STOCKTON INNOVATIONS
A Journal of Undergraduate Research & Creativity 2014

Volume 3
Issue 1
Cover Design by Kyle Collins
Layout Design by Daviel Byrd, Briana Caravella, Kiera Perry
Image graphics in page 20 and 32 by Allison Stickle
<table>
<thead>
<tr>
<th>Page</th>
<th>Title</th>
<th>Author</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Resting State EEG as a Predictor for the Disposition Effect</td>
<td>John J. Berroa</td>
</tr>
<tr>
<td>7</td>
<td>Mothers and Daughters: A Shared Tragedy</td>
<td>Kayla Delgado-Partridge</td>
</tr>
<tr>
<td>9</td>
<td>Using the Cauchy-Crofton Formula to Approximate the Perimeter of an Ellipse</td>
<td>Jared Bland</td>
</tr>
<tr>
<td>11</td>
<td>From Liberal to Conservative: A Political History of America, 1960-88</td>
<td>Michelle Dunn</td>
</tr>
<tr>
<td>13</td>
<td>Children’s Play in The Warsaw Ghetto</td>
<td>Nicholas Hitzel</td>
</tr>
<tr>
<td>15</td>
<td>A Personal Evolution: Confrontation &amp; Sexuality</td>
<td>Danielle Jonas</td>
</tr>
<tr>
<td>18</td>
<td>Adventure Agenda - An Innovative, Java-Based Gaming-Inspired Personal Calendar</td>
<td>Elizabeth W. Kang, Cuomg Nguyen, and Donald J. Freas</td>
</tr>
<tr>
<td>20</td>
<td>Of the Good and the Bad: An Analysis of the Black-White Economic Divide in the U.S.</td>
<td>Heidi Maria Shelley</td>
</tr>
<tr>
<td>22</td>
<td>EGFR Kinase Inhibitors of Lung Cancer</td>
<td>Shannon Tarby</td>
</tr>
<tr>
<td>25</td>
<td>Knight’s Tours on Cylindrical Chessboards</td>
<td>Kara Teehan</td>
</tr>
<tr>
<td>28</td>
<td>Evaluating the Impacts of the BP Oil Spill on Louisiana Marsh Fishes</td>
<td>Jessica Valenti</td>
</tr>
<tr>
<td>32</td>
<td>The Victorian Feminist Movement</td>
<td>Jennifer Van Bavel</td>
</tr>
<tr>
<td>35</td>
<td>Modeling Ecological Networks</td>
<td>Frank Malatino and Matthew Widjaja</td>
</tr>
<tr>
<td>38</td>
<td>Editors’ Biographies</td>
<td></td>
</tr>
</tbody>
</table>
A new paradigm shift is happening in the world of finance. Financiers and economic scientists are moving away from only accepting the previously widespread Efficient Market Hypothesis, and are moving towards a mix of efficient markets and Behavioral Finance and Economics. As can be deduced from their names, behavioral finance and economics deal with the behavioral underpinnings of investor behavior.

The efficient market hypothesis states that stock prices reflect all available and relevant information about a stock’s value and, therefore, the stock’s price cannot be discounted or overvalued. Behavioral finance, however, has many instances of evidence contrary to that assumption, such as the housing bubble in 2007 and the over-exposure to subprime securities by banks. These events can be explained by psychological ideas, such as overconfidence and the representativeness heuristic, which states, essentially, that past prices are over extrapolated into the future, making people believe price will still rise.

Speculative bubbles are not the only occurrences explained by behavioral finance. Individual investor or trader behavior can be explained as well. Type A and Type B personalities are correlated with financial riskiness, with Type A’s being more risky with their money than Type B (Carducci and Wong 355-359). An individual’s emotions or feelings, called affect, has also been shown to influence investment behavior. Aspara and Tikkanen found that an investor’s affect towards a company influenced how much they wanted to invest in it (78–89). The more positive the affect, the more money invested. This is due to the affect heuristic, which states that an individual will make a decision using their feelings rather than weighing all the options because it is easier.

Another interesting psychological effect present in the behavioral finance literature is the disposition effect. Shefrin and Statman came up with the idea in 1985 and describe the behavior that some investors display, namely that they hold on to their losers and sell their winners. This may be all well and good in a bull market, but if an investor happens to have just a couple of losers that they hold on to waiting for them to recover, they are missing out on putting that tied up money in a different investment that will provide them with a positive return. In a bear market, the effect becomes disastrous as losses continue to accumulate. There are two general theories as to why the disposition effect exists. First is the mean-reversion hypothesis. Essentially, traders hold losers because they assume price will rise back to the mean, and not keep devaluing. Second is the psychological explanation,
Motivation systems have also been researched in regards to baseline EEGs. Gray’s Behavioral Inhibition System (BIS) and Behavioral Approach System (BAS) is an example. The BAS system is driven by achieving success and reward, whereas the BIS system is driven by avoiding failure and punishment. Sutton and Davidson found that participants with higher activity (lower alpha activity) over the left frontal cortex were more likely to have a stronger BAS system, while the opposite was true for the BIS system.

Therefore, the purpose of this research was to examine brain activity, as measured through EEG, as a predictor of the disposition effect. The BIS system was hypothesized to be correlated with the disposition effect. The data collected included questionnaires on motivation (BAS-BIS) and risk-taking (DOSPERT), resting state brain activity, and performance on a stock trading task. The stock-trading task involved participants trading 1000 shares of an arbitrary stock, in an attempt to make as much money as possible. Each participant started with a bank of $10, so if they lost money in the study, they would lose money in reality as well.

On this task, there was wide variability among the thirty-three participants’ behavior. Some traded very few times, with the minimum being two trades, while some traded very frequently with the maximum being 26. On average, participants traded the stock 10 times. Partly due to the bullish nature of the price series, the majority of participants made money, with the average being $1273 in task profits. Six were able to “beat the market,” or make more than if they just bought at the beginning and held the stock until the end. When analyzing the amount of time spent in each trade, the disposition effect can clearly be seen in the sample overall. Participants spent, on average, a whole minute and six seconds holding losing positions longer than winning positions. This clearly displays a disposition effect.

Some correlations were found among the variables examined, however no trading task variables were significantly correlated with the EEG, and the hypothesis had to be rejected. The BAS Reward subscale was correlated with the disposition effect, and BAS total score was correlated with risk taking, suggesting that
participants held their losers longer in an effort to gain the reward of them becoming profitable. Looking at the EEG, correlations were found between alpha power at posterior electrode sites (C3, C4, P3, P4; see diagram) and risk taking, especially gambling risk. These findings are intriguing, and a larger sample size might have been able to tease out the effects more strongly across all the relevant variables. The lack of power, especially in the EEG, can be evidenced by the lack of significance in the correlation between BAS/BIS and frontal asymmetry, which has been independently confirmed in prior studies as mentioned before. Further research in regards to the disposition effect and its psychological underpinnings is recommended.

First picture of the trading task with red and green bars is of trade frequency per data point. The second image is the head map showing where C3 C4 P3 P4 is, where Red = p < .01 Yellow = p < .05

References


Name: John J. Berroa
Hometown: Barnegat, NJ
Expected Semester of Graduation / Class Year: Spring 2014
Major: Psychology with a Minor in Behavioral Neuroscience
Course/Professor: Project for Distinction with Dr. Fleck, Dr. Spinella and Dr. Berg

Why you decided to research: “I was trying to tie finance into my major [psychology]. I looked into behavioral finance, and I really wanted to work with Dr. Fleck, so paired EEG and finance to establish my topic.”

How does the research relate to you personally: “I trade stocks on my own, so I have witnessed the disposition effect in myself. This research can improve the way that you trade, if you know how to counteract the effect.”

Plans for future research: “None at the moment, but it would be fun.”

Career Aspirations: Finance or a pilot
Numerous psychology books and articles discuss the uniqueness of mother-daughter bonds. One psychologist argued that the bond between mothers and daughters is the most primal of all relationships. Mother and daughters share a bond that is significantly different from many other family dynamics. After reading various memoirs that display different family bonds within the context of the Holocaust the desire to expand on the topic has grown. In an attempt to attain a better understanding of these different family dynamics, a comparison of both mothers and daughters, as well as fathers and sons during the Holocaust will be explored. Ofer and Weitzman explain: “Although all Jews were designated for extermination, the Nazis treated Jewish men and women differently”. Additionally, the comparison of men and women as well as their responses and how they differ in context to the trials and tribulations of the Holocaust will be compared.

In *Night*, by Elie Wiesel, Wiesel describes his time in Auschwitz-Birkenau and Buchenwald with his father. Among other fathers and sons, Wiesel discovers the horrible reality of what it takes to survive the Holocaust. He is told by another prisoner: “Listen to me, kid. Don’t forget that you are in a concentration camp. In this place, it is every man for himself, and you cannot think of others. Not even your father. In this place, there is no such thing as father, brother, friend. Each of us lives and dies alone”. Wiesel realizes that trying to survive together could put them in greater danger and create a dilemma for him. He observes this dilemma in other fathers and sons. For example, while on a death march, Wiesel witnesses an older man distressed over not being able to find his son. In fact, Wiesel had seen the son further ahead of his father: “A terrible thought crossed my mind: What if he had wanted to be rid of his father? He had felt his father growing weaker and, believing that the end was near, had thought by this separation to free himself of a burden that could diminish his own chance for survival”. Wiesel discovers early on that desire for survival can override the love of a parent. One of the more disturbing displays of this was a young man killing his father over a piece of bread. The father had a discarded piece of bread and before he even had a chance to break some off for his son, he found himself attacked by his son. The father pleaded, reminding his son who he was, but this ended in the death of the father. In January 1945, Elie Wiesel’s father died. Wiesel woke up to his father’s empty bunk. Despite being devastated, Wiesel knew that he would have a greater chance to survive. “I did not weep, and it pained me that I could not weep. But I was out of tears. And deep inside me, if I could have searched the recesses of my feeble conscience, I might have found something like: Free at last!” (112).

Like Elie Wiesel, Murray Kohn was at Auschwitz with his father. Kohn’s memoir, *Weep Tears of Blood*, shows a much different father and son relationship. Kohn describes how they kept each other alive. The two of them appeared to be willing to risk their lives for each other. One morning men were selected for medical experiments. Kohn avoided the selection because of his father. “My father, who was very perceptive, grabbed me and pushed me behind him before they got ahold of me. I was very lucky”. Kohn and his father made a conscious effort to keep each other alive on a daily basis. “I ate as much as I wanted during this period… We wanted to share with others, so we stole and brought the salami back to camp. I helped my father by bringing him food”. Risking his own life, Kohn was willing to take the risk of getting beaten or killed to help keep his father alive.

In *Auschwitz: True Tales from a Grotesque Land*, by Sara Nomberg-Przytyk, we see an example of mother and daughter bonding. Nomberg-Przytyk recalls her experiences at Auschwitz. Nomberg-Przytyk tells of a French mother and daughter—fifteen-year-old Odette and her mother Marie. Nomberg-Przytyk describes both Odette and Marie as young, slim, and beautiful.
almost like sisters. Nomberg-Przytyk discusses how she envied them: “I envied them because they were together. When they cuddled up together, lying on the bed, they must have dreamt that they were together in their own home”. A child or even an adult often desires the comfort of her mother when in distress or illness, and although Odette and Marie had a hard time from day one, they had each other. Their relationship was tested when Marie became sick and ended up in the infirmary. Odette was at her mother’s bedside as often as possible—every morning and night: “They whispered endearing words to each other, because Odette could not bring her anything else… Odette would storm into the area and go straight to the block where her mother was lying. She said “Good morning.” kissed her mother, hugged her, and was gone”. This visceral and endearing love made Odette’s death more poignant. Odette arrived at the infirmary to find her mother gone. Odette discovered her mother’s body in the mud: Shortly after her mother’s death, Odette was killed for a rebellion she took part in.

She sank down onto the snow and let out a scream so penetrating that I can still hear it to this day. She sat there for a few minutes and then fell on her mother’s corpse. Finally, she arose and ran to the Kommando. She had to be on time at the gate. Poor little Odette. She was now alone in this terrible world.

Ruth Werner’s memoir, On The Run: Mother & Daughter, Holocaust Survivors, in the USSR, describes her life with her mother, Anna, constantly running from the Germans. Ruth and Anna were living in Poland together before the Holocaust. Ruth’s father was in the U.S. working but Ruth and Anna were unable to join him. In 1939, Ruth and Anna’s town in Poland was invaded. One night while lying in bed with her mother, Ruth encounters German soldiers. “The door opened and two German soldiers barged into the apartment. . . .”

Returning home one day, Ruth heard a rumor regarding the death of her mother. “At that moment, I wished I was dead too because we only had each other. . . . My mom was my whole life. My mother was my everything” (26-27). Anna miraculously recuperated. Ruth relates: “She was the best mother a child ever had. I still miss her after thirty-six years” (28).

“The door opened and two German soldiers barged into the apartment. . . .”

Rose Ickowicz Rechnic, along with her friends and family, were deported to Auschwitz: “Each wagon was packed to the brim with people. Mommy, Bronia, Marek, and I were with several aunts and their children. Fortunately, we were all together to share our fate, whatever that might be”. After Rose and her family disembarked the train, Rose’s mother, Andzia, Rose, and sister Bronia were chosen to work in the laundry. At night when Andzia would wake from night terrors, yelling and screaming about her son, she had her two daughters to try and calm her down. Andzia saved food and tried her best to keep the girls positive. “Mommy was trying to lift everybody’s spirits even as low as hers were. She realized how lost and lonely the young people were without their families”. In January of 1944 a typhoid epidemic broke out. Andzia sickened first, followed by Rose. The SS selected people in the infirmary; one of the first names called was Andzia’s. Andzia requested Rose to “Try to survive and tell the world”. Rose memoir’s is Try to Survive and Tell the World in honor of her mother. Rose sat in the infirmary questioning what she would without her mother. “What was to become of me? Without Mommy I would not survive” (72). Rose also learning of her sister’s death was very depressed, wishing to meet a similar end. Her Aunt Regina, a surrogate mother, brought her milk, and Rose recovered.

These stories display the various dynamics of the father-son and mother-daughter relationship. Many of the daughters attribute their survival to their mothers. When faced with the death of their mothers, each struggled to find a reason to live. Ofer and Weitzman explain: “Such bonding was not exclusive to women, but it is difficult to find consistent evidence of men’s caring about one another to the extent that women did”.

References:
Finding the lengths of curves is a mathematical problem that has perplexed mathematicians for centuries. For instance, when a DNA sample is taken in a biology lab, how long is the strand of DNA on the slide? The Cauchy-Crofton formula relates the number of intersections of a group of straight lines on a curve to the length of that curve on a flat surface. In more general terms, we may take a set of straight lines, rotate them, and count the number of intersections on a curve that lies on a plane.

The total number of these intersections is twice the length of the curve. We can, in turn, use this information to find the length of a curve and the solution to the mathematical problem. One example of a curved line is an ellipse; the ellipse is a “stretched circle” with one “radius” of length $a$, and the other radius of length $b$. Our method approximates the total number of intersections to find an approximation of the length of a curve, which is a simple method compared to the alternatives (Carmo).

We will examine the perimeter of an ellipse. There are several approximations to this problem, so we will propose an additional technique. We will take a set of parallel lines and rotate them by 45 degrees until we return to our original set; three of the four are shown in the figure. Each line will intersect twice with the ellipse, and is spaced at a distance $r$ away from the next line. To simplify, we make an assumption. Let us assume the line segments $a$ and $b$ are measured in meters, and both are longer than 1 meter. We will set the distance between lines, $r$, to be 1 cm. This assumption allows for us to ignore the possibility that a line only touches the ellipse once. Let’s count the number of intersections for the cases where we have vertical and horizontal lines. We have a distance of $2b$ vertically, 100 lines per length, and 2 intersections per line that make a total of $400b$ intersections. Repeat the argument.

The Cauchy-Crofton formula stems from differential geometry; through this type of mathematics, every map ever made can be proven wrong.

by Jared Bland
Cauchy-Crofton Formula
(continued from Page 9)

for \( a \), and find 400\( a \) intersections. We have 400\( b \) intersections or more per angle; since the method is an approximation, miscounting by one or two is not a problem. The angled section is more difficult to calculate; however, by the symmetry of the ellipse, we only need to count the lines making a 45 degree angle. The angle of 135 degrees is symmetric to this; we just need to multiply the answer by two. The final approximation is given in the figure. Conveniently, the 100 lines per length assumption cancels out. To improve the method, we would need to count using smaller distances between the angles (Carmo).

Now, let’s apply this to an example problem. If \( a \) is 3 units and \( b \) is 2 units, then we get an answer of 16.4355 units. This is slightly larger than a couple of the other approximation techniques available at mathisfun.com, which means we may want to use more angles to improve the approximation. In conclusion, the length of a curve can be computed by using the Cauchy-Crofton formula which relates the intersections of a set of straight lines on a curve to the length of the curve itself. When it comes to research in math and science, finding the length of a curve is invaluable from the study of DNA to the development of geographically-correct maps.

References:
In the early 1960s, it seemed that the country was becoming more liberal after the 1960 election of John F. Kennedy and his warm welcome into office by many Americans. Yet by 1980, the country had shifted right with the presidency of Ronald Reagan and his two terms in office. Over the span of 20 years, conservatives were able to emerge and shift the country in the ‘right’ direction. Historians view the 1960s as a great decade for liberals with the Camelot Era of JFK, election of Lyndon Johnson, the Great Society, among many other events. In contrast, the 1960s marked the rise of a new Republican Party, one that eventually paved the way for the election of Ronald Reagan in 1980.

From the 1930s through the 1960s, the Democrats dominated Washington and the states for a majority of those years. The election of John F. Kennedy seemed to seal the deal for the control of the Democratic Party in the White House in the beginning of the 1960s. The hero of the Cuban Missile Crisis, President Kennedy seemed to be leading the country in the right direction as his rating in the Gallup polls increased. Kennedy’s approval ratings were shaken with the Bay of Pigs invasion and he started the escalation of U.S. involvement in Vietnam. The charisma of Kennedy gave the nation hope as the youthful president was seen as a symbol of energy and change in America.

The tragic death of Kennedy helped Lyndon Johnson’s campaign for presidency in 1964 as he told the country he would continue to hold onto the policies of the martyred president. Americans in the 1940s and 1950s were comfortable, as many were rising into the middle class and the ‘American Dream’ seemed possible. Americans continued this confidence in the nation during the Camelot era of the Kennedy administration. Lyndon Johnson promised to continue this positive growth in America and continue to build upon the Americans trust in the government.

Historians focus on the great liberal era of the 1960s and the cultural movements that shaped the nation. While civil rights measures and a changing America were occurring, a backlash against the rapid changes and a rising grassroots conservative drive tend to go unnoticed. During the 1964 campaign, Lyndon Johnson identified himself with the policies of John F. Kennedy and petitioned for the potential programs that we promised would create the Great Society.

Lyndon Johnson won in a landslide against conservative Barry Goldwater. Democrats and the liberal media point to the 1964 election as the rise of the liberal movement and the end of any chance for the Republican Party to take hold of power in politics. Barry Goldwater’s crushing defeat appeared to demonstrate that Americans were embracing liberalism, “but observers focused on the candidate rather than the cause, on the electoral results rather than on the evidence of transformation within the Republican Party.” Conservatives point to the 1980s and the popularity of Ronald Reagan as the beginning of popularity for the Republican Party, but this popularity would have not been possible without Barry Goldwater calling for the Republican Party in 1964 to begin to define themselves and come together.

The failures and unpopularity of Lyndon Johnson’s presidency helped the conservative movement strengthen its power and political hold in Washington. The Great Society that Johnson promised seemed to backfire and left the American people dependent on federal funds. President Johnson held onto the promises of continuing with Kennedy’s legacy and signed the Civil Rights Act on July 2nd, 1964, an act that Kennedy had proposed but did not live long enough to see accomplished. The changes in the American society caused clashes and riots leading to the majority of white southerners supporting the Republican Party as well as unresolved Civil Rights issues that led to non-white criticism of President Johnson.

The escalation of the war in Vietnam had negative implications on the Johnson administration and had more Americans calling for a more conservative outlook in the White House and among the leaders. The American public was hit with a war overseas, a high cost of living as a result of higher taxes to support the war, and crimes and riots in the cities in opposition to the war and...
civil rights movement. By 1968, it was clear to many Americans that they had been misled by Lyndon Johnson as his promises from four years earlier changed. Too much change had Americans worried and Johnson’s approval ratings plummeted.

Domestic issues, the war in Vietnam, the turbulent 60s, and Barry Goldwater’s call for Republicans to unite had an outcome on the election of 1968. Richard Nixon developed the Southern Strategy as a way to recast the Republican Party’s image and obtain more support. The election of 1968 drew clear lines of division between the liberal and conservative movements. Barry Goldwater helped to frame the Republican Party’s position in 1964 and Richard Nixon continued to transform the party while gaining more popularity in the south.

The Watergate Scandals as well as the escalation of the Vietnam War gave Richard Nixon a bad reputation and on August 9th 1974 Gerald Ford assumed the presidency with the goal of trying to reestablish trust in the government. Historians coined the term ‘accidental president’ when referring to Gerald Ford, but actually he is responsible for holding together the Republican Party in the midst of an earth shattering scandal. By the summer of 1975 the American public was content with the White House. The media had no scandals to pursue, and not too many negative images were shown of the Ford administration on the nightly news. Gerald Ford helped to build up the confidence in the Republican Party through his achievements in office and he had a strong public backing from Barry Goldwater which helped to ease the minds of conservatives who were worried about the future of the conservative movement.

Gerald Ford was able to secure the Republican Party and keep it on the right track, but the nation was still weary after the escalation in Vietnam and the Watergate Scandal. Democrat Jimmy Carter won the 1976 election, but a string of bad luck and negative events during his presidency ended the liberal sensibility. Ronald Reagan was a shoe-in to win the presidential elections in 1980.

Ronald Reagan’s win and the popularity of the conservative movement would not have been possible without Barry Goldwater’s 1964 campaign. Ronald Reagan built off of the groundwork that Barry Goldwater laid in the 60s and benefited greatly from his speech “A Time for Choosing” that he gave on Goldwater’s behalf in 1964. Ronald Reagan and Barry Goldwater are linked together in the transformation of the conservative movement and are both responsible for its popularity and growth, especially in the 1980s. Without being asked to make the speech for Goldwater, Ronald Reagan would have not been given the same political opportunities and the election of 1980 would have had a much different outcome.

As a result of Barry Goldwater’s efforts and the organization of a grassroots constituency, the Republican Party began to define itself. “If there had been no Barry Goldwater, there could have been no Ronald Reagan. Although the movements surrounding the two men differed in style and goals, the conservatives of the 1960s and 1980s built on the structures created in the 1960s and utilized the techniques and the personnel cultivated during that time”. Every presidential term changes American society and politics. The 1964 election marked the political swing as the country began its move towards the Republican Party. Ronald Reagan’s presidency signaled a major shift from liberalism to conservatism that Barry Goldwater initiated.

References


Name: Michelle Dunn
Hometown: Brigantine, NJ
Expected Semester of Graduation / Class Year: Spring 2015
Major: Historical Studies and Education
Career Aspirations: History Teacher in High School or Middle School
Course/Professor: Thesis Course with Professor Nichols
Why you decided to research: “About a year ago Michelle began researching the 1960s political era. During her research she came upon a trend she discusses in her article.”
How does the research relate to you personally: “Growing up, Michelle explained that her favorite era was always the 1960s. The time period always sparked her interest, so doing research on this period of time was very exciting.”
Plans for future research: “Although she has no concrete plans for her research, Michelle is sure she would like to continue researching. She is willing to research on anything that sparks her interest.”

Michelle Dunn
Brigantine, NJ
Expected Semester of Graduation / Class Year: Spring 2015
Major: Historical Studies and Education
Career Aspirations: History Teacher in High School or Middle School
Course/Professor: Thesis Course with Professor Nichols
Why you decided to research: “About a year ago Michelle began researching the 1960s political era. During her research she came upon a trend she discusses in her article.”
How does the research relate to you personally: “Growing up, Michelle explained that her favorite era was always the 1960s. The time period always sparked her interest, so doing research on this period of time was very exciting.”
Plans for future research: “Although she has no concrete plans for her research, Michelle is sure she would like to continue researching. She is willing to research on anything that sparks her interest.”
Children’s Play in The Warsaw Ghetto

by Nicholas Hitzel

This study focuses on children’s play in the Warsaw Ghetto and how the lessons learned apply to storytelling in videogame design.

The Warsaw Ghetto in Poland was the largest ghetto. The Jewish population of Warsaw was relocated there in 1940 (Berenbaum). Intense overpopulation, lack of resources, and forced labor led to inhumane conditions, widespread disease, and death. One could assume that children would have received better treatment, but it was often the opposite. Children were primary targets of the Nazis. To the Nazis, Jews were vermin who needed to be exterminated. Murdering children was viewed as pulling the biological roots of the Jews. Children were a vulnerable target and had the lowest rate of survival of any Jewish demographic during the Holocaust. Pregnant women were executed or forced to abort. Children were randomly rounded up from the streets and deported to death camps. Children were especially vulnerable to starvation and disease, and often they became homeless orphans when their parents died. This meant they had to resort to begging to feed themselves and sometimes younger siblings. Warsaw was granted an orphanage for a period of time, but these children were later deported to Treblinka Death Camp. Organizations for the benefit of children, such as public education and health care, were banned.

Under this context, it’s hard to imagine child’s play existing. Yet, at the most basic level, play became a form of therapy for children to deal with what they saw and experienced. On a more functional level, play introduced children to the survival skills. At the highest levels, play was a form of resistance and defiance.

The role of play as a form of therapy tended to be the most consistent quality in the ghetto. Play offered children a spiritual cloak, a protective shelter that allowed them to cope with their environment. This value of play for the well being of children was immediately apparent to parents and caretakers in the ghetto. During early periods of ghettoization, adults were willing to face serious retribution for taking children to public parks. Once the ghetto was closed off, they risked their lives to organize forbidden play areas and classrooms for the children. The therapeutic properties of play were so great that adults felt the effects too; children playing raised the morale of adults.

Part of play in the Warsaw Ghetto focused on toys. Individual Warsaw Ghetto children formed strong emotional bonds to toys. Through these personal relationships, children found the emotional security they needed to cope. Children’s toys became an extension of themselves and allowed them to explore their feelings and feel connected to another. Intuitively, this can be compared to how toys help our children to develop in normal circumstances. In the ghetto environment, their relationships with toys offered a method of self-therapy. A child’s bond to a toy often became even stronger because these relationships often replaced lost loved ones. A child’s toy became part of this or her immediate family. There are reports of children refusing to give up their toys when being deported. A boy in the Warsaw Ghetto told a Nazi, “This is my horse and you can’t have him!” (Eisen 74). Toys were often unavailable, especially to orphans, so children made due with whatever they could find. Rags, rocks, mop bottoms, and other items became dolls and pretend pets. Ghetto orphans crying to their toys was a nightly occurrence in the Warsaw Ghetto. Imaginary friends were also common for children who couldn’t find or make toys.

Individual children found therapy in their play, but children in groups found additional functional tools in the games they played together. Children’s games reflect society, and ghetto children’s games that were adapted to their situation served as survival tools. By imitating their hardships and those of their parents, playing make-believe introduced children to survival skills.

These games reflected the harshness of ghetto life. Themes of hunger, death, forced labor, imprisonment, illness, Nazis, ghetto leadership and other elements were common. Children played hide and seek where policemen tried to find Jews to hand over to the Nazis. Boys would often mimic their fathers’ jobs. A smuggling game was played where Jewish workers tried to sneak contraband past guards. Any boys caught were sent to a jail. Girls would mimic their mothers’ attempts to find food for their families. They played a food game where girls would fight for a spot in a line for food rations that didn’t have enough rations for all of the girls in line. Through mimicking...
Children’s Play in The Warsaw Ghetto
(continued from Page 15)
their parents, their games helped children better prepare for the hardships they would face later in life.

Children often improvised to create games for themselves. The colored sides of cigarette boxes became cards, trash became board game pieces, and wooden debris became musical instruments. Children would play their games and click their wooden instruments in the street for adults to see and hear.

Warsaw Ghetto residents were constantly surprised with the ingenuity of children to create new ways to play. A particularly interesting phenomenon was the popularity of soccer. There are reports of Jewish boys in the Warsaw Ghetto being captured only to be invited to a game of soccer by the guards. More often than not, the Jews were victorious over the team of “superior race.” The children were not punished, but instead were invited to rematches and treated as friends. It turns out that the power of play was strong enough to soothe the enemy.

Perhaps the highest function of play in the ghetto was that it became a form of resistance. Armed resistance is not the only form of resistance. As mentioned earlier, the destruction of Jewish children was a primary goal of the Nazis. The act of children playing and the efforts of adults to allow children to play directly defied their oppressors.

Children’s play often took on a role of spiritual resistance. Their resistance was not always spiritual: They didn’t want to die and they showed it; for example, children being deported were known to respond with more defiance than adults, with direct aggression towards those deporting them. In their ghetto play, children typically formed teams of Jews and Nazis. Children usually resisted playing the role of a Nazi. On the other hand, playing a Jew didn’t require role-play. They rarely pretended to be adults. Children vilified the Nazis in their role-play and spoke their minds about the oppressors. Thus, children raised the spirits of resistance in the adults around them.

After an examination of children’s play in the Warsaw Ghetto, we have a better understanding of how children behave in these circumstances. This allows us to tell more meaningful and genuine stories through the medium of videogames. The perspective of an orphan is particularly interesting because it allows for freedom of choice and themes of survival and exploration. The lack of a family forces the player to form his or her own relationships and tackle the challenge of survival in an open-ended way. A toy or imaginary friend communicating with the player can help breakdown the barrier between the inner thoughts of the player and the in-game character because the toy is actually an extension of the character speaking to the player. This barrier is often a problem in games trying to tell a historically precise story, so such a solution is valuable. Playing games with other children can be used as a way to introduce gameplay mechanics that will be needed for survival later in the game, in the spirit of how ghetto games prepared children for adulthood. This allows for the introduction of core gameplay mechanics to be presented to the player in a way that feels less like a tutorial and more like the games being depicted.

It’s also important to remember that videogames are not reality and embracing that difference is what makes them interesting and artistic. Even if these lessons are applied to a non-genocide setting or different forms of media, the understanding of how children behave in times of great crisis holds great value in our ability to tell stories that keep history remembered.

References


Name: Nicholas Hitzel
Hometown: Belcoville, NJ
Expected Semester of Graduation / Class Year: Spring 2015
Major: Computer Science
Career Aspirations: Video game or software design
Course/Professor: Holocaust Resource Center Internship
Why you decided to research: “My mother recently opened up children’s museum, and that inspired me to relate my holocaust research to children’s games.”

How does the research relate to you personally? “This research relates to my ultimate career goal of software design and my interest in video games in general.”

Plans for future research: “I will be going on a study tour to Europe, and will have the opportunity to visit the orphanage I wrote about in my article. I hope to write another paper on the orphanage after my visit.”
A Personal Evolution: Confrontation & Sexuality

by Danielle Jonas

In my own personal artwork, I learn from artists in the past and present, build on their work, and make it original and innovative.

While beginning my capstone project for a BFA in Painting, I began a personal journey of research about other female artists and how they handled the topic of sexual identity. We all know that it is human nature to judge people for face value, putting them into a category of who they might be without understanding anything about them. For centuries, women have been thrown into the category of housewife or similar clichés due to their gender, appearance, or occupation. As the presence of female artists has grown over the past few centuries, the public has become more comfortable and aware of the voice of women through their choice of expression. Some female artists have taken the bull by the horns so to speak. Rather than hiding behind the clichés or expectations that society puts on women, some renegades have pushed forward and attacked the subject matter with ferocious purpose. Women have grown with a sense of independence and power. Freedom of expression for women through the Arts has blossomed into the continuation of a true personal evolution through confrontation, elegance, and utilizing female sexuality in a way that is combined with strength.

Martha Rosler’s career as a groundbreaking Feminist artist became the starting point to multiple semesters’ worth of personal research. Her most familiar work titled “Semiotics of the Kitchen” was created in 1975 as a six-minute long video, vocalizing the names of specific tools that are used to cook. She is shown motioning how the tools are used in a loud and sometimes violent manner, all while standing in a kitchen. When interviewed about this work, she described her video as “an anti-Julia Child replaces the domesticated ‘meaning’ of tools with a lexicon of rage and frustration” (“Semiotics of the Kitchen”). Her bold choice to confront the stereotypes or clichés of women created an open discussion of what women are expected to do versus what women actually want to do. According to Martha Rosler, “when the woman speaks, she names her own oppression”, thus showing her intention to create a tension against the stereotype for women to be in the kitchen (“Semiotics of the Kitchen”). My personal reaction stemmed from her fearless choice of playing on the cliché that women should be in a kitchen. It becomes taboo in a sense, since the energy shifts from being submissive to aggressive and defiant.

Since Martha Rosler created “Semiotics of the Kitchen”, women have gained opportunities and rights that level the playing field of gender equality. Yet, women still face the challenge of outdated stereotypes, creating difficulties. Contemporary female artists that address this inequality can seem to be radical in comparison to male artists, using psychology-based ideas, emotions, and feminine imagery within their work.

Four years following Martha Rosler’s “Semiotics of the Kitchen,” Judy Chicago created an artistically monumental installation titled “The Dinner Party.” The Brooklyn Museum of Art has “The Dinner Party” on permanent display in the Elizabeth A. Sackler Center for Feminist Art. Within the triangular shaped room, Judy Chicago created a banquet style triangular table with thirty-nine settings that correspond to various iconic women. Each setting contains its own unique chalice, set of utensils,
hand-painted and sculpted plate, and an embroidered runner with a corresponding name. The Brooklyn Museum states that “the names of another 999 women are inscribed in gold on the white tile floor below the triangular table”, with a total of 1,038 women being represented within the installation (Exhibitions: The Dinner Party by Judy Chicago).

Judy Chicago created an installation that created uniformity in format, yet stayed personal and unique to each woman that was represented with a table setting. The decorative plates give a nod to the individual woman, through the stylistic choices such as color and overall form. There is a connective thread between all thirty-nine settings, which comes from the feminine forms that are mimicked at varying degrees. For example, the setting for Georgia O’Keefe is in the shape of a flower she typically paints in her work, but mimics the shape of a vagina in the center of the plate. Each plate nods to the female forms to varying degrees, dependent on the woman being represented.

Returning to the case of Georgia O’Keefe’s setting, she was known for her paintings of flowers that deliberately replicated the shape of the female reproductive organs, thus making the plate completely appropriate. A unique feature to the place setting for Georgia O’Keefe is the height of her plate, where Judy Chicago signified O’Keefe’s “artistic liberation and success as a female artist” (“Place Setting: Georgia O’Keefe”). When viewing this setting, the viewer cannot ignore the obvious acknowledgement of using the shape of a vagina, which possibly can be seen as radical to some. In reality, Judy Chicago was taking Georgia O’Keefe’s topic of work and putting it into a different setting. Whether the context makes it vulgar or more intriguing is up to the person viewing the installation.

The balance between vulgarity and addressing the female form carries over into the work of Jenny Saville. From the age of 21, Jenny Saville was graced with the opportunity to have her first gallery show as a featured artist. The critics compared her painting style to Lucian Freud, a well-known male painter who was
also known for his psychologically uncertain paintings with thick brushwork and direct gazes. Jenny Saville’s approach to handling the paint onto her surfaces allows for a smooth representation of flesh, but still uses saturated pigments amongst pale flesh tones to create a life-like and uneasy depiction. Alongside the realism of Saville’s paint handling, there is a presence of blocky and patchy planes to make her paintings seem intentionally rough between the transitions of colors.

The subject matter in Jenny Saville’s paintings focus on curvaceous women from extreme angles to contort the body, and focus on the physical figure in a raw, non-idealized context. On the same token, her paintings connect with an emotion, or steer away from a possible emotional link, through her utilization of the gaze as a way to elevate her work on another level. With a direct gaze, there is a sense of confrontation and connection between the viewer and subject that cannot be ignored. The viewer is instantly connected to the subject’s eyes, making it difficult to remove the humanized aspect of the painted figure. The notion that a woman was behind the brush that painted “Plan” pushes the vulgarity of being completely faced with her pubic region and curvaceous body, towards a vulnerable context. Rather than idealizing the form of a woman, Saville used a model that is the average, modern woman. The viewer sees the hair-covered pubic region, wide hips, and topical map upon her curves while having an uncomfortable expression and covering her breasts in a tight embrace. In comparison to the classical representation of women in paintings such as Botticelli’s “Venus” or Manet’s “Olympia”, Saville’s approach takes away the stiff stance in favor for a more confrontational angle and a direct gaze that is the opposite of delicate. In 2012 Jenny Saville was quoted saying that she “want(s) to be a painter of modern life, and modern bodies” (Cooke). Does it take a woman’s eye to remove the factor of idealizing a woman’s body in painting? It is a strong possibility that it is more easily done through shifting from a male to female painter.

A common thread between the three well-known “feminist” artists stems from their bold choice to make artistic decisions that may cross “conventional” lines but, present their strong points-of-view. When creating two semesters worth of paintings for a capstone project to be presented in our own gallery, these three artists became the trinity of inspiration for strength while displaying vulnerability.

The modern-day woman is not the woman depicted in Botticelli’s “Venus” or Manet’s “Olympia”; rather, the modern-day woman is the accumulation of centuries of oppression through stereotypes that will not disappear, and breaking the mold by intentionally showcasing uncomfortable forms or concepts. We are not always the woman that will constantly slave in the kitchen, or care for the house. Women are not afraid to demonstrate that exposed bodies can command attention without being pornographic material; instead, women are in command of their sexuality and body as a whole. The transition from being completely oppressed with artistic freedom to being able to show the modern woman in a non-idealized manner comes from the boldness that the “Feminist” artists of decades past presented. The voice of a woman in Art has become as free as the voice of a man. In actuality, women such as Rosler, Chicago, and Saville present a more aggressive voice with their sexuality and emotions independent of age. Equality of financial successes among male and female artists is something that is gradually being achieved. The day will come when the personal evolution of women will match the degree of freedom male artists have, coupled with financial success and respect as an artist sans consideration of gender.

References


Is it possible to make a personal calendar that is innovative, engaging, and encouraging? Elizabeth Kang, one of the article’s researchers and authors, has gone through several different agenda styles in order to find one that suits her life. After talking with several students, she found out that there were other students that tried using traditional agendas but were not able to find one that was helpful to them.

When Dr. Helen Wei assigned a class project for her Programming and Problem Solving II class in Fall 2013, Kang and her team decided to take on a project beyond what was expected of them and try to create something that could help out a lot of people who were similar to them. Like many students, the authors struggle with time management, and they also love playing games. They decided to combine their previously mentioned struggle and hobby in the development of Adventure Agenda.

In order to fulfill the requirements of the class, the Adventure Agenda had to meet certain requirements. First, it had to be written in the Java programming language. One advantage of the Java programming language is that it can be run on many different operating systems, such as Windows or Mac’s OSX. Second, the calendar was required to let users select a month and year and display the appropriate days and dates for that particular month and year.

In addition to the required criteria, the Adventure Agenda also includes a few unique features. Two major features of this calendar are the leveling system and the random task generator (Figure 1).

The leveling system consists of an experience point calculator and four buttons – one for an easy day, one for a normal day, one for a hard day, and one for a crazy day. Clicking on the appropriate button automatically gives a user the appropriate amount of experience points (XP). An easy day gives a user 1 XP, a normal day gives a user 2 XP, a hard day gives a user 3 XP, and a crazy day gives a user 5 XP. Once a user earns 42 XPs, s/he gains a level. The leveling system is intended to help users measure their progress and develop positive habits.

Users can use the three random task buttons if they have extra time in their schedules. Quick tasks take approximately fifteen minutes, moderate tasks take approximately an hour, and lengthy tasks take approximately three hours. Each of these three types of tasks is designed to help the user learn how to use their “extra” time to do something productive.
The authors were good at games but bad at time management and so they decided to create a calendar that combined these two traits. Mainstream [calendars] in the market [are not] working for us.

One feature that the researchers would like to work on in the future is the ability to network with other users though Facebook. There has been much research done on the benefits of calendars that are interconnected with each other.

The Adventure Agenda is a productivity tool designed with a game-based approach that encourages users to learn positive time-management habits by awarding users levels when they complete tasks. The authors hope that this program, which was originally a class project, will one day be helpful for many people.

References
O

f the good things in life, the Negro has approximately one half those of whites; of the bad things of life, he has twice,” Dr. Martin Luther King Jr. boldly declared as he addressed the nation’s biggest political debate of the 1950s: racial and economic equality (Malveaux, 2012). Dr. King explained that, when compared to whites, blacks had half the income, wealth, and number of people who own homes, and had double the unemployment, poverty, and hunger rates. African Americans believed that the Civil Rights Movement would give them a chance to finally be equal. However, the black and white economic divide has only gotten worse.

Since 1980, when the government started collecting data on income, defined as flow of dollars, whites have consistently earned more than the national median household income, as blacks have consistently earned less. Currently, the largest percentage of African Americans earn under $10,000, while the largest percentage of whites earn between $100,000 and $149,000 (U.S. Census Bureau). This can be attributed to the types of occupations each group holds, as well as disparity in unemployment rates. According to the Bureau of Labor Statistics, African Americans hold the majority of the lower-paying jobs when compared to whites, Asians, and Hispanics, and they typically see twice the amount of unemployment (Bureau of Labor Statistics, 2012).

What is worse is the extent to which wealth, defined as assets, widens the economic gap. More than 80% of wealth is inherited from previous generations. While 1 in every 4 white families receives a family inheritance, only 1 in 20 black families inherits wealth. In addition, the average inheritance a white family receives is $144,652, while a black family receives only $41,985. Currently, the median net wealth of white households is 20 times that of black households, which is why 50% of white parents and only 20% of black parents are able to support their children’s college tuition (Adamson, Brewer, Leondar-Wright, Lui, & Robles, 2006).

“… Racism has led to inequality, and … inequality is the number one cause of violence, teen pregnancy, imprisonment, and domestic violence. The problem is that racial inequality is only gettinworse.”

by Heidi Maria Shelley
Racism from the housing market has had the most influence on the black-white wealth gap. In the 1930s, during the Great Depression, The Home Owner’s Loan Corporation helped numerous white homeowners avoid defaulting on their loans. However, these benefits were only offered to whites. The same corporation then introduced the practice of redlining, in which areas evaluated as “high-risk” would be assigned a red rating, which meant that loans would not be issued to those areas. Most black neighborhoods received this title, and as a result, 75% of white families now own their own homes while more than 50% of black families are forced to rent.

One cannot simply declare freedom and expect freedom to be granted, when income level is linked to discrimination, and wealth accumulation is the result of intergenerational exchange. The causes of the racial divide have had unprecedented economic consequences to the African American population, and until these causes are directly targeted for change, the black-white economic gap, as well as the economic wellbeing of African Americans, will only continue to decline. population, and until these causes are directly targeted for change, the black-white economic gap, as well as the economic wellbeing of African Americans, will only continue to decline.

References


EGFR Kinase Inhibitors of Lung Cancer

by Shannon Tarby

With over 174,000 new cases of lung cancer being diagnosed in the United States each year, novel chemotherapy treatments with efficacy towards both small-cell and non-small cell lung carcinoma is of interest to increase the survival rate of cancer patients (Veale, and Chang). Historically, pharmaceutical treatments have been based on surgery, radiation therapy, and a broad spectrum of chemotherapies. New research is now focused on targeted approaches that seek to either inhibit specific proteins necessary for cellular proliferation or to initiate apoptosis for the removal of cancerous cells. Apoptosis is the ability to target an unwanted cell without harming healthy cells in the process. Epithelial Growth Factor (EGF) and its Receptor (EGFR) is a protein that initiates cellular growth and has been found to be overexpressed in cancer cells which makes it an effective targeted approach to cancer treatment (Lee, Gong, and Ji). This research sought to understand the blockade of the EGFR to inhibit lung cancer formation. Specifically, this research determined structural blockade of the tyrosine kinase receptor of the EGFR as a way to inhibit cancer propagation with the use of several FDA approved drugs.

This project was designed around the structural understanding and pharmaceutical engineering of the EGFR kinase. Epithelial Growth Factor (EGF) is a growth factor that is expressed for the normal growth of epithelial cells as linings of cavities and surfaces inside the body. The EGFR is the receptor which is activated by the EGF protein to initiate epithelial propagation. Epithelial propagation is the idea of the body’s blood vessels being able to grow throughout a human’s lifetime. Under normal circumstances, the EGF – EGFR complex is initiated under normal growth conditions; however, overexpression or stimulation by cancer cells can cause or promote unchecked cellular proliferation (i.e. cancer).

Non-small cell lung cancer is the leading cause of mortality among all other types of cancer. Certain factors have been discovered that contribute towards this disease. Non-small cell lung cancer is found to be increased in patients with adenocarcinoma histology, those of Asian ethnicity, in females, and even in non-smokers. Non-small cell lung cancer pertains to cancer in the lining of the bronchi in the lungs rather than the lung itself. In response to this type of cancer, there has been studies with two FDA-approved
drugs in particular, gefitinib and erlotinib. These drugs have been tested in the advanced stages of patients with non-small cell lung cancer. These drugs have been used in severe cases in combination with traditional EGFR mutation to reduce the chances of relapse (Sui, Kong, Wang, and et al 8-12). An EGFR mutation is categorized as an increase in the EGFR tyrosine kinase inhibitors. It stimulates the extra growth, causing the buildup of cells which, in turn, results in lung cancer.

Erlotinib is known as an epidermal growth factor receptor tyrosine kinase inhibitor (EGFR-TKI). There have been random trial studies of patients with non-small cell lung cancer who qualify as candidates in the research of the drug. In the trials with patients who experienced traditional EGFR mutations, it was found that the drug erlotinib did have a significant effect on the patient’s prognosis. Not only is the drug erlotinib used in conjunction with EGFR mutations of lung cancer, it has also been tested with whole-brain radiation therapy in patients who develop brain metastasis. It has been stated that approximately ten percent of patients who develop non-small cell lung cancer were first diagnosed and treated for brain metastases. The prognosis of patients who developed brain metastasis along with non-small cell lung cancer was about six months. However in the study where patients participated in the whole-brain radiation therapy and the treatment of erlotinib, it was found that the procedure may change the concentration of erlotinib in the cerebrospinal fluid. In a further study, the fluid concentrations of erlotinib in six patients who had a combination of whole-brain radiation therapy and erlotinib were measured, and the result showed that the addition of the drug erlotinib had an impact on their prognosis (Deng, Feng, Wu, and et al 116-120).

Another FDA-approved drug used along with EGFR kinase inhibitors is getfitinib. This drug is used mostly when there is a disease flare which is caused by a more aggressive progression of the symptoms of an EGFR mutation. It was found in a further study that patients who had experienced a disease flare and were treated with getfitinib were experiencing a prolonged benefit of the drug. The exact role of getfitinib activity in combination with chemotherapy is still being researched since the drug fails to be a treatment that works on its own (Song, and Zhang 875-878).

In this research of the EGFR kinase inhibitors of lung cancer, 22 crystal structures of the tyrosine kinase of the EGFR protein were docked using an analysis program called IGEMDock. These 22 crystal structures were run against 714 FDA-approved drugs to determine the structural correlation in hopes to find the most effective binders. Structural similarities were determined with IGEMDock and vROCS, in which a partition coefficient was determined using another computer program DRAGON. This program was able to identify the molecular descriptors of each molecule (molecular weight, fat and water solubility).

The IGEMDock data for the EGFR drug candidates can be viewed in figure 3. This data found a cluster of approximately 25 drugs to preferentially bind to the EGFR tyrosine kinase for the use of targeted cancer treatments. This work will be used in the engineering of improved EGFR tyrosine kinase inhibitors.

Twenty two isoforms of EGFR that contained active site molecules were selected from the RCSB protein databank. These 22 proteins used can be seen in figure 1. From that, 715 approved pharmaceuticals were selected as ligands and computationally bound to the original 22 isoforms of the EGFR kinase protein using IGEMDock. An ANOVA was done to determine if any discrepancies in binding were found between proteins. The ANOVA for this data can be viewed in figure 2. Additional grouping of the molecular functionalities was used to determine differences. The best ten grouping based on binding energies were selected and structural data such as molecular weight and partition coefficient was collected using DRAGON.

Upon analysis of the data, multiple compounds were identified as effective based upon their interactions with each protein. An ANOVA determination of the differences between the 22 proteins analyzed indicated a statistical difference. From this data, ten drugs were chosen due to their low binding energies (for both binding interactions). These drugs range from Bortezomib (pro-
teasome inhibitor – cancer drug) and Evans Blue (a diazo dye) to Flutamide (non-steroidal antiandrogen drug). Structural analysis found that many of these molecules are relatively small with similar partition coefficient (-0.009 to 0.372) of the top binders.

In conclusion, this research was performed to analyze the binding energies of FDA-approved pharmaceuticals to identify possible interaction with the EGFR kinase moiety. The overall goal of this research was to investigate the interaction of multiple drug candidates to find the best structural motifs for targeted inhibition of the EGFR kinase moiety. After analysis of these energies, it was found that the 22 chosen pharmaceuticals did in fact have a better binding energy than control pharmaceuticals. The similarities found between these drugs will allow for a better understanding of EGFR kinase inhibition. With further research, this new approach to cancer treatment contributes to the hopes for a cure in the near future.

Acknowledgement
This Project was supported by The School of Natural Science and Mathematics at The Richard Stockton College of New Jersey.

Figure 1 shows each protein, the protein data bank number (PDB #), and each structural title. Figure 1 gives a better understanding of the original proteins of this research that were further studied for better binding receptors of EGFR kinase inhibitors.

Figure 2 shows the top ten chosen FDA drugs, the FDA drug title, and the binding energy from IGEMDock. This shows that the lower the binding factor, the better the FDA drug could potentially bind to a given protein. Therefore, for this research, the main goal is to find the lowest binding drug value to have a better understanding of how each FDA drug may bind in proteins.

Figure 3 shows the AVONA constructed for this research to determine the difference in variation across the FDA approved drugs and the 22 chosen protein ligands. As seen on figure 3, the F value is 5.97267, which means there is a frequency between the FDA drugs and the 22 proteins equal to that value.

References


Knight’s Tours on Cylindrical Chessboards

by Kara Teehan

The knight’s tour problem is an ancient problem that has been studied by graph theorists since 9 A.D. A knight moves about a chessboard in an “L” shape. A closed knight’s tour requires a knight to traverse the chessboard, visiting every square exactly once, and return to his starting square. In 1991, a mathematician named Allen Schwenk published exactly which dimensions of chessboards support a closed tour, and which do not. Specifically, the board sizes that cannot support a tour include boards of smaller dimensions and those dimensions with an odd number of squares by an odd number of squares, such as a 3 by 5 chessboard (Schwenk 325-332).

In 2002, a mathematician named John Watkins figured out that turning a chessboard into a cylinder allowed for boards of many more dimensions to support a closed knight’s tour. One creates a cylindrical chessboard simply by rolling the board and gluing the top and bottom ends of the board together at what we denote the “cylinder edge” (Watkins “Across the Board: The Mathematics of Chessboard Problems”). Watkins made legitimate progress; however, he did not specify the extent to which the dimension change of the chessboard contributed to the completion of a tour on each board size. I set out to find this “in between” area: the minimum number of moves over the cylinder edge sufficient to complete a knight’s tour on every dimension.

In Figure 1, one can observe the minimum number of cylindrical moves sufficient to tour a chessboard on m x n dimensions, with m being rows and n being columns. The 0’s in the chart represent what Schwenk figured out, which are the boards that can support a tour on a rectangular board. The ∞ represents Watkins’ findings, which are the boards on which a closed knight’s tour is not possible. All the rest of the numbers represent the minimum number of cylindrical moves that suffice to complete a closed knight’s tour, and this is what I figured out through my research. This chart actually continues endlessly both below and to the right. My findings also include an argument that allows us to predict a pattern for how many cylindrical moves are adequate.

Of particular interest are the larger odd-by-odd boards. The reason no tour can occur on boards of such dimensions lies in the fact that a tour must begin and end on the same square. In a rectangular knight move, a knight simply moves from one square to another in an L shape, moving two squares vertically or horizontally, and one square perpendicularly. Making such a move takes the night from a square of one color, to a square of the opposing color every time. On an odd-by-odd board, there are an odd
number of total squares. This means that one cannot possibly end on the square he or she started from because that would require making one move from to and from a square of the same color. This is just one example to demonstrate the motivation behind figuring out if one cylindrical move is sufficient for a knight to complete a tour, once the board is turned into a cylinder.

For some smaller boards, we can use a pattern to add on to the right of the boards. For example, for boards of with 3 rows and an odd number of columns that is greater than or equal to 7, we can use a 3 x 7 board and a 3 x 9 board as our starting “base” boards, which we will build on to. A tour that visits each square in a particular cycle on these boards will include one cylindrical move, and also will include a rectangular move, or normal knight move, in a unique spot that will allow us to add more rectangular moves on to the right of the board. This creates a tour on a board of increased horizontal size that uses still only one cylindrical move. This process is illustrated in Figure 2, which is an example of a 3 x 7 board with one cylindrical move. To the right, we add on a 3 x 4 board, which we connect with a rectangular cylindrical move. Specifically, the tour on this board used the move from (1, n-1)-(3, n) and the cylindrical move going from the square at position (2, 6) to the position (3, 5), with the first coordinate denoting the row and second denoting the column number.

The cylindrical move is unchanged no matter how many more squares and moves we add on to the right. Additionally, the move (1, n-1)-(3, n) must always be included. This means that on the original 3x7 board, the move (1, 6)-(3, 7) has to be one of the rectangular moves. But as you can see, this edge was deleted when we added the 3 x 4 board to the right. It is necessary to delete this edge to maintain the requirement that each square is visited once and only once. The two squares at position (1, 6) and (3, 7) are the squares we use to connect to the 3 x 4 board on the left. We must make sure then, that the move (1, 10)-(3, 11) is included in the tour on the newly created 3 x 11 board. If we keep making sure this edge is included, we can add on this specific 3 x 4 board infinitely many times, allowing us to create every “3 x odd” board using only one cylindrical move.

We can do a similar thing for boards with 4 rows with the number of columns greater than or equal to 5. Additionally, for boards with an odd number of rows and odd number of columns, with both dimensions greater than or equal to 5, we can find a tour on each so that one cylindrical move is sufficient. The patterns for extending the tours horizontally are comparable to the case of boards with 3 rows. When one wants to create wider cylindrical boards, simply tack on squares to the right of the board that allow us to easily.

There is a really awesome pattern to boards with odd-by-odd dimensions of 9 x 7 and larger. I created the 3 x n and 5 x n, with n odd, boards pointedly. The cylindrical edges actually line up in such a way that we can stack 3 x n boards with other 3 x n boards or with 5 x n boards, or stack 5 x n boards with 5 x n boards, and we still have a board with a closed tour that includes only one cylindrical move. An example of the process is shown in Figure 3. We simply need to add a cylindrical edge from the top of the new board to the bottom of this board, adhering to the general placement of the old cylindrical move on the two smaller top and bottom boards we used to build this larger board. We then must delete the old cylinder edges, and connect each board in the middle to the other boards by a simple method similar to the adding and deleting method we utilized for horizontally increasing tours. Figure 3 demonstrates that this indeed works out nicely. We can continue this process for any necessary combination of 3xn or 5 x n boards so that we obtain a closed tour on every odd x odd board greater than or equal to 9 x 7, in just one cylindrical move.

These are two of the more interesting patterns for tours on cylindrical chessboards. There are many more that have not been
discussed, but the culmination of all of these produces evidence for the minimum number of cylindrical moves sufficient for every allowable m x n board. The chart in Figure 1 sums up the number of cylinder moves for every board up to 12 x 12, and the repeating patterns of 1’s and 0’s continue if one extends the chart vertically and horizontally. The knight’s tour problem has so many different branches to study that it is full of potential challenges just waiting to be solved.

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>∞</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
</tr>
<tr>
<td>2</td>
<td>∞</td>
<td>∞</td>
<td>4</td>
<td>∞</td>
<td>4</td>
<td>∞</td>
<td>4</td>
<td>∞</td>
<td>4</td>
<td>∞</td>
<td>4</td>
<td>∞</td>
</tr>
<tr>
<td>3</td>
<td>∞</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>∞</td>
<td>∞</td>
<td>1</td>
<td>∞</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>∞</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>6</td>
<td>∞</td>
<td>∞</td>
<td>2</td>
<td>∞</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>7</td>
<td>∞</td>
<td>4</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>8</td>
<td>∞</td>
<td>∞</td>
<td>1</td>
<td>∞</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>9</td>
<td>∞</td>
<td>4</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>10</td>
<td>∞</td>
<td>∞</td>
<td>0</td>
<td>∞</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>11</td>
<td>∞</td>
<td>4</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>12</td>
<td>∞</td>
<td>∞</td>
<td>0</td>
<td>∞</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

References
Allen J. Schwenk, Which Rectangular Chessboards have a Knight’s Tour, Mathematics Magazine 64:5 (1991), 325-332.


Name: Kara Teehan
Hometown: Middletown, NJ
Expected Semester of Graduation / Class Year: Spring 2015
Major: Mathematics
Career Aspirations: To be accepted into a PhD. program in pure mathematics and teach math at the college level
Course/Professor: Independent

Why you decided to research: “I find math fascinating, challenging and fun. Doing research is a great way to learn new things and figure out concepts you normally would not explore in an undergraduate class.”

How does the research relate to you personally? “My research is in graph theory and is beginning to take on a topological aspect. I hope to study this type of pure mathematics in graduate school and maybe teach a related branch of mathematics at a university afterwards.”

Any plans for future research: “I hope to be doing even more intense math research in graduate school and after when I become a professor. I am continuing my research on knight’s tours by extending to knight’s tours on tori chessboards, which are basically donut shaped chessboards and studying the tours’ relations to the fundamental group, which is a topic of mathematics involving group theory and topology.”
Evaluating the Impacts of the BP Oil Spill on Louisiana Marsh Fishes

by Jessica Valenti

Salt marshes are areas of high productivity that serve as nursery habitats for fish and other wildlife, protect against storms, and help stabilize the shoreline. In addition to the many ecosystem services they provide, salt marshes also offer socio-economic benefits. About 30% of the commercial fishery production in the United States is dependent on the marshes in Louisiana’s Mississippi River Delta ecosystem. In addition, these wetlands support 50% of the oil refining capacity in the United States.

Unfortunately, U.S. salt marshes suffered a 0.9% loss (33,230 acres) from 1998 to 2004. The majority of the loss in land occurred in coastal Louisiana where the wetlands were flooded by salt water. Some other stressors that contribute to the decline of wetlands in Louisiana are artificial waterways and wave erosion.

Wetland systems are also vulnerable to stressors from rapid population growth and the development of coastal communities. Marsh stressors associated with the development of coastal communities include construction, bulkheads, and dredging.

To add to these stressors, the Gulf of Mexico was the location of the Deepwater Horizon Oil Spill on April 20th 2010. The explosion of the oil drilling platform claimed eleven lives and resulted in the release of approximately 4.9 million barrels of crude oil over a period of 87 days, producing an oil spill that exceeded the Exxon Valdez oil spill by at least one order of magnitude. Even with extensive clean-up efforts offshore, the oil still reached the coastline of the Gulf States. The distribution of oil along the Louisiana marshes was significant, but patchy.
The immediate effects of the Deepwater Horizon oil spill were obvious from the visible mortality of marine organisms. The amount of time it takes for marshes to recover after being affected by an oil spill varies and depends on factors specific to the oil spill and the sites that were affected. High concentrations of hydrocarbons in the sediments of the Louisiana marshes from the Deepwater Horizon oil spill could expose the marine flora and fauna present there to a consistent source of harmful pollutants. Consequently, the sublethal effects of this oil spill must be a key aspect of long term research performed in the Gulf of Mexico.

Sentinel species will be crucial factors in these long term studies in the Gulf of Mexico. Sentinel species are those whose presence, absence, and/or relative health directly correlates to the overall state of the environment in which they live. Marsh fishes are essential to marsh ecosystems as both predators and prey, generally live in the marshes year round, are usually abundant, and therefore have potential to serve as sentinel species. For that reason, in this study it was chosen to evaluate the marsh fish response to the BP Oil Spill.

The objective was to assess the long-term effects of the BP Oil Spill by evaluating (1) fish species composition, (2) fish abundance, (3) habitat use patterns, and (4) length frequency distributions of dominant marsh surface fishes.

Sampled sites were 22 oiled and unoiled sites across Caminada, Terrebonne, and Barataria bays (Figure 1) with an emphasis on four marsh subhabitats (marsh edges, creeks, ponds, and depressions) (Figure 2) during three sampling events: June 2012 (13 sites), May 2013 (17 sites), and October 2013 (12 sites). We sampled using wire mesh traps, commonly known as minnow traps (depicted in author photo). At each site, minnow traps were deployed in groups of three to four per subhabitat for approximately one hour. After one hour the traps were retrieved and the samples were transported back to the lab where they were sorted, identified, and measured.

It was noted that four dominant species were consistently collected throughout the study and at most of our study sites. The four species accounted for 95% of the total fish collected and
served as our sentinel species throughout the study. Those fish were Fundulus grandis (Gulf killifish), Fundulus xenicus (diamond killifish), Cyprinodon variegatus (sheepshead minnow), and Poecilia latipinna (sailfin molly) (Figure 3a). Since these four species were present in both oiled and unoiled sites, it appeared that the species composition was not affected by the presence of weathered oil.

In unoiled sites, the four dominant species were present in even proportions (22 – 29%); however, oiled sites were mostly dominated by the Gulf killifish (57%) and the diamond killifish (35%) (Figure 3a). Oiled sites may be dominated by the Gulf killifish and the diamond killifish because they are able to tolerate the effects of weathered oil better than the sheepshead minnow and the sailfin molly.

Upon analysis of the subhabitat use patterns, ponds were determined to be the preferred subhabitat for the four sentinel species (65% ponds, 20% creeks, 15% depressions, <1% marsh edge) (Figure 3b). However, when abundance numbers were analyzed based on catch per unit effort (CPUE), or the number of fish per trap, the one way ANOVA (analysis of variance) results indicated that there were no statistical differences in catch rates among subhabitats in oiled or unoiled sites. In other words, habitat use patterns were apparently not affected by the presence of weathered oil because each species used the same subhabitats within oiled and unoiled sites. Habitat use may be strongly influenced by salinity, temperature, reproductive strategies, and other ecological characteristics, not the presence or absence of weathered oil.

Length frequency distributions were prepared and analyzed for the two most abundant species present in our catch: the Gulf killifish and the diamond killifish. The length frequency distributions depicted in Figure 3c show differences in mean lengths for the Gulf killifish and the diamond killifish between oiled and unoiled sites at creeks, ponds, and depressions. Since 99% percent of the fish were collected in creeks, ponds, and depressions, marsh edges were left out of this comparison due to their small sample size. The length frequency distributions indicated that the mean length of Gulf killifish collected in oiled creeks was greater than
in unoiled creeks, while diamond killifish were smaller in oiled creeks than in unoiled creeks. In oiled ponds, the mean lengths of both species were less than in unoiled ponds. However, in oiled depressions, both species members’ were larger on average than those in unoiled depressions.

To summarize the findings of this study, we found that (1) species composition did not vary between oiled and unoiled sites, (2) the percent breakdown of the four sentinel species in unoiled sites was evenly distributed, but oiled sites were mostly dominated by the Gulf killifish and the diamond killifish, (3) habitat use patterns were apparently not affected by the presence of weathered oil, and (4) Gulf killifish and diamond killifish displayed differences in mean lengths between oiled and unoiled sites and across subhabitats.

Even though these marshes were exposed to oil, there were no indications of decreased abundance in fish populations because we captured various species in a range of sizes, at all sites, in all sampling events. It could be possible that initial mortality occurred before our sampling took place and there has been some recovery of the population since then. Another possible explanation for our results is that all our sites have a history of oil exposure and completely unoiled marshes do not exist in Louisiana, thus these marsh fishes may have been preadapted to oil exposure to a certain extent.

In addition to giving insight on the long term effects of the BP Oil Spill on dominant marsh surface fishes, this study has set up a baseline of data upon which comparisons can be made if another oil spill were to reach the coastline of Louisiana. This baseline of data is essential for before and after comparisons and will contribute significantly to determining the immediate effects of an oil spill within our study sites. Knowing the direct effects of an oil spill allows for accurate damage assessments, and more importantly, indicates exactly what needs to be addressed in order for the environment to be restored to its state prior to exposure to oil.

In the Gulf of Mexico, this is extremely important since the Gulf supports a large percentage of the fishing industry that the United States depends on for food and income. In addition, the marshes act as a barrier from storms and provide nursery habitat for commercially important species. Without healthy marshes in the Gulf of Mexico, one of the United States’ most valuable resources would fail to exist.

References


Name: Jessica Valenti
Hometown: Toms River, NJ
Expected Semester of Graduation / Class Year: May 2014
Major: Marine Science
Career Aspirations: Jessica would like to continue on in her education and receive her PhD at Rutgers for Oceanography. Ultimately, she would like to become a College Professor.
Course/Professor: Summer REU Internship

Why you decided to research: As an aspiring professor, Jessica wanted to experience and conduct research on a topic she was passionate about.

How does the research relate to you personally? The BP oil spill in the Gulf of Mexico affected many people and animals. As a person and as a scientist, this incident sparked an interest for Jessica. She was very curious about the effects of the spills on the environment and what the ultimate impact would be.

Any plans for future research: Jessica hopes to continue her research on this topic. She would also like to learn how to use computer models to predict potential effects of human induced changes in the fishes environment.
The Victorian Feminist Movement

by Jennifer Van Bavel

The Victorian Feminist Movement was a hard-fought battle for women’s rights, by both women and men. The movement did not gain much momentum until the mid-century, due in large part to public mobilization. While men played a part in this movement, it was the roles encompassed by the thousands of women that gave the feminist movement its real power. Women from every walk of life, such as mother, daughter, wife, activist, victim, worker, student, and suffragist, banded together in the 78 years of the main feminist movement to bring about the radical changes, which earned them greater legal rights, and social independence.

In 1854, Caroline Norton published a political pamphlet in which she discussed the unfortunate circumstances of her marriage and how they related to women’s laws. This, along with her unyielding efforts toward garnering fairer legal rights for women, laid the groundwork for three acts passed between 1839 and 1870. Prior to 1839, guardianship of children rested solely and absolutely with the father. This fact allowed for George Norton to remove his sons from their home and place them in Scotland with a caretaker of his appointment, all while denying his wife’s access to them and refusing to disclose their location. Communication between mother and children was wholly cut off. This
ordeal aided in great part to the passing of the first act, the Infant Custody Act of 1839, which established a procedure for women to gain the custody of her children under seven years of age through a petition to the courts.

Next, the 1857 Matrimonial Causes Act broadened wives’ access to divorce by moving hearings from the Ecclesiastical courts to Civil courts and granting wives the ability to divorce from their husbands on the grounds of cruelty, abuse, or abandonment. However, these accusations could not stand on their own, they had to also be coupled with proof of another crime, such as adultery. Nevertheless, husbands were still able to divorce their wives on the singular claim of adultery. Expansions were made to the 1857 act throughout the rest of the nineteenth century and into the first half of the twentieth. The final expansion in 1937 allowed for either the wife or husband to gain instant divorce upon proof of adultery alone.

Young women of the lower middle class, who could not make a suitable marriage, typically took up the job of a governess. This was not ideal since the position was entirely dependent upon the family whom the young woman was employed with. She was expected to go above and beyond in the day-to-day care and education of young children, all while knowing that one small error could lead to dismissal and a bad referral to other families, leading to unemployment. With this in mind the Governess’ Benevolent Institution was founded in 1841. This institution provided housing and care for governesses who were unemployed, or retired with no housing of their own, and dispensed some money to live on until employment could be found.

Women of the working class had it harder. There was plenty of work to be found, but the jobs that typically paid well were the most labor intensive and/or dangerous. This was true of women’s work in the mines across England, where a potential income of 2s per day could be earned. However, in 1842 the Mines Act excluded women and children from work in the mines. While this act ended the exploitation of women and children in these labor-intensive positions, it also eliminated the job of “pit-brow” women. Women workers banded together in order to save this occupation above the mine sorting coal.

Another important aspect of the feminist movement was the campaign for the repeal of the Contagious Diseases Acts. These acts, meant to control the spread of venereal diseases within the Armed Forces, were first passed in 1864, and expanded on in 1866 and 1869. They required that all prostitutes submit to an internal expanding science and technology, jobs became more specialized and required learned skill. For women looking to fill skilled positions, such as doctors, higher education was required. Ideas such as this sparked the campaign for women’s rights to university level education. Queen’s College was established in London in 1848 for women who intended to teach. In 1849 Bedford College was founded in London and incorporated a staff of teachers from University College including a physiologist, mathematician, and logician. In 1869 Girton College, the first women’s college at Cambridge, was founded. Because of these innovations women were able to make huge strides in education and employment, like Elizabeth Garrett Anderson in 1865, who was the first woman in England to qualify as a physician and earn her license to practice medicine.

Before the passing of the 1870 act, women’s work was considered to be fulfilling the duties of a good wife. This entailed the education of young children, overseeing the maintenance of the home and staff, and sometimes venturing into charity work where no wages were earned. This was the condition of women and wives in the upper middle class. Some wives, such as Caroline Norton, worked as writers, earning income by their pen.

With the nineteenth-century came change, and England found itself right in the middle of the Industrial Revolution. With ever
examination, which was forced upon them if the women did not volunteer willingly. They were imprisoned with or without the sentence of hard labor, first for one month, and next for three months and were locked in a hospital to undergo medical treatment should any venereal diseases be detected. While the exam and required treatment was important for public health and safety, the CD Acts did not clearly specify the definition of a “common prostitute”. Women who were falsely accused of prostitution were so terrified of appearing for trial that they willingly signed a “voluntary submission”, in which they agreed to appear for periodic examinations for twelve months, but as a result, they fell in with the ranks of common prostitutes, condemning their good name and reputation for the rest of their lives. Josephine Butler, who believed that these acts violated the sacred rights of womanhood, was the forerunner in the campaign for the repeal, forming the Ladies National Association for the Repeal of the Contagious Diseases Acts in 1870. Almost two decades after the final Act had been passed, the CD Acts were repealed in 1886.

Finally, and perhaps the most important campaign for feminists in the later nineteenth-century and into the twentieth, was the suffrage movement. The first petition on women’s suffrage was presented to Parliament in 1866, and was promptly rejected. Until the end of the nineteenth century the campaign did not gather much momentum. At the turn of the century, however, feminists made the enfranchisement of women a priority. The National Union of Women’s Suffrage Societies was founded in 1898 with feminist Millicent Fawcett as its leader. The first gain toward enfranchisement for all women came in 1894 with the passing of the Local Government Act, which allowed for women who owned property to vote in local elections. The next step was in 1918 with the Representation of the People Act, enfranchising women over the age of 30. Finally, in 1928, the Representation of the People Act was passed, giving women the right to vote on the same terms as men, (over the age of 21), awarding them full enfranchisement.

All of these small campaigns together across more than seventy years secured for women the means, and the rights, to earn independent lives separate from their husbands. But it also opened doors that had before been shut tight. The feminist movement of Victorian England entirely reshaped the lives of women then, as it still does now.

References


Human impacts on the ecosystems of our planets are wide ranging, affecting everything from the rainforest to the oceans. While there might be differing ecological networks for each region, each with its own set of organisms and interactions, the underlying mechanics for most of these ecological networks are similar. For example, many networks frequently benefit from the complex relationships between predators and prey.

Unfortunately, this healthy relationship between predators and prey does not always occur, often due to the introduction of an invasive species. This is when certain species are introduced to a new environment in which they have no natural predator. Ultimately, these new species are able to reproduce without constraints, creating detrimental effects for every other organism. An example of this would be the feral European rabbit, Oryctolagus cuniculus, which was introduced to Australia around 1827. The rabbit has no natural predator, and thus, the rabbit was able to reproduce and dominate the ecosystem without bounds.

Our ability to manipulate these complex ecological networks is vital because the ability to predict and control these networks would help scientists bolster the populations of endangered species and lower the populations of invasive species with a greater level of certainty and efficiency. Such control is difficult due to the unknown nature and vast amount of interactions across many organisms, which lead to an extremely large and complex ecological network.

In our project, we took a modeling approach developed for gene networks and adapted it for use with ecological networks. We chose this approach because it does not make any assumptions regarding the interactions between various nodes (in our case, species) and requires fewer resources compared to traditional modeling techniques. The cost of this simplicity is that an approximate model of the network is generated; however, the approach produces similar results when compared with more precise, yet extremely complicated, models.

In the model, species are artificially divided into two categories. The primary type is the master species, i.e. keystone species. These greatly influence the population of many other species in the network. The second type is the slave species, i.e. non-keystone species. While they can influence some populations of the ecosystem, it is not usually to the degree of a master species. For example, the type of vegetation upon which many species feed could be considered a master species as it affects the population of many others.
For our model, we make two approximations. We assume the populations of each slave species is exclusively controlled by the masters and take the form of \( x_s = B_1 x_1 + B_2 x_2 + ... + B_n x_n \) where \( x_s \) represents the population of a slave species, \( x_i \) represent the population of a master species, and \( B \) represents the interactions between the two (i.e. the model parameters).

This could raise a few questions though. For starters, how do we obtain \( B \) (the parameters) so that we can model the population of the slave species? Also, the model is linear, and ecological networks are typically nonlinear. How can our linear model fit such a system?

FIGURE ONE We can answer both questions by considering how our model is constructed. We first conduct some simple experiments such as measuring the population values of each organism in its natural habitat and then by perturbing the populations of each master species individually. These experiments give us a set of points that define the blue plane as seen in Figure 1. (Shulman et al., “Gene Networks” 48). This triangular plane is the effective model.

Now, we can compare our effective model (the blue plane) to the larger gray surface behind it. This large gray surface represents the real-world population of the slave species. Fortunately, both the triangular plane of our effective model and the surface of the real world population are close to each other. This means that our model, in theory, should be able to approximate the populations of slave species with a good level of accuracy. Furthermore, we credit this strong accuracy to the geometrical constraints of our points and the robustness of a typical ecological network.

We began searching for methods to test these ideas. Before performing experiments on actual ecological networks with real organisms, we proceeded to test the methodology using a synthetic ecological network generated on a computer. This synthetic network allowed us to generate synthetic data, which could be used as a proxy for real experimental data. We chose a Lotka-Volterra model for our synthetic system because it is the standard benchmark for ecological modeling. Lotka-Volterra makes the assumption that the prey will multiply over time until it hits some resource capacity. Meanwhile, the growing amounts of prey will foster an environment where the predators will also multiply as well. The growing amount of predators will consume the prey at greater rates, until there is not enough prey to sustain the predators. At this point, the prey populations will be reduced which will result in a corresponding reduction in predators. Free from its natural predator, the prey will begin to multiply again, and the cycle repeats.

FIGURE TWO In this work, we used the competitive Lotka-Volterra model which does not involve predators and prey but instead models competition among species for resources. In the case of plants, for example, an increase in the population of a species can be detrimental to others if its members have access to a larger portion of the sunlight. We constructed an eight node competitive Lotka-Volterra network (see Figure 2). Two red nodes were considered master nodes since they interacted strongly with the other blue nodes, considered to be slaves.

In summary, conducting simple experiments in which the populations are measured in response to perturbing the master species populations produces the effective model. These populations can be represented by points on the surface and define a plane. The plane (effective model) is often close to the surface, making it a good approximation to the actual system. We can test the accuracy of the model by comparing it with the real world population of slave species, or in our current case, the synthetic data from a competitive Lotka-Volterra model.

FIGURE THREE. We ran both models using the synthetic data and the following graphs show our results. Here, X8 and X4 represent the populations of species 4 and 8. These are the master species, which directly control the populations of the slave species X1 or X5. As in figure 1, the plane is the effective model and the surface is the competitive Lotka-Volterra model.

One can see that the planes coincide with sections of the surfaces, meaning that the effective model predicts populations that are the same as the synthtic system in these regions. As the surfaces curve, becoming non-planar, the deviation between the planes and surfaces increases. The model is less accurate in these regions. However, accuracy is maintained for a broad range of
populations. We conclude that the effective model accurately represents systems with characteristics similar to the competitive Lotka-Volterra model.

While the Lotka-Volterra model is a standard representation of ecological networks, it is incredibly complex to use. Unfortunately, the process of obtaining the parameters for Lotka-Volterra is vastly complicated, if not impossible for many real world situations. Our model is based on experimental data, which are significantly easier to obtain. We found that it is equivalent to Lotka-Volterra for broad population ranges, yet it can be constructed using few resources.

Moving forward, we will begin testing to determine if the effective model can be used to control the synthetic system. For example, we aim to calculate what master species populations are needed to obtain the desired slave populations. Eventually, we will attempt to validate our approach using real ecological networks.

References


[Editors’ Biographies]

Name: Taylor Adams  
Major: Literature with a Minor in WGSS  
Expected Graduation Year: 2017  
Career Aspirations: I hope to work in any career path that will allow room for personal growth as well as an opportunity to make an impact in the lives of others, specifically in working towards women’s equal rights and raising awareness on the importance of mental health.  
Why I decided to be an editor: Seeing others’ passions for their research inspires me to be passionate about my own education.  
Quote: Instead of striving for the typical aspirations of wealth and power, I intend to live a life of meaning.

Name: Katherine Austin  
Major: Health Sciences  
Expected Graduation: May 2015  
Career Aspirations: Pediatric Occupational Therapist  
Why I decided to be an editor: I decided to join the editorial board after my experience editing a literary magazine in high school. I was always a strong English student, but I came to college seeking a degree in the sciences. I think my shift from creative writing to scientific writing is a great representation of my individual growth as both a student and a researcher. I hope that I am able to encourage my peers to continue their research endeavors through my interactions as an editor.  
Quote: Engaging students in research at the undergraduate level is a crucial element in the development of a graduate with the tools and desire to make changes in the world. Research encourages students to ask questions and seek answers to those questions, rather than simply accept the truth as it is known.
Name: Tahira Ayub  
Major: Health Sciences, Pre-professional Communication Disorders Concentration  
Expected graduation year: May 2016  
Career aspirations: Speech Language Pathologist  
Why I decided to be an editor: Since I was little, I’ve always loved to read and write. In my desired profession, I know there isn’t too great of a need to write, so I like to have every opportunity to do so, so that I may keep the habit and practice of the skills I have.  
Quote: – “Be a voice, not an echo.” anonymous  
I love the quiet power of this quote. Without bluntly stating that you have to go out and be that change you want to see, it tells you to speak out in your own way, even if that means being quiet and showing your actions instead of your words. Don’t get lost in the crowd, and use your own voice.

Name: Nicole Schoenstein  
Major: Psychology (minors in computer science and behavioral neuroscience)  
Expected graduation year: 2016  
Career aspirations: Nicole is interested in teaching or working as a human factors researcher.  
Why I decided to be an editor: Nicole chose to become an editor of Stockton Innovations for the last two years because she thoroughly enjoys research, writing, editing, and also graphic design.  
Quote “Exploration is really the essence of the human spirit” - Frank Borman, NASA astronaut and engineer.