2006 and 2007 when the spending changes of the classes is more prominent, the interest rates took a larger change, nearly 4%, whereas it was only about 2% from 2016 to 2019. The smaller change from 2016-2019 may not have been a large enough change to really affect the spending of any of the classes whereas it was more prominent when the rates spiked 4% previously. Due to this data, the hypothesis cannot be proven wrong or correct as the data can both support and contradict the hypothesis.

VII. Conclusions

General Conclusions

The data and information presented in this paper can neither prove nor disprove the hypothesis. Some data shows the spending of the lower socioeconomic class can be negatively impacted by the rise in interest rates which were shown in the early 2000s. There is also data presented from 2016 to 2019 that there was not a negative effect on the lower socioeconomic class when interest rates rose slightly. The rise in interest rates during high inflation never benefitted the lower socioeconomic class but did not negatively impact it consistently to prove the hypothesis correct.

Implications for Practice

Based on the conclusion of the data presented, the implications for practice can be directed mainly toward bankers and real estate agents. Bankers and real estate agents are targeted because large loans such as mortgage and car loans will be most affected by the rise in the federal funds interest rate. Therefore, bankers and real estate agents can expect that in times of high inflation and rising interest rates, people with low income will not be looking at purchasing homes or cars due to the extra expense of the higher interest.

Implications for Research

Following the conclusions of the data presented, future research can be done that focuses more on the specific spending sectors of the socioeconomic classes. When looking at the spending of the socioeconomic classes, there was more disparity in where people spent their money during high-interest rates. It was evident that the entertainment segment varied more than the other segments based on inflation and interest rates because entertainment is a variable expense. Future research should look into where the money is spent rather than the overall spending.

Limitations of Research

Limitations of the research included the data analyzed. The U.S. Bureau of Labor did not specify who the people surveyed for the spending was. This made it difficult to get accurate information because not all participants were exposed to the same expenses. People from New York City are subject to higher expenses than those in more rural areas. This limited the accuracy of the data provided.

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Influence of Empathetic Management
on Unionization in the Workplace

Joy Mei Muller (Business Administration)[1]

Trust is the cornerstone of organizational relationships, rooted in the formation of empathy. Merriam-Webster defines empathy as the capacity to understand or feel what another person is experiencing within their frame of reference or to place oneself in another's position. This thesis will analyze the prosocial behavior of managers and organizations and its effect on employees forming a union. This research will test how empathetic management can be integrated as a critical part of an organization to optimize and decrease the number of unions formed. The study will determine empathy's role in manager and organization leadership and employee unionization. Companies such as Amazon, Starbucks, and Google are rated as one of "Fortune's 500 Best Companies to Work For". However, the increasingly recent winning percentage of unions within top-rated companies proves to say otherwise. A literature review of these cases will explore whether empathy or lack thereof, has anything to do with this labor movement. Do managers or companies lacking empathy lead employees to form a union?

I. Introduction

With new graduates entering the workforce, there is often a fear of impressing the boss or getting along with senior coworkers. This paper will analyze undesirable work environments employees face in Fortune 500 companies, ultimately leading to increasing union formation. Over time, employees have found their voice with the number of union elections on the upward tick.

This thesis is important because managers or organizations should be more empathetic towards their employees by developing strong, peaceful, and justifiable institutions acknowledged by the United Nations Sustainable Development Goals. It is highly impactful for employees to see Fortune 500 organizations recognize sustainable development goals. This concept will be analyzed further throughout this paper.

To portray the image of empathetic management and unions, tables and figures will be implemented to show readers visually how the lack of empathy will lead employees to form a union. These tables and figures will focus on the treatment of individuals, the

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[1] Written under the direction of Dr. Shani Carter in partial fulfillment of the Senior Program requirements.

number of union elections, and the winning percentage of unions. All these variables exemplify how managers or companies who lack empathy will lead employees to form a union. With the percentage of union elections won steadily increasing, this follows the ideology that managers or companies who lack empathy will steer employees to create a labor movement.

All the variables concerning managers or companies who lack empathy will be examined, leading employees to form a union. The presence of empathetic management is crucial to show that employees are respected and valued within a company. Each manager and company have its strengths and weaknesses, but employees will feel undervalued with the lack of empathy in the workplace. As graduation approaches for young adults, they must see managers and companies who understand their frame of reference within the workplace.

II. Literature Review

Expectancy Theory

The Expectancy Theory of Motivation describes an employee's cognitive process to make choices that will lead to the best personal outcome (Lloyd & Mertens, 2018). Employees who expect a level of effort will achieve the desired level of performance. Employees expect performance to lead to specific desired outcomes, such as rewards or benefits (Starke & Behling, 1975).

Furthermore, the Expectancy Theory explains how employees perform based on their expectations. For example, employees read their company's human resource pamphlet of standards and regulations and then apply their standards (Colquitt et al., 2019).

Factors that Affect Expectancy Theory

Motivation is a set of energetic forces that originates within and outside the employee, initiates work-related effort, and determines its direction, intensity, and persistence (Colquitt et al., 2019).

However, it is essential to note that individuals can have different motivations at the same level (Kollmann et al., 2020). For example, consider two students taking an accounting course—student A is taking it to gain knowledge for a CPA exam, and student B is taking the course as a requirement (Colquitt et al., 2019).

Upward influence refers to the attempt made by a subordinate or coworker to secure a desired response from a boss (Russell, 2019). Upward influence is essential in an organization because an individual's knowledge transfers from other employees, including the supervisor and direct reports (Colquitt et al., 2019). For example, an

employee should find work that elevates the manager or supervisor. Upward influence is significant because it initiates critical thinking in the organization to take a fresh perspective or look at a task or decision (Moore et al., 2020).

By implementing upward influence and empathetic management, managerial effectiveness will allow for effective and stable relationships in which employees will encourage themselves and others (Moore et al., 2020). Empathy is the action of understanding, being aware of, being sensitive to, and vicariously experiencing the feelings, thoughts, and experiences of another ("Empathy", 2023).

However, if the employer fails to learn its employees' motivations within the organization's social context, it could be costly and destructively work against the firm (Lloyd & Mertens, 2018). For instance, it may lead to the formation of unions. Organizations may prevent the formation of unions by creating a positive and creative environment rooted in empathy and intuitively establishing motivated employees (Brower, 2021).

Managers or organizations should be aware of the work environment's social context that drives employees' motivations and social behaviors when providing incentives in the negotiation process (Lloyd & Mertens, 2018). In addition to motivation, factors such as self-efficiency, instrumentality, and valence shape an individual's expectancy (Colquitt et al., 2019).

Employees' expectations and standards should be higher than their boss's (Lloyd & Mertens, 2018). If the expectancy theory is applied correctly, it takes the responsibility away from managers releasing stress and burden (Moore et al., 2020). For instance, an employee should cut out the intermediary and not email to ask what is expected of a task--instead, it should be up to the individual's job standards (Swain et al., 2020).

According to Brower, individuals setting their standards in an empathetic environment increases organizational innovation and learning (2021). For instance, 61% of employees reported that to develop innovative ideas, such as preprogrammed questions before a meeting challenging the whole organization to take a "fresh look" to maximize decisions (Brower, 2021).

Self-efficiency

Self-efficiency is an essential factor when referring to an individual's expectancy. Self-efficiency refers to the belief that one has the attributes and capabilities to execute a required task (Colquitt et al., 2019).

In addition, being knowledgeable about oneself will increase self-confidence and self-esteem regarding a task (Russell, 2019). The knowledge of one's efficiency is dictated by factors such as past experiences, observations, or emotional cues (Lloyd &

Mertens, 2018). For example, consider a free throw shot in basketball. An individual is highly likely to make it because of increased practice shots and close distance (Swain et al., 2020).

Instrumentality

Instrumentality is an individual's belief that specific outcomes will lead to attaining other outcomes (Starke & Behling, 1975).

In addition, instrumentality is a low level of trust or belief that meeting an objective will result in a desired outcome (Swain et al., 2020). Employees most likely need to perceive a high level of instrumentality in the workplace, and good performers will begin to expect rewards. They may look elsewhere if a company does not provide them (Colquitt et al., 2019). For example, it is likely for employees to trust they would receive a bonus for completing a project if a manager delivered on the action in prior years (Swain et al., 2020).

However, empathy may play a part in increasing instrumentality (Lloyd & Mertens, 2018). For instance, 76% of employees experienced empathy from their managers, compared to 32% who experienced less empathy, reported feeling more engaged in their organization (Brower, 2021).

Valence

Valence refers to the degree to which an individual prefers outcomes associated with performance (Lloyd & Mertens, 2018). According to Starke and Behling, two types of valences exist in Vlad Vroom's Expectancy Theory: (1) an individual's subjective perception that certain activities will lead to desired outcomes and (2) the outcomes viewed as desirable by the individual (1975).

Additionally, an individual's desirable outcomes foster extrinsic and intrinsic motivation (Lloyd & Mertens, 2018). Extrinsic motivation refers to controlled motivation depending on task performance, while intrinsic motivation is felt when task performance serves its reward (Colquitt et al., 2019).

Equity Theory

The Equity Theory of Motivation states that an individual's cognitive motivation is based on their output ratio to inputs compared to other workers' ratios (Greenberg, 1988). One motivator of the Equity Theory is trying to be fair (Swain et al., 2020). There are two critical factors when considering the equity theory: inputs and outputs (Greenberg, 1988). The equity theory suggests that individuals create a "mental ledger" of their inputs and outputs (Colquitt et al., 2019).

However, a "mental ledger" may expand the gap between employers and employees (Colquitt et al., 2019). For example, if inequity exists in an organization, employers may ask employees to reduce their output-to-input ratio (Swain et al., 2020).

Inputs of Equity Theory

The Equity Theory is based on the idea that individuals compare their inputs and outcomes to others to determine whether they are treated fairly (Colquitt et al., 2019). Inputs of the Equity Theory refer to things an employee does to help an organization achieve a goal ("Adams' Equity Theory…", n.d.). For instance, inputs such as training or education. Furthermore, inputs of the equity theory may be recognized as an element of equitable treatment within an organization (Greenberg, 1988). Inputs are essential because they add an employee's value to a task. Furthermore, employees who feel they are being mistreated compared to others may take action to restore equity, such as forming a union (Swain et al., 2020).

In addition, a sense of inclusivity and fairness should be established within an organization because it will ensure the best levels of motivation and engagement between manager and employee ("Adam's Equity Theory…", n.d.). For example, 50% of employees with empathetic managers reported that their workplace was inclusive, compared to only 17% whose managers were less empathic (Brower, 2022).

       Training. Training is a systematic effort by organizations to facilitate the learning of job-related knowledge and behavior (Colquitt et al., 2019). Training provides an incentive for people in the organization to learn more. Research shows that 40% of employees will leave their position in the first year if they do not receive the necessary job training (Bressler et al., 2019). Furthermore, companies with 100 to 500 employees provided only six minutes of manager training, compared to companies with less than 100 employees, which provided twelve minutes in six months (Bressler et al., 2019, as cited in Freifeld, 2018).

In addition, mental health plays a huge role in training and job quality. According to Brower, 67% of people are experiencing an increase in stress, 54% are mentally exhausted, and 20% are taking longer to finish tasks (2021). Managers or companies should assign daily mindfulness training to combat mental health because employees are likelier to report more helping behaviors over five days (Hafenbrack et al., 2020).

Some may argue that training is costly for organizations. More cost-effective methods for training are founded on soft tactics that depend on a manager's ability to identify an employee's motivation (Russell, 2019). For instance, there is a difference between an employee motivated to learn and working to get a salary (Colquitt et al., 2019). So, how do managers differentiate motivation in employees? Managers may

isolate their employees with a task to get to know how an employee thinks, their commitment, or if they are trying to climb the ranks (Hafenbrack et al., 2020).

      Education and Experience. Education is gaining knowledge through instruction, while experience is gaining knowledge through practical participation or observation.

      Many managers and companies rely on an individual's education and experience to support their business for a superior rating (Bressler et al., 2019). For example, a recent survey of 50,000 employers found a desire for education and experience from potential candidates ("Education vs. experience…", 2019).

      However, companies may require a specific degree for a job description. Requiring a certain degree is a mistake because training a bachelor's degree candidate is more cost-saving than hiring an individual with a master's degree (Colquitt et al., 2019). Managers or companies should evaluate job descriptions semi-annually so employees can move to positions where they will shine best (Colquitt et al., 2019).

      Additionally, the experience or education of an individual may not be as relevant as their creativity or adaptability for an organization. Managers should seek employees based on what they see in the future for the organization (Bressler et al., 2019). For example, managers or companies can recruit adaptable individuals by devising a questionnaire for potential candidates that asks them to come up with three or four ways to sell "X" (Bressler et al., 2019). If individuals can think on their feet and quickly devise a plan, they will most likely adapt to a speedy market.

      Furthermore, while it is true that hard skills are essential to specific industries, managers or companies should seek soft skills in new employees, such as multitasking, prioritizing, and interpersonal strengths ("Education vs. experience…", 2019).

Outputs of Equity Theory

      The outputs of Equity Theory are broken down into two groups: tangible and intangible (Colquitt et al., 2019). Tangible outcomes are measurable such as benefits, pay, or commitment. Intangible outcomes include status, reputation, or job security.

      In addition, the workplace environment is constantly evolving. Organizations must find ways to create work environments that satisfy the needs of their employees of different age groups (Kollmann et al., 2020). According to Greenberg, employees feel satisfied when they feel that what they receive from a manager or company is deserved in proportion to what they give to the organization (1988).

      Tangible Outcomes. Tangible outcomes are typically items managers or companies can measure, such as pay. The value of money is a powerful motivator in jobs. Many individuals view the value of money differently. For example, some employees see

money as a means to express power and prestige, while others see money as a means of living (Kollmann et al., 2020). Furthermore, if employees know their payment will be temporary, they may need more motivation to sustain the same high-level performance (Greenberg, 1988).

However, pay or money may not be the most wanted or highest motivator within organizations (Colquitt et al., 2019). Benefits and perks are sought more than salary (Weir, 2018). For example, an organization offering a benefits package based on a point system where individuals choose what type of benefits they need or want (Kollmann et al., 2020). Furthermore, a benefits package based on a point system will give an employee 'skin in the game,' most likely making the individual feel valued and treated fairly ("Adam's Equity Theory…", n.d.).

Intangible Outcomes

Intangible outcomes are not measurable or things a manager or company cannot calculate on a spreadsheet. The intangible outcomes are more important because they empower employees and motivate them to perform at their best (Weir, 2018). Many managers and employees focus on tangible outcomes, such as benefits or pay.

However, transformational leaders are managers or companies who are agile and adaptable to a changing market or environment. Transformational leaders are individuals who manage change well. Companies should be more transformational to prevent unions (Colquitt et al., 2019). Transformational leaders tend to focus on intangible outcomes over tangible outcomes because they seek to enhance the motivation and morale of employees while identifying changes needed in the organization (Bressler et al., 2019). For example, decentralized companies let each department and individual plan their goals to support the more major company initiatives (Weir, 2018). Furthermore, transformational leaders will heighten their employees' awareness of specific outcomes while increasing their confidence (Colquitt et al., 2019).

Of millennials, 26% say recognition motivates them to do their best work (Bressler et al., 2019). Employees who are 'status strivers' reflect a strong desire to obtain power and influence the company's structure to express their personality (Colquitt et al., 2019). One study found that personality is a reputation from outside the individual, mediated by the influence of individual differences on career success and satisfaction (Dietl & Blickle, 2017).

Emotional cues such as fear or anxiety can affect an employee's motivation and reputation. Emotional cues are feelings that boost confidence or create doubt about task accomplishment (Colquitt et al., 2019). Everyone is scared to death to find out they are not good enough, no matter how confident they seem. Furthermore, every manager and

company could benefit from measuring the personality or reputation of its employees (Dietl & Blickle, 2017).

In addition, managers' and companies' status and reputations are paramount. According to Denise Wilkerson, the HIRE author with FIRE, candidates will remember how they were treated during the interview, impacting your and your company's reputations (Bressler et al., 2019).

Job security is rooted in seniority in most companies. An employee who seeks job security most likely values freedom or autonomy. It is essential to note the meaning of freedom or autonomy within an organization. Essentially, autonomy does not exist in companies because, most of the time, employees are guided by managers or organizations (Colquitt et al., 2019).

Instead, an intangible outcome an employee should seek is growth. Growth means moving or leaning toward a direction forward. Furthermore, growth presents new business opportunities for employees and managers or companies (Bressler et al., 2019)

Additionally, access is essential in the context of growth. Access refers to an employee's exposure to important meetings or individuals (Dietl & Blickle, 2017). For instance, watching a crucial meeting means something to that employee for no cost, except maybe a cup of coffee (Colquitt et al., 2019).

However, managers or organizations should allow employees to gain better perspectives about the company in more cost-efficient ways to improve job security and growth (Dietl & Blickle, 2017). For instance, managers may implement team-building exercises that cross-train employees or may offer anonymous surveys before a monthly review comes out (Colquitt et al., 2019).

<div align="center">Empathetic Management</div>

According to Martinovki, empathy is the capacity to understand or feel what another person is experiencing and adopt an alternative perspective (2007). Trust refers to the willingness to be vulnerable to an authority based on positive expectations about the authority's actions and intentions (Colquitt et al., 2019). The involvement of trust rooted in the formation of empathy encourages collaborative behavior (Kalshoven et al., 2013). It may lead to a planned or desired outcome-seeking to maximize both parties and create a win-win relationship (Martinovki et al., 2007).

Some may argue that empathetic management is a problem. These individuals state that empathetic management is not a company policy, as empathy is an attribute between employee and manager (Colquitt et al., 2019).

However, empathy drives significant business results (Brower, 2021). Managers who develop empathy as a skill create an employee-centric work environment that transforms

the organization's culture (Moore et al., 2020). For example, empathic accuracy mediates prosocial orientation and career satisfaction (Cote et al., 2011).

Empathy is necessary for an organization because employees experience multiple kinds of stress and expect the boss to be the expert (Brower, 2021). A manager who develops empathic leadership encourages collaborative ideas and autonomy (Moore et al., 2020). Collaborative ideas and autonomy lead to innovation and adaptability in a changing business environment (Kalshoven et al., 2013). For instance, in a study of 899 employees by Catalyst, 61%, compared to 13% of employees, reported they were more innovative with empathic leaders (Brower, 2021).

The perception of fairness also plays a role in empathetic management (Colquitt et al., 2019). Employee motivation will most likely suffer from those who do not feel valued or treated fairly (Swain et al., 2020).

Empathetic management shows employees how meaningful their work is to the organization. For instance, managers may offer an employee to walk to meet the Vice President of Finance, who gets the employee's report every month (Colquitt et al., 2019). Managers or companies implementing empathetic management create an environment or atmosphere where employees are acknowledged at every level (Dietl & Blickle, 2017).

According to Levinson, management by objectives is self-defeating and increases pressure on the individual (2003). Managers must learn how to manage effectively. For example, managers should be taught to manage the outcome rather than their employees (Colquitt et al., 2019).

A high level of empathetic management will encourage employees to be more courteous and helpful throughout the organization (Kalshoven et al., 2013). A pooled mutual advantage between employees and organizations' is met when the employee's needs and the organization's requirements are synergistic (Levinson, 2003). According to Brower, managers or companies are the most successful when they consider others and when they, express their concerns or inquiries and listen to employee responses (2021).

Treatment of individuals

This thesis examines the treatment of employees in Fortune 500 companies to discover the reason behind increasing union booms. Managers should treat their employees under ethical leadership, which includes being concerned for others, allowing voice, and demonstrating consistency and integrity (Kalshoven et al., 2013).

Managers and companies need to feel comfortable with different employees—for instance, age or skill levels, not necessarily race or ethnicity (Colquitt et al., 2019). For example, in a 20-item sub-scalable Mayor-Salovey-Caruso Emotional Intelligence Test (MSCEIT), managers' and companies' empathic accuracy and agreeableness in power

conditions were optimistic (Cote et al., 2011). A positive relationship where managers learn how to influence and treat their employees in all directions, becoming well-rounded leaders (Russell, 2019).

Additionally, employers are not allowed to retaliate against employees who decide to join or form a union. According to the Department of Labor, employers cannot cut wages or fire employees for unionization efforts (2023). Employees can file an unfair labor practice charge alleging their employer violated the labor law ("National Labor Relations Board", 2023).

A recent study showed that in two out of every five organizing campaigns, employers are charged with engaging in unfair labor practices and retaliating against pro-union employees in one out of five campaigns ("U.S. Department of Labor", 2023). Furthermore, federal labor officials have stepped up legal challenges accusing high-profile employers of unfair labor practices (Hsu & Selyukh, 2022). High-profile employers like Amazon and Starbucks have denied accusations (Logan, 2022).

Amazon. Amazon, one of the world's largest employers, has faced criticism for its treatment of employees. According to Merriam-Webster, unionization refers to uniting or joining two or more things into one ("Union", 2023).

Amazon has been accused of violating multiple labor laws and using aggressive tactics to prevent its employees from unionizing (Scheiber, 2023). These violations range from unsafe working conditions to anti-union practices (Logan, 2021). The issue of Amazon's treatment of employees remains a highly contentious and polarizing issue as high-profile unionization drives steadily increase. Proponents of unionization argue that employees deserve better treatment and more representation in the workplace (Kantor &Weise, 2022). At the same time, opponents argue that unionization could harm a company's competitiveness and hurt employees in the long term (O'Brien, 2022). Despite opinions, in recent years, there have been several attempts by Amazon employees to unionize.

The first notable effort of Amazon employees took place in early 2021 in Bessemer, Alabama (Logan, 2021). Some Amazon workers have accused the company of unfair labor practices, such as anti-union practices. Anti-union practices include illegally threatening to hold wages and benefit increases if an employee chose to unionize and promised programs to subsidize educational expenses if an employee did not choose to unionize (Scheiber, 2023). Amazon employees sought to form a union with the Retail, Wholesale, and Department Store Union (RWDSU) (O'Brien, 2022). The vote ultimately failed, with 1,798 workers voting against unionization and 791 employees voting in favor (Logan, 2021).

However, RWDSU challenged the results claiming the company has engaged in anti-union tactics and that the votes should be overturned (Scheiber, 2023). The National Labor Relations Board brought attention to the matter by holding hearings but rejected the RWDSU's challenge in April 2021(Weise & Scheiber, 2022).

Another Amazon warehouse, known as JFK8, located on Staten Island, NY, followed Alabama with a landmark win for its employees. The warehouse has more than 8,300 workers, 2,654 of whom cast votes to be represented by a union and 2,131 against, giving the union a win by more than 10% (Weise & Scheiber, 2022). In weeks before the elections, Amazon summoned employees to an anti-union meeting to emphasize the costs of union dues and threatened workers that they might end up worse off under a union (Scheiber, 2023). The treatment of Amazon employees caused the company to have high turnover rates (O'Brien, 2022).

The result is a milestone for Amazon employees and the broader labor movement in the United States. It is the first union in the tech giant's twenty-seven-year history (Weise & Scheiber, 2022). The union vote can upend how Amazon, the country's second-largest private employer, engages with some members of its vast workforce (Scheiber, 2022). President Biden has also spoken out about unionization and is glad to see workers ensure their voices are heard (O'Brien, 2022).

    Starbucks. Starbucks, an international coffee retailer, has one of many companies under the microscope as its employees have sought to unionize. Unionization typically arises when employees do not feel their employer treats them fairly. Some Starbucks employees have reported feeling overworked, underpaid, and lacking job security ("Starbucks Union…", 2022).

The pandemic was also a driving factor in the Starbucks campaign, where workers felt abandoned by management as the team was understaffed and did not have proper safety precautions (Logan, 2022).

The current Starbucks unionization movement began in Buffalo, New York, in December 2021, where employees have expressed concern about limited opportunities in the company, lack of benefits, and unpredictable scheduling practices (Maruf, 2021). Starbucks Workers United (SWU) has created economic and non-economic proposals alongside Starbucks Partners and Workers United Upstate. Some non-economic proposals include the right to organize without fear, seniority rights, and non-discrimination, while economic proposals include better compensation, such as a $15 per hour starting wage ("Starbucks Union…", 2022).

In response, the company ran multiple illegal anti-union efforts. The National Labor Relations Board found that Starbucks unlawfully fired union activists, spied on workers, and offered unlawful benefits to discourage unionization (Logan, 2023).

Additionally, employees see others succeed in forming a union and get the courage to form one. The company's anti-union efforts did not discourage its workers, as more than 250 Starbuck stores are unionized ("Starbucks Union…", 2022). For instance, following Buffalo, a Mesa, Arizona store union won by a 25-3 vote in one of the most conservative cities in America (Logan, 2022).

Some critics of the labor movement have pointed to the small size of Starbucks stores that make it easy to win elections ("Starbucks Union…", 2022). While this may be true, more than 70% of National Labor Relations Board union elections won every year are in small units (Logan, 2023). Proponents of Starbucks' campaigns have argued that unionization provides employees with a stronger voice and protects them from retaliation or discrimination (Logan, 2022).

Additionally, with the labor movement increasing, many investors in these companies may benefit. For example, unions generally help employees receive better benefits, which means fewer profits for the company ("Starbucks Union…", 2022).

Google. Employees of Google, one of the largest technology companies, have decided to join the union boom after years of activism. Google employees are among the best-paid workers across America, with a median pay of $258,708 (Needleman, 2021).

However, in January 2021, a group of Google employees formed the Alphabet Workers Union (AWU) (Cogner, 2021). Alphabet Workers Union comes from Google's parent company and holds more than 600 employees with the support of Communications Workers of America (Allyn, 2021). The unionization effort at Google has gained momentum since 2018 when 20,000 employees worldwide staged a walkout to protest the company's actions to protect sexual harassment perpetrators (Allyn, 2021).

In addition, employees also criticized Google's controversial involvement with an AI Initiative known as Project Maven. Employees were critical of the company's work with the Defense Department on Project Maven because the company planned to explore censored search engines for Chinese citizens (Cogner, 2021). According to Fung, Google employees stated that the company has collaborated with repressive governments, profited from ads by hate groups, and failed to make the changes necessary to retain people of color (2021).

Additionally, the Alphabet Workers Union quickly boomed after Google fired a Black researcher, Timnit Gebru, who examined the ethics of artificial intelligence and criticized the diversity efforts at Google (Needleman, 2021). Gebru's firing erupted more than 2,600 employees to sign a public letter denouncing Google, who insisted Gebru was a resignation and sparked fury against top executives (Allyn, 2021). Furthermore, Google even fired some employees who raised their voices on the termination of Gebru and, in some cases, led to complaints to the National Labor Relations Board (Needleman, 2021).

The National Labor Relations Board accused Google of breaking the law by firing two employees for organizing a labor movement in December 2021 (Fung, 2021).

Google employees state that the reasons behind their labor movement are to make the company acknowledge its societal role and reshape its culture (Cogner, 2021). According to Needleman, Google Union's primary goal is to have a voice in business and speak out on problems such as retaliatory firings (2021).

Unlike Amazon and Starbucks unions, the Alphabet Workers union is known as a "minority union" (Needleman, 2021). A minority union gives employees the right to organize without winning a formal vote before the National Labor Relations Board (Cogner, 2021). In addition, a minority union does not have the power to bargain and negotiate pay and benefits (Allyn, 2021).

However, after the Alphabet Workers Union staged rallies on both U.S. coasts, 5,000 workers of contract received a raise bringing wages up to $15 per hour (Alba, 2023).

Union Elections

A labor union is a group of two or more employees who collectively join to advance efforts of wage, benefits, schedules, and other employment terms and conditions ("U.S. Department of Labor," 2023). Organized labor in the United States started in 1636 when a group of fishermen in Maine went on strike ("Starbucks union…", 2022). In the case of *Commonwealth v. Hunt*, labor won, making labor unions legal in 1842 ("Starbucks union…", 2022).

Additionally, Congress passed the National Labor Relations Act in 1935, making it a policy to encourage collective bargaining by protecting workers' complete freedom of association ("National Labor Relations Board", 2023). Furthermore, an employer can voluntarily recognize unions if enough workers indicate they want the union to negotiate on their behalf (Fung, 2021).

In the United States, unions are the primary way for groups of employees to bargain with their employer through an election conducted by the National Labor Relations Board (NLRB) (Lowery et al., 2022). Employee organizers collect signed cards or petitions from bargaining unit members. They can either follow: (1) a majority sign-up if their employer recognizes their union voluntarily or (2) a secret ballot representation election ("U.S. Department of Labor", 2023). Experts say the pandemic is the main factor that sparked the union election boom ("Starbucks Union…", 2022).

According to Russell, there is a growing trend in American companies of flattened organizational structures (2019). The remarkable success of unions in some of the most anti-union corporations has shown that young workers are taking the lead in the labor market (Logan, 2022).

Most of Generation Z has taken the lead in the labor market movement. For example, Kate Bronfenbrenner, Director of Labor Education Research at Cornell University, notes that Gen-Z employees have seen opportunities disappear for their generation and are afraid they will be worse off than their parents (Maurf, 2021). The desire for Gen-Z employees aged 18 to 29 is more prevalent than their older coworkers: 77% of full-time or part-time Gen-Z employees are either a member of a union or would join a union if it were available (Liedke, 2022).

The public has also grown supportive of unions. For example, 71% of Americans approve of unions and union campaigns, compared to 48% in 2010 (Maruf, 2021). Amazon, Starbucks, and Google campaigns have shown how vulnerable labor laws are (Logan, 2023).

Number of elections

The number of elections is an essential indicator of employee representation. Elections provide employees with a safeguard of rights to organize, engage in better working conditions, and choose whether to negotiate with their employer ("Recent election results", 2023).

One measurement of union election is the number of elections filed under the National Labor Relations Board. Union elections certify or decertify a union as the bargaining representative of a group of employees is decided by a majority of votes ("National Labor Relations Board", 2023). In analyzing the number of elections filed by groups of employees to the National Labor Relations Board, a study discovered that unions are steadily increasing over the past five years since the start of the pandemic ("Recent election results", 2023). For example, there were 1,249 union elections in the fiscal year 2022—a 50% increase from the year before (Hsu & Selyukh, 2022).

According to Combs, the number of employees who joined unions due to National Labor Relations Board elections more than doubled from 2021 to 2022 (2023). Some may argue that union membership declined in 2020 to roughly 10% because of the declined labor income of more than 51% ("Starbucks union…", 2022).

However, a recent study by the Pew Research Center found that over 16% of journalist employees are currently union members, and 41% would join one if it were available to them (Liedke, 2022). Furthermore, from 2020 to 2022, the number of workers organized due to National Labor Relations Board elections increased from 72,177 to 75,290 individuals (Combs, 2023).

A solution to this aspect of unionization, which could also benefit the overall organizational structure, is for managers or companies to implement empathetic management for employees to feel understood and seen. Some companies found that

empathy can be a powerful antidote to contribute to positive outcomes, as 62% of women of color have said they are unlikely to leave their companies when they feel respected and valued by their managers (Brower, 2021).

Winning percentage

The percentage of elections won by unions is a crucial indicator of organized labor unions across the United States. The National Labor Relations Board calculates the winning percentage of union elections. For example, in 2022, unions won 76% of 1,573 National Labor Relations Board elections—a statistical tie for the highest success rate in American history (Combs, 2023). According to the U.S. Department of Labor, 14 million U.S. workers, or 10.3% of the American workforce, were union members in 2021 ("U.S. Department of Labor", 2023).

In addition, of all wage and salary workers across the United States, 20.6% of employees in the utility industry belonged to unions—the highest unionization rate in the private sector last year (DeSilver, 2021).

Critics of organized labor movements may state that the number of union members continues to fall, and thus the percentage of elections won is lower. For instance, DeSilver states that there were 321,000 fewer union members than in 2019 compared to 2020 (2021).

However, the support for organized labor movements is spreading across the United States. To illustrate, 68% of Americans approve of unions, a level of support not seen since 1965 (Hsu & Selyukh, 2022). With a large percentage of American approval of organized labor movements, more groups of employees will most likely follow in the footsteps of others. The overall employee labor movement of wage and salary workers increased as only 2.2% of the unionized workforce lost their jobs in 2020 due to the pandemic (DeSilver, 2021).

<div align="center">Civic Engagement</div>

Managers should establish Goal Sixteen of the United Nations Sustainable Development Goals to accomplish this mission. Goal Sixteen is to promote peaceful and inclusive societies or institutions at all levels by providing access to justice and building effective and inclusive relationships at all levels ("17 goals to transform …", n.d.). Specifically, a target of Goal Sixteen is to promote and enforce non-discriminatory laws or policies for sustainable development because a proportion of the population has reported feeling discriminated against or harassed in the workplace over the last twelve months ("17 goals to transform …", n.d.).

Managers or organizations understanding empathy in their institutional environment is crucial, showing its importance on employee productivity. For example, creating a work environment with a climate of empathic concern helps to stimulate courtesy and will increase ethical leadership (Kalshoven et al., 2013).

Empathetic action emphasizes actions that reduce corruption and strengthen global governance. Managers and companies who focus on learning to be on the receptive and interactive end of the relationship with employees to understand better their viewpoint are highly impactful in the workplace (Kalshoven et al., 2013).

Additionally, managers or companies who lead with empathy promote peaceful and inclusive societies because appreciating an employee's view and engaging in a healthy debate builds a better solution (Brower, 2021). Furthermore, empathy provides access to an effective organization where employees will remember their managers' or companies' peaceful and inclusive leadership at all levels (Colquitt et al., 2019).

III. Hypothesis

H1: Managers or companies lacking empathy will lead employees to form a union.

IV. Method

<center>Subjects</center>

Companies that will be examined are organizations rated as Fortune 500 companies or America's Best Large Employers to work for. These companies have been chosen because the increasing acceptance of unions within these top-rated companies prove otherwise. The companies and their employees are all headquartered within the United States. In addition, all companies operate on an international scale.

Amazon

Amazon operates in the e-commerce industry by offering retail consumer goods. The company was ranked 375 out of 500 of America's Best Large Employers and has 1,608,000 employees ("Amazon", 2023). Amazon's net income was ($27,000,000) ending December 31, 2022 ("Amazon Com Inc. February…", 2022). As of March 27, 2023, at 4 p.m., the share price closed at $98.04 ("Amazon.com…", 2023).

Starbucks

Starbucks provides specialty coffee, food, and merchandise in the restaurant and retail industry. The company was ranked 282 out of 500 of America's Best Large Employers and has 245,000 employees ("Starbucks", 2023). According to the Securities and Exchange Commission, Starbucks Corporation's most recent 10-Q noted the

company's total net revenue was $87,132,000 ending January 1, 2023 ("Starbucks Corp. February…", 2023). As of March 27, 2023, at 4 p.m., the company's share price closed at $98.66 ("Starbucks Corporation (SBUX)", 2023).

Google

Google provides tools and services in the computer software industry, such as software, search engines, and hardware products. The company was ranked 11 out of 500 of America's Best Large Employers and has 156,500 employees ("Google", 2023). According to the Securities and Exchange Commission, Google's most recent 10-K noted the company's revenue was $282,836,000 ending December 31, 2022 ("Alphabet Inc. February…", 2022). As of March 27, 2023, at 4 p.m., the company's share price closed at $103.06 ("Alphabet Inc. (GOOG)", 2023).

<div align="center">Variables and Instruments</div>

Variables

Empathetic management is leaders able to understand or feel what an employee is experiencing and adopt an alternative perspective (Martinovki et al., 2007). Union elections is another variable that compares union wins to union losses. Furthermore, this variable analyzes the percentage of elections won by unions compared to the percentage of eligible workers organized.

Instruments & Hypotheses

Table 1: Hypothesis, Variables, and Statistical Analysis

	Variables		Hypotheses & Variable Relationships	Statistical Tests
Hypothesis	Empathetic Management (EM)	Union Elections (UE)		
H1: Managers or organizations lacking empathy will lead employees to form a union.	EM	UE	EM ≠ UE	correlation; regression; line charts
Adapted from: Rudestam, K.E. & Newton, R.R. (1992). Surviving Your Dissertation. Newbury Park, California: Sage Publications, Inc. page 138.				

Table 2: Detail About Variables

Data	Variables			
	Empathetic Management (EM)	Empathetic Management (EM)	Union Elections (UE)	Union Elections (UE)
Instrument / Survey	Mayer-Salovey-Caruso Emotional Intelligence Test (MSCEIT)	Study-specific: Video Interview Survey	Union Winning Percentage	Recent Election Results
Author / Publisher	(Côté et al., 2011)	(Côté et al., 2011)	(Combs, 2023)	National Labor Relations Board
Type of data	Quantitative	Quantitative	Quantitative	Quantitative
Range of scores	20-item scalable score: 89 to 103 *Note: The average score is 100 and the standard deviation is 15.	Survey Scale: 1 (Disagree) to 7 (Agree)	Percentage: 20% to 80%	NLRB – This is an excellent source of recent election results. However, I may not have enough time to analyze all the raw data.
Adapted from: Rudestam, K.E. & Newton, R.R. (1992). Surviving Your Dissertation. Newbury Park, California: Sage Publications, Inc. page 140.				

Procedure

Procedure to Locate Journal Articles and Data

  The data has been collected from the Business Source Premier database since February 2023. Peer-reviewed journal articles filtered search results within the last fifteen years. Search terms such as empathy, unions, emotional intelligence, social behavior, and commitment were utilized. The articles were chosen within fifteen years to recognize the relationship between increasing win percentages of unions and organizations. The articles selected will benefit this research by comparing the effect of managers' social and leadership behaviors on their employees-specifically, the treatment of individuals and unions within an organization. In addition, the connection between social behavior and the research's variables will be identified.

  In addition, sources were gathered from Google and Google Scholar with similar search terms. The results from Google's search engine relevant to this research were U.S. Labor Department, Pew Research Center, the Securities and Exchange Commission, Harvard Business Review, Forbes, and Bloomberg.

  These articles analyzed the relationship between empathetic management and the formation of unions in Fortune 500 companies such as Amazon, Starbucks, and

Google. In addition, the treatment of individuals and unions in Fortune 500 companies was analyzed.

Statistical Methods to Present and Analyze the Data

After analyzing the data presented, tables and line charts depicting the correlations and regressions between empathetic management and union elections were developed.

V. Results

<u>Treatment of Individuals</u>

Table 3 contains data on participants' empathic accuracy across experimental conditions in a two-factorial design—power (high vs. low) and emotion (compassion vs. neutral). For example, participants in the higher power condition and compassion condition exhibited significantly higher empathic accuracy than participants in the neutral condition.

Table 3: Empathic Accuracy Across Experimental Conditions

	High Power Condition		Lower Power Condition	
Condition	M	SD	M	SD
Compassion	-2.36	0.69	-2.73	0.74
Neutral	-2.73	0.58	-2.60	0.72

Note. Less negative values represent higher empathic accuracy.
Source: Côté, et al. 2011

Table 4 contains data on the relationship between ethical or transformational leadership, moral awareness, and empathic concern. For example, transformational and ethical leadership are highly related.

Table 4: Means, Standard Deviations, and Correlations of Ethical and Transformational Leadership

Variable	M	SD	1	2	3	4	5	6
Transformational leadership	3.66	0.44						
Ethical leadership	3.82	0.54	.75**					
Ethical leadership mean	3.64	0.3	.52**	.67**				
Moral awareness	3.52	0.39	.31**	.35**	.45**			

Empathic concern	3.88	0.27	.20**	0.07	0.07	.38**		
Altruism behavior	4.1	0.63	0.13	0.25**	.19**	0.11	.16*	
Courtesy	3.86	0.62	0.12	.20**	0.12	0.1	0.1	.45**

Note. N = 133. Moral awareness and empathic concern are workgroup levels.
** p < .01; * p < .05
Source: Kalshoven et al., 2013

Figure 1 shows the association between prosocial orientation and power with an individual's career satisfaction through empathic accuracy. For example, empathic accuracy mediates the relationship between prosocial orientation and career satisfaction, and the relationship's strength depends on power.
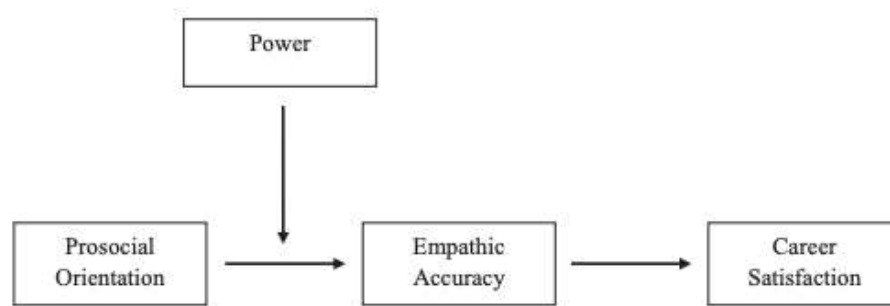
Figure 1: Moderated mediation model of power (Source: Cote et al., 2019)

<u>Number of Elections</u>

Figure 2 shows the percentage of wage and salary workers 16 and older who belong to a union from 2000 to 2020. For example, 10.8% of U.S. wage and salary workers reported being a part of a labor union in 2020.Figure 3 shows the percentage of wage and salary workers 16 and older who belong to a union by state. For instance, Hawaii has the highest labor union percentage of 23.7%. By contrast, South Carolina has the lowest labor union percentage of 2.9%

Table 5 shows the number of votes for and votes against unions in the tri-state area from January 2023 to April 2023. For example, in New York, there were 3,413 votes on unions. Of the 3,413 votes, 2,695 favored unions, and 718 were against unions.

Figure 4 shows the number of votes for and against unions in the tri-state area from January 2023 to April 2023. For example, New Jersey shows the lowest number of total votes.
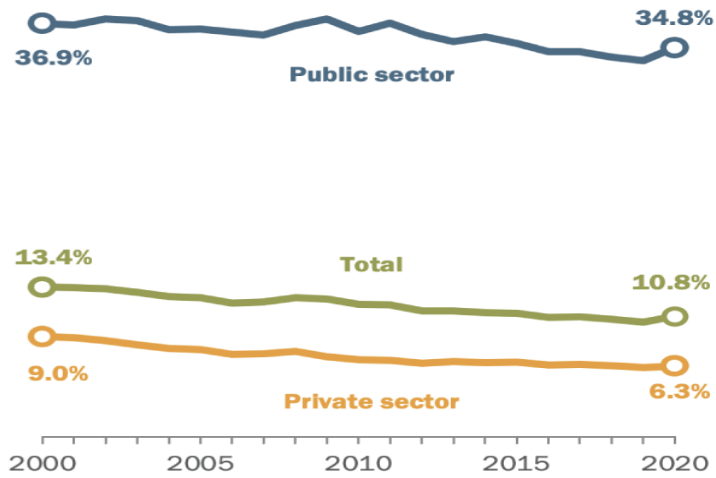
Figure 2: Percentage of Wage and Salary Workers 16 and older who Belong to a Union (Source: Pew Research Center)
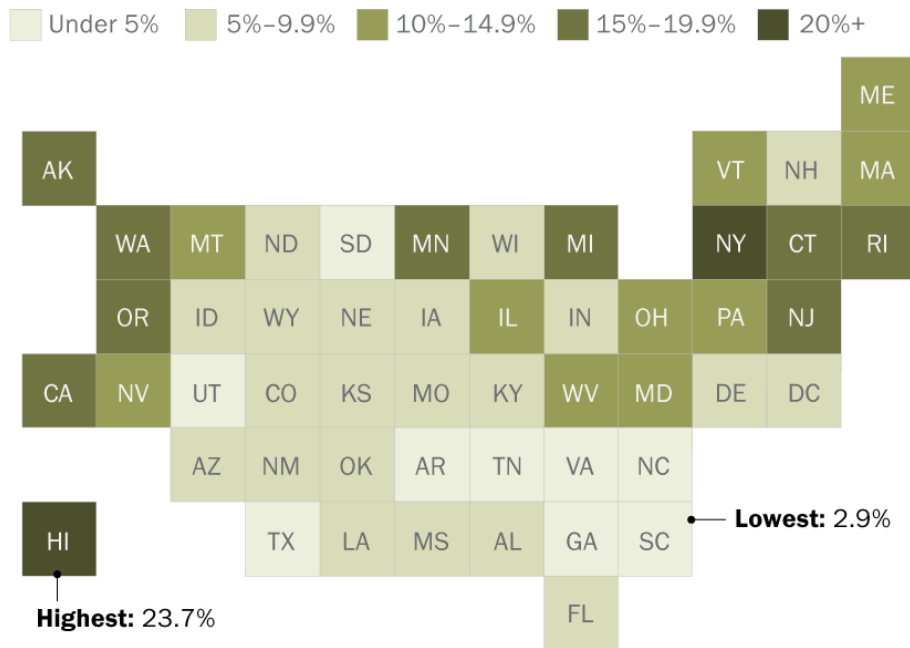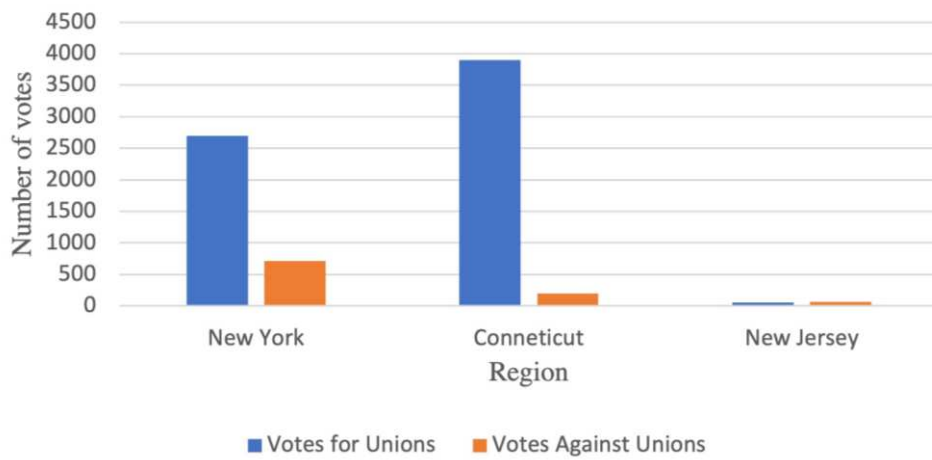

Figure 3: States where Labor is Most and Least Unionized (Source: Pew Research Center)

Table 5: NLRB Closed Case Election Results January 2023-April 2023

Region	Votes for Unions	Votes Against Unions	Total Votes
New York	2,695	718	3,413
Connecticut	3,896	199	4,095
New Jersey	56	63	119
Total	**6,647**	**980**	**7,627**

Source: National Labor Relations Board

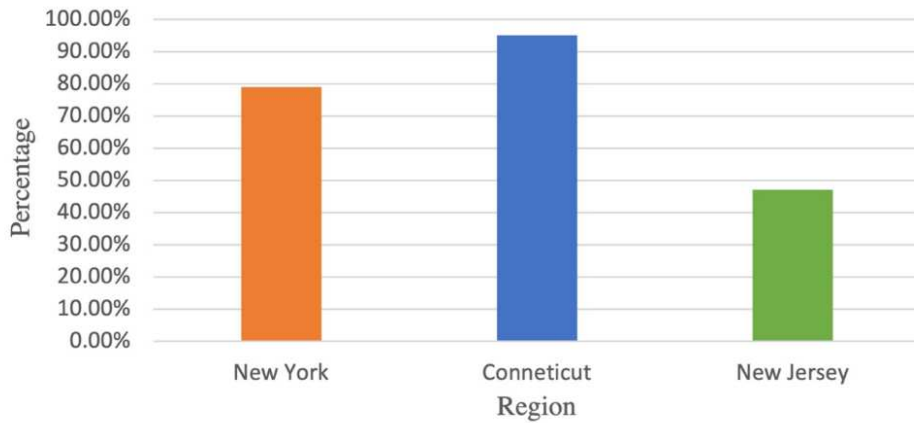**Figure 4: NLRB Closed Case Election Results January 2023-April 2023** (Source: National Labor Relations Board)

Figure 5 shows the number of union wins and losses from 1988 to 2022. For example, the figure shows a noticeable increase in unionization from 1988 to 2022 and the most significant one-year increase in union wins to losses from 2021 to 2022.

<u>Winning Percentage</u>

Figure 6 shows the winning percentage of unions in the New York, Connecticut, and New Jersey regions from January 2023 to April 2023. For example, Connecticut had a win percentage of 95%.
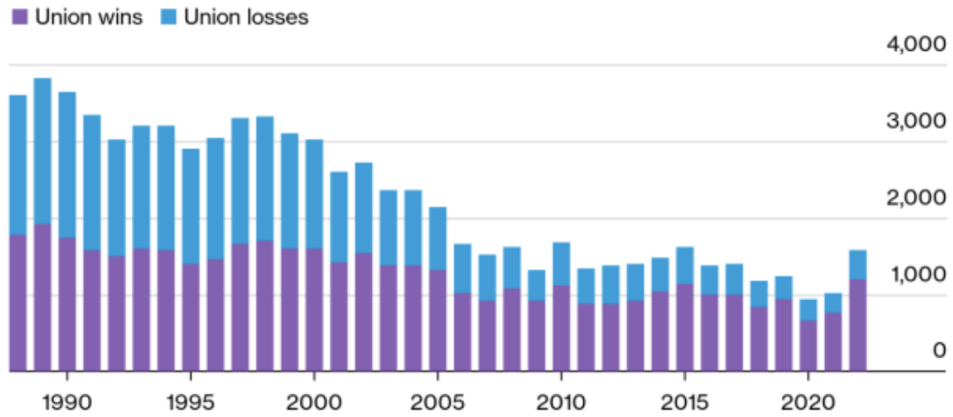
Figure 5: NLRB Election Results by Union Win and Union Losses 1988-2022
(Source: Bloomberg Law)

Figure 6: NLRB Closed Case Winning Percentage January 2023 to April 2023
(Source: National Labor Relations Board)

Figure 7 shows the percentage of union wins and losses from 1988 to 2022. For example, in 2022, the figure shows that union wins exhibited 80% of eligible workers organized, and unions won 76% of NLRB elections.
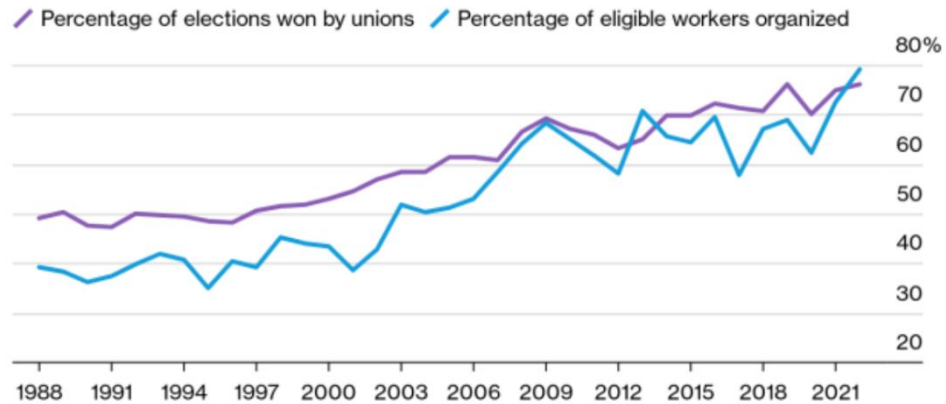
Figure 7: Percentage of Labor Success in NLRB Elections 1988-2022 (Source: Bloomberg Law)

VI. Discussion

The hypothesis analyzed the level of empathy of managers or companies. The hypothesis examines how empathetic management, or lack thereof, relates to employees forming a union.

The first variable in this thesis, empathetic management, was evaluated through empathic accuracy across high and low-power conditions in the workplace. The results in Table 3 indicate that compassionate managers exhibit higher empathic accuracy than neutral managers. While empathic accuracy in lower power conditions does not show a significant difference between compassion and neutral conditions, the data displays that managers in the compassion condition exhibit higher empathic accuracy than managers in the neutral condition. This data supports the hypothesis as a -2.36 mean of participants in the compassion condition compared to a -2.73 mean of those in the neutral condition, a 0.37 difference, have exhibited higher empathic accuracy. With a -2.73 and -2.60 mean in the neutral condition, the hypothesis remains that managers lacking empathy will lead employees to form a union. It is important to note that a less negative value represents a higher empathic accuracy.

Additionally, Table 4 shows the mean and standard deviation between ethical and transformational leadership from individual and group levels. The data suggest that ethical leadership is related to empathic concern or courtesy with r = .20. This supports the hypothesis that managers or companies with empathic concern, or lack thereof, will affect employees to form an organized labor movement. Empathic concern is an enhancer of ethical leadership about courtesy. This supports the idea that employees react to managers and companies better when empathic concern and ethical leadership are

76

present. With r =.20, this supports the hypothesis that managers or companies who are ethical leaders and share empathic concerns with employees will allow their workers to feel valued and understood.

Figure 1 represents the association between prosocial orientation and power with an individual's career satisfaction through empathic accuracy. In the model, empathic accuracy mediates the relationship between prosocial orientation and career satisfaction. The direction of the model displays that the relationship's strength depends on power. This relationship grows more positive as empathic accuracy or compassion increases, depicting that empathy increases job satisfaction and will not lead employees to form a union. This qualitative data supports the idea that managers or companies with empathy will make employees feel satisfied and will not likely form a union.

The second variable, union elections, consider the number of elections and the winning percentage. Figure 2 reveals that the data of public sector companies, such as Amazon, Starbucks, and Google, are increasingly rising from 2019 to 2020. Many employees felt abandoned during 2020 because of the workplace pandemic by management. This data supports the hypothesis because managers lacked empathy or left their employees, leading employees to form labor unions.

The data in Figure 3 reveals that the percentage of labor unions is higher in the states of the subjects examined in the thesis. States such as New York, Connecticut, and New Jersey are some of the states that contain the most labor unions. This data supports the hypothesis because the treatment of employees and lack of empathy has caused 15 to 20 plus percent of labor unionization in the states where the employees campaign the most against the subjects studied in this thesis. With the Northeast having the most labor unions, the relationship between states and labor unions also depicts the public political view of employment labor laws across the United States.

Table 5 reveals that the number of votes for unions is higher than the number of votes against unions when comparing closed-case election results in the tri-state area. The breakdown of regions for the number of union votes demonstrates a large gap between those who vote for unions and those who vote against unions. Approximately 87.15% voted in favor of unions, compared to 12.15% who voted against unions. With 7,627 total employees voting in a union election, 6,647 voting in favor is significantly high. With only 980 out of 7,627 votes being against a labor union, this supports the idea that managers who lack empathy will cause employees to form a union.

Figure 4 reveals that the number of votes in favor of unions is significantly higher when comparing the number of votes against unions. The data expresses that across the tri-state area, a higher number of votes are in favor of unions than votes against unions. This difference was the most significant in the state of Connecticut. Specifically,

95.14% of votes compared to 4.86%, a 90.28% difference between votes in favor versus against, have voted in favor of union formation in recent closed-case union elections. The hypothesis remains consistent: Managers or companies who lack empathy will lead employees to form a union.

The results in Figure 5 indicate that union wins are more likely to increase over the coming years than union losses. While the total number of National Labor Relations Board elections has decreased since 1990, the data display that over the years, a higher number of union wins, compared to losses, have accounted for the total number of NLRB elections. Precisely, in 2021, approximately 760 wins compared to about 2,000 wins in 2022, a 1,240 difference. This is the most significant increase in union representation in the last five years. The trend of increasing union representation in the previous five years keeps the hypothesis consistent that groups of employees are forming unions. A 1,240 difference in union wins over one year supports the idea that managers who abandon or lack empathy for their employees will lead to union formation.

Figure 6 represents that the formation of unions has high success rates in the tri-state area. The data expresses that a high winning percentage was held between each region. While New Jersey has a lower win percentage than the other regions, the figure displays that recent National Labor Relations Board closed-case elections have high win percentages. Specifically, approximately 95% of Connecticut NLRB elections and about 79% of New York National Labor Relations Board elections have won the total number of elections in their respective regions. This data portion exemplifies that the number of employee unions is growing and supports the hypothesis that a lack of empathetic management will lead employees to form unions.

The results in Figure 7 indicate the percentage of National Labor Relations Board elections won by unions compared to the percentage of eligible workers organized from 1988 and ending in 2021. In that period, there is a clear trend of the percentage of elections won by unions increasing compared to the percentage of eligible workers organized. The data expresses that the percentage of eligible workers organized and the percentage of elections won by unions have been higher in recent years, specifically in the past five years. This union organizing performance grows to reach new heights as time progresses, supporting the hypothesis that current Fortune 500 managers or companies who lack empathy will lead employees to form a union.

VII. Conclusions

<div align="center">General Conclusions</div>

The report has explained the relationship between empathetic management and employees forming a union. The research has proposed that managers or companies who

lack empathy will lead employees to form a union. This study has identified the mistreatment of employees in Fortune 500 companies, including unsafe working conditions, sexual harassment, and unfair pay. The managers within Fortune 500 companies need more empathy when understanding their employees' needs and wants surrounding employment terms and conditions. Labor unions have been on an upward tick in companies since 2020. Therefore, managers or companies lacking empathy will lead employees to form a union.

<div align="center">Implications for Practice</div>

Fortune 500 companies need to be more conscious of how they treat their employees and what their employees expect from the company. The company needs to prioritize implementing empathetic management into their company's culture. The thesis states that empathetic management mediates prosocial orientation and employee career satisfaction. Recruiters for Fortune 500 companies should be more aware of empathy when hiring new individuals to create an inclusive and transparent organizational culture. Furthermore, companies should train their management team in empathetic management to increase awareness of employee values and strategies to determine each ideal.

<div align="center">Implications for Research</div>

Researchers should analyze the various negotiation styles of managers and companies to determine which is the most or least effective in bargaining with employees during union elections. With labor unions on a steady uptick, companies have begun acknowledging the importance of employee voices and labor movements. However, there is still evident progress that needs to be made regarding how managers treat their employees in the workplace based on the research conducted in this paper. Therefore, further analyzing the negotiation approach managers and companies utilize when bargaining with groups of employees, such as a cooperator style, will be beneficial in addressing the number of union elections. Specifically, implementing empathetic management in the workplace which are highlighted in this paper.

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Section III: Critical Essays

Free Will: Philosophical Debate, Neuroscientific Perspective, Practical Implications

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<u>Introduction</u>

Free will has been a matter of interest since humans started to think critically. Civilized societies and their justice systems have always been based on the proposition that humans have free will and consequently that they are responsible for the actions they freely decide to perform (Roskies, 2002). It is commonly thought that thinking and acting are essential and irreducible manifestations of our freedom and rationality as human beings. From ancient Greece to the present day, philosophers, scientists, and ethicists have been trying to demonstrate logically and rationally the existence of free will. Their arguments have attempted to answer the question "does free will exist, or is it an illusion created by our brain to make us feel masters of our actions?"

Although there has been conceptual progress, philosophy hasn't been able to solve this dilemma (Lavazza A., 2016). This led to irreconcilable positions about human freedom in the current debate: compatibilism on one side and incompatibilism on the other side, further split between the libertarian and the illusionist theses. Although this matter has been addressed only by philosophers for many years, in recent years we have witnessed neurosciences' raising interest in this field of research. Neuroscientists endeavored to study the physiological processes in a person's brain aiming to discover whether human actions are intentional or merely a result of physical reactions. Neuropsychologists and social psychologists also began to explore this field of research, conducting experiments whose results revealed unexpected evidence. Experiments and research conducted so far seem to show that free will does not exist as we commonly tend to define it. Although in science a truth is never absolute, but always uncertain and falsifiable, these results incite us to reflect on the "potentially dramatic implications for our perspective on ethics and for social justice" (Roskies, 2002, p.21). Because philosophy and neuroscience can no longer separately address the matter, but instead a scientific and intellectual discourse is necessary, it has raised in recent years a new interdisciplinary field: neuroethics.

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Definition and Debate on Free Will

Free will has been defined by the Stanford Encyclopedia of Philosophy (2010) as a "philosophical term of art for a particular sort of capacity of rational agents to choose a course of action from among various alternatives" (O'Connor, 2010, para. 1). We could argue that there is not only one definition of free will, or that the one provided above is not the most accurate; however, more important than defining the concept of free will, is to specify what conditions must occur in order to say that there is free will. First, it is necessary to have an alternative course of action to choose from, defined as *Principle of Alternative Possibilities* (PAP). In addition, there is a second condition: the *Ultimate Responsibility* (UR). This means that an agent must be also the author of the choice; this process entails conscious self-determination (Ruoso, 2014).

Scholars attempting to study human freedom date back to ancient Greece. However, the concept behind the word "free will" varies depending on the period and on the philosopher that it is being considered. The Greek philosopher Plato, for example, refers to human freedom as a kind of self-mastery: "reason as the guide, the spirited nature as the ally of reason, exhorting oneself to do what reason deems proper, and the passions as subjugated to the determinations of reason" (O'Connor & Franklin, 2022, para. 1.1). If a person manages to have this inner balance, they are considered free, otherwise they are enslaved to their passions. Today such a definition of freedom is not accepted anymore, and this is greatly due to the different perception that nowadays we have of the physical world. When we refer to the physical world around us, we tend to perceive it according to a deterministic view: the physical world is ruled by natural laws, meaning that all the events are part of a cause-effect chain, where the cause is sufficient to explain an effect. Consequently, we can affirm that, given certain causes A, it necessarily derives an event B. But is the human mind part of this chain as well? How do free will and determinism combine? There is no single answer to this question, as there are different schools of thought in the current debate.

The belief that determinism can or cannot coexist with free will leads to two different theories: compatibilism and incompatibilism. Compatibilism is "the thesis that free will is compatible with determinism" (McKenna & Coates, 2019, para. 1). Compatibilists base their theory on a different concept of freedom than the one most people tend to believe. An action is defined as free if its cause is the will of the subject and if the agent is able to pursue it in the absence of external impediments. This condition is necessary and sufficient, implying that it is not relevant whether the will is in turn free or not. The will, in fact, due to the deterministic theory they agree with, is not free but determined by various inner and external factors. Various criticisms have been raised

against this theory, particularly because it does not respect the *Principle of Alternative Possibilities* (PAP). Among them stands out the "consequence argument" by Peter van Inwagen. He asserts, using a syllogism, that we are not free: no one has the power over the past and over the laws of nature, and, if determinism is true, the facts of the past and the laws of nature entail every fact of the future. It derives that we are not free.

Incompatibilist theories, instead, are based on the preposition that determinism and free will are not compatible. Among those we find libertarian and illusionist theses: the first states that determinism is not true, therefore we are free, the second one that determinism is true, therefore there is no free will. Libertarians believe that even if the physical world is regulated by cause-effect processes, humans are an exception, because they can initiate causal chains. Even though this thesis meets both conditions (*Principle of Alternative Possibilities* and *Ultimate Responsibility*)*,* it is not exempt from criticism. In fact, since humans are physical entities, how can they not be subject to natural laws?

Illusionists, on the other hand, assert that we are not free, because of the deterministic world we live in, therefore free will is an illusion. Decisions are determined by physical states of the brain; human will is only an epiphenomenon, but not the cause of actions (Enrico, 2022).

<div align="center">Brain, Mind and Neuroscience</div>

It is fundamental, in order to discuss free will, to understand what the human mind is, if it is a different entity from the brain, and, if that is the case, how mind and brain interact together. On this matter we can find supporters of dualism theory or of identity theory: dualism is based on the preposition that mind and brain are different entities, while identity theory holds that the mind is identical to the brain. The first relevant scholar to address this topic was René Descartes (1596–1650). His theory is strongly dualistic; he asserts that mind and body are two different substances: the mind is knowable through introspection, while the body is knowable through the senses. Therefore, he argues that everything that is physical (*res extensa)* is doubtful, hence the only thing knowable with certainty is the mind (*res cogitans*), a thinking subject. If Descartes' thesis was true, there would be some philosophical problems; among all the most relevant one would be: "If minds and bodies are so fundamentally different, how do they seem to interact constantly?" (Marc Novikoff, 2022, para. 5). To answer this question, it is necessary to introduce the most accredited position nowadays, which has the consensus of most scientists: physicalism. According to physicalism everything that exists is traceable to physical matter and can be explained through its physical properties. Hence, the mind can be led back to the set of physical-chemical processes that occur in the brain and can only be explained by the laws of the natural sciences. A physicalist

view of the mind-body problem together with a deterministic view of the physical world is a serious threat to the idea of human free will. Decisions are then merely a consequence of a series of physical reactions that must necessarily occur because of both internal and external inputs that the brain receives, and of the structure of the brain itself, which is in turn determined by genes (Ruoso, 2014).

Researchers attempted to prove physicalist theory both in the field of neuroscience and neuropsychology, in order to demonstrate whether free will exists or not. Among the neuroscientific experiments there is Benjamin Libet's experience in 1983. The study aimed to analyze the temporal relation between the start of a person's cerebral activity that prepares an action and the conscious intention to act. The participants had to press a button in front of them, while looking at a watch, and then report the time when they decided to perform their action. The result showed that the brain activity, registered by an electroencephalogram, called RP (readiness potential, or *bereitschaftspotential)*, started 350ms before the subjects were aware of their intention. More recently, in 2008, this experiment has been adapted from Soon, in order to add more complexity to it. The participants no longer had to decide only when to perform a certain action, they also had to decide what kind of action they wanted to undertake, indeed whether to move the left or the right finger to press a button. The goal of the experimenter was to predict the choice according to the raising cerebral activity in a certain region of the brain. Observing the frontopolar cortex, they were able to predict the decision 7 seconds before the subject's awareness and with a 60% accuracy.

Libet and Soon's experiments seem to show that free will is an illusion, or at least that it has no causality power. Many scholars analyzed those experiments, and others of the same type that followed, trying to infer different conclusions, or to reinterpret the results in a different key. An example is given in a recent journal published by Gonçalves Coelho (2021), where the author investigates the relation between the brain and the conscious mind, in order to prove that free will is not an illusion. Particularly, he analyzes the mind and the brain's mutual causality power to determine whether brain events cause conscious events or vice versa, aiming to define if the agent of voluntary action is the brain, the mind, or the two of them working together. Gonçalves Coelho (2021) argues that "the brain is the agent and the conscious mind, in its various forms - cognitive, volitional and emotional - and contents, is its guide of action" (Gonçalves Coelho, J., 2021, abstract). Hence, even if the brain is the agent of the action, it bases its decisions on the conscious continents of the mind, therefore the mind can be defined as a property of the brain. According to this vision, it is possible to refer to the brain as a "conscious brain". Therefore, Libet and Soon's experiments, which ascribed the agency power to the brain, no longer demonstrate that free will is an illusion,

because the conscious brain is the agent of voluntary actions (Gonçalves Coelho, J., 2021).

Society and Free Will

How much is human's freedom of deliberation and action conditioned by society and the situation that we found ourselves in? Should we redefine moral responsibility considering evidence provided by neuroscientific experiments on free will? What influence does the assumption that people have free will have in the social systems?

It is necessary to introduce the notion of situationism. Galletti (2021) defines situationism as the theory that people's actions are influenced or even determined by the circumstances the agents are found in (Galletti, 2012). In 1961 and 1971, two renowned experiments in the field of social psychology were conducted, respectively by Stanley Milgram and Philip Zimbardo. Due to the incredible and astonishing results, the experiments have become pillars among researchers and scholars. Milgram's experiment aimed to investigate people's acquiescence to authority, particularly to what extent people would obey an order that goes against their values and morality only because it is given by an authoritative figure. The people who decided to take part in the experiment were assigned the role of "teachers", and they had to test the memory ability of a "learner", who pretended to be a volunteer, but was a confederate of the experimenter. If the learner answered incorrectly to the question, the teacher would have to administer an electric shock; the teacher was told that the voltage of the electric shocks would increase at each administration, till the point (labeled XXX) that it would be fatal to the learner, but in reality there were no actual shocks. Even though the teacher was placed in a distinct room with the experimenter, he was able to hear the screams of the learner after the shocks were administered. The experimenter had to exhort the teacher verbally to continue with the experiment whenever he protested about the cruelty of the experiment and asked to end it. There were four exhortations in an exact order ("Please continue" *or* "Please go on", "The experiment requires that you continue", "It is absolutely essential that you continue", "You have no other choice; you *must* go on"), and the experimenter could use the following one if the previous one resulted unsuccessful; if the learner still asked to halt the experiment after the fourth prod, the experiment was stopped. Despite the screams, 26 teachers out of the 40 who decided to take part in the experiment reached the highest voltage, a result that overturned the estimated 0-3% rate of the prediction.

Similarly, Zimbardo's experiment had an unexpected outcome. The experiment was held by the department of psychology of Stanford University, and it took place in the basement of the building, which was adapted to simulate a prison. Similarly to Milgram's

experiment, there were two categories of people: the "prisoners", who got arrested, and the "guards" who had to supervise them according to the assigned day and night shifts. The guards, in a position of power, started to act cruelly, mistreating and abusing the prisoners, who after a little time did not rebel anymore and instead started to bear with the violence of the authority figures, acting as victims. These conditions led to the precocious interruption of the experiment, on the sixth day. The prison environment prevailed on the individual intentions of the participants and their ability to consciously resist evil (Galletti, 2012, p.5,6). Due to the result of the experiment, Zimbardo himself coined the term "lucifer effect" to refer to when certain circumstances influence people to the point that they become perpetrators of immoral or "evil" behaviors. The evidence provided by the two described experiments puts in crisis the proposition that humans have free will; the predominance of situational influence over individual conscious deliberation in decision making, makes the voluntary control of the actions doubtable.

Defining whether a person's action is a result of free decision or of some type of coercion, is not merely speculation, but it has a practical implication. It is directly correlated with the concept of moral responsibility. As highlighted in the Stanford Encyclopedia of Philosophy (2022), there is not only one type of moral responsibility, instead there are three different species: moral responsibility as answerability, attributability, or accountability. Although, for what pertains to the free will discussion, this last species is the one that it is commonly referred to. Hence "An agent S is morally accountable for performing an action ϕ=df. S deserves praise if ϕ goes beyond what can be reasonably expected of S and S deserves blame if ϕ is morally wrong" (O'Connor et al., 2022, para. 2.1). This definition would consequently implicate that one who performs a morally wrong action is blameworthy. But how is it possible to blame a person if the action is not up to them? If our decisions cannot be said to be a result of free deliberation, but instead they are a consequence of brain states that are in turn determined by our genes, previous events, and current circumstances, who is responsible for our actions? If we give credit to the experimental results of neuroscientists and psychologists, we should consider redefining the rules of attribution of moral responsibility (Galletti, 2012).

It is worth analyzing to what extent the concept of moral responsibility influences the way we act. In fact, people who believe in free will tend also to believe that they are morally responsible for their actions, because they freely choose to perform them; as a result, people are prone to act in a way for which they would consequently deserve praise, rather than perform actions that are morally wrong, for which they would deserve blame. In an article published by Frontiers, Caspar (2017) mentions that "A substantial body of scientific research has highlighted the prosocial benefits of believing in free will, as well as the negative effects of denying its existence" (Caspar et al., 2017,

p. 1). Hence, the sense of responsibility of agents who believe to be free has an implication on "the moral character of their subsequent behavior" (Caspar et al., 2017, p.1). In order to provide evidence to this, it is worth mentioning the experiment conducted in 2008 by two American psychologists, Jonathan Schooler and Kathleen Vohs. The experiment consisted of two groups of people who were told to read distinct articles: the first group was assigned with a neutral one, the second group with one validating the deterministic thesis, and consequently denying the existence of free will. After reading them, the participants had to perform some mathematical questions and cognitive tests. The experiment was set up in a way that would have allowed participants to cheat easily. The results showed that the people who were told to read the pro-deterministic article were more inclined to cheat compared with the other group. However, in the research article Satre (1943/ 1956) is quoted as an example of a counter perspective on this topic: "We are always ready to take refuge in a belief in determinism if this freedom weighs upon us or if we need an excuse" (pp. 78–79). This raises the question "might the adoption of a deterministic worldview serve as an excuse for untoward behaviors?" (Vohs, Schooler, 2008, pp. 49-54).

Conclusion

Free will is an intricate issue, whose importance and relevance has attracted scholars from various fields throughout the years. Philosophers, neuroscientists, neuropsychologists attempted to explain this mysterious concept to prove that humans have the power to act freely. For this to be possible, two conditions need to be satisfied: the *Principle of Alternative Possibilities* and the *Ultimate Responsibility.* Philosophers integrated those two conditions with either a deterministic or non-deterministic vision of the physical world, and elaborated various theories that either support or deny the existence of free will. However, the debate is still open because all the positions present both strong theses and criticisms.

Neuroscience in recent years started to address this topic as well. The main problem was defining what relation exists between the so-called "mind" and "brain", in order to determine if conscious awareness is involved in the decision-making process or not. Libet and Soon's experiments revealed unexpected evidence: the neuronal processes start before a subject's awareness. These results have been analyzed and reinterpreted by different scientists, who often presented arguments and theses in order to defend human freedom.

The existence of free will has not only been challenged by neuroscience, but important experiments have been conducted in the field of social psychology as well. The results showed the predominance of situational influence over individual conscious

deliberation, and put in crisis the traditional way of perceiving the decision-making process. Hence, a person's actions are not only influenced, if not determined, by biological and physiological factors, but also by environmental factors.

Setting aside the philosophical debate and the evidence provided by scientific experiments, free will results to be a fundamental belief: people who believe in their freedom also believe in the concept of moral responsibility. If people did not believe in this crucial concept, on which our society is based, laws of social justice would no longer be observed, and this might lead to societal collapse.

Regardless of all the research and the progress achieved throughout the years, "As humans, we can identify galaxies light years away, we can study particles smaller than an atom. But we still haven't unlocked the mystery of the three pounds of matter that sits between our ears" (Obama, 2013).

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"We have Indigenous Solutions": Leadership Lessons of Indigenous Trailblazers

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"One word could shatter your sense of belonging," wrote Fred Sasakamoose (1933-2020), the first Indigenous player to play in the National Hockey League (NHL) in his 2021 memoir *Call Me Indian.* "One moment you could feel like just another guy on the team and the next you would be reminded you were an outsider."[2] Breaking new ground despite prejudice and hardship in the Canadian residential schools, he paved the way during the 1950s for other Indigenous hockey stars that dreamed of making it big. Like Sasakamoose, Wilma Pearl Mankiller (1945-2010) became a role model with her appointment as first female Principal Chief of the Cherokee nation in 1985. She was twice re-elected due to her social work and leadership skills that enabled her to improve rural community services–education, healthcare and housing– and build trust for her vision.[3] They both had a significant impact on the lives and well-being of their generation of Indigenous peoples and for the generations who came after. Fred Sasakamoose and Wilma Pearl Mankiller were Native American trailblazers and visionaries who paved the way for Indigenous generations to come.

Born in Big River First Nation, Saskatchewan, on December 25th, 1933, Fred Sasakamoose grew up in a six meter by seven meter home at Sandy Lake, now known as Ahtahkakoop Cree Nation in Canada.[4] He was raised by his father Roderick Sasakamoose and his mother Judith Sasakamoose. He grew up with a strong bond between him and his family, especially with his grandfather Alexander Sasakamoose. Although his grandfather could not hear nor speak, he gave Fred a gift that would eventually save his life – hockey. Fred learned to play hockey using bob skates tied to the bottom of his moccasins, a tree branch carved into the shape of a hockey stick, and a

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[2] Fred Sasakamoose, *Call Me Indian: From Trauma of Residential School to Becoming the NHL's First Treaty Indigenous Player* (Penguin Random House, 2021), foreword by Bryan Trottier, 76.

[3] Linda Wilson, "Wilma Mankiller," in *The Encyclopedia of Oklahoma History and Culture*, Oklahoma Historical Society.

[4] Sasakamoose, *Call Me Indian*, 9.

frozen piece of cow manure as a puck. He practiced hard and enhanced his skills on a frozen lake while his grandfather ice fished nearby.

In 1941, when Fred was only seven years old, a canvas-covered grain truck appeared in front of his small home in Sandy Lake. Three men got out of the truck and approached the family, one he recognized as the "reserves Indian agent", "an RCMP officer", and another Caucasian man "wearing a long black robe."[5] He would later learn that this was a priest. Despite being loved unconditionally and cared for everyday, the Canadian Government were able to deem any parents as "unfit" to care for their children and so Fred was taken away from his family.[6] The truck crammed with approximately thirty children, traveled for hours as the children screamed, cried and pleaded.

From the creation of the school system in 1867 to their closure, "approximately 150,000 [Indigenous] children went through one of the 135 residential schools" across Canada. [7] The government worked with the Catholic church and the Protestant church to run these schools. Both believed that the ultimate goal of such schools was "killing the Indian in the child."[8] In their goal of "civilizing" Indigenous children, they attempted to assimilate them into European culture by stripping them of their language and cultural teachings.[9] These schools took children away from their homes in order to "break their cultural bonds."[10] The school system used mental, physical, and sexual abuse as punishment to further assimilate the children. Their hair was chopped off, they were stripped of their traditional clothing, and violently scrubbed clean upon arrival at these schools. No traces of their identity were to be remembered.

In 1920, the government gained more control over the Indigenous population with the creation of the *Indian Act*, which made it mandatory for all Indigenous children aged seven years old to 15 to attend either a residential school or an Indian day school.[11] The churches would often go to court to get injunctions, threatening parents with arrests

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[5] Sasakamoose, *Call Me Indian,* 25.

[6] Phil Fontaine and Aimée Craft. *A Knock on the Door: The Essential History of Residential schools from the Truth and Reconciliation Commission of Canada, Edited and Abridged*. Vol. 1 (Univ. of Manitoba Press, 2015), 6.

[7] Virginia Arsenault. "The Indian Residential School System." *Resistance to the Canadian Truth and Reconciliation Commission* (Swisspeace: 2015), 5.

[8] Bryanne Young. "'Killing the Indian in the Child': Death, Cruelty, and Subject-Formation in the Canadian Indian Residential School System." *Mosaic: An Interdisciplinary Critical Journal* 48, no. 4 (2015), 65.

[9] Arsenault, *Resistance*, 5.

[10] Arsenault, *Resistance*, 5.

[11] Arsenault, *Resistance*, 5.

if they did not allow their children to attend these schools. The residential school system was a brutal and dark part of Canadian history. The Canadian government and the Catholic Church have the blood of approximately 6,000 Indigenous children (and counting) on their hands. Following the discovery of 215 Indigenous children's unmarked graves, attention was drawn to the roughly 6,000 students who had died during their stay at the 130 residential schools."[12] Thankfully, Fred Sasakamoose was not one of these children.

The Indian residential school system has created intergenerational trauma that still affects Indigenous communities to this day. Fred's nine years at Duck Lake Residential School were extremely traumatic. Upon arrival, the nuns cut off his braid and forced him to speak English and would punish him if he spoke otherwise, despite the fact that Cree was his first language. He experienced emotional, physical, and sexual abuse. The only escape he had from this torture was skating.[13] In 1944, Georges Roussel, a priest, arrived at the school and became a mentor or coach to Fred. He began assisting Fred in enhancing his hockey skills when he joined the school's team. In an interview published in *Sundog Highway: Writing from Saskatchewan* (2000) Roussel stated that Fred "lived for hockey." Fred began getting attention from Junior hockey team scouts after a provincial championship win with his team. He was recruited to play hockey in Moose Jaw for the Moose Jaw Canucks.[14] Fred was hesitant to go, but his parents saw it as a way to improve his life. Moving away to play hockey meant that he did not have to go back to that horrible school. His skill was very evident but it was not only hockey that he had to worry about.

As he achieved professional success, he had to get used to being a young Indigenous man in a racist world. During a 2015 interview with Larry Loyie, Sasakamoose stated that: "It was quite a journey, not only to Moose Jaw, but also to live in a white society" among over 75 white recruits.[15] It was not until after his final game with the Moose Jaw Canucks in their 1953-54 season that Fred was called up to play for the Black Hawks, a National Hockey League team based out of Chicago. Fred played eleven games with the Black Hawks during the 1953-1954 season. This is when he made

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[12] Thorne, Niki, and Maria Moss. 2022. "Unmarked Graves: Yet Another Legacy of Canada's Residential School System: An Interview with Niki Thorne". *New American Studies Journal: A Forum* 72 (April), 2.

[13] Sasakamoose, *Call Me Indian,* 43.

[14] Sasakamoose, *Call Me Indian,* 61.

[15] Larry Loyie and Constance Brissenden, " Fred Sasakamoose" *The Canadian Encyclopedia*, March 11, 2015.

history, as the first statused Indigenous person to play in the National Hockey League.[16] Playing in the NHL was not all fun and games for Sasakamoose because, much like the 1946 signing of Jackie Robinson, Sasakamoose experienced a lot of racism and hatred directed towards him.[17] Similarly to Sasakamoose, Jackie Robinson broke the color barrier in the Major League Baseball when he became the first African American to play in the Major Leagues. He was taunted on and off the ice, getting called names like "Squaw humper" and "F-ing Indian."[18] Men from other teams always picked fist fights with him on ice, never winning because of the boxing skills Fred learned at residential school. Sasakamoose was not only mentally tough, but he was also physically tough. He played many sports other than hockey at school, took unimaginable beatings from priests and nuns, and also gained farming skills and strength by being forced to do the school's chores.[19]

For over half a century, Sasakamoose expressed a transformational leadership style. He was a "passionate advocate for creating opportunities for Indigenous youth to play sports." Sasakamoose spent 60 years of his life creating "hockey programs, leagues, and camps" for Indigenous and non-Indigenous youth to attend. [20] He directed the 'Fred Sasakamoose Hockey School' and also served on the "National Hockey League's Ethnic Diversity Task Force where he helped advance the recreational opportunities for less-fortunate children."[21] He served as a councilor on the Ahtahkakoop reserve's Chief and Council for 35 years and was also a Senator with the Federation of Saskatchewan Indian Nations. Sasakamoose will be remembered as a role model for generations to come. His leadership skills were very versatile and he was known for using his voice to give Indigenous youth opportunities that were not as accessible to all.

Fred was a trailblazer for young Indigenous athletes across North America including players like Ted Nolan, Gino Odjick, Jonathan Cheechoo, and Sheldon Souray.[22] More recently Indigenous hockey players like Ethan Bear of the Vancouver

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[16] Sasakamoose, *Call Me Indian,* 111.

[17] Aviam Soifer, "Confronting deep strictures: Robinson, Rickey, and racism." *Cardozo L. Rev.* 6 (1984): 865.

[18] Sasakamoose, *Call Me Indian,* 76.

[19] Sasakamoose, *Call Me Indian,* 32.

[20] "Sasakamoose Remembered as a Role Model Who Made Hockey History - Alumni and Friends." 2020. Alumni and Friends. November 25, 2020.

[21] Frederick Sasakamoose "Indspire." 2020, September 23, 2020.

[22] John Valentine, "New racism and old stereotypes in the National Hockey League: The "stacking" of Aboriginal players into the role of enforcer." *Race and Sport in Canada: Intersecting inequalities* (2012), 111.

Canucks have been taking pride in their culture while on the ice.[23] Fred Sasakamoose was an Indian Residential School survivor. He overcame trauma from the emotional, physical, and sexual abuse he experienced at Duck Lake and chose a path he never would have thought he would have gotten the opportunity to choose. He was extremely creative. His strength, strong will, and work ethic are what made him a great leader. He led through actions and as he got older and grew more as a person, he began leading Indigenous children through words. He broke through barriers, overcame adversity, and created a path for generations of Indigenous athletes to come.

The Seventh Generation Principle is based on a Haudenosaunee nation philosophy which believes "that the decision we make today should result in a sustainable world seven generations into the future."[24] This philosophy has since been adopted by many different Indigenous nations. Fred Sasakamoose's decisions directly impacted future generations of Indigenous youth, much like Wilma Pearl Mankiller's impact on future generations of the Cherokee people, as well as leaders of all races and ethnicities.

A very influential and highly respected leader, Wilma Pearl Mankiller was most known for her advocacy for Native American and women's rights. She also spent a lot of time working in promoting economic and social development within her community. Born on November 18, 1945, in Tahlequah, Oklahoma, Mankiller moved with her family to San Francisco in 1957 under a program to urbanize Native Americans. Her father was a full-blooded Cherokee and her family debated politics at the dinner table.[25] This upbringing placed her at age 24, in 1969, in close proximity to the Native American take-over of Alcatraz, described below, which impacted her social justice ambitions. She moved back to Oklahoma in 1971 with her two daughters, following her divorce. Her social work skills and grant writing enabled her to make an impact on rural community life. Later she served as the first woman deputy chief of the Cherokee beginning in August 1983. Mankiller served as the first female Principal Chief of the Cherokee Nation from 1985 to 1995, winning elections twice in 1987 and 1991.[26] During her time as Chief, Wilma Mankiller was very popular and widely praised for her work and efforts

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[23] Dakota Wing and Ana-Maria Jerca. ""You were Really Good For First Time in English": Raciolingustic Discourse, Accommodation, and Gatekeeping Surrounding Harnatayan Singh's English Canadian NHL Broadcasts" (2021), 1.

[24] Joseph, Bob. "What Is the Seventh Generation Principle?" Indigenous Corporate Training Inc., June 6, 2023.

[25] Wilson, "Wilma Mankiller.".

[26] King, Janis L. "Justificatory rhetoric for a female political candidate: A case study of Wilma Mankiller." *Women's Studies in Communication* 13, no. 2 (1990), 21.

to improve the lives of Cherokee Nation members as a whole. She worked to expand health care services, strengthen tribal government, and increase educational opportunities for members of the Cherokee Nation.[27] She emphasized the importance of preserving Cherokee culture and heritage.[28]

The Cherokee Heritage Center opened in 1967 and is dedicated to preserving and promoting Cherokee culture and heritage. The center serves as a place for Indigenous people to reconnect or learn more about their heritage. Mankiller was an active supporter of the center which acts as a museum and cultural gathering space dedicated to preserving Cherokee culture and traditions.[29] During her campaign for Chief, she learned important Cherokee history from elders in her community. She was educated on the "tenacity of the Cherokee people, their belief in the importance of balance and harmony between humans and nature, and their high regard for women."[30] Her vast knowledge of the Cherokee way of living and great importance of community was priceless in her campaign and is what led her to being elected Chief in 1987. Her primary focus as a leader was on improving infrastructure and educational opportunities. To successfully revitalize the Cherokee Nation, she believed more in partnership and giving people opportunities rather than doing everything for them. She empowered her people "by providing the resources but encouraging the people to actually do the work."[31] During her time as principal Chief she encouraged the people to decide what from the outside world was of good use for their economic growth. In doing so, she also maintained traditional Cherokee culture and values. Wilma Mankiller was "instrumental in achieving a balance between the two worlds, while promoting Cherokee self-determination."[32] Mankiller was a very proactive leader, she once said that "we must trust our own thinking. Trust where we are going. And get it done." This quote perfectly describes her proactivity and how trust is essential for good leadership and confidence.

In 1969, a group of Native Americans took over the federal penitentiary on Alcatraz Island and laid claim to it by right of discovery. This was a way to expose the suffering endured by Indigenous people in the country. In her 1993 autobiography

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[27] Maureen O'Dea Caragliano, "Beyond Princess and Squaw: Wilma Mankiller and the Cherokee gynocentric system" (1997), 83.

[28] Candessa Tehee, "The Cherokee Heritage Center: Balancing Diverse needs." *Practicing Anthropology* 37, no. 3 (2015): 45.

[29] Tehee. *Practicing Anthropology*, 45.

[30] O'Dea Caragliano, "Beyond Princess and Squaw," 70.

[31] O'Dea Caragliano, "Beyond Princess and Squaw," 74.

[32] O'Dea Caragliano, "Beyond princess and squaw", 66.

"Mankiller: a Chief and her People", Mankiller said, "when Alcatraz occurred, I became aware of what needed to be done to let the rest of the world know that Indians had rights, too." The Alcatraz occupation lasted 19 months from 1969 to 1971. [33] Mankiller was not directly involved with the occupation of Alcatraz, but she was a supporter of the movement and its goals. Her involvement with the Alcatraz occupation reflects her commitment to advocating for Indigenous rights and social justice. She continued to be involved in activism throughout her life as her leadership and advocacy had a significant impact on the Cherokee Nation.

Fred Sasakamoose and Wilma Mankiller are two Indigenous people who made significant contributions to their communities as they broke down barriers for Indigenous people in their respective fields. Both Fred Sasakamoose and Wilma Mankiller demonstrated strong leadership in their respective areas of work. Fred Sasakamoose showed leadership both on and off the ice. He was known for his dedication, hard work, and perseverance as a hockey player, which allowed him to break down barriers in professional sports. He laid the foundation for Zach Whitecloud and Brandon Montour, two Indigenous professional hockey players, who faced-off against each other in the 2023 Stanley Cup Finals. He also used his platform to promote Indigenous issues and inspire young Indigenous athletes to pursue their dreams. Wilma Mankiller worked to improve healthcare, education, and economic development in her community, and was a strong advocate for Indigenous rights and sovereignty from the 1970s onward. She also established programs that supported the empowerment of women and girls in her community. As the first woman to be elected as the principal chief of the Cherokee Nation, she showed exceptional leadership in her role. Mankiller states in her autobiography, "If I am to be remembered, I want it to be because I am fortunate enough to have become my tribe's first female chief. But I also want to be remembered for emphasizing the fact that we have indigenous solutions to our problems."[34] In summary, Sasakamoose and Mankiller demonstrated dedication and perseverance, as well as advocacy for Indigenous rights, which are important qualities of effective leadership and established a legacy.

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[33] Troy Johnson, "The Occupation of Alcatraz Island: Roots of American Indian Activism," *Wicazo Sa Review* (1994), 64.
[34] Wilson, "Wilma Mankiller."

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