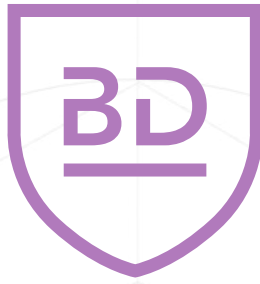


Senior Projects

2023–2024



BASIS ORO VALLEY



SENIOR PROJECTS

At this point in their senior year, BASIS Charter School students have completed a set of four BASIS Capstone classes to earn their BASIS Honors Diploma. In addition, many students are in the process of completing the College Board's AP Capstone Diploma™, a challenging, two-year sequence of AP Seminar™ and AP Research™, plus four other AP® Exams—all of which require extensive research, writing, and oral defense. The BASIS Diploma Senior Project marks the culmination of this hard work and perseverance.

Completed in the third trimester of a student's senior year, the Senior Project is unique, self-designed, and reflective of each student's varied academic interests and passions. Regardless of the discipline—business, art, humanities, science, engineering, social work, medicine, or law—each senior must develop and explore a research question. Creating an abstract that sets the tone of the research, participating seniors must submit a project proposal, and later, orally defend their methodologies.

Under the guidance of an external advisor who is a professional in their field, as well as a faculty advisor from their school, students dedicate 10–15 hours per week to the completion of their Senior Project. To document their journey, students post weekly blog entries about their experiences, successes, and challenges as they explore their guiding question. This journaling provides a unique viewpoint on the students' activities and adds a reflective layer to their research process.

Throughout the development of the Senior Project, BASIS Charter Schools support their seniors every step of the way. The project summaries in this publication clearly illustrate each senior's ability to apply the knowledge and intellectual curiosity they have acquired in the classroom to professional research methods. At the successful conclusion of this project, students are eligible for a BASIS Diploma with High Honors, the most distinguished accolade offered by BASIS Charter Schools.

Each member of the BASIS Charter Schools network commends our seniors for their dedication and motivation—not only for completing this Senior Project, but for their commitment to the BASIS Charter School Curriculum. Congratulations to them on this powerful achievement, and our best wishes as they move forward on their educational journey.



Carolyn McGarvey
Chief Executive Officer
BASIS Ed AZ, DC, LA



David Hubalik
Chief Executive Officer
BASIS Ed Texas



Oro Valley SENIOR PROJECTS

SARAH A.



AUTHENTICITY IN FRAME: THE DEBATE OF REPRESENTATION IN MEDIA

SUMMARY: In the last 10 years, there has been a growing divide in the public response to media and its surrounding culture, especially regarding representation. Many people find representation has let diversity bloom and increased the range of voices we hear. For these people, seeing oneself on the screen is a method of empowerment, of spreading knowledge on their history and culture. Simultaneously, some feel like a focus on diversity has stifled media to stereotypes and inauthentic storytelling. This group usually finds representation attempts to be a form of pandering to modern tastes, or non-effective entirely. Through my project, I'll be discussing this topic with varied groups of people, specifically regarding questions like, "Does representation in media matter to you?" and "Is the current form of diversity in media functional?" When choosing my working group, I'll interview as many people with differences in race, gender, sexuality, politics, and connection to media. I'll record these interviews, audio clips, and polls to create a short documentary showing why both arguments are common, and why specific groups of people may feel the way they do.

• **BASIS ADVISOR:** Denry Willson • **ON-SITE MENTOR:** Jake Deason • **LOCATION:** University of Arizona

BRENNAN B.



RAMP DESIGN: ASSESSING SIDEWALK ACCESSIBILITY FOR THE DISABLED COMMUNITY

SUMMARY: Curb access ramps are often utilized daily without much notice, seamlessly integrating into our regular commutes and shopping routines. Despite their essential role in ensuring pedestrian mobility and safety, many roadway construction companies tend to overlook their significance. Consequently, messy curb access ramps are frequently constructed due to a lack of attention to the required design process. These oversights lead to discrepancies in ADA compliance, posing challenges for the disabled community. Every aspect of ramp design, from the correct sloping for wheelchair users to the implementation of truncated domes for the visually impaired, holds critical importance for the success of the project. Failure to execute these elements properly can result in long-term costs. Collaborating with DJ Gregory, a professional engineer and roadway designer at Infrastructure Industries, Inc., I am currently learning to utilize Autodesk Civil 3D and apply my independent research on curb access ramps to practical design tasks. Through this experience, I aim to deepen my understanding of roadway design and ultimately contribute to the improvement of sidewalk and roadway accessibility for individuals with disabilities by designing my own ramp for a real construction project.

• **BASIS ADVISOR:** Garion Johnson • **ON-SITE MENTOR:** DJ Gregory • **LOCATION:** Infrastructure Industries Inc.

AUBRIANNA B.



CULINARY EXPLORATION OF CULTURES ACROSS THE CONTINENTS

SUMMARY: Language, belief, music, dance, tradition, and, of course, culinary artistry—the rich tapestry of our world unfolds with myriad cultural practices across diverse countries. While certain similarities may exist, it is the unique differences that illuminate each culture in its distinctive brilliance. I am steadfast in my belief that cultivating knowledge and heightened awareness of the aspects that set individuals apart is of great importance. In my perspective, one of the most effortless means of forging connections with people is through the shared enjoyment of food, particularly desserts—an endeavor I ardently embrace. From the moment I could join my mother in the realm of baking, this culinary pursuit has been a source of unbridled joy for me. Motivated by my passion for baking and a sincere desire to deepen my understanding of global cultural distinctions, I aspire to explore and unveil new desserts spanning six continents. The historical and environmental influences on each dish form integral components of their distinctiveness. Consider, for instance, the contrast between what different countries consider cake. It could be a tiered tower of fluffy cake and frosting or a pastry-like shell of a slightly savory filling, and then take the time to look at the connection those cakes have to holidays or folktales. Embarking on this project, my initial step involves reaching out to acquaintances, gathering cherished family narratives associated with each dessert, and presenting the culminating creations in a meticulously curated cookbook. The concept of a cookbook aligns seamlessly with my overarching goal, as it provides a singular repository featuring a fusion of narratives and recipes—rendering it both accessible and compelling to anyone with an inclination for exploration and appreciation.

• **BASIS ADVISOR:** Adrienne Fluitt • **ON-SITE MENTOR:** Scott Martley • **LOCATION:** Blue Finch Bakery

CARSON B.



MAKE A WISH: GRAPHIC NOVEL CREATION, DESIGN, AND PUBLISHING

SUMMARY: It is often said that a picture paints a thousand words. However, sometimes pictures themselves just do not suffice. There are instances where visuals alone fall short, and words themselves seem inadequate to capture the essence of a scene. That is where graphic novels come into play. While comic strips have existed since the 1920s, it was in the 1970s that they evolved into the contemporary form of graphic novels: long-form stories told with panels that blend visual and textual storytelling. With their rise to digital platforms such as Webtoon, it appears that the industry's audience is only growing. My goal is dissecting the process of making a graphic novel, from storyboarding and creation of a script, to making and designing the panels, to production. I venture to ascertain all there is to know in the field as well as produce a chapter of an original graphic novel. I will research commonly used methods to create comics and with the help of a professional artist, create eye-catching characters and breathtaking vistas in the digital world of webcomics. I wish to create a narrative that elicits a range of emotions, from jubilant to melancholy. I want to create a story that resonates with readers' hearts and minds long after they have read it. This has been a dream of mine since I was a young child. I grew up on graphic novels, and it is a medium that any generation can enjoy.

• **BASIS ADVISOR:** Kolb Ettenger • **ON-SITE MENTOR:** Will Burns • **LOCATION:** Gearbox Software

DAVID B.



GETTING THE BAND BACK TOGETHER: MAKING AND RECORDING MUSIC

SUMMARY: Music has held profound significance in my life for a long time, constituting an enduring passion that has never waned. A particular source of joy is mastering my favorite compositions on the guitar. The aspiration to create my own musical compositions and delve into the intricacies of music production has long been compelling. This project serves as my earnest attempt to actualize these ambitions and address lingering inquiries that have occupied my thoughts over the years. I have harbored a persistent curiosity about establishing an affordable home studio for recording scratches. My approach involves engaging with individuals possessing greater expertise, coupled with diligent independent research on audio recording equipment. Overcoming certain obstacles necessitates dedicated practice, be it in honing songwriting skills, delving into music theory, or refining our collective ability to play in synchrony. The overarching objective of this undertaking is to gain a comprehensive understanding of the songwriting and recording processes. While the prospect of failure looms as a plausible outcome, I am resolute in my commitment to learning. A potential lack of success will not serve as a deterrent but rather as a catalyst for continued growth and exploration. Ultimately, my aspiration is that this project contributes, in some measure, to the enjoyment of those who resonate with the musical creations that emerge from the collaborative efforts of myself and my friends.

• **BASIS ADVISOR:** Sean Aiken • **ON-SITE MENTOR:** Chad Essig • **LOCATION:** Grandmaster Recorders

JULIA C.T.



COMING OUT OF THE FOG: STORIES OF TRANSRACIAL ASIAN ADOPTEES

SUMMARY: Everyone loves adoptees until they speak up and say that adoption is not so beautiful—that it's not just about luck, but also trauma. The wound cuts deeper into the adoptee than one might anticipate. The loss of your biological family (the adoptee), the loss of not being able to have a child (the adoptive parent), and the loss of a child aren't all that different (birth mom). This project is exploring the psychology behind transracial Asian adoptees who are adopted between the ages of 5–17. I am navigating through the shared traits that all these adoptees have in common—including identity, coming out of the fog (starting the identity journey), the lack of personal information due to government intervention, the guilt, shame, microaggressions and racism, self-esteem, drawing boundaries with loved ones, and starting a new independent life—all stemming from the losses of adoption. I am spending time interviewing fellow adoptees and writing stories in the form of free-form poetry. I am working with an adoptee-specialized therapist who is also a transracial adoptee and birth mom. I am hoping with this senior project to raise awareness for non-adoptees to be able to understand the feelings behind the whole adoption journey. As a transracial Asian adoptee, adopted at the age of 5, I want to inform about the truth of adoption—it's not all wonderful.

• **BASIS ADVISOR:** Adrienne Fluitt • **ON-SITE MENTOR:** Dr. Abby Hasberry
• **LOCATION:** Counseling at the Green House Texas

ANNABEL C.



EXPLORING MUSIC'S CULTURAL AND COMMUNITY IMPACT IN THE DIY SCENE

SUMMARY: I love art. I think music can often be the most impactful form of art. It has a way of defining eras and generations, encouraging us to emotionally connect with each other. I was inspired to undertake this project after being a member of BASIS OV's History of Rock Club for the past three years. I wanted to explore how music has shaped people's lives: their childhoods, adulthoods, and personal values/beliefs. I also wanted to know how music can serve as an educational tool and as a community for youth. To conduct my research, I interviewed around 20 different individuals about what kind of music they listen to, how they interact with live music and music subcultures, and how music has taken a place in their lives. The participants were from a range of ages and life experiences to ensure a more in-depth picture of how different generations have consumed and experienced music. These interviews are in a podcast/transcription format. In the second part of my project, I volunteered at a small, local music venue called Groundworks which specializes in the DIY music scene and youth community engagement. At Groundworks, youth bands play and kids come after school to get music lessons, undertake art projects, and participate in various music scenes. As I volunteered (setting up equipment for shows, running concessions, cleaning, fixing lighting, organizing venue tools, etc.), I tried to capture the energy of Groundworks, interviewing staff and performing band members. Through this project, I hope to capture the importance of music in our development as people and the connections it forges between one another.

• **BASIS ADVISOR:** Tommaso Cioni • **ON-SITE MENTOR:** Stephanie J. Fanning • **LOCATION:** Groundworks

KEREM D.



CONSTRUCTING AND DESIGNING SOLAR POWERED WATER IRRIGATION SYSTEM

SUMMARY: The future is heading towards the world of sustainable technology. Solar, nuclear, wind, tidal, and other sustainable energy sources have been big topics in every industry. While having an interest in electrical engineering, I also have an interest in sustainable technology. Since there is a massive demand for solar-powering facilities and houses all over the U.S., I have found a fascination with solar power. It is known that 44 quadrillion watts are transferred from the Sun to the Earth every year, so it is necessary to continue developing solar energy collection devices to harness that energy. As a result, a former Embry-Riddle Aeronautical University professor provided me with advice and mentoring about the mathematical and physics aspects of how a solar panel works, should be built, and should be adjusted for positioning. For my project, I have decided to research solar panel designs while powering a water irrigation system using solar energy. My design process investigates the efficiency of using a self-made solar cell compared to a manufactured solar cell, framing and sealing of a solar panel, and motorization of the solar panel positioning towards the sun. I plan to use the solar panel to power an automated irrigation system where it will distribute water to plants over fixed periods to measure successful growth. I hope to further develop my skills in engineering while coming up with new ideas and applications for using clean energy.

• **BASIS ADVISOR:** David Stropka • **ON-SITE MENTOR:** Dr. Murat Okcay • **LOCATION:** Raytheon

JUSTIN F.

C# PROGRAMMING UTILIZING THE UNITY ENGINE IN INDIE GAME DEVELOPMENT



SUMMARY: I am working on an indie game project tentatively titled, "Wander Bread." My primary focus is programming within the Unity game development environment. I explore the journey of translating creative concepts into functional and captivating gameplay through lines of meticulous code. Leveraging Unity's robust scripting capabilities, the project delves into the intricacies of coding to bring a unique gaming experience to life. The game's core features, interactions, and dynamic elements will be meticulously crafted, reflecting the programming experience I'll contribute to the project. Through the lens of code, I'll navigate the challenges of game logic, user interactions, and performance optimization, shaping the foundation upon which the artistic and design elements will be integrated. This project serves as an immersive learning experience for me, highlighting the significance of coding in shaping the narrative, mechanics, and overall user engagement within the game development process. I am learning the intricacies of the Unity game engine, as well as how to properly work and cooperate with a team to work towards a creative vision. I'll utilize best the tools that Unity provides to bring "Wander Bread" to life.

• **BASIS ADVISOR:** Jack Kness-Knezinskis • **ON-SITE MENTOR:** Jason Peipelman • **LOCATION:** IBM

LAURENA F.

THE MARATHON BLUEPRINT: CRAFTING A JOURNEY OF TRANSFORMATION



SUMMARY: Only a minuscule fraction, precisely 0.01%, of the global population has ever engaged in the demanding pursuit of running a marathon. The magnitude of the distance, spanning 26.2 miles, can evoke intimidation, especially considering the rigorous training regimen it entails. While the prospect of running may initially appear formidable, the invaluable health and mental benefits it yields cannot be overstated. In the realm of physical well-being, running plays a pivotal role in significantly reducing the risk of mortality, coronary artery disease, hypertension, and stroke. Moreover, its positive impact extends to mental health, fostering enhanced self-confidence and promoting healthy aging. The transformative power of running is not confined to the tangible health benefits alone; it encompasses pushing the boundaries of one's mental capacity and personal growth. For my senior project, I have undertaken the ambitious endeavor of running a marathon. Within this comprehensive exploration, I will document the myriad facets of my training and lifestyle habits that influence my ability to conquer this challenge. This entails breaking down my structured training plan, candidly discussing the obstacles I overcome, delving into the nuances of nutrition and recovery practices, and thoroughly exploring the multifaceted journey leading up to a marathon. My primary objective is to demystify the seemingly daunting nature of marathon running, presenting it as an achievable feat through a more approachable lens. I aspire to inspire others by showcasing that life-altering transformations can be realized by undertaking this endeavor, emphasizing that the perceived difficulty diminishes with dedicated effort. Through this project, I aim to not only test the limits of the human body based on my own experiences but also to serve as a beacon for those who may harbor reservations about embarking on a similar transformative journey.

• **BASIS ADVISOR:** Vikki Thompson • **ON-SITE MENTOR:** Erin Paradis • **LOCATION:** University of Arizona

TYLER F.



A WORLD OF QUESTIONS: IMPROVING STORYCRAFT THROUGH THE MEDIUM OF SUBCREATION

SUMMARY: Tolkien, Martin, Sanderson. These are names associated with masterful worldbuilding and brilliant attention to detail, which undoubtedly improve the quality of the stories they are associated with. But there is quite a fine line between immersive, story-driving worldbuilding, and gratuitous, head-spinning detail. When it comes to what makes these techniques work, the answer can typically vary between people. What matters, in my opinion, is how well the worldbuilding details that are relevant to the story contribute to that story's "point," or to its overarching themes. In this project, I plan to put this idea into practice, constructing a fictional world with a particular point in mind, and exploring the various aspects I'll need to focus on to contribute to that point.

• **BASIS ADVISOR:** Dallin Bundy • **ON-SITE MENTOR:** Kate Mathis • **LOCATION:** PowWow Publishing

MADLINE G.



DANCE INSIGHT: NURTURING GROWTH AND CONFIDENCE IN NOVICE DANCERS THROUGH TAILORED LEARNING STYLES

SUMMARY: Embarking on a journey into the dance industry as a teenager can be a formidable challenge, especially when surrounded by peers with years of experience. Drawing from personal experience, this project aims to provide a transformative crash course in multiple dance styles to a diverse group of individuals aged 15 to 18, with varying levels of prior dance exposure. Through a structured curriculum encompassing a wide range of dance genres, participants will be guided through an immersive learning experience designed to accelerate their understanding and proficiency in dance. The project seeks to cultivate a supportive environment where each participant is empowered to discover their unique learning style and develop confidence in their abilities. Central to the project's objectives is the exploration of effective teaching strategies tailored to the needs of teenage learners with diverse backgrounds and aptitudes. By facilitating self-discovery and personalized learning approaches, the project aims to equip participants with the tools and confidence necessary to navigate the challenges of mastering new dance styles.

• **BASIS ADVISOR:** Adrienne Fluit • **ON-SITE MENTOR:** Lauren Mashburn • **LOCATION:** Heart and Soul Dance Studio

COLBY H.



MAINTENANCE OF EXTERNAL BEAM RADIATION THERAPY MACHINES

SUMMARY: Radiation oncology remains one of the most effective methods of cancer treatment in the world. In this method, cancerous cells are killed using high doses of radiation that are targeted to only affect a small area. Using this method, doctors can effectively kill early cancer growths with precision. To administer these doses of radiation, special equipment is used that must be tuned and maintained very acutely. In my project, I aim to understand the equipment behind radiation oncology through an engineering perspective by helping to perform the quality assurance and maintenance checks performed on this equipment on a monthly, weekly, and daily basis. This project allows me to observe how engineering is used to help cancer patients in the real world, along with developing an understanding of the design choices made by the engineers who built this machinery. I am learning about radiation as it is seen from both medical and physical perspectives and developing an understanding of radiation oncology as a cancer treatment, why it is used, when it is used, and what its pros and cons are.

- **BASIS ADVISOR:** Alejandro Barraza • **ON-SITE MENTOR:** Dr. Dario Pasalic
- **LOCATION:** Rocky Mountain Cancer Center

BRADY H.



QUEST TO REPLACE TRANSISTORS: NICKEL OXIDE BASED MAGNETIC TUNNEL JUNCTIONS

SUMMARY: As technology improves we constantly demand more, faster storage. We currently store information as 1's and 0's with transistors, which have "on" and "off" states differentiated by the flow of electricity. However, the only way to improve this technology is to create them at ever smaller sizes and increase the number of transistors in each microchip, and at some point, we reach a limit. Transistors require the constant use of energy to keep 1's and 0's from switching back and forth, and as they get smaller, the amount of energy required to stop electrons from flowing increases. Now, the theoretical limit for the size of a transistor is nearing. The Wang Lab at the University of Arizona explores a field of condensed matter physics called spintronics. The idea is to use the spin of electrons to differentiate between 1's and 0's allowing for ultra-small and energy-efficient storage devices. My specific project involves magnetic tunnel junctions. These structures are composed of an insulator sandwiched between two metals. The bottom layer has the spin of electrons fixed in one direction, while the spin of the top layer can be changed by applying a magnetic field. The orientation of the spin in the top layer creates high and low resistance states that mimic the functionality of transistors on a smaller scale and with no maintenance voltage meaning a non-volatile storage solution. . This technology is still maturing as new combinations of materials are theorized and experimented to optimize its performance further. I am helping to produce samples composed of new materials and doing various measurements to assess their viability in real-world applications.

- **BASIS ADVISOR:** Jaclyn Deppmeier • **ON-SITE MENTOR:** Ali Habiboglu • **LOCATION:** University of Arizona

KAMERON K.

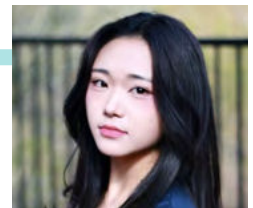


MUSITUM: THE PROCESS OF WORLDBUILDING FOR A FANTASY SUPPLEMENT

SUMMARY: Worldbuilding has intensely varied applications. Novels, movies, manga, video games, and more all directly correlate with the magical process of fabricating realities. Each world provides a medium for the imagination to run wild, allowing enthusiasts to add their own spins and create fan-fiction which can incorporate their ideas with your creation; the entire process can be enchanting. I am exploring what goes into the deepening of a setting, and what needs to be done to stratify my setting into a usable guide of its own for the most popular table-top role-playing game out there, Dungeons & Dragons. My project will explain the process and problems of developing a setting and turning it into a usable expansion that can link with pre-existing media. Some of these steps will be brainstorming, organizing knowledge, revising language, cross-referencing design elements, narrative immersion, finalizing elements, assembling a final draft with all completed elements, and publishing what I've made. To do this, I am taking inspiration and influence from multiple other settings and creators to create my own unique and comprehensive guide to a savage world composed of magic and danger. In this process, I am forming a greater understanding of how worldbuilders create their lifelike parallel realities and realize exactly what goes into making a game expansion for the public.

• **BASIS ADVISOR:** Kolb Ettenger • **ON-SITE MENTOR:** Owen Biche • **LOCATION:** Independent

MINJU K.



EMPOWERING PATIENTS THROUGH SELF-EXPRESSION: HOSPITAL GOWNS

SUMMARY: Fashion is an important aspect of self-expression, meaning a long patient stay may lead to identity loss due to the long-term use of a hospital gown. There have been studies demonstrating that patients have felt an increased sense of exposure, discomfort, disempowerment, embarrassment, and even dehumanization during their hospitalization due to these flimsy, nondescript gowns. My senior project involves redesigning the hospital gown for long-term patients. After receiving consent from the hospital and patients, I am asking patients to take a well-being inventory, then interviewing several patients in hospitals and rehabilitation centers about their feelings about the present gown and ideas for redesign. Under the guidance of Dr. Lee, an internal medicine doctor at the rehabilitation center, and Mr. Jang, CEO of a hospital cloth manufacturing company, I am redesigning the gowns to minimize patients' dissatisfaction with the current hospital gowns, taking material, length, coverage, color, pattern, and style into consideration. After designing an array of gowns from which patients can select, the patients will ideally wear the gowns for a week, then be reinterviewed to see if there is an improvement in the well-being of the patient from the new gown. In the end, I will use the wellness test results in addition to interview questions and answers to write up the conclusion for my senior project, considering multivariate factors in design implementation, from self-expressiveness and self-confidence to comfort and ease of use, both physical and emotional.

• **BASIS ADVISOR:** Jaclyn Deppmeier • **ON-SITE MENTOR:** Dr. Yeo Kyung Lee • **LOCATION:** Carelon Health

BROOKE L.



THE HAPPIEST VACATION ON EARTH: A MODERN AND NUANCED APPROACH TO DISNEY PLANNING

SUMMARY: In recent years, it has become harder and harder for families to affordably and conveniently take trips to Disneyland and Disney World. There are many hoops to jump through to plan a Disney trip, from learning terminology like Genie+ and Early Entry to making park reservations. On top of that, the park is busier than ever. There's never really an off-season. This makes it so frustrating for a family who has never gone to the parks before to go without ending up being miserable and waiting forever in lines. I aim to make planning a Disney trip as easy as possible. To do this, I am working with Somewhere Beyond Vacations as a Navigator to streamline the vacation planning process. My services are 100% free, from choosing ideal dates to planning out their itinerary and booking their hotels. I am also creating schedules to maximize my client's time within the parks using optimization and AI. I hope to make traveling to these theme parks as easy and cheap as possible. Disney shouldn't just be for rich families or California/Florida residents, it should be accessible to everyone. Although I can't change the price of tickets or hotel rooms, I can make their trip the best it can be. I believe that through the utilization of a deep understanding of the parks and technology, the planning experience can be improved.

• **BASIS ADVISOR:** Adrienne Fluit • **ON-SITE MENTOR:** Rachel Money • **LOCATION:** Simpleview

AMIYA L.



THE MICROBIAL EFFECTS OF REGENERATIVE AGRICULTURE ON SOIL MYCELIUM

SUMMARY: With the rise of industrialization in the modern era, a globalized culture deeply rooted in consumer capitalism causes excessive greenhouse gasses to be released into the atmosphere. However, pushback comes from conservationists and environmental scientists, who pioneer new solutions to our climate crisis. In particular, the regenerative agriculture movement is revolutionizing traditional farming, as it allows farmers to sequester massive amounts of carbon back into the soil where it belongs. It is rooted in indigenous farming techniques, where the soil, air, water, and sunlight are treated as one interconnected web, each supplanting benefits to the other. A powerful sociocultural relationship emerges between the farmer and the land, where farmers hone their ability to "communicate" with the land and embrace nature rather than combat it. Key practices of regenerative agriculture are cover cropping, diversification of crops, and soil coverage. I would like to explore soil coverage by working to develop the community garden with the Tucson Village Farm at the University of Arizona's Campus of Agriculture. To deepen my understanding of the ecological benefits regenerative agriculture provides, I am analyzing samples of soil from the community garden in the Campus of Agriculture labs to examine the microbial benefits of this practice on soil. By taking a dual scientific and engaged approach to this practice I hope to see the full spectrum of benefits this practice provides. The long-term goal is to raise scientific awareness of the benefits of regenerative agriculture to push more farms across the United States to pursue regenerative agriculture.

• **BASIS ADVISOR:** Eric Fetkenhour • **ON-SITE MENTOR:** Liz Sparks • **LOCATION:** Tucson Village Farm

ARYAN M.

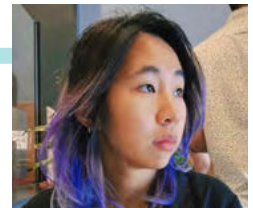


AN OPEN-SOURCE SOLUTION TO SPIKE SORTING ANALYSIS IN NEUROPHYSIOLOGY

SUMMARY: Several studies have developed more accessible tools to spike sorting analysis in neuro and electrophysiology. While still being locked behind significant costs of entry, the development of a free, open-source script for spike sorting analysis still remains. Electrophysiological recordings of mechanical stimulation from the cockroach ventral nerve cord and femur are obtained through low-cost SpikerBox amplifiers and the accompanying spike recorder. The script requires users to define parameters for spike sorting analysis including a voltage threshold, beginning, and end time interval. Only after which can the data be sorted and filtered into spikes that both surpass the voltage threshold, and represent biphasic extracellular action potential waveforms. Feature extraction is done on every individual spike in the analysis interval to extrapolate a subset of characteristics. The spikes are subsequently characterized through Principal Component Analysis dimensionality reduction to group and cluster similar neurons in a two dimensional K-Means clustering algorithm. The interspike interval and frequency of each type of neuron are calculated and displayed for in-depth analysis and consideration in students' studies. The resulting script, available for free and open-source through Python, exhibits no significant variability from the commercial counterparts. The accessibility of this script detracts from the significant financial inequality in the scientific community burdened by underrepresented rural communities, and provides a meaningful avenue for neurophysiological research across a widened span of backgrounds.

• **BASIS ADVISOR:** Clara Estey • **ON-SITE MENTOR:** Dr. Ulises Ricoy • **LOCATION:** University of Arizona

TIANA N.



THE LENS OF THE PLAYER: UX DEVELOPMENT OF WANDER BREAD, A SINGLE-PLAYER STORY BASED ROGUE-LIKE

SUMMARY: Starting as a cute little idea for a game about sandwich making, Wander Bread will become a reality. Wander Bread aims to be a single-player rogue-like featuring a main character (the player), who is a burnt-out student working part-time as a sandwich maker at a chain, who has been transported into a world made up of sandwich ingredients. The player explores this world full of mystery while trying to figure out a way to get back home. I am designing how the player experiences the game, more specifically the user interface design (UI design). User experience (UX) plays a huge part in any game because it determines the tone of the game and the mood of the player. The UI is only a part of the UX that is meant to display information for the player, but by exploring the different types of game interfaces and working with my mentor, I aim to make the game experience as accessible and immersive as possible. At the same time, I will be teaching myself the basis of the most common coding language used for game design through Unity.

• **BASIS ADVISOR:** Sivashanmugapriya Sankaralingam • **ON-SITE MENTOR:** Dr. Erin Chiou
• **LOCATION:** Arizona State University

BRIANA P.



THE ROLE OF RESPECT IN LAW ENFORCEMENT AND THE JUDICIAL SYSTEM

SUMMARY: The legal system exerts its influence on every individual. On a day-to-day basis, police officers leverage their training and experience to ascertain the nature of crimes committed by individuals and the applicable charges for each situation. Subsequently, these individuals undergo legal proceedings, during which the judge or jury, guided by local laws and the testimonies of involved parties, determine the appropriate outcome. The significance of these interactions between citizens, police officers, and the court cannot be overstated, as they profoundly impact public trust and respect for both law enforcement and the judicial system. As an Oro Valley Police Cadet, I have been instilled with the principles of acting respectfully and professionally, whether in competitive scenarios or while volunteering with the public. I firmly believe that respect constitutes a fundamental element for all parties involved in the legal system, as it significantly influences the outcomes of interactions between citizens, police officers, and the court. The fair and respectful treatment of individuals who have committed a crime throughout the legal process holds substantial importance. Such treatment positions these individuals to potentially influence others in the community to trust those entrusted with the responsibilities of law enforcement and the courts. I am collaborating with and interviewing various stakeholders within the law enforcement and judicial system, including the Judge of the Oro Valley Court, Oro Valley Police Officers, and the Court Administrator (and project mentor) Anizza Alvarez, among others. These interactions afford me firsthand insights into the pivotal role that respect plays within the system.

• **BASIS ADVISOR:** Justin Campbell • **ON-SITE MENTOR:** Ms. Anizza Alvarez • **LOCATION:** Oro Valley Court

ANGELA P.



MEMORIES LOST AND FOUND: CONSTRUCTING A CREATIVE MANUSCRIPT

SUMMARY: Through writing we can convey individual ideas and emotions to a vast audience. I have always been interested in creative writing, as well as sharing stories. Fiction has allowed me to shape my inner mind in a way that others can understand and relate to. As is the case for many young Americans, I come from an immigrant family. My maternal grandparents fled Cuba when they were young, and I was raised on the stories of their homeland. More recently, my grandmother fought dementia, losing much of her memories, before passing away. This compelled me to find a path towards preserving the memories she shared with me while mourning the loss of her and the stories she never got to tell. In my project, I will draft a manuscript of a novel inspired by these emotions and experiences. This pursuit will allow me to improve my writing abilities and learn what facets make a compelling work of fiction, under the guidance of Dr. Christina Ramirez. In a fantastical interpretation of my grandmother and my life, I hope to create a piece that is not only entertaining but can convey the feelings behind the story, and provide comfort and familiarity to those in a similar situation.

• **BASIS ADVISOR:** Dallin Bundy • **ON-SITE MENTOR:** Dr. Cristina Ramirez • **LOCATION:** University of Arizona

CORINTHIAN Q.



FROM RECIPE TO DOUGH TO BREAD: FOLLOWING THE CHARACTER DESIGN PROCESS BEHIND THE UNIQUE CAST OF WANDER BREAD

SUMMARY: Equilibrium has been disrupted and a supreme being of the universe has been angered. Revealed by the golden letters on a mysterious receipt, it has been prophesied, that you, the chosen one, must embark on a perilous journey across the multiverse to find a way to appease the being and return the world to its rightful state. The only way to do this is to... create the perfect sandwich. Will you fail and let the world fall apart, crumb by crumb? Or will you rise to the occasion and deliver a sandwich worthy of the stars? Minds filled with countless plots from Nintendo games, YA fantasy books, and Studio Ghibli animations, Wander Bread is a product of our wildest imaginations. Our group of two developers and two artists aims to create a demo of a 2D rogue-style game set in the whimsical food universe. Our demo will highlight the first world that our protagonist will stumble upon; the flour-y lands of Kalach, heavily inspired by Russian culture and architecture, where Tsar Kara and her faithful servant, Cinna, rule over the warm and cheery bread people; however, underneath these yeast-filled lands, a mold festers, slowly claiming the lives of the innocent bread citizens and turning them into dough-hungry killers. My role is to create character designs using Procreate. From their outfits to their expressions, I'm in charge of taking every detail from our lore and setting into account to create comprehensive designs that fully capture the essence of our bread world. Through this experience, I hope to be able to practice my techniques and develop a comprehensive style, as well as go out of my comfort zone to learn new things!

• **BASIS ADVISOR:** Sivashanmugapriya Sankaralingam • **ON-SITE MENTOR:** Stewart Yale • **LOCATION:** Freelance

CALEB R.



REDEFINING MASCULINITY: A STUDY OF MENTAL HEALTH CRISES, GENDER INEQUALITY, AND FATHERHOOD

SUMMARY: Over the past century, America has experienced a revolution in dismantling restrictive gender roles: yet, antiquated standards of masculinity persist. The daily pressure to be tough, unemotional, self-sufficient, and hypersexual—often known as hegemonic masculinity or the “man box”—results in elevated rates of depression, substance abuse, and suicide among men. These same pressures perpetuate outsized male risk-taking, gender-based violence against women, and homo/transphobia. The expectation of men to be “breadwinners” rather than primary caregivers stands as barrier to gender equality, as both married women and single mothers continue to be disproportionately saddled with the burden of child-rearing. My project investigates all facets of this issue, beginning with identifying the fundamental sources of masculine standards and contrasting what is attributable to social conventions versus genetic traits. Furthermore, I consider ways to blunt the social, economic, and personal consequences of “harmful” masculinity while amplifying positive associations with manhood. In my thesis paper, I discuss my research as well as takeaways from interviews with men and women about their experiences with masculinity. Ultimately, I hope my work will encourage redefining masculinity in a more positive light, serving as a crucial step towards achieving better mental health, economic stability, and gender equality.

• **BASIS ADVISOR:** Lukas Adams • **ON-SITE MENTOR:** Evan Martin-Casler • **LOCATION:** University of Arizona

HWANGSUNG R.



INTERCONTINENTAL CROSSOVER OF MUSICAL GENRE AND INSTRUMENTS

SUMMARY: Due to the long history of constant isolation and lack of communication between the Eastern and Western worlds, there remained an evident separation between the musical cultures of both regions even after a shift to a global connective society. The differences between the basic musical scales used in composition and the characteristic instruments that set the atmosphere and effectively define the music of each region unavoidably created distinctive genres utterly devoid of artistic resemblance between the two worlds, which then continued to split up and evolve into even more various genres and subgenres of music that further fortified the previously established distinction. However, fusion genres and crossover music provided opportunities for a convergence of cultures in recent years. By working with and receiving advice from a professional composer, I aim to compose an orchestral piece blending the unique elements and foundational principles of both the Eastern and Western worlds through the employment of digital composition software. With a presentation of the orchestral piece through the utilization of a MIDI track, I hope to demonstrate the compatibility of the two distinct cultures with an end goal of introducing a foreign musical genre by arranging a harmonious intermingling of occidental and oriental musical concepts and techniques.

• **BASIS ADVISOR:** Lynn Davidson • **ON-SITE MENTOR:** Miyeong Son • **LOCATION:** Freelance

TARA S.



CAPTURING CULTURE: THE DEVELOPMENT OF A PHOTOGRAPHY PORTFOLIO

SUMMARY: I've always harbored a deep fascination for the art of photography. From a young age, I would furtively borrow my parents' phones to capture candid moments of my family engaged in lively conversation during dinners or holidays. What captivated me about photography was the ability to immortalize the emotions of people in a single moment, or to encapsulate their unique personalities. I could vividly capture the shared love for music between my grandfather and cousin as they sang Christmas carols together, or my aunt's rapt attention as my grandmother regaled her with stories from Vietnam over dinner. My aim with photography is to not only reflect people's inherent personalities but also to narrate a compelling story. For my senior project, I will be collaborating with my cousin, a professional photographer, to refine my skills in both image capture and editing using Lightroom. The goal is to develop a photography portfolio chronicling my travels to Vietnam and India, countries that represent my biracial heritage. Through this endeavor, I aspire to discover my capacity to capture the rich cultural tapestry and captivating beauty of these lands, while simultaneously honing my portraiture abilities by photographing people.

• **BASIS ADVISOR:** Leigh Preuss • **ON-SITE MENTOR:** Nakul Bhatnager • **LOCATION:** Sales Force

GRACE S.



LEARNING TO EAT YOUR ART: ART DEVELOPMENT FOR WANDER BREAD

SUMMARY: Video games, often dismissed as mere time-wasting activities, serve as powerful mediums for creativity. Similar to literature's ability to shape perspectives, games possess a unique magic that not only offers novel experiences but also has the potential to profoundly impact us. Despite lacking expertise in game development aspects such as environment design, color language, storyboarding, and animation, I, as an artist, aspire to undertake the role of art director in the creation of "Wander Bread." This collaborative video game project revolves around the narrative of an overworked sandwich artist on a cosmic quest to craft the perfect sandwich and save the universe. Acknowledging my limited knowledge of essential aspects of game art, I am determined to embrace this challenge. With sheer determination and the invaluable input of feedback and guidance from mentors, I will lead the artistic direction of the game. "Wander Bread" will immerse players in a new planetary system teeming with food-inspired environments and characters resembling those on Earth. The project team comprises two artists, including myself, and two developers. Through a process of experimentation, trial and error, and mentorship from experienced professionals, I aim to create game assets, animations, and environments for our video game. This endeavor will provide me with firsthand experience in developing and designing fictional spaces, offering a comprehensive understanding of the entire artistic process in video game creation. This knowledge gained through "Wander Bread," is expected to be instrumental in shaping my capabilities for future endeavors in the realm of game art.

• **BASIS ADVISOR:** Jack Kness-Knezinskis • **ON-SITE MENTOR:** Stewart Yale • **LOCATION:** Freelance

BANESA V.



THE REAL COST OF LEARNING A LANGUAGE: THE PROCESS AND PRICE OF LEARNING VIETNAMESE

SUMMARY: Learning languages is a fun hobby for many people, but at the same time can also be and useful skill providing a strong advantage in the workforce. But what goes into learning a whole new language? What barriers are there to learning a language? I'm sure not many people have thought about the financial obstacles that many face when attempting to become proficient in a foreign language. My senior project will address the fiscal impediments to sufficiently acquiring a second language, in my case, Vietnamese, solely using free resources. I am planning to track how well-versed in Vietnamese I can become through 10 weeks of intensive studying through the utilization of free resources such as Duolingo, YouTube, HelloTalk, e-learning websites, and library books. I am hoping to shine a light on lesser-known learning resources that could conceivably aid in the studying of an entirely new language for a multitude of people, especially those with a lower income. For my project, I chose Vietnamese because it is considered a critical language, meaning it requires more trained speakers than are available, and it is a tonal language, which I believe will be interesting to learn more about. I hope to spread awareness of the economic hurdles many must overcome to learn a foreign language, while also providing more information on potential resources for others on a language-learning journey.

• **BASIS ADVISOR:** Ennis Bustos • **ON-SITE MENTOR:** Mr. Sinh Le • **LOCATION:** The University of Arizona

AUTUMN W.



LYON'S TAILS: THE CREATIVE WORLD OF CHILDREN'S LITERATURE

SUMMARY: Every year, tens of thousands of American horses are sent to slaughter. Even more live in inhumane conditions or are abused. My rescue horse, Lyon, was abandoned and left to starve for a year on the U.S.-Mexico border in 2018. Nowadays, too few people are willing to invest time and money into rescue horses because they are stereotyped as dangerous and not competitively successful. It is my goal to eliminate that stereotype and reduce the number of horses who are inhumanely killed in foreign slaughterhouses. This project uses children's literature and illustration as a medium to tell the story of my rescue horse, ultimately to spread awareness and make change starting in the youth of our society. I hope to inspire more young people to take on the challenge of adopting a horse and assist competitive equestrians to understand that all horses can be successful like Lyon, who recently was ranked as top ten in the United States at dressage finals, and is the best in his breed that is ridden by a Junior rider in the USDF circuit. Working under the guidance of graphic designer and artist Carolina Caples, I will gain instrumental knowledge in the fields of planning, illustrating, and laying out that I will apply to this book.

• **BASIS ADVISOR:** Ruben Ramirez • **ON-SITE MENTOR:** Carolina Caples • **LOCATION:** Pima County Library

JADEN W.



EXPLORING THE USE OF AI IN EDUCATION AND MAXIMIZING TIME IN A UNIVERSITY LAB: A HIGH SCHOOLER'S PERSPECTIVE

SUMMARY: AI is increasingly used for various applications, including in education. While proponents argue AI can serve as a readily available, no cost, "private tutor", capable of providing personalized guidance and feedback for students, others point out concerns over AI's accuracy and potential effects on student's creativity and critical thinking. In this project, I review past studies to develop surveys—one for high school students and one for high school teachers—exploring opinions and usage of AI. From understanding the specific AI tools and tasks students and teachers use AI for to determining students' and teachers' perceptions on AI's effect on education equity, this survey aims to provide valuable insights for educators, policymakers, and researchers evaluating the impact of AI on the high school classroom and working to integrate and support responsible and effective use of AI in high school education. In the second part of my project, I reflect on my time in this lab as well as other research labs I've been involved with. I detail misconceptions about university labs and present 10 practical strategies for making/learning the most during your time at a lab. Ultimately, the paper aims to provide valuable insights and guidance to individuals navigating university lab settings for the first time.

• **BASIS ADVISOR:** David Stropka • **ON-SITE MENTOR:** Dr. Marvin J. Slepian
• **LOCATION:** University of Arizona; Arizona Center for Accelerated BioMedical Innovation



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