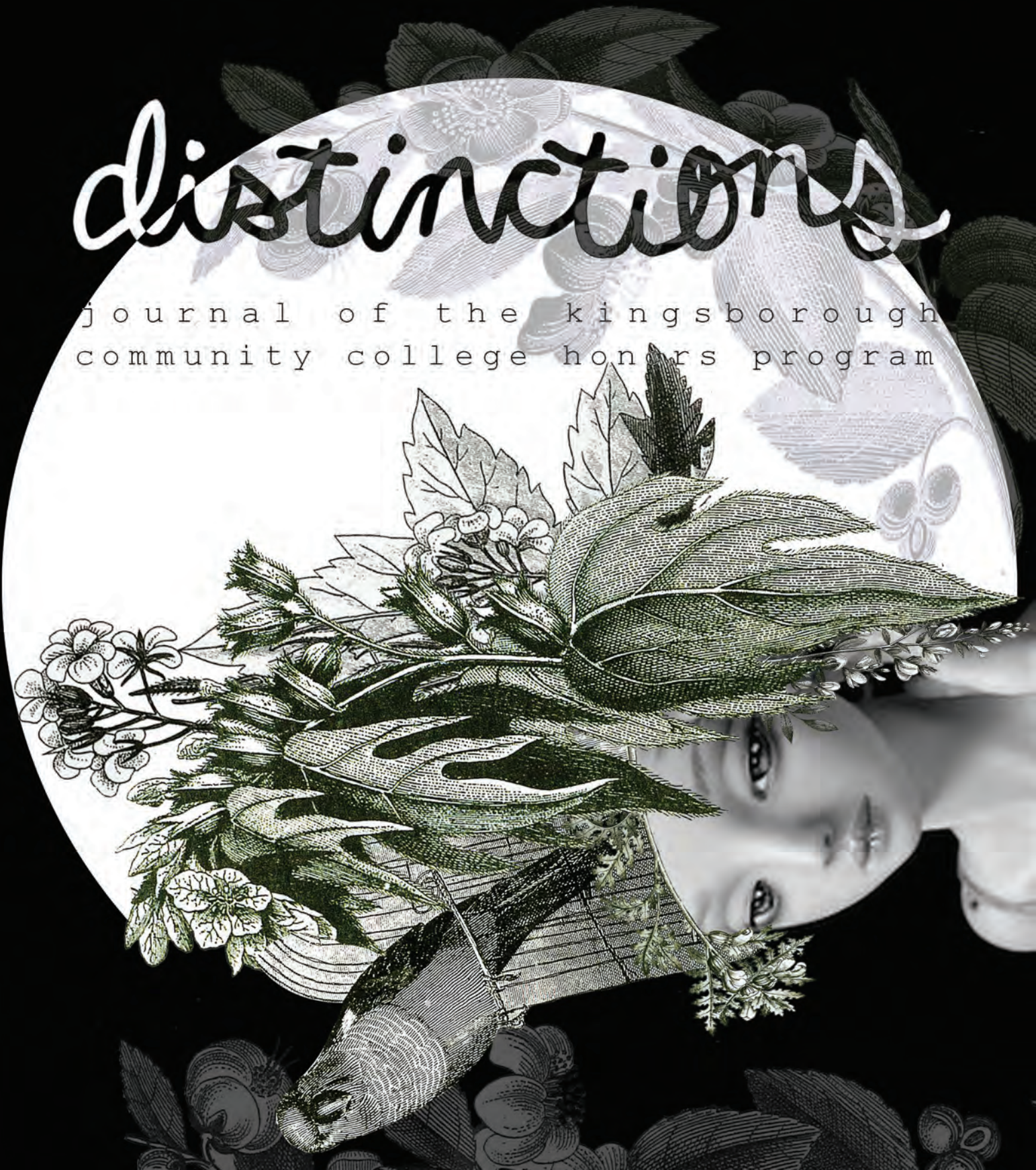


distinctions

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EDITOR'S COLUMN

Only I Can Criticize My Mother

When the World Trade Center towers fell, I watched them from the roof of the building I lived in, one block from the river, in Williamsburg. Although it was one of the most traumatic events I have ever experienced, I remember at the time feeling unsurprised that a group could be that incensed over the excesses of the capitalist U.S. system, that this catastrophe was a long time coming. This fall, as the 10th anniversary of that horrific day greeted us, I revisited this issue in my classes, in the form of two rather different texts: the KCC Reads selection for this year, Colum McCann's 2009 novel *Let the Great World Spin*, and Ian Buruma and Avishai Margalit's 2004 history of ideas *Occidentalism: The West in the Eyes of Its Enemies*, the latter of which traces the history of criticisms of "North-Atlantic" societies (to use Richard Rorty's designation for "The West") since the Enlightenment.

Buruma and Margalit highlight the origins of "Occidentalism" in pastoral German critiques of cosmopolitan Paris, in nineteenth-century Russian debates about the relationship between soul and soil, in Marx and Engels's exposés of the ills of industrialization, in the conflicted relationship Japanese society has had with Westernization, and in the longstanding country vs. city debate in China. They emphasize that ideological attacks on the West, such as those of Al-Qaeda, have a long history, much of them originating in the West itself. And interestingly, we now are seeing such critiques renewed in the United States. Two-thousand-eleven has become a watershed year—between the Arab Spring, the global economic downturn which is now claiming such seemingly untouchable figures as Silvio Berlusconi, and the mass protests of the Occupy Wall Street movement across our own country. As my students have written papers comparing the critiques Buruma and Margalit highlight to those in Terry Gilliam's dystopic 1985 film *Brazil*, many have drawn connections to the criticisms leveled by the Occupy movement, as well as those of the Tea Party. They are dismantling "us" and "them," seeing interrelationships in more nuanced ways, making clearer distinctions.

In this issue of *Distinctions*, there is the same attempt to discern subtle shifts in emotion, argument, design. We visit recent changes in military policy, the ecological peculiarities of horseshoe crabs, and the issue of mate choice. There is a new take on the zodiac, discussion of voice technique, and a peek inside an art-world love affair. We will see what the clothes of the future might have been, new depictions of nineteenth-century plays, and understand the surprising role of aluminum in our galaxy. I hope you enjoy this issue.

Robert Cowan
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IRINA SAMKOVA

Zodiac Signs¹

Each of us was born under a specific zodiac sign, and each sign has its own unique characteristics. Additionally, there are corresponding flora and fauna to every sign of which most people are unaware. I created a community of goddesses, each of them representing an astrological sign with its unique flora and fauna.

It was fascinating to study and examine the personalities of people born under a certain sign, and also to note how certain plants may or may not be considered reflective of those personalities. *The Complete Encyclopedia of Illustration* by J. G. Heck was my inspiration for the style of the images. It is a very old encyclopedia that contains all the original illustrations from the 1851 edition of the *Iconographic Encyclopedia of Science, Literature and Art*. I juxtaposed the vintage images with contemporary models of a plastic female doll's head into collages. Each of my goddesses is different and has their own unique energy.

The project put me into the deep thought about the idea of character and who assigns it to what. Is it the audience, the perceiver, or do things have their own innate characteristics that stand alone?

¹ Completed under the mentorship of Professor Valerie Sokolova for Art 43: Digital Illustration.















BRANDON MORIARTY

Is the Military's "Don't Ask, Don't Tell" Policy Really Justified?¹

To voluntarily enter into military service is an enormously courageous act. Whatever a person's motive to join may be, whether for personal betterment, the desire for adventure, or just for veterans' benefits, there is a lot of sacrifice tied to becoming a service member. Any person willing to risk his or her life to protect his or her country deserves to be respected, regardless of race, religion, sex, or sexual orientation. Unfortunately, the United States Armed Forces has a different opinion towards lesbians, gays, and bisexuals (LGB).² The "Don't Ask, Don't Tell" (DADT) policy disqualifies openly LGB applicants from becoming service members, and requires the discharge of any service members who make known or show any hint of their respective orientations (U.S. Department of Defense Directive 1304.26, 1994).

Herein lies the hypocrisy. Why should open lesbians, gays, or bisexuals be denied the opportunity to do something so courageous while many "straight" people are unwilling to serve? Why should heterosexual soldiers be able to speak openly about their spouses, lovers, and flings, while LGB soldiers are forced to hide a part of who they are? Should one person's sexual orientation really affect the morale of other soldiers? And what type of example does this set for the rest of society? In this country, the "Land of the Free," there are men and women whose only disqualification to serve is their orientation, which begs the question: *Is the military's "Don't Ask, Don't Tell" policy really justified?*

The DADT policy was introduced in 1993 as a compromise between the anti-gay and pro-tolerance voices in the debate over whether LGB members should be allowed to serve in the Armed Forces. Although it was a step in the right direction in that it eased the restriction against homosexuals being allowed to serve, the policy today is outdated; it is not in concordance with our fast-paced progressivism, and is thereby clearly unjustified. It will be shown that the DADT policy clearly reduces military capability, has an insignificant impact on military morale, and overall has a delirious effect on American society.

The capability of the United States Armed Forces is vast, but not limitless. With over 1.1 million active-duty service members on American soil and all over the world (U.S. Dept. of Defense, June 2010), the American military represents one of the strongest powers in the world. Of these troops, it is estimated that 36,000 gays and lesbians serve actively, not including nearly 30,000 additional members serving in the guard and reserves (Gates, 2004). One perspective may suggest that such a relatively small number of soldiers, which represents merely 3% of all active military enrollment, would barely affect the overall dynamic of the military, if at all. Negating the issue of pure bias, it is very easy to agree that a 3% drop in

¹ Completed under the mentorship of Professor José Nanín for HE 52: Human Sexuality.

² More commonly referred to as LGBTQ (including transgendered and genderqueer people). However, language in the DADT statute covers homosexual behavior, which does not specifically encompass transgendered and genderqueer people.

military personnel is virtually insignificant. However, taking a deeper look into military necessity completely debunks the opinion that the Armed Forces can effectively do without these women and men.

Understanding the needs of the military is essential to its success, and these needs are impossible to assess by solely looking at raw figures. Were DADT proponents to read more deeply into the facts, regardless of their biases, they would realize that this policy – or any LGB ban at all – in fact depletes the military’s ability to work efficiently. Upwards of 14,000 service members have been discharged under DADT guidelines in the seventeen years since its inception (Servicemembers United, 2010), among them very valuable people who served in various positions. Many of these positions are of crucial importance, yet are very difficult to fill; there are very few who are qualified to handle them. For example, Arabic linguists are in very high demand; few, however, are trained for the position. Even with this severe shortage, more than 58 Arabic linguists have been discharged as of June 2007 in compliance with this policy, further depleting the military of a very necessary resource and losing ready access to information that could very well save lives (Benjamin, 2007). Considering that translators of other languages, such as Russian, Chinese, and Tarsi, are also in high demand and short supply, “Don’t Ask, Don’t Tell” leaves gaping holes in military intelligence that could be vital to its success.

Overall, as of the release of a 2005 report by the Government Accountability Office, 757 troops with “critical occupations” had been discharged by the Armed Forces under DADT legislation (Frank, 2009). Relying on raw head counts overlooks this important fact, and therefore puts the military and those the military protects in danger. For example, millions of messages are intercepted by the National Security Agency each day, some of which contain omens and threats. Messages intercepted from “high priority sources” on September 10, 2001 precipitating the World Trade Center attacks were left untranslated for two days, due to a shortage in linguists (Frank 2009, p. 215). This should be a lesson that, whether a translator is heterosexual or LGB, it has no bearing on his or her ability to do a job critical to the security of a nation and the success of its military. In a recent private interview, one young woman related: “the sex of the person I kiss goodnight has no bearing on the tasks I perform during the day” (personal communication with A.W., Nov 10, 2010). It takes great ignorance to believe that sexual propensities of LGB service members are a threat to the American military, especially when compared to the damage that could be incurred without their services.

It is obvious that the need for the services of qualified service members has for a long time been an issue of debate. The inclusion of homosexuals, however qualified they may be, has held a place as being less acceptable than the lack of such members. Many felt that including the LGB community as candidates for military service could undermine the morale of other troops. While troop morale is a vital element to military success, it is not an element that would be sacrificed by shunning a group of people willing to work toward the greater goal of the Armed Forces. Foreign militaries had long since begun seeing the injustice of excluding an entire community from being permitted to served in their armed forces and, as a result, the impact on military morale by the integration of LGB applicants was being tested, observed, and documented. One by one, legislators in other nations began paying close attention to the effects of militaries lifting their ban on gays. As of 2009, twenty-four foreign militaries had concluded that there was no legitimate undermining effect on military morale (Frank, 2009), and had adopted a policy that accepted the service of openly homosexual women and men.

Prime examples that debunk the idea that unit cohesion might suffer from lifting the DADT policy can be found in the militaries of Israel and Great Britain. As Belkin and Levitt (2001) suggest, the people of Israel are “considerably less tolerant of homosexuality than Americans”. However, the 1993 repeal of their ban on gays in the military proved that, after an initial outcry, gay service became a nonissue; the change in their policy had no negative effect on morale or on recruitment. Great Britain also repealed their policy against the service of openly gay soldiers in 2000 and found that, in contrast to their original

presumptions, the overturn in policy created an environment where there was *less* anxiety about sexual orientation among their units (Frank, 2009).

Even in the United States, numerous studies, public and private, have been conducted with the intent of gauging the overall readiness of the military to incorporate openly LGB members. Soldiers and civilians have been interviewed and polled exhaustively in the pursuit of America's standpoint on DADT and its injustices. A report by the Pentagon, released in November 2010, is the most recent and among the most important of these studies. Among its most important findings, as reported by the *New York Times*, was that 70% of service members feel that, were DADT repealed, "the impact on their units would be positive, mixed or of no consequence at all" (Bumiller 2010). The report goes on to address possible negative impacts on unit cohesion and morale, citing that, just as in the Israeli military, there would be isolated incidents of protest and disruption over the short term; these incidents, however, could be handled by proper leadership. In a privately conducted interview, one former soldier who served in the Army concurred with this hypothesis, citing that "no one in [his] unit had time to be bothered by what one man did on his own time; as long as he was shooting at the same people I was shooting at, we were on the same team" (personal communication with D.A., Nov 10, 2010).

Having witnessed two dozen countries' progression from intolerance to acceptance of the LGB community's desire to serve, it is time that the United States follows suit and takes the correct action. The abundance of meaningful evidence presented by these foreign militaries, as well as from our own, clearly substantiates that unit cohesion and military morale would incur no significant injury as a result of abolishing the DADT policy. After a decade of observing the effects of accepting openly gay service members in the British militias and almost two decades of aftermath from the Israeli Armed Forces, it should be quite clear that, there is no reason the American military should experience a change in morale any different from that of its overseas counterparts.

American society has had a history of being bigoted and xenophobic. Any group of people that was perceived as different or inferior to mainstream American society has always been seen as a threat, and thus was treated as such. For example, emancipated slaves in the South continued to bear discrimination – most notably through segregation – for a century after the Civil War. Women, traditionally limited to being housewives, continued to bear inequity until feminist movements gained success. Even American citizens of Japanese descent were interned during World War II, based simply on their ethnic origin. These biases have proven consistent with history in that Western culture has typically had a difficult time accepting and incorporating minorities through the ages (Carroll, 2007). The "Don't Ask, Don't Tell" policy is just another way America shows its inability to accept the differences of a minority group. As a policy that requires a highly-esteemed organization like the Armed Forces to exclude openly gay members, DADT has a delirious effect on the rest of society. The policy encodes that being a part of the LGB community makes a person a second-class citizen unworthy of serving as part of a hallowed assemblage like the military. Much like the policy of racial segregation – which encoded the idea of white supremacy – that stood until 1948 (Executive Order 9981), DADT clearly encodes heterosexism in the military. As a result, a disillusioned opinion of the LGB community as being different from the general populace – and therefore second class – is propagated to American society, and, in turn, potentially perpetuates second-class treatment of homosexuals in the military and in civilian life. Such delirium only helps fuel the bias of ignorant heterosexuals and homophobes and gives them a pillar on which they can support their opinions.

In contrast to military policy, the Office of Personnel Management (OPM), which monitors all Federal Government employees, has a standpoint more accepting of minority sexual orientations. The agency, in concordance with Executive Order 13087, protects all civilian federal employees from discrimination based on sexual orientation and, according to its website, hopes to use its position as the United States' largest employer to set an example for other employers (U.S. Office of Personnel Management, n.d.).

There is a stark hypocrisy in that the military, which is essentially employed by the Federal Government, does not have to follow these same anti-discrimination guidelines. “Don’t Ask, Don’t Tell” has a damaging effect in that it undermines the effect that the OPM is trying to have on American society by setting an example of tolerance and acceptance.

The military holds a high regard for personal strength, character, and moral value. Included in the moral values prized by the military is honesty – a trait betrayed by DADT supporters who feel that LGB service members (and *only* LGB service members) should hide their sexual identities. The character of an applicant to join the Armed Forces is also expected to maintain the type of character that would be expected of a person representative of his or her position as a member of the military. In contrast to that, the military has granted waivers to military applicants convicted of felonies and misdemeanors – the number of which has increased sharply in the past few years (Alvarez, 2008) – in order to help meet the demands for enlistments. There is an obvious note of lunacy in the mindset of military leadership to believe that a person with a history of armed robbery or arson would be less of a threat to the military and its morale than a person who shares his or her love with a person of the same sex.

Like many minority groups, the LGB community has battled for many years to gain full membership in society. The right to serve openly in the military has been a focal point in this battle, and until this right is granted, the battle will rage on. Since the presidential election campaigns of 2008, the ban on LGB service in the military has been closer to the chopping block than it has been since Bill Clinton campaigned similarly to end the ban in 1992. The climate, however, is very different now from what it was in 1992; for example, Sam Nunn, a former Senator and major figurehead in the “Don’t Ask, Don’t Tell” compromise between a gay ban and the total repeal thereof, has since publicly stated his opinion that it is time to take another look at DADT (West, 2009). The public opinion has also changed and support of repealing a ban on openly gay service has almost doubled since the enactment of DADT (West, 2009).

Today, as members of the LGB community face scrutiny, their right to live their lives as full members of society is restricted. While they do have the right to wear a military uniform, exercising that right comes with the sacrifice of having to conceal an important part of their identity as long as this policy remains in place. As Americans continue to become more enlightened – and more tolerant and, in some cases, accepting, as a result – the policies enforced by the American government and its military ought to fall in line with its people’s ideals.

There have been some major victories for the LGB community in the battle against DADT as of late, the most prolific one being the passage of an amendment in the House of Representatives that will pave the way for the policy’s repeal. Most recently, as mentioned previously, the Pentagon released the results of an exhaustive nine-month study outlining the possible impact of the repeal of DADT – a study whose results furthered the argument that the policy is obsolete (U.S. Department of Defense, Nov 2010). The biggest hurdle that must still be jumped is that the amendment must be passed in the Senate. Until then, the path to repeal is essentially one step away from seeing the justice it has long awaited. When that step to repeal the clearly unjust “Don’t Ask, Don’t Tell” policy is taken, America, its government, and its military will finally be on the same page, operating on a more acceptable policy: “Don’t Discriminate, Don’t Judge.”

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CELESTINA BRADSHER-LAYNE

Echoes of Emotion: An Analysis of Menotti's *Old Maid and the Thief*¹

Echoes of Emotion is an analysis of Gian Carlo Menotti's "Steal Me Sweet Thief" from the opera entitled *The Old Maid and the Thief* and a journal of my experience learning and performing the piece.

Gian Carlo Menotti was an Italian-American Composer born in Cadegliano, Italy. He is famous primarily for his operas, which are known for being eccentric and surprising. Menotti's operas display an intimacy of emotion as well as a child-like sense of wonder and enjoyment. For almost all his works, he was the playwright and director as well as composer. His mother, an amateur musician, taught Menotti how to compose at age seven. At the age of 11 years old Menotti wrote and composed two operas: *The Death of Pierrot* and *The Little Mermaid*, adapted from the Hans Christian Andersen story. By age 13, he had written two operas and was entering his first semester at the Verdi Conservatory in Milan. Menotti's professional career began in 1937 with the launching of his opera, *Amelia Goes to the Ball*, which is a one-act opera. Some of his other early works include *The Old Maid and the Thief*, a radio opera commissioned by NBC (1939), *Sebastian*, his first ballet (1944), and the short operas *The Medium* (1946), and *The Telephone* (1947). In 1950, Menotti was given both the New York Drama Critics Award and the Pulitzer Prize in music for *The Consul*, his first full-length opera. He won both prizes again for *The Saint of Bleeker Street* in 1955. His most famous work, *Amahl and the Night Visitors* was written in 1951 for NBC-TV, and was the first American opera written specifically for television.²

The Old Maid and the Thief is an opera for radio, meant to be imagined and heard rather than seen with the eyes. In between some scenes there are radio commercials and plot announcements that help to create the feeling of a live radio show. Every sound in the piece is therefore very important, as it informs the listener of what is going on in the plot. The opera is performed in one act, and tells the story of a middle age woman who allows a strange man into her home. The story begins with Miss Todd serving tea to her neighbor Miss Pinkerton, when a beggar named Bob comes to the back door. After Miss Pinkerton leaves Miss Todd's servant Laetitia lets Bob in.³ Miss Todd and Laetitia convince Bob to stay and live with them. However, soon after Bob's arrival, Miss Todd learns of an escaped criminal who fits Bob's description from her neighbor Miss Pinkerton. Both Miss Todd and the Laetitia believe the culprit to be their houseguest yet still continue to harbor him. They work together to try and get Bob to admit his guilt or leave, so they are not found to be harboring a fugitive. To this end, the women leave money around the

¹ Completed under the mentorship of Professor Sara Paar for THA 46: Training the Performing Voice.

²All referenced from: Wittke, Paul. "Gian Carlo Menotti: Renaissance Man of the Theater." *Schirmer*. © 1991 G. Schirmer, Inc., Aug. 2005. Web. 02 June 2011. <<http://www.schirmer.com/default.aspx?TabId=2419>>.

³Bruce Archibald. "Old Maid and the Thief, The." *The New Grove Dictionary of Opera*. 7 Apr. 2011.

house hoping he will steal it and leave however; Bob takes the money and continues to live at the house. Miss Todd and Laetitia even go to the extent of robbing a liquor store to get Bob gin. When Miss Todd tells Bob of their thievery Bob says that she should be placed in jail rather than him. Miss Todd threatens to go to the police and tell them about Bob yet, never does so. Laetitia and Bob decide to run away together to escape the police. While Miss Todd is gone they steal money, household items and her car.

The scena for the aria “Steal Me, Sweet Thief” is set at four o’clock in the kitchen, where Laetitia is mending and then pressing Bob’s trousers. Bob has been staying at the house for a while and Leticia believes that they can have a future together. Her only qualm is that Bob is too shy to make the first move. Steal Me Sweet Thief begins with a recitative, a technique that subdivides a vocal number. The orchestration for the piece is piano which denotes the tone and quality of the song well. The piano’s introduction in measures one and two foreshadow darkness in its sharp and loud dynamics and pitch right before Laetitia speaks. This dissonance in sound seems to portray her frustration and anger. When she begins singing it is very striking, as if her emotions have been pent up and she has been ruminating on them for some time. Laetitia’s opening line is “What a curse for a woman is a timid man”.⁴ She sings as if she is placing a vindictive curse. One can interpret this to mean that she is fed-up with Bob since he has been living with her and Miss Todd and has not made any romantic advances towards her. The melody in measure three of the accompaniment is very rhythmic, echoing the action of sewing. In measure five the accompaniment becomes stunted in rhythm echoing the sentiment in the lyrics: “but he made no advances”.⁵ The song then continues as the tempo changes to *poco piu mosso*⁶ and Laetitia begins to list all the things that have happened between Bob and Miss Todd throughout the week. Miss Todd has taken on the role of thief under the illusion that it will get Bob to declare his love for her. Laetitia sings in measure six, “Miss Todd schemes and labors to get him some money. She robs friends and neighbors the club and the church.” Then the music pauses as if to say “Guess what?” before Laetitia sings “He takes all the money”. The music changes to a slower tempo as she continues saying “with a smile that entrances”. The tempo and lyrics evoke Laetitia’s entrancement with Bob, the supposed thief. However the dynamics change with the lyrics “but still makes no advances”⁷ while the piano echoes her disappointment. The rhythm in the music then illustrates that Laetitia returns to her sewing in measure twelve. However in measure fourteen the accompaniment becomes thunderous as the lyrics declare “All the drawers are wide open...” This invokes in the listener a feeling of “Come on! Really?” In measure seventeen, the tempo picks up as Laetitia speaks with disgust and anger about Bob’s lazing about the house and not doing anything productive. At the same time the music picks up in tempo and dynamic with a *mezzo forte, pesante*⁸ in the music. In measure twenty-one the singer repeats “What a curse for a women, is a timid man,” but this time as a lament rather than the angry curse used at the beginning of the song.

At this point Laetitia stops sewing and begins ironing. The song becomes an aria as the music and singer soften to wistful tones. The aria begins in the piano in measure twenty-three with a soft legato sound. This is in great contrast to the earlier recitative. The music is marked *pianissimo* and *adagio ma non troppo*, as Laetitia begins to dreamily press Bob’s trousers. The aria is dream-like with hints of morbidity from measure twenty-four through thirty-six. Laetitia sings of Bob as a thief who she asks to steal her from death. Her words become romantic and wistful rather than angry and accusing. Laetitia’s concern over her age is illustrated in the lyrics as she sings “...steal me, sweet thief, for time’s flight is stealing my youth and the cares of life steal fleeting time...”⁹ Laetitia has felt the ravishes of time and wishes for love and

⁴ Measure three.

⁵ Menotti, Gian Carlo. *The old Maid and the Thief*, Scene VI. The Kitchen (A week Later): Steal Me Sweet Thief.

⁶ Poco piu mosso means a little more motion.

⁷ Measure 11.

⁸ Pesante means Heavy, Lumpy, Ponderous.

⁹ Measures 25 through 28.

family before she becomes too old. The piano is marked *affrettando un poco*¹⁰ which exaggerates the feeling of running out of time. In measure thirty-one the piano dynamic changes to mezzo-forte with emotion. Laetitia at this point sings of death coming as a thief and stealing life. The music continues with a crescendo as Laetitia sings –“sweet thief, I pray make me die before dark death steals her prey.” The emotions within this section are desperate and painful. Laetitia is asking for companionship and is crying out in pain for lack of it. In measures thirty-seven through forty-four the piano plays in a tolling bell-like fashion as Laetitia sings –“steal my lips before they crumble to dust....”. The imagery in her words is very clear and her fear of never feeling love before she dies and her beauty fades is plain. The music builds upon this sentiment as Laetitia repeats it with emphasis and ardor until measure forty-nine where the song climaxes with one final –“steal me!” The piano then slows before Laetitia sings in sad and depressing tones –“For time’s flight is stealing my youth.”¹¹ The piano plays a final bell toll as Laetitia holds out the word –“youth” for the last two measures, leaving the listener with the echoes of death.

Laetitia is definitely not a heroine in *The Old Maid and the Thief*. –“Steal Me Sweet Thief” is a song of a woman craving male love and affection before she becomes too old. Laetitia conveys a definite fear of becoming an old spinster like her employer Miss Todd. They are also the true thieves of the story since they are the ones actually committing crimes. Menotti shows the painful irony of life by forcing the innocent Bob to stealing from Miss Todd with the help of Laetitia, so that he would not go to jail. Therefore the piece is rightly entitled Steal Me Sweet Thief which conveys a sense of irony to the listener and alludes to the ending of the opera.

My experiences learning the history and instrumentation for this song reminded me often of attending the opera as an audience member. The following are journal entries I wrote while preparing to perform the song for class.

The first opera I attended was through the Kingsborough Community College Honors Program. The Honors Program invited students to the Metropolitan Opera during the fall 2011 semester to see Verdi’s *Don Carlo*. The experience is one I will never forget. I remember sitting and waiting in anticipation for the curtain to rise and the performance to begin. The stage was huge and the audience was one of the largest I have ever seen. I would love to be able to see it from the stage as an actor or a singer does during a performance. The Honors program held a workshop prior to the performance so that the students would understand what was going on in the plot. The opera was performed in Italian yet it was as if they were speaking English. The emotions were displayed both by the performers and the music. This experience inspired me to learn more about opera as a musical genre for performing.

As a singer it is important to use the correct technique for whatever style of music you sing. Musical theatre pieces often call for a nasal quality whereas operatic songs require different types of tonal qualities depending on the part being portrayed. Swallowing your sound as a singer, may result in lost vowels and softer sounds. This is often heard when people try to sing in an operatic style with no formal training in that particular style. The tongue while singing should not be thinned, pointed, or depressed. The larynx should also not depress as this impedes the breath, allowing the sound to be swallowed or muffled rather than move forward from the mouth. People that sing in this way must break their bad habits before they are able to attempt further techniques.

It is important to articulate and pronounce consonants especially when singing in an operatic style. The long vowels when singing are held over notes since one cannot hold a consonant.

¹⁰ *affrettando un poco* means Hurry and pushing a little.

¹¹ Measure 50 to 52 (end).

Entry 1

After meeting with my professor we found that when singing I would often depress my larynx and tongue which would cause me to muffle my sound and lose the consonants in the song. The rehearsal techniques focused on larynx stability, articulation, tongue relaxation and the ideal way to breathe. Today's technique given by my professor was to flex my abdominal muscles while breathing. The Italian term for this is *appoggio* which felt like trying to breathe while not breathing. There are three main steps to inhaling: step one is to relax the abdominal muscles, step two is to lift or expand the ribcage and step three is to lift the sternum allowing oxygen to fill your lungs. The opposite of these steps happen when you breathe out. The trick to this technique, while singing, is to try to push your abdomen out while it is being pulled in. This technique is also known as belting because one attempts to use their abdominal muscles in a belt-like fashion.

Entry 2

After my first rehearsal, I was challenged to sing the song with my tongue hanging over a straw. The goal was to relax the muscles of the tongue, especially the back muscles, so that the sound can pass through the throat without restriction. When practicing this method in the mirror the tongue should be flat and relaxed, it should not be pointy or thinned. Another method I used was to sing while holding a cork between my teeth in order to enunciate the lyrics more clearly. I will continue to practice and use these techniques while rehearsing to gain the quality I want in my voice. These techniques are useful for singing in general and I will most likely return to them often.

Entry 3

Having practiced these techniques for a while I find it easier to reach the higher notes of this and other songs. When I was younger my range was much wider than it is now. I have found that by practicing these techniques my vocal range is returning. I have also found it easier to hit high notes faster. Whereas before I would have thought being a coloratura to be beyond my abilities, I can see that it is a learned skill as long as a person has the vocal range and abdominal strength.

Entry 4

The most challenging part of "Steal Me, Sweet Thief" for me is definitely the timing used throughout the song. The changes in the counting are varied throughout the song, and require great amounts of practice. Performing the piece was fun. I would have preferred more rehearsal time with the accompanist to work with the timing, but I did study it using my personal theory skills and some YouTube videos of the song performed by various people. The emotions of the piece are very expressive, and I did my best to convey the undertones of anger and longing throughout the song. I explained the scenario and plot of the piece before singing it and it seemed that the audience perceived the sentiments of the piece throughout the performance. Prior to singing the song I felt great anticipation, however once it was over I felt great relief. As the only student in the voice class to sing a classical opera song, I wondered what the response would be from the student audience. The performance went well though I did sing the timing incorrectly at certain points in the piece. The audience enjoyed the experience, as did I.

My experience singing "Steal Me, Sweet Thief" as part of an Honor's Program Contract has opened my eyes to the genre of classical music. I enjoyed working with my faculty mentor for the performance and learning about the different techniques used for singing. The lessons I have learned can be used for all of my lifetime, not only for singing but also for speaking. I plan to continue to practice and use the techniques I have learned this semester throughout my life. Opera is now a genre I plan to pursue and explore during my vocal career and I will always have the memory of this project to remind me of where I began.

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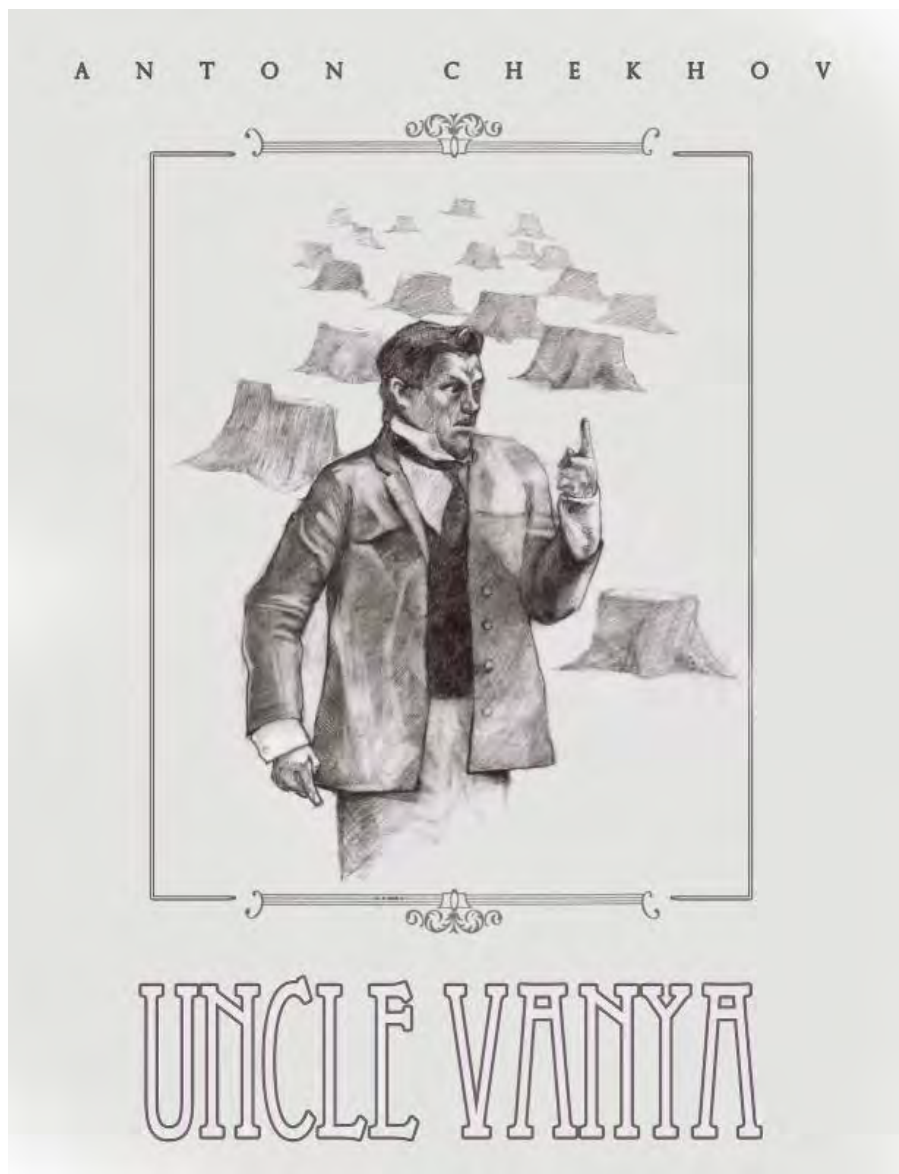
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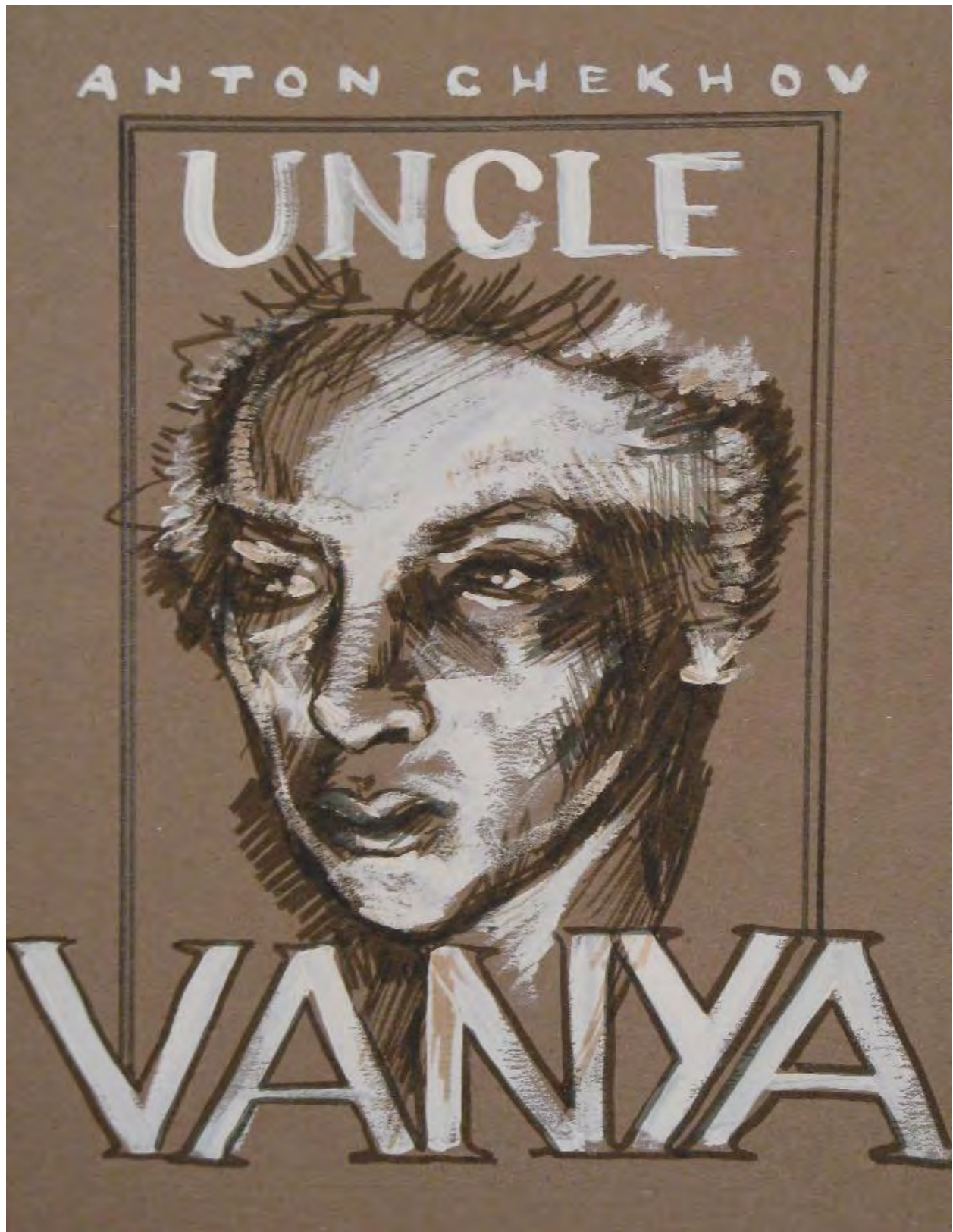
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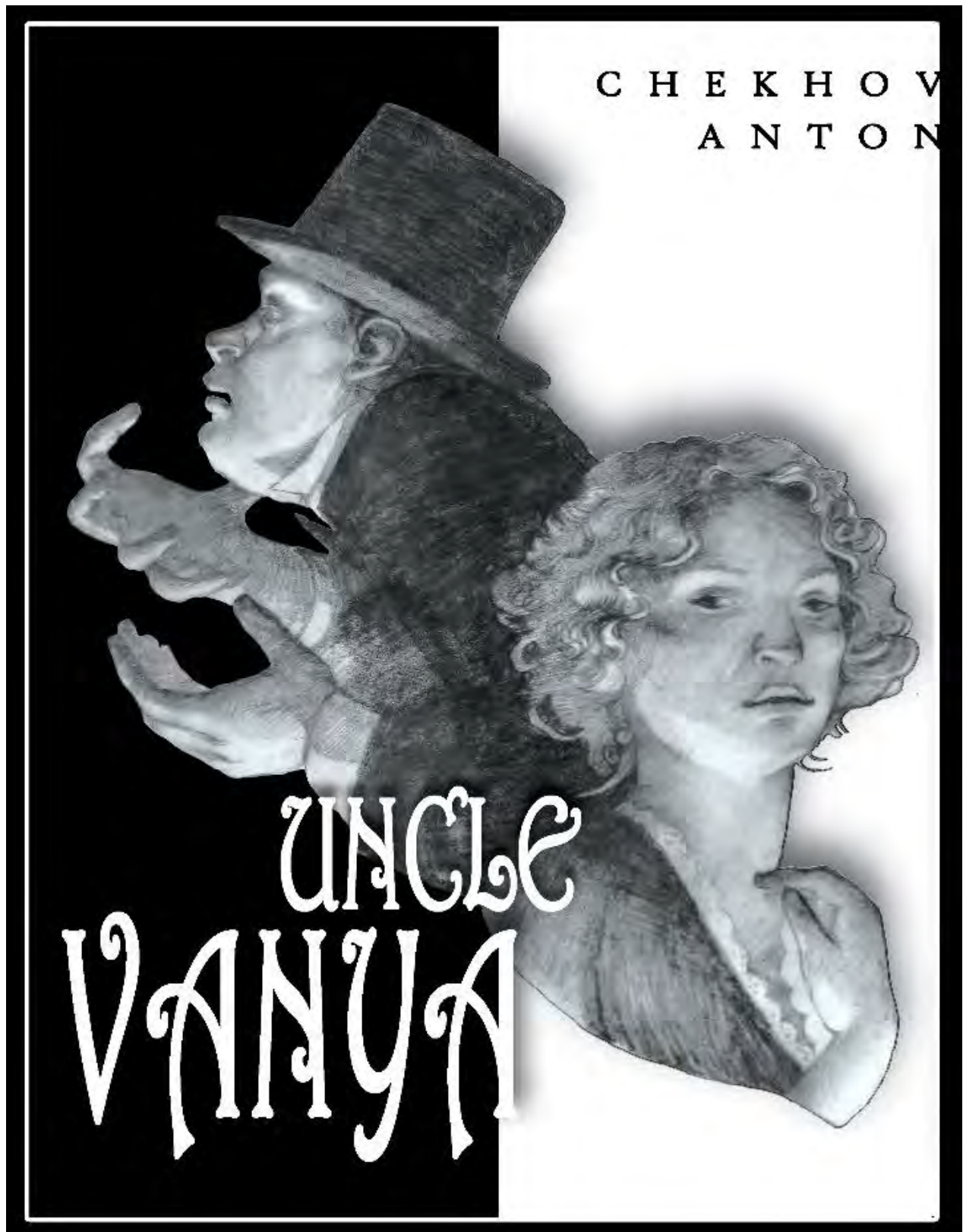
OLGA DOBRAYA

*Uncle Vanya Posters*¹



¹ Completed under the mentorship of Professor Lynne Foster for Art 69: Illustration Style.





MARIA SMIRNOVA

The Biology and Ecology of Adult and Juvenile Horseshoe Crabs¹



Introduction

The horseshoe crab is a fascinating creature. As evidenced by fossils, their ancestors date back some 500 million years ago. Therefore, horseshoe crabs are considered as “living fossils”. The horseshoe crab’s current form has undergone virtually little change during all these years, as today’s horseshoe crab looks almost identical with its ancestor.

There are only four species of horseshoe crabs worldwide that are all similar in their biology, life history, and ecology. Those include *Limulus polyphemus*, *Carcinoscorpius rotundicaudata*, *Tachypleus tridentatus* and *Tachypleus gigas*. The Atlantic horseshoe crab (*L. polyphemus*) is most commonly found in the Atlantic Ocean along the western Atlantic coast from Maine to the Gulf of Mexico as far as the Yucatan Peninsula with the center of their distribution located near Delaware Bay.^[14]

Anatomy

Originally, the horseshoe crab was erroneously classified as a crab. Horseshoe crabs are more closely related to arachnids such as spiders, scorpions and ticks. Beneath the carapace (shell) they look quite similar to a large spider. True crabs have two pairs of antennae, a pair of jaws, and five pairs of legs. In contrast, horseshoe crabs lack antennae and jaw. They have seven pairs of legs as well as a pair of chelicerae. Chelicerae are appendages, similar to those of spiders and scorpions, which are used for crushing and grasping. In addition, horseshoe crabs have book lungs, similar to spiders and different from crabs, which have gills.^[23]

The horseshoe crab's carapace is divided into three sections; the anterior with the larger section called prosoma; the middle section, which is called the opithosoma, and connects to the prosoma via a hinge; and the “tail,” which is called the telson. The prosoma is covered by smooth carapace on the spinal surface. This section contains five pairs of eyes, brain, heart, and five pairs of walking legs. The four pairs of its legs end in a claw and the fifth pair allows the animal to lurch forward. Among females, the four large legs are all alike but among males, the first pair of walking legs has modified hook-like structures

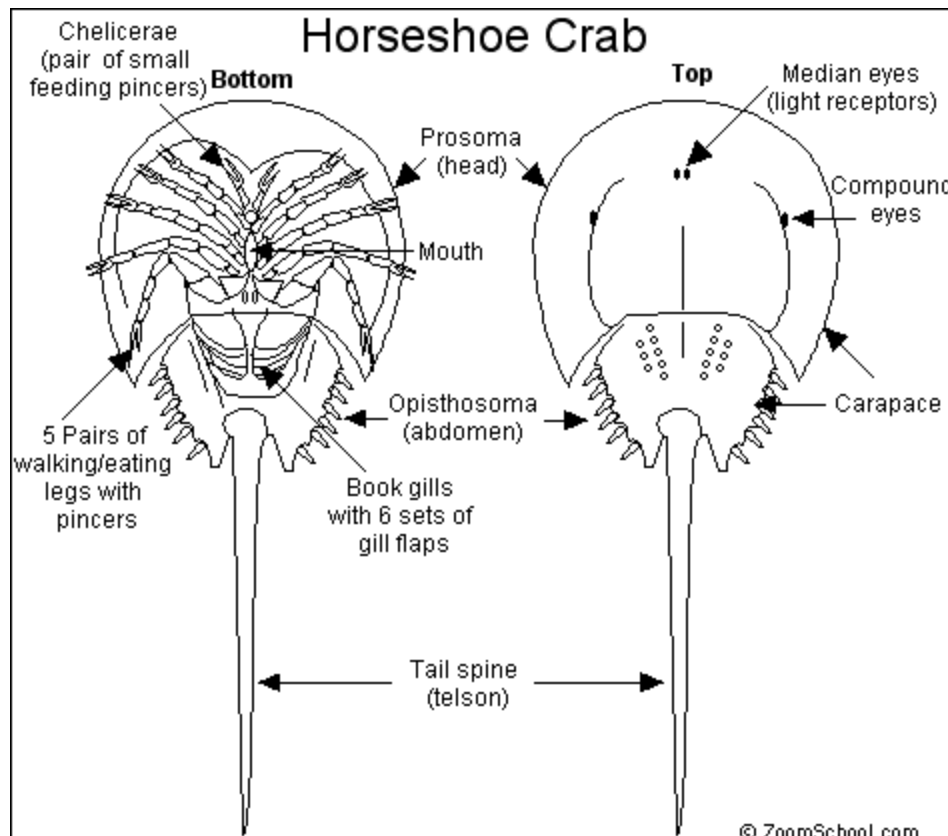
¹ Completed under the mentorship of Professor Carla Beeber for BIO 13: General Biology.

that are used to attach to females during mating while she is depositing eggs and him waiting to fertilize them. ^[16]

The middle portion - opithosoma has book gills (respiratory organs) that are attached to it as well as the genital operculum. ^[16] The first pair of gills has been modified into the operculum, which bears the openings of the genital pores where eggs and sperm are released during mating. The operculum covers the five other pairs of gills, which are used for respiration. ^[14] The third section, spike-shaped tail, is attached to abdomen and functions as a tool of digging in the sand, and levering if the animal stuck upside down. ^[16]

Vision

Despite of the fact that horseshoe crab has ten eyes, it has “poor” eyesight that is designated solely to sense light and locate mates. It has two large compound eyes, two ventral eyes, and five eyes located on the prosoma and photoreceptors on the telson that constitute the last eye. Each compound eye of a horseshoe crab has about 1,000 receptors of ommatidia. Each ommatidia has its own relatively large nerve. The size of the nerves is large enough that it possible for electrophysiologists to easily observe the nervous response to light stimulation. Also the cones and rods of their lateral eyes have similar to the structure of human eyes. One exception is that they are approximately 100 times larger than the humans'. ^[16]



For the vision research of the horseshoe crabs *L. polyphemus* is considered to be an excellent model. After conducting research for over 70 years on the physiological properties of the *Limulus* lateral's eye, the basic methods of visual functions that are shared by many animals as well as humans were revealed. Nevertheless, the role of the lateral eyes of *L. polyphemus* in their behavior has acquired less attention from scientists. Studies conducted previously illustrated that for finding mates, adult males usually make use of their eyes while female adults avert any mate-like object. Many scientists have endeavored to examine such behaviors in laboratories but failed to observe them because the adults did not exhibit them

while in captivity. Hence, scientists have shifted their attention toward juvenile or young *L. polyphemus*. The visual behavioral characteristics on both the field and the laboratory are being reported for further investigation and analysis.^[9]

In order to examine these hypotheses scientists set up experiments in their natural habitats. On tidal flats of North Monomoy Island Wildlife Refuge, Chatham, Cape Cod, Massachusetts (0.3–1 m depth), the visually guided behavior of young crabs has been observed by M. Errigo et al. on the submerged flats during high tides. The results of research revealed the first evidence that juvenile horseshoe crabs could see. They are able to avert high-contrast items. It is evident from the previous studies that adult females usually migrate to shallow waters to build nests and to search for vacant areas. To avoid an encounter with other females they avert dark female-size objects. The reason why juveniles avoid dark objects is that those high-contrast objects resemble possible predators. Adult males avoided dark objects only if they were held overhead. Similar to juveniles that observe dark objects on the bottom as predators, adult males might view overhead objects like predators too. Since the sex of one-year-old juveniles could not be identified, specific behaviors that are observed in juveniles cannot be associated directly with the sex of the animal. Horseshoe crabs obtain external sexual traits at the time of reaching the stage of maturity, which is usually at the age of six. Possibly all the juveniles that were observed were females and avoided the high-contrast objects the same way they would do during their adult life. Alternatively, the juveniles that were tested could be comprised of both females and males. Then the reason juvenile males could avoid dark objects might have been explained by their immaturity. Compared to the mature males, who move towards those objects as potential mates, the juvenile males tend to avoid those objects.^[9]

Julie Medina and Richard Tankersley did research on the orientation of larval and juvenile horseshoe crabs *L. polyphemus* to visual cues and effect of chemical odors. They conducted an experiment based on two hypotheses: first, larval and juvenile crabs can detect and respond to visual targets; and second, certain chemical cues that are associated with their habitat affect their sense of orientation and direction. The visually directed movements of larvae and first stage juveniles were observed in order to see if they move in the direction of horizons containing dark visual targets with different sizes. The crabs were placed in different circular dishes: one set filled with offshore water that lacked estuarine chemical cues and the other contained smells from marine vegetation and predators. Other variables included responses of crabs to rectangles subtending angles at degrees varying from 30 to 330. Their observation showed that in offshore water, larvae moved towards darker horizons, while juveniles moved away from dark horizons, which was represented by rectangles angled at greater than 60 degrees. When chemical odors from potential nursery habitats such as the seagrasses *Halodule wrightii* and *Syringodium filiforme* were placed in water the crabs moved in the opposite direction than they did in offshore water. The introduction of odors from the mummichug *Fundulus grandis* and blue crab *Callinectes sapidus*, which are known predators, did not have any effect on the larvae, but the juveniles responded by moving towards what they could see. Therefore, the results supported the hypothesis that the visual orientation of larval and juvenile horseshoe crabs changes upon exposure to habitat and predator cues and that the direction of the response undergoes an ontogenetic shift following metamorphosis.^[13]

Locomotion and Feeding Behavior

Horseshoe crabs are omnivorous scavengers. Adult horseshoe crabs are benthic animals feeding upon small mollusks, worms, small fish, and algae that are found on the bottom of the sea. Adults and juvenile horseshoe crabs use swimming or crawling as their primary means for locomotion. The locomotion and feeding in horseshoe crabs are closely related. Since horseshoe crabs are lacking jaws, while walking the food is grinded by the bristles that cover its mouth located at the base of the legs.^[16] Then the food is picked up by the chelicerae and passed to the mouth, which is then passed through the digestive system, and expelled through the anus.^[14]

In the past, scientists like Douglas Borst and Robert Barlow attempted to determine the locomotor activity cycle of adult horseshoe crabs in laboratories. Unfortunately, their attempts mostly were unsuccessful.

They examined more than 100 crabs and only one of them showed circadian activity in darkness. After failure in assessing the locomotor activity of adult crabs, Douglas and Robert decided to test juvenile horseshoe crabs. They discovered that most juveniles were active during nighttime under natural cyclic lighting and some of them maintained rhythmic activity in constant darkness. ^[1]

Conditions for Development of Embryos and Larvae

Adult horseshoe crabs inhabit subtidal areas of estuaries where salinities vary from 5 to 34ppt. The embryos and larvae within nests are exposed to conditions that vary in a much wider range of temperature and salinity during summer spawning periods. Gretchen Ehlinger and Richard Tankersley conducted an experiment where the development time, survival and molt cycle duration of juvenile *L. polyphemus* were examined in 20 different combinations of salinity and temperature. Additionally, the effect of hyperosmotic and hypoosmotic shock on the osmolarity of the perivitelline fluid of embryos was determined at salinities between 5 and 90 ppt. Data showed that the embryos fully developed and molted at salinities below 60ppt; however, they failed to develop when temperature went above 35 °C. The larvae survival declined at extreme salinities such as 8, 80 and 90 ppt, but was high at salinities from 10 to 70 ppt. The results showed that the temperature and salinity had an effect on the development rate of horseshoe crabs, but only extreme temperature and salinity had an impact on their survival. ^[8]

Embryos and larvae can withstand a much wider range of salinities than juveniles and adults can. The ability to tolerate such extreme conditions is especially important in nontidal estuarine systems and lagoons, such as the Indian River Lagoon (IRL), a large and shallow estuary along the east coast of Florida, USA. Though embryos and larvae of *L. polyphemus* are capable of tolerating high salinities experienced in the IRL, temperature during summer spawning and development periods may surpass their tolerance limits. Consequently it may lead to the decrease of larvae and embryos. ^[7]

Reproduction

Early spring is the breeding season for horseshoe crabs. By that time, the estuarine temperature approaches 20 °C (68 °F) and male and female horseshoe crabs start to move toward beaches of the islands to seek suitable spawning habitats. They prefer locations with large inertial sand flats near the spawning beach. Mating activity and nesting coincide with high tides. Females follow flooding tides with males attached to their carapace. Once they reach to the beach the female escalates nests and deposits thousands of them. While the female deposits her eggs in the nest cavity the male attached to her carapace fertilizes them. She repeats this process several times over the spawning cycle, usually returning to deposit more eggs on subsequent high tides. ^[23]

One supplementary feature that occurs during the mating process involves the horseshoe crab's use of multisensory cues that enhances their ability to detect mates. A study conducted in 2010 by Katharine Saunders et al. supported the hypothesis that horseshoe crabs from Florida to New Hampshire were using chemical cues to locate spawning pairs. The New Hampshire experiment completely excluded visual cues from horseshoe crabs. The results of the experiment showed that unattached males were attracted to spawning pairs with chemical cues alone when nesting in shallow water near shore. Thus, these results again confirmed the notion that male horseshoe crabs were using chemical cues with visual cues in order to find mates. ^[17]

Male horseshoe crabs have two mating tactics. Some males come ashore attached to a female and nest with them on the intertidal portion of the beach during the high tide. Other males come ashore unattached and crowd around nesting couples. Previous studies have shown that male crabs find females by using their compound eyes (lateral eyes) and that attached males had carapaces that were less damaged than those of unattached males. Erin Duffy et al. conducted an experiment to see if the damage of male's compound eyes and abnormalities of their claspers affected their mating maneuvers. Sexually mature males had two types of eye problems. One is the degeneration due to disease or problems caused by

sessile invertebrates, such as bryozoans, mussels, and tube-building polychaetes. The other one is the overgrowing of their eyes. Lateral eyes of attached males were much less damaged than unattached; however, the attached males had their vision affected more by encrusting invertebrates. Although overgrowth did not have an effect on a male's ability to pair with a female as much as eye decay, it is possible that amplexus may have occurred before epibiont coverage could be sufficient to obscure vision.^[5]

In the experimental group, blindfolded males whose lateral eyes were painted with black nail polish were less likely to attach to a female than male from the control group. Damage to arms and legs of the crabs were more prevalent in unattached males. In particular, none of the attached males had damaged claspers (the modified first legs required for amplexus) as opposed to 6.4% of unattached males with damaged claspers. An examination of carapace wear of unattached males indicated that unattached males in the population were older than attached males. These results showed that older crabs, with impaired vision and/or damaged claspers, had less chance to mate successfully with females. Therefore, it highlights their choice of the other alternative of satellite male mating tactics.^[5]

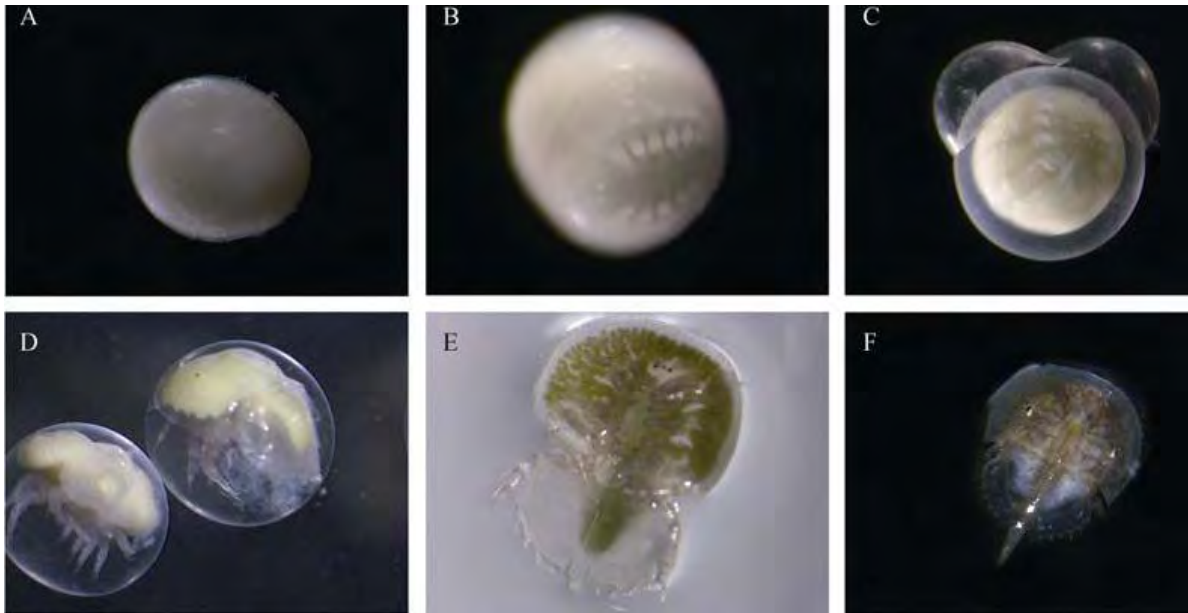


Photo by Mark Botton

Developmental Ecology

In approximately the third week of their life span, larval horseshoe crabs emerge from their nests. Juvenile crabs spend their first two years near beaches where they were spawned and then move toward deeper waters. The reproductive and developmental biology of horseshoe crabs is intriguing and extraordinary. It helps to comprehend the reasons why this species has thrived so successfully over evolutionary time. In order to understand this developmental ecology of the American horseshoe crab, *L. polyphemus*, Mark Botton et al. performed a study on the stages of development of a horseshoe crab embryo. It is hard to tell when the first stages of development have begun because the eggs were covered with a substance that was hard to see through. The first sign of development was the formation of the rudimentary prosomatic appendages at the “limb bud” stage confirming that the development process took place. In the next few days, after the formation of the rudimentary prosomatic appendages, a series of changes occurred inside the egg. First, the outer chorion shed and then the developing embryo grew. It then underwent a series of molts within the clear inner egg membrane. The trilobite's first instar continued within the beach sediments for several more weeks, until the eggs started to hatch. Different

environmental factors such as hydration, agitation, and osmotic shock as well as the penetration of seawater into the nests aid hatching of horseshoe crabs' eggs. ^[2]

Trilobites demonstrate endogenous circatidal swimming rhythms entrained by mechanical agitation, which suggests that larval swimming peaks when high tides bring water into the nests. Larvae swim around the nests and do not go far from them. The rate of larvae development is very flexible and is susceptible to the environmental factors such as temperature, salinity, level of dissolved oxygen, and existence of pollutants in their habitats. Therefore, the fact that larvae do not swim far from their nests and the broad environmental tolerances of horseshoe crab embryos and larvae may provide some important information about where they might have come from geographically, their current distribution, and how they evolved through time for so long. ^[2]

Growth Patterns

In order to continue growing horseshoe crabs must molt. Before attaining sexual maturity at 9 to 12 years of age they have to shed their shells some 16 to 19 times. The growth patterns of juvenile *Tachypleus tridentatus* and *Carcinoscorpius rotundicauda* were investigated by Christine Lee and Brian Morton after they collected them from their nursery beaches in Hong Kong. Juveniles were fed with a mixture of squid, prawn, and fish. Growth data was acquired by measuring the width of their prosoma and their wet weight weekly. Within the first five and a half months in captivity more than half of the juveniles molted, and after each ecdysis, the growth of prosoma and wet weight were measured respectively. The results showed that weight gain for *T. tridentatus*, and perhaps for *C. rotundicauda*, was faster than prosomal width growth after each ecdysis. The influence of water temperature on growth was ascertained as well. This study suggests that Hong Kong horseshoe crabs molt more often than average at higher sediment/water temperatures ($\sim 28^\circ\text{C}$) with the presence of food. Therefore, Hong Kong horseshoe crabs need less time to attain sexual maturity than their conspecifics in Japan. ^[12]

Ecology

Horseshoe crabs have an approximate life span of 30 years. ^[23] Interestingly, females keep growing and thus keep shedding until they die as opposed to males that stop growing once they reach sexual maturity. Instead of spending energy on the growing process males utilize their energy for reproduction. Therefore, females get to be almost twice the size of males. The small size of male horseshoe crabs is beneficial to them as they can crowd in closer to a female to inseminate her eggs. ^{[21] (p 16)}

Ecologically, horseshoe crabs are important in marine food chain. They are preyed upon by many species of sea loggerhead turtles and sharks as well as fish and migratory birds. The abundance of the Atlantic horseshoe crab eggs to shorebirds in the Delaware Bay is crucial to their survival. At least twenty species of migratory birds depend on the horseshoe crab eggs as their primary source of fat. Each bird that flies to the Arctic spends two to three weeks replenishing in the Delaware Bay. For example, red knot (*Calidris canutus*) can double its duration during those two weeks by eating horseshoe crab's eggs. ^[6] According to Wenner's observations, harvesting of horseshoe crabs had already affected the red knot's population and it started to decline significantly in the past years. ^[23]

Commercial Usage

The color of the blood in these creatures is between gray-white and pale yellow. Horseshoe crabs do not have hemoglobin in their blood; instead hemocyanin carries the oxygen in the horseshoe crabs' blood. When the blood of horseshoe crab is exposed to oxygen, it turns to dark blue, which is due to the change in color of hemocyanin when it oxidizes. Thanks to its blood horseshoe crabs are very valuable in medical research. The horseshoe crab has a simple but effective immune system. When a horseshoe crab gets wounded, their primitive cells swarm to the area, coagulate, and simply immobilize the bacteria. The substance that is present in horseshoe crab's blood called *Limulus Amebocyte Lysate* (LAL) almost instantly clots into a gel-like material and traps the foreign body. This clotting agent in the crab's blood is

used worldwide to detect pathogens and endotoxins in medical intravenous fluids and medical supplies in order to ensure the safety of products.^[16] Since 1977, the Food and Drug Administration has required that every scalpel, drug, syringe, and flu shot to be tested with a horseshoe crab derivative, because no other test other than horseshoe crabs' works as easily and reliably for this purpose.^[23]

LAL is also used to detect Gram-negative bacteria that are present everywhere in the natural environment as well as in human bodies. It is found in the gastrointestinal tract and it is beneficial to humans because it helps human digestion of food. It becomes dangerous only when it enters the blood stream. Gram-negative bacteria release endotoxins into the blood stream that cause a raging fever. If it is not immediately treated the result is death in 24 hours.^{[21] (p. 3; 38)}

In addition, horseshoe crabs have been used in the development of wound dressings and surgical sutures. Besides pharmaceutical and biomedical industries, horseshoe crabs have been harvested in large numbers to provide the bait used in the whelk and eel fisheries along the Atlantic coast.^[23]

Demand for horseshoe crabs continues to grow. As a result of overharvesting of horseshoe crabs there is a significant decline in their population. It has become a matter of big concern for wildlife scientists as well as environmental activists. Responding to these concerns, new fishery regulations have been introduced in various states. In South Carolina for example, only the LAL industry is permitted to harvest horseshoe crabs.

Biomedical Bleeding

A study about the impact of biomedical bleeding on horseshoe crabs, *L. polyphemus*, showed that 20% of horseshoe crabs harvested for LAL production die, even though the Food and Drug Administration requires that they be returned after bleeding process to the water alive. In the summer of 2001, ten bled and ten healthy horseshoe crabs were observed for 26 days in a small estuary on Cape Cod, Massachusetts. The purpose of this study was to determine if the bleeding of *L. polyphemus* had an effect on them. After bleeding, both groups were dispersed around the area of the estuary in a similar way, but the crabs that were bled had a random direction of movement compared to the directional movement pattern of the control (healthy) group. Therefore, the bled crabs experienced more disorientation.^[10] Notwithstanding the aforementioned, most of these studies only examined males which did not reflect the mortality rates of bled females after the spawning season when much of the actual biomedical harvest occurs. Mortality in female horseshoe crabs is of particular concern because they are more important than males in terms of the survival of the species. Females are preferentially harvested because they are bigger in size and contain more blood. They are more stressed than males from physiologically due to the energy they spend for egg production. The study shows that only 3% of female crabs from the control group (healthy) died as opposed to the 29.8% mortality rate in the experimental (bled) group. Mortality rates in the bled treatment group were twice as much than those used in the current management of the biomedical fishery field.^[11]

Conservation

In 1998 the Atlantic States Marine Fisheries Commission (ASMFC) adopted an Interstate Fisheries Management Plan (FMP). The plan's goal is to "conserve and protect the horseshoe crab resource to maintain sustainable levels of spawning stock biomass to ensure its continued role in the ecology of coastal ecosystems, while providing for continued use over time."^[15]

Several other organizations had been created in order to protect these remarkable creatures. One of these organizations is "The Horseshoe Crab Conservation Fund" whose goal is to seek solutions to prevent or mitigate the damage to horseshoe crabs' populations and habitats due to human activities. In 1998, The Ecological Research & Development Group (ERDG) launched a very successful program known as "Just Flip 'Em" in Delaware Bay. This program was established to encourage beachgoers to flip "stuck"

horseshoe crabs stranded on the beach during mating season. ^[22] These measures have led to more sustainable living conditions for the horseshoe crabs. Other conservation measures are gaining traction due to funding support and general public awareness.

To enhance the conservation measures of horseshoe crabs' population and habitats in Delaware Bay, it was very important to let the public know about their migratory and spawning patterns. To study the migration patterns and spawning behavior of *L. polyphemus*, David Smith et al. performed a study over a large-spatial area (>100 km) in the Delaware Bay. In 2004, 160 females and 60 males were tagged and let go, and in 2005, 215 females were tagged and let go. Horseshoe crabs were grouped according to their ages, which were determined by carapace wear. Older females were inclined to spawn earlier in the season and more often than young females, but these observations became more evident in 2004, when spawning ensued earlier than in 2005. One of the possible explanations for a delay in the spawning season in 2005 was the decrease in water temperatures. After adjusting for the day of the first spring tide, the day of first spawning was four days earlier for every one degree (°C) rise in the mean daily water temperature in May. Most of the spawning occurred during nighttime high tides (79%). Majority of spawning took place during three days of the spring tide. In the same spawning season, males and females were supervised while they were spawning or resting. Data was gathered from more than one beach with each beach greater than five kilometers distance from each other. Between 2004 and 2005, most crabs (77%) did not come back to spawn at the same beach. The reason for not returning could be correlated with their ages. The older the crabs were, the more likely that they would get stranded. Horseshoe crabs that inhabited the shallow waters on the east of the channel spawned only along the eastern (NJ) shoreline; however, those that inhabited the west of the channel spawned throughout the bay. This study shed light on some aspects of horseshoe crabs ecology and biology. This knowledge will be useful in conserving the Delaware Bay horseshoe crab population and habitats. ^[19]

Susanne Schaller et al. were focused on the annual movement patterns of *L. polyphemus* in the Great Bay Estuary, New Hampshire. Thirty-seven adult crabs were traced during a timeframe ranging from two to thirty-one months. In the winter, horseshoe crabs almost did not move. Conversely, the moving patterns of *L. polyphemus* changed significantly in the spring. About one month before the spawning season, when water temperature rose above 11°C, horseshoe crabs moved at least 1 km further up into the estuary to less deep subtidal areas. The average distance traveled during spring migration was 2.6 ± 0.5 ($n=20$) km up the estuary. The peak of mating activity was observed in May and June. During these months animals expressed less movement and spent most of their time in shallow subtidal areas next to mating beaches. During the summer (July-August), animals moved 1.5 ± 0.5 ($n=26$) km down the estuary, in the direction of the ocean. In the fall (September-November) movement was narrower (0.5 ± 0.5 km; $n = 24$), while animals lodged in locations where they spent the winter and stayed there until next spring. The annual average of distance traveled for all crabs was 4.5 ± 0.3 km ($n = 35$) and the maximum distance traveled by a single horseshoe crab within one year was 9.2 km. During this study it was observed that none of the horseshoe crabs abandoned the estuary. ^[18]

The decline in populations of horseshoe crabs on shores in Hong Kong is more drastic compared to the population of *L. polyphemus* along the Atlantic Coast of the United States. Three Asia-Pacific horseshoe crabs once thrived on many beaches in Hong Kong have largely disappeared since the late 1950s. Though there were nursery beaches and breeding grounds, the effect from humans on these creatures has been dramatic. Due to the environmental pollution and overfishing only about three mudflats could be found that contained juvenile *Tachypleus tridentatus* and *Carcinoscorpius rotundicauda* nowadays. ^[24] The latest studies on 17 shores in Hong Kong showed that juvenile horseshoe crabs (*T. tridentatus* and *C. rotundicauda*) were significantly curtailed by over 90% in density since 2002 and Adult *Tachypleus* could no longer be found. The receding of the coastline is another reason attributed to the decline in the population. The decrease in horseshoe crab populations is not limited to Hong Kong. It has been observed in Japan, Taiwan, and Thailand as well. Apparently, if this dramatic decline continues and effective

conservation measures to protect horseshoe crabs are not executed, it will lead to their possible extinction. [20] (347-348)

Apart from fishing, pollution, and medical uses, two of the Asian species of horseshoe crabs, *C. rotundicauda* and *T. tridentatus*, are considered a delicacy in China, Hong Kong, and Vietnam. Harvested by local fishermen or imported from China and Malaysia, female horseshoe crabs are sold for their eggs and large quantities of meat. The sale of females can result in reduction of reproductive pairs in the wild. As a result it will affect the juvenile populations on the shores. [20] (p.359)

While it is well documented that factors such as overharvesting for fishing bait and for the pharmaceutical industry have contributed to a decrease in the population of horseshoe crabs, recent research has revealed that climate change has also been a contributor to the shrinking population by affecting the quantity of successfully reproducing horseshoe crabs. Prospectively, climate forecast models present a potential scenario that may exacerbate the situation by limiting horseshoe crab distribution and interbreeding. Consequently, continued careful harvesting practices with attention to be paid especially to the female population should help mitigate these aforementioned negative factors. [4]

Juveniles' Diet and Crawl Rates

In order to better understand local needs to preserve and protect horseshoe crabs such as *T. tridentatus* and *C. rotundicauda* (Xiphosura) scientists conducted studies on their diets. One of those studies on their diets was proposed for conservation of these two species in Hong Kong. H. Zhou and Brian Morton conducted a study in order to provide basic information on this most elementary aspect of their biology. They compared the inside of stomachs of nine *T. tridentatus* (8.5–67mm prosoma width) and two *C. rotundicauda* (50 and 52mm prosoma width) with the composition of the ambient assemblage of meiobenthos on a nursery beach at Pak Nai, Hong Kong. The results showed that the diet of juvenile *T. Tridentatus* and *C. rotundicauda* was consisted mainly of insect larvae, polychaetes, oligochaetes, small crabs, and thin-shelled bivalves. They strongly preferred to eat insect larvae. [24]

Another study performed by Helen Chiu and Brian Morton observed the behavior of juvenile horseshoe crabs, *T. tridentatus* on a nursery beach in Shui Hau Wan, Hong Kong. This study aimed to understand common aspects of feeding in *T. tridentatus* juveniles and to determine whether they used various forms of adaptability to survive on sand flats in distinct environmental conditions. Different levels of temperature, water salinity, and degree of tidal presence were monitored. Chiu and Morton collected data on the juvenile's patterns of feeding trails and their crawl rates. On each visit between September 1997 and June 1998 the animals were observed while exposed on the sand during low tides at Shui Hau, Lantau Island in Hong Kong. The results showed that after the sand was exposed for one hour the juveniles began to crawl. The number of animals increased and peaked after another hour. Generally the juveniles crawled out in pool areas that were formed in the sand. When the tide came back, the juveniles re-burrowed themselves and their activity decreased. The observations also showed that the juveniles were out most during the summer, and least during the winter. [3]

Conclusion

The horseshoe crab is one of our oldest neighbors and hopefully it will continue to survive. There are some aspects of their biology and ecology that are still unknown and should be researched. For instance, horseshoe crabs use chemical cues to locate mates and part of their anatomy that produces those cues has yet to be identified. Little is known about movement patterns of juveniles as well as diseases that affect their health and how crabs' primitive immune systems protect them. Previous studies coupled with the ones in the future will hopefully help this species to be protected. Moreover, the regular citizens as well as conservation managers would make better decisions about protecting horseshoe crabs and other species with similar evolutionary histories.

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NICOLE BLAINE

The Space Age Collection¹

The Space Race of the 1960s was major competition between the United States and Soviet Union, involving the exploration of space and the race to be first to land on the moon. This competition had a huge impact on the way people dressed. The world began to look into the future, predicting the way we would live, the technology that would be used, and the clothes we would wear. Thus, the “Mod” style began.

Epitomizing the modern look, English designer Mary Quant raised hemlines by creating the mini skirt. Yves Saint Laurent presented a futuristic, simple, box look with the shift-style dress and massive geometric patterns.

With these futuristic mod concepts in mind and my own vision of fashion in the future, I began by illustrating 60 thumbnail sketches to develop my thinking process. After I decided the best looks, I drew my final full illustrations in prisma color markers and gouache paint. For fabrics, I decided on a sleek palette of eggshells, gold, beige, and crisp black satins. I chose heavier satins to maintain my crisp, space-age aesthetic.

¹ Completed under the mentorship of Professor Kate Nareski for FD 11: Fashion Illustration.







EDWARD RIVERA

Irony in the Works of Edna St. Vincent Millay¹

The works of Edna St. Vincent Millay reflect a character that is as anachronistic as it is worldly; her anthologies and her life stand as a foreshadowing of events to come in both literature and American life at large. Born in 1892, her career spanning both world wars, she predated by decades the sexual revolution of the 60's and by half a century the tremendous shift in literary tone that has brought us to the modern day, but her bohemian lifestyle and her tongue-in-cheek style seem more appropriate for our age than her own. Her use of a sardonic tone to cast barbs at a male-dominated society is evident in such indicatively named sonnets as "Oh, Oh, you will be sorry for that word" and "Being Born a Woman and Distressed," and even in the title of "The Penitent." Her irony is paired with a more directed, dismissive voice is seen in "Thursday," "Second Fig," and "The Unexplorer." Throughout, her poems are peppered with references to her philosophy: better to burn twice as bright and half as long, as can be seen in "Midnight Oil," "First Fig," and "What lips my lips have kissed, and where, and why." On closer reading, her poems portray a woman who was not afraid to eschew social convention on any axis, and one who flung daggers at her detractors through fanged irony, a concept which is now prevalent in colloquial discourse, if not often as expertly executed as Millay's. Her voice is a character on its own, a woman's spirit both intelligent and strong-willed, much like its owner. As we will see, this voice, heavily laden with sarcasm, is what makes her work accessible to modern audiences, but was a source of misunderstanding and criticism from her contemporaries.

One of Millay's signature stylistic tendencies is the use of pointed irony to sharply rebuke someone that is condescending or scornful. Nowhere is this more fully displayed than in "Being Born a Woman and Distressed," which is fourteen lines of biting sarcasm in the form of a Petrarchan sonnet. This classical form, the use of which Millay was well-versed and practiced in, has a fairly rigid structure and rhyme scheme. It is divided into an octave of eight lines, which introduces a problem, and a sestet of six, which offers a resolution. Here, we see Millay make good use of the form to set up an expectation, and then to unravel it. What at first in the octave seems to be a flattering, if prompt rejection, is in itself a layered rebuke made clear by the sestet, where the speaker succinctly states that she has no love or even pity for the one to whom she is speaking, and that she seems to loathe him. In the line "find this frenzy insufficient reason / For conversation when we meet again," the word "frenzy" would, in a more modern setting, be enclosed in scare quotes to highlight its irony. Millay, writing in strict poetic form and with a greater respect for her audience, allows the scare quotes to materialize through the overall tone of the piece. Rereading the poem, one notes several examples of such words that are used as ironic hyperbole, such as when the speaker says she will be "undone, possessed," and refers to her body's animal attraction to the man as a "poor treason" against her mind. Nearly the entire poem, then, is spoken ironically, even the final lines wherein she spells out her rejection.

¹ Completed under the mentorship of Professor Leslie Fintz for ENG 67: Women's Literature.

A less ferocious, but still sharp use of irony, there is “Oh, Oh, you will be sorry for that word,” a Shakespearean sonnet devoted to dispelling chauvinistic ideas about young women. The poem is a response to what is assumed to be a misguided courting attempt or conversational prompt, “What a big book for such a little head!” It is likely that the form was chosen, rather than her usual Petrarchan sonnets, because Shakespearean sonnets are associated with love poems. They are divided into three quatrains, of four lines, and end with a rhyming couplet that usually serves as either a final poetic image or a strong concluding sentiment. Again, here, we see Millay using the form to divide the poem into conceptual parts. In the second quatrain, she affects a bubbly persona in mocking derision, going so far as to state with tongue-in-cheek “Oh, I shall love you still, and all of that,” a false reassurance that initially appears innocuous but, in the final couplet, is revealed to be a lie. Another subtle bit of word-play reveals that even her intention to pretend to be vacuous is, itself, a sham, as she describes herself as “sweet and crafty, soft and sly,” the former term in each pair referring to her fake persona, and the latter to her genuine self. Furthermore, she then goes on to say “you will not catch me reading any more,” the misdirected implication being that she will still, indeed, find time to read, so long as her husband isn’t around to witness it. In the couplet, we see her trademark irony delivering the coup-de-grace. The imagery of her baffled husband standing in the doorway and whistling for her to return is potent, as it exposes him as the simple, ignorant one, unaware that his calling for her in such a way is, contrary to his intentions, the reason she isn’t coming home.

When speaking of hearing recordings of Millay read her works, modern critics have noted a sense of ironic performance not felt by her contemporaries. In response to Millay’s reading of Sonnet 11, “Not in a silver casket cool with pearls,” from *Fatal Interview*, Derek Furr notes “I am inclined to hear irony in Millay’s reading of the sestet. . . . Millay’s affectations in this sonnet reading are perhaps Wildean, a mask of earnestness that should cause us to question the poem’s propositions and Millay’s sincerity” (95). However, he also states that her contemporaries took at face value Millay’s presentation of the poem. Furr supports his modern findings of irony by stating “. . . among contemporary critics, I am not alone in detecting irony in Millay’s theatrics. In her essay ‘Uncanny Millay,’ Suzanne Clark argues that ‘Masquerade functions as critique’ in Millay’s poetry--critique, that is, of the very gendered subject positions that Millay’s lyric speakers take” (95). In this way, Millay criticized the role she was expected to fill, by, in performance, overacting the part.

It may also be that prevailing views in the earlier twentieth century created an unbridgeable gap between Millay’s intent and what the audience would expect or accept from a female poet.

Even blatant examples of irony in her works were often missed by her critics for seemingly sexist reasons. Her later, more political, works were often lambasted by contemporary reviews. Where her earlier works focused on issues of love, freedom of lifestyle and gender, her later pieces often held a political message. John T. Newcomb, American literary theorist, argues that the turning point in Millay’s career occurred when she found herself impotent to stop the death sentence of Sacco and Vanzetti (261). The poem “Justice denied in Massachusetts” was seen as a weak effort by Millay’s contemporary critics. “Those commentators unsympathetic to Millay’s efforts to write poetry of explicit political critique have treated ‘Justice Denied in Massachusetts’ as somewhat of a notorious fall from grace, the poet’s first betrayal of her ‘natural lyric gift.’ In 1935, for example, Cleanth Brooks used the poem as a lynchpin of his argument that Millay’s ‘preoccupation with social and economic justice’ had yielded ‘disappointing’ results” (Newcomb 263).

Newcomb notes that “in order to do so, however, Brooks had to contort the poem into offering the ‘advice’ that ‘those who loved justice’ should ‘sit in the sitting room,’ convinced that justice was truly dead and that no other effort in behalf of justice was worth making, ‘exhibiting a lack of sensitivity to the poet’s irony which was downright astonishing in a critic who would later make irony a constitutive element of his theory of literature’” (263). Thus, her critic misread her work, either out of deliberate or unconscious bias. Newcomb continues, “recognizing no difference between the poem’s speaker and the poet, Brooks went on to patronize Millay as having the ‘attitude . . . of a child whose latest and favorite project has been smashed;’ evoking the stereotypical equation of woman - even woman writer - with

child” (263). Although obvious satire is often misunderstood, even today, this convenient misreading epitomizes the condescending attitude held towards women poets and political advocates of the day. Millay’s strong political leanings would have seemed unbecoming, but she made her voice heard.

And while she may be remembered for her views in the political realm, her impact on literature is unmistakable. Millay’s legacy as one of the most important poets of the twentieth century, woman or otherwise, is not without reason. Modern writers could benefit from studying her mastery of a sardonic, daring tone, her misdirection and her wit. Her outspoken character in both pen and deed is both brilliant and inspiring, and the strange way in which she lived her life, which at the time would be considered shameful, is becoming more and more common in American society and abroad. Were it not for women writers like her, the modern landscape of American literature would be unrecognizable, and all the worse for being so.

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UMUT M. SICA

Münter and Kandinsky: A Love of Art¹

Tennessee Williams is quoted as saying, “The strongest influences in my life and my work are always whomever I love.” While we cannot ever know to what extent long-term relationships affect us, it is safe to say that they steer our growth as human beings. Whether we allow such changes, or even recognize them when they happen, they are inevitably etched in our minds. Such influences can take a physical form when they are present in the lives of artists.

Since it is the nature of artists to express themselves through their art, we are given visual clues to the inner working of their minds, and more importantly, to what influences them. Gabriele Münter is perhaps one of the most influential female artists of the last century, but her work has only recently been showcased at the level of other great artists of her time. While some people attribute this to the fact that the art world has a long history of suppressing creative women, there are those who believe that her common-law husband, Wassily Kandinsky, father of the Blue Rider Group, who trapped her in his shadow. Münter’s place in history was long defined solely by this relationship. While she dedicated her life to her art as much as Kandinsky did, Münter never achieved Kandinsky’s level of success. This is a shame. During the early 1900s, when new painting styles regularly emerged, Münter improved and personalized her technique with every passing year. Her experiments with Impressionism, Fauvism, and Expressionism took the forms of both landscapes and portraits.

To truly appreciate the evolution of Münter’s professional work, it is important to examine her personal life, and how her love affair with Kandinsky waxed and waned, pulling her art with it – as if a great timeline had been drawn, but with turning points not decided by dates, but by changes in her and Kandinsky’s relationship. Actually, the same can be said of Kandinsky; observing the time he spent with Münter, we find a peephole into the heart and soul of a great couple in the history of art.

At the start of her formal education, Münter left behind her upper-middle class family, and joined the women’s academy at the Schule des Kunstlerinnen Vereins in Munich. The faculty there regarded women as amateurs, so in 1901 she joined the Phalanx Academy, where she met Kandinsky, who was one of its founding members. They began a love affair that spanned 15

¹ Completed under the mentorship of Professor Linida Butti for ART 39: History of Women in Art.

years. Their real journey together began in 1904, when they left the academy behind, no longer teacher and student, and traveled across Europe as bohemians.

It was during this time that Münter influenced the first change on Kandinsky's portfolio. In 1905, Kandinsky painted his first and only portrait, of Münter (*Gabriele Münter*, 1905). Such a divergence is surprising in a man who was one of the founders of abstract art. Some art historians argue that Kandinsky's portrait was an expression of love and devotion to a woman who inspired him. But when looking at it, I cannot help but notice the lack of bright tones – this from a man who would become synonymous with brightness and contrast. Perhaps his style had not developed; but then I must ask, what of her dull eyes and emotionless mouth? Surely a man inspired by the Impressionists would have thought to add his emotion to his painting of her. Perhaps Kandinsky chose to paint this portrait to mirror the work of one of his great influences, Edouard Manet, who frequently painted another artist, Berthe Morissot, for whom he harbored a secret love.

In the following year, Münter created a portrait (*Portrait of Wassily Kandinsky* 1906) of her own, representing Kandinsky with a colored woodcut. Her work combined a clear [ed: realist?] image of her subject with an impressionist background. Kandinsky is distinguished with his beard, pipe, and glasses, dressed in a suit and cravat. The colorful sky and sun behind him serve to draw out the image of Kandinsky.

It is clear that Münter took extra care in creating this piece. Other portraits she made are much more traditional. I see this one as a testament of her love of Kandinsky, who inspired her to explore a new path.

Five years after the couple first made portraits of one another, Münter painted them together in *Boating* (1910). At this point, Münter was struggling with her place in their new life. The painting techniques she utilized here show that she saw her honored Kandinsky as the center of her life and commander of the artists that would form the Blue Riders. Kandinsky holds the vertical center of the painting and is the only subject to pass the horizontal divide. As he leads the group into new artistic endeavors, Münter remains quietly as the anchor on the other end of the boat. Without her there to balance Kandinsky's command, the boat would simply capsize under him.

Münter depicts herself with her back to the viewer. This is telling of her personal feelings of subjugation. While she follows the same vertical line (the direction the boat is heading), she follows Kandinsky. She also paints herself in the same color scheme with which she paints Kandinsky, revealing that they are the same at their core. This technique also foreshadows Kandinsky's future love of abstract art. While the couple also shares the same shapes. Every brushstroke Münter uses to paint Kandinsky's form she uses a second time, in her own body. She even goes so far as to emulate the color and curve of Kandinsky's beard in her bonnet; her white blouse is flanked on both sides by the blue of her bonnet and skirt, which mirrors Kandinsky's blue blazer over his white shirt.

While the image of Kandinsky looms over her, Münter can be seen rowing the boat. The direct implication of this is that she is his subordinate, existing to serve the will of her commander,

and so forgotten in his mighty shadow that her face is not pictured. This painting represented a difficult time in their relationship, but even so, with it, Münter represented the artistic emergence of the man she loved.

Kandinsky was not as concerned with showcasing the people around him, but did produce his own painting of a boat (*Boat Trip*, 1910) the same year. While Kandinsky used a darker palette, his focal elements were colored the same as Münter's (blue, black, and white). As the rowers and the sea are depicted with some line and form, the skyline behind them is more abstract. The slew of colors and lines would be indiscernible if not for the sun standing clearly over it all; this is a glimpse into the future of his art. In fact, one could argue that the only hint that Münter was on his mind at all when he made this painting was the fact that he depicted a boat in the same year she did. Perhaps this was just an attempt by him to direct her work. Indeed she would have adored his new work, even if it were made just to show her what she had done wrong.

The great change in painting styles that happened during their stay in Murnau would not be the last change that Münter would take on. In Münter's own words –“took a great leap forward – from copying nature – in a more or less Impressionist style to feeling the content of things, abstracting and conveying an extract” (A. Hoberg 14). While this concentration of artistic thinking did lead her to a style that was all her own, Münter was undoubtedly adapting Kandinsky's principles. As she pulled more and more at what she deemed to be the most essential attributes of any art piece, Münter was able to find a balance that suited her. She began to use the curved shapes and bold colors of the landscape around her to make that vision a reality. She began to see life as a bright, contrasting, ever-flowing source of inspiration.

Kandinsky was quite a bit more determined in his vision of what art should be, but was also affected by his love affair with Münter. The distinguished Russian gentleman may not have even noticed the effect that Münter had. While other artists developed and experimented with their personal style, Kandinsky did not –leap,” at least not in his own eyes. Kandinsky would not be happy until he reached total abstraction. To do that he had to leave the –form-filled” work of Münter behind.

I believe that Kandinsky did truly love Münter, but loved his art even more. While some might argue that he simply was a womanizer or that he was only in love with the idea of loving another artist, I must disagree. From the works I have read on Kandinsky it seems clear that he was a man who enjoyed holding the reins of his life. After choosing to abandon the path of a lawyer, a profession that his father chose for him, he had a clear vision of who he wanted to be. His love affair with Münter, and even his fellowship with the Blue Rider group, was a great learning experience for Kandinsky, and that is exactly how he saw it.

Kandinsky would not allow his love of Münter to stop his artistic process. After moving together to Switzerland to avoid the effects of World War I, the couple grew closer together for a time. But their [ed: how long?] sojourn in Switzerland would turn out to be the last time they were together. In 1914, Kandinsky left Münter for Russia. There, he started a relationship with Nina Andreevskaya, the daughter of a Russian General. Just six months after meeting Andreevskaya, he married her.

During his time in Russia, Kandinsky's art colleagues started to view his work as too abstract, and he was soon under attack in his homeland. Kandinsky had fallen, and his Constructivist opponents descended upon him. Kandinsky would publish a series of articles at the time and wrote in his defense, "One can just as easily be a realist academic as an abstract academic." "A form without content is not a hand, just an empty glove full of air". But the constant onslaught became too much for him and in 1922, he returned to Germany.

Whether you believe his love for Münter sculpted his craft or not is debatable, but his leaving of Russia tells us something very clearly; Wassily Kandinsky felt safer expressing himself in the German culture than he did in his own. He returned to Germany to find the welcoming atmosphere that once allowed him to transcend the imagery that he felt clouded people's perception of art. Soon after, he applied for German citizenship. Of all of the artistically expressive countries in Europe he chose to make a permanent home of Gabriele Münter's homeland.

Life after love was a very different experience for Münter than it was for Kandinsky, firstly because she did not know it was over. Münter only that Kandinsky had married months after it occurred. From this point on, she stopped all communication with the man who fueled her expressive outlet. Münter almost ended her painting career as well, producing only a few pieces in the coming years.

Münter would not leave behind her former love. Indeed, she is the very reason why we know so much about their relationship and his work. During World War II Münter hid the Kandinsky's work, keeping safe paintings that could have easily been lost to pillagers and Swiss bank accounts. In addition, she chronicled their love affair and correspondences in her journal, shedding light on a love that still inspires us. While the inspiration fostered between these two people – one a rigid Russian lawyer, the other a young expressive German painter – was not perfect, it was an artistic wonder. Art brought out a looser and more instinctive side in this once-stiff man, and it was with Münter that it grew, quietly, and safely into an entire art form. The young woman experimenting with expressing herself at a time when women were only beginning to emerge as artists, found tutelage, love, and a cause in Kandinsky.

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GARVIN MING

Aluminum 26 and the Early Solar System¹

Abstract

Aluminum-26 is an isotope of aluminum that is of particular interest to planetary scientist and meteoriticists. This isotope is the subject of much controversy, both for its potential role in early solar system development, as well as its current role as a chronological dating tool used by scientists hoping to time stamp specific events at the birth of our solar system. The purpose of this paper is to give a general synopsis of the formation of the solar system, the examination of its history via the techniques used by scientists, and the controversy surrounding the Aluminum-26 isotope in both of these areas.

Introduction

Aluminum 26 is a radioactive isotope of the element aluminum, and its significance to planetary science has been the subject of some debate. Due to the nature of its half-life, some scientists believe that Al-26 is an excellent choice of isotope to arrive at accurate dates for events that took place during the early part of the history of the solar system. In addition, Al-26 might have had a vital role in planetary melting, as its decay would have been a source of thermal energy for newly formed terrestrial bodies. However, there are multiple problems that limit the use of Al-26 as a chronological tool, and the distribution of Al-26 throughout the early solar system would affect its importance as a source for thermal energy for planetary bodies.

The Early Solar System

In order to understand the implications of Al-26 and the ways in which it may be used, a basic comprehension of the planetary bodies and their structure and composition as well as the theories derived from such research is paramount. Meteoritics, the study of meteorites, is an essential component to our understanding of the formation of planets and planetary bodies. An understanding of radiometric dating is also required for the role of Al-26 to be made clear.

Scientists use radiometric dating (also known as radioactive dating) to determine the age of an object. Radiometric dating utilizes the known half-life of an isotope residing in the object. Half-life is the span of time it takes for half the available mass of a specific radioactive isotope to decay. The half-life changes from isotope to isotope, meaning the half-life of each radioactive isotope is different. This can allow us to refine data on the age of planetary bodies such as asteroids.

¹ Completed under the mentorship of Professor Michael Weisberg for EPS 36: Introduction to Earth Science.

The oldest and unchanged objects in the solar system are asteroids that never underwent planetary differentiation. Meteors from these asteroids are known as *chondrites*, which are composed primarily of small spherical bodies called *chondrules*. *Chondrites* themselves are made up of these *chondrules*, calcium-aluminum-rich inclusions (CAI) and a matrix of fine-grained material. *Chondrules* were some of the first solid materials to be formed in the solar system. After the surrounding gases had been pulled together by gravity and cooled down they condensed and formed tiny spherules, the composition of which is mainly iron, magnesium and silicate solids.

Chondrites have undergone remarkably little change since their original formation. Therefore they offer planetary scientists a window into the early period of the solar system formation. The CAIs are believed to be among the first refractory (materials that are able to resist high temperatures) that condensed out of the solar nebula. A small amount of this material has been found to be Magnesium-26, an isotope that may form from the decay of Al-26. The half-life of Aluminum-26 is approximately 730,000 years, making it ideal for more precise dating of events that took place at the solar system's genesis.

Alexander Krot, a researcher at the Hawai'i Institute of Geophysics, has investigated the Magnesium-26 ratios of both CAI's, as well as that of *chondrules* found in *chondrites*. His findings (in collaboration with other researchers at the institute) have shown that there is a difference in the ratio of excess Magnesium-26 between CAI's and *chondrules*. Initial ratios of Al-26/Al-27 in CAI's are estimated at $4 - 5 \times 10^{-5}$, whereas the initial ratio for *chondrules* approaches to 1.5×10^{-5} . According to Krot, Glenn MacPherson of the Smithsonian Institution believes this to be a result of the formation of CAI's being approximately one to two million years before that of the *chondrules* (Krot "Earliest Solids"). However, the origin of this Al-26 is still under debate. If, as MacPherson and his colleagues believe, the Al-26 is of extra-solar origin, it would have been evenly distributed throughout the solar system at this time. It has been suggested by Centre de Spectrométrie Nucléaire et de Spectrométrie de Masse that this Al-26 originated from within the solar system. Therefore it would not be evenly distributed. Should the latter be the case, Al-26 would have extremely limited use as a chronometer (Krot "Earliest Solids"). The solar system is hypothesized to have formed from the gaseous and nebulous remains of a star. This mass, known as the solar nebula, was first hypothesized by Pierre-Simon de Laplace. Gravity pulled the mass together, and to conserve angular momentum, it spun more and more rapidly as it contracted. After the majority of gas collapsed to form the young Sun, the rest was swept away from the star by the early solar winds. This remnant coalesced to form the planets and the asteroid belt (Seeds, Backman, 115).

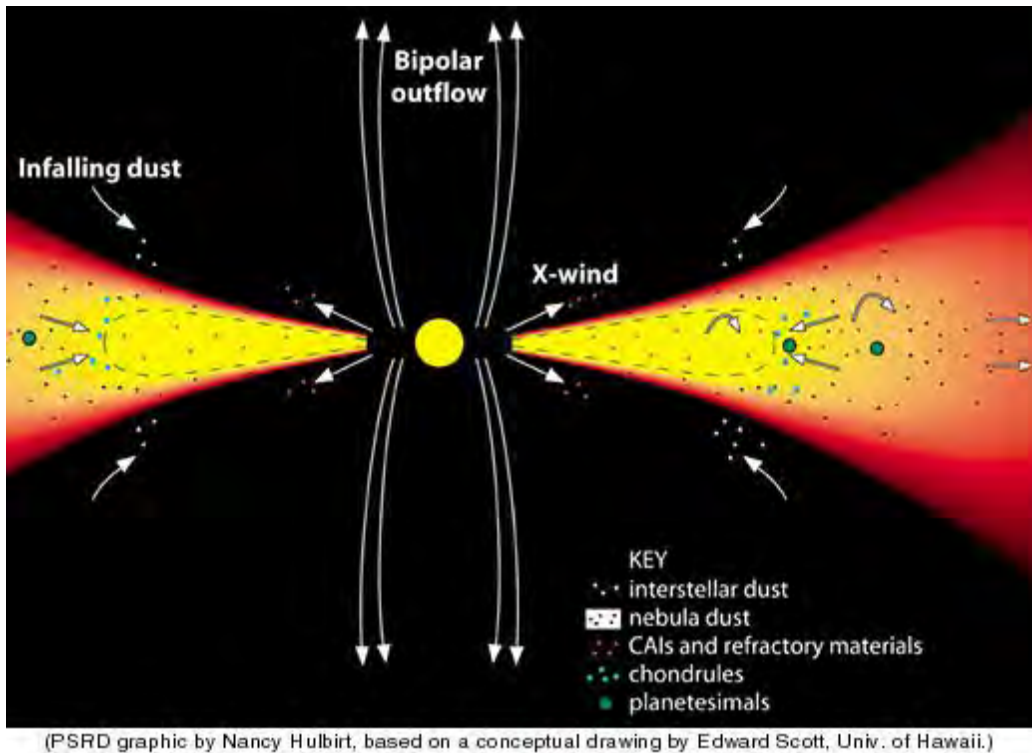


Figure 1 Nebular disk surrounding the early sun, PSRD

Refractory materials, such as calcium, aluminum, magnesium, iron and the silicates would have been some of the first materials to form solids, as their high-melting points meant they would have condensed at higher temperatures than more volatile components. Though the relative age of the terrestrial materials can be deduced through various methods of observation, absolute dates can only be acquired with the use of a radioactive isotope as a chronometer. For this reason, it's important to use radioactive isotope materials with higher or similarly high melting points. As Al-26 is an isotope of aluminum, it would have condensed out of the solar nebula around the same time as the CAI's.

Other radioactive isotopes have been used in planetary science for absolute dating, such as Potassium-40, Uranium-238, and Rubidium-87. However, the scarcity of these isotopes and their daughter isotopes (the substances they decay into) in *chondrites* limits their use. For instance, Pb-Pb dating is also used for radioactive dating; however, it is available in only trace amounts. In addition, the half-life of Uranium-238 is 4.468 billion years and has less accuracy than that of Al-26. Similarly, the half-life for Potassium-40 is 1.3 billion years while the half-life for Rubidium-87 is 47 billion years.

These radioactive isotopes might have once played an important role in the creation of the planetary bodies we observe today. Scientists use them for dating of planetary material. The melting of these bodies due to the heat resulted from the process of accretion and the radioactive decay of isotopes allowed differentiation to occur in these bodies. This differentiation is responsible for the formation of the terrestrial inner planets, as well as that of several large asteroids.

As the initial refractory materials condensed out of the solar nebula, their gravity caused these small particles to collide and form larger objects. Over time, many numerous solid bodies would have formed at various intervals throughout the solar nebula, and these larger bodies would attract each other, resulting in further collisions. Frictional heat resulted from these collisions, and at certain periods of time there

would have been collisions between these proto-planetary bodies in a relatively short amount of time. These are also known as periods of bombardment. The process of larger bodies being formed from many smaller ones is known as accretion.

The heat from accretion caused many of these bodies to melt. Though their significance is subject to some debate, radioactive isotope decay would have contributed to this process. Once molten the different densities of various elements would cause some of them to sink towards the innards of the planet and others to rise to the surface. It is this process that we refer to as differentiation, and the crust-mantle-core structure of the planets is a consequence.

Techniques, Theory, Controversy

As has been stated, one of the primary concerns of planetary scientists is the viability of using Aluminum-26 as a chronometer with which to arrive at absolute dates for various samples and bodies in the solar system. The Pb-Pb dating system has been utilized in the past to arrive at absolute dates for meteor samples. As its half-life is too short to be used for such absolute dating methods (since any of the original Al-26 should have completely decayed long ago), it requires a careful examination of its daughter isotope Mg-26 and its relative ratios in the sample.

Professor Ernest Zimmer of the Washington University of St Louis Missouri compared the absolute dates determined by Pb-Pb dating to the relative ages obtained using Al-26 dating. The ages determined were for samples known as Ste Marguerite and Forest Vale and the dates appeared to be in agreement, based on the relative error and precision of each chronometer scale. For instance, in the case of the Ste Marguerite sample, the age determined by the Al-26 method is 5.4 ± 0.1 million years, while the age determined by Pb-Pb dating is 4.5 ± 0.9 million years.

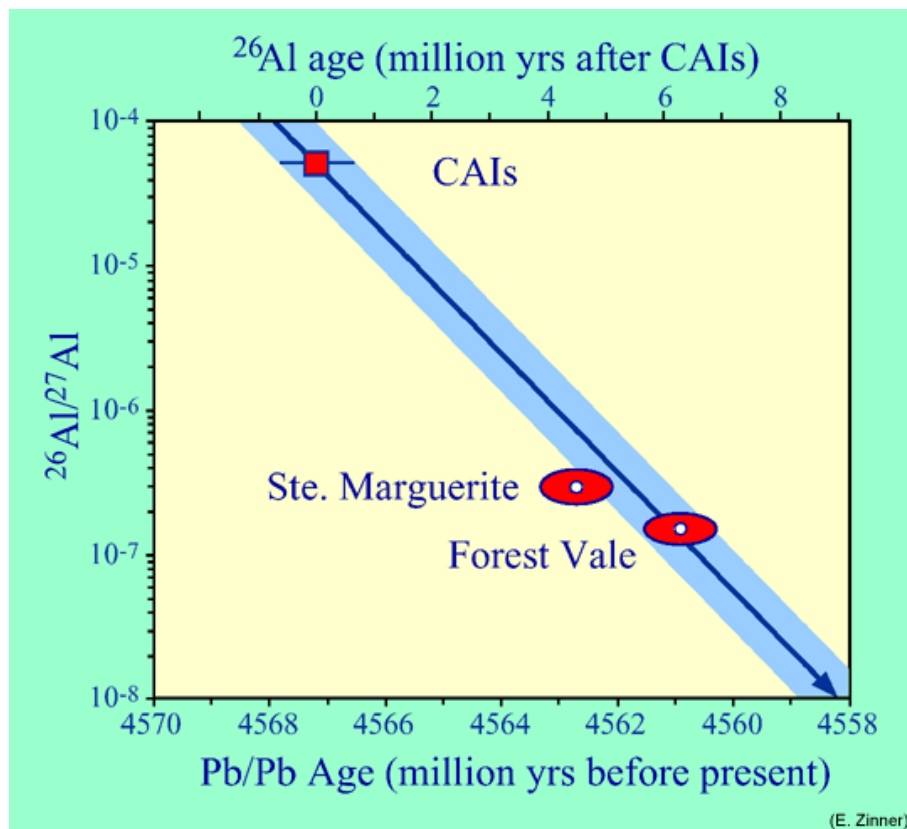
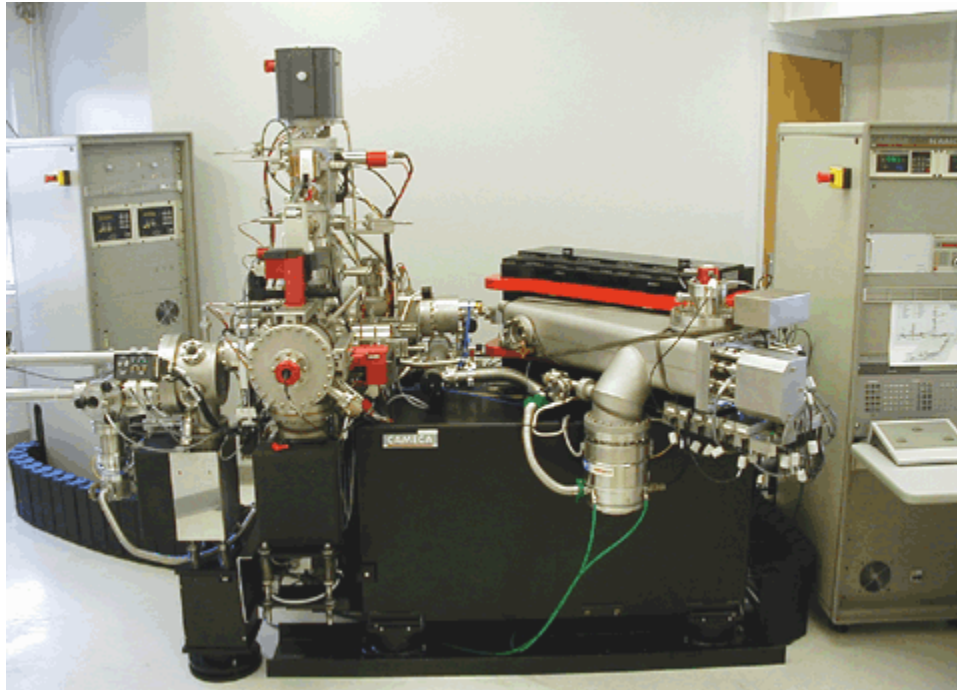


Figure 2 Comparison of ages determined by Al-26 and Pb-Pb dating, PSRD

Obtaining very small amounts of matter for the use of absolute and relative dating is done with the ion microprobe mass spectrometer instrument. The instrument uses a beam of ions and focuses it on the surface of the sample. This causes the emission of various ions from the samples, which then pass to a mass spectrometer after being accelerated. The mass spectrometer then analyzes these ions to determine their atomic weights. This technique of measuring atoms and isotopes is known as secondary ion mass spectrometry. The advantage of using this technique for measuring ions is that it focuses on a very small area of the sample and can work with even trace amounts of isotopes, making it especially useful for detecting Mg-26 excesses.



(Photo courtesy of Frank Stadermann.)

Figure 3 Ion Microprobe Instrument at Washington University, PSRD

Conclusion

Despite the ongoing debate about its ultimate origins, Aluminum-26 has been shown to be a credible method of aging a planetary body, such as a *chondrite*, that contains calcium-aluminum-rich inclusions. Much needs to be accounted for in its use, not withstanding changes in the ratios of its daughter isotopes due to later heating and cooling of a body via other means. Cosmic radiation can induce creation of new Al-26. Using it as a chronometer is dependent on the geological context of any particular body's history. However, due to the unknown nature of the isotopes origins, it is difficult to determine how much of a role it played in planetary melting and planetary differentiation. New ideas and innovations in the field of planetary science will have to come to the forefront before the controversies surrounding this isotope are put to rest. It is evident that with continued refinement in the field, Al-26 will serve in some capacity as a means to arrive at accurate ages of planetary bodies.

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JUNIE JOUTE

Is Daddy the Man of Your Dreams?¹

Abstract

When selecting a potential romantic partner, women look for certain characteristics. Different characteristics play a role, for example race, economic stability, and nationality. The question is where these ideas derive from. Who is responsible for placing these requirements in their head? I hypothesize that these ideas come from the first model a woman has for her ideal concept of masculinity, her father. A woman may unconsciously select a mate who closely resembles the traits that are present in her father, regardless of whether these are actually desirable traits. Whether her father is an alcoholic, a drug addict or healthy, whether he is irresponsible and abusive or reliable and loving, these traits may be present in the woman's partner(s). Positive or negative, a father's behavior can leave lasting impressions in the lives of his daughters. According to my research, a father's traits are a key component for the majority of women when making a selection of romantic partner. Women tend to choose men that please their fathers, as well as sharing their fathers' characteristics. As a result, these women feel confident in the selection that they make.

Introduction

Is it possible that women tend to get into relationships with men that resemble the women's fathers? Because the first important male figure in a woman's life is usually her father, she may unconsciously select a mate that shares the same traits as her father. Whether these traits are external or internal, and whether they are good or harmful, may vary. Some women may find themselves in an abusive relationship and continue to participate in the relationship because they witnessed their fathers abusing their mothers, and as a result think that it is normal. She may not realize that she thinks this. Women who tend to be in relationships with a particular type of partner may find that her "type" shares characteristics with her father. Depending on what those traits are, they may have some difficulty finding a proper mate for themselves.

Literature Review

Previous research has been conducted on father-daughter relationships, on the ways in which a daughter's selection of possible mates may be influenced by her father, and on how this may affect her in the future. In the traditional European and North American bourgeois nuclear family, the father was understood as the source of authority, rulemaking, financial security, and discipline, mostly because he tended to be the parent who worked, and had only limited responsibilities in caring for the children. Over the generations, however, fatherhood has become a more emotional, caring, and nurturing role.

¹ Completed under the mentorship of Professor Charles Swift for SOC 31: Introduction to Sociology.

While results have been mixed on the effects of father presence as compared with father absence, the bulk of the research indicates that the presence of a positive father figure can be significantly related to improved child outcomes. Dubowitz and colleagues (2001) found that children with a father figure had higher levels of cognitive performance and social acceptance than children without one. This finding contradicted earlier research, which Dubowitz et. al. suggested might be due to their sample of families drawing on a higher-risk population. Conversely, the presence of an abusive father can have negative effects on child outcomes (Downs & Miller, 1998a). One potential explanation for the ambiguity of the effects of father absence is that the harmful effects of an abusive father figure on the development of girls may be more negative than the effects of an absent father figure. These lines of research lead to the possibility that abusive fathers in particular can have long-term negative effects that last into adulthood for women. This possibility raises the question of whether absence of a father figure during childhood has better overall consequences for women than presence of an abusive father figure during childhood (Downs, W., & Rindels, B. (2004).

Research has verified the fact that women are likely to marry someone resembling her father. Mate choice is considerably more influenced by mothers than by fathers. However, although the father's influence is weaker overall, it is more likely to be reflected in a daughter's mate choices than it is in those of a son. One explanation for this might be that daughters shift the idealized love object from mother to father in a way that sons typically do not. This shift occurs during the resolution of the Electra complex, which is when the daughter at a young age starts to vie for the father's attention more than for the mother's. Symbols of sexuality associated with the parent are particularly important during this stage. In general the shifting of the ideal romantic figure from mother to father is plays an important role in women's development (Davor, 1984).

Existing literature has also suggested that women may be deeply affected by the father they knew as a child. Sophie Freud (1988), in a text that highlighted the identity struggles faced by postmodern women, dedicated an entire chapter to the pain experienced by a woman when she feels abandoned by her father because she is no longer **his** "little princess," **his** admiring disciple or **his** little angel. The literature suggests that most women will experience the loss of their fathers' love simply by growing up; for even in the best of circumstances, men find it difficult to relate to their adult **daughter** in the same manner that they related when she was a little girl (Freud, 1988; Secunda, 1992). In a comprehensive text that discussed various father-**daughter** relationships, Secunda (1992) described a woman's father as her "first love," regardless of her experience with her father.

If theorists are correct, it may be assumed that the father-**daughter relationship** has the potential to shape interaction patterns that surface as women enter into adult college relationships. Although there is an agreement in the literature that father-**daughter** relationships take many forms, most father-**daughter** research focuses on abusive or absent fathers (Downs & Miller, 1998; Hetherington, 1972; Oates, Forrest & Peacock, 1985), and on the impact, these relationships have on a woman's adult intimacies. The psychological premise most commonly cited in research is that women with abusive or absent fathers have difficulty with men and often choose husbands who abuse or abandon them (Secunda, 1992). Further research is needed that seeks to identify the varied interactions between a father and **his daughter**, and to understand the impact these interactions have on a woman's emotional, cognitive and behavioral life-style (Perkins2001). This research has shown that women are likely to choose mates based on their first role model, which is their father. Whether a father has positive or negative traits, sadly, the daughter in her adult career will mostly likely chose a mate with similar characteristics.

Hypothesis

I hypothesize that women may make decisions regarding choosing a mate based on the qualities present within their father. For example, research shows women who grew up in an abusive household tend not only to feel worthless, but also to find themselves in abusive adult relationship, and to choose husbands

who are likely to abuse and abandon them as well. These ideas of feeling abandoned come from the first male model a woman has when selecting a mate, her father. Different factors may contribute to a woman's mate selection, but one important factor is the woman's father. Women may unconsciously select a mate who shares many traits with her father. These traits could be internal or external, so whether he is an alcoholic, a drug addict, an abusive father, or a responsible father, these traits may be present in their partner(s); these decisions may affect her as she reaches her adulthood.

Sampling Design

A qualitative research design method was utilized for this study. 21 open-ended questions were constructed to investigate similarities or differences between the relationships that young Haitian American women between the ages of 18-23 have with their fathers, and the relationships these women have with their boyfriends.

The questions used in the study are listed in Appendix B.

Results

Young Haitian American women were asked to compare their relationships with their fathers and with their boyfriends. The results were interesting in the sense that nearly all of the participants said that their fathers had nothing to do with their selection of boyfriends. When the young ladies were asked, "What attracted you to your boyfriend?" most responded that there it was not a matter of physical attraction but rather the fact that their boyfriends were sweet and sincere. However, one subject reported that she was attracted to her boyfriend due to the fact that he was physically well built. She also reported that both her boyfriend and her father are both physically fit due to their occupations. Based on my research, I was able to draw the conclusion that since her father is a Security Guard and her boyfriend is a Fire Fighter, they share that domineering look.

The participants claimed that they chose their boyfriends solely on their own desire, and not of the expectations that their father would have in mind for them. For most of the ladies, their boyfriends did share some similar characteristics as their fathers. When asked to name some of their fathers' traits, most of them included "earing, (Downs, W., & Rindels, B. (2004). . I also found it interesting that some of the young ladies were in interracial relationships. Most Haitian women tend to stick with their own race, but in this study, one subject's boyfriend's ethnic background was Ukrainian, and another's was Irish and German. The fact that they stepped out of their boundaries of what is considered of them which is to date and/or marry a Haitian man proves that these young women were not looking for a partner who is exactly like their father in physical feature.

Discussion

Some of the problems that I came across while doing this study involved the fact that the existing research did not center on Haitian families (and those that do typically focus on father-son relationships or father-child relationships in general, rather than father-daughter relationships), making it difficult to connect my research to the existing material. Cultural barriers also played a role. Haitian families tend to stick closely together most Haitian families are very quiet and keep to themselves: they do not let out anything about their family life. Therefore, it was difficult to convince the subjects to answer the survey questions fully. In addition to this general reticence, I found that individual subjects were reluctant to answer specific questions, perhaps for personal reasons. One subject would often hesitate and think very carefully as she chose her words whenever I asked her questions about her father, as if she did not want to say anything that might make her father look bad. Another subject behaved this way when I asked her questions about her boyfriend: she did not want to say anything that might make him look bad. No matter how many times I told the subjects that the questionnaires would not reach the hands of their fathers and boyfriends, some were still skeptical. They may have been skeptical about the way the may seem to be based on how

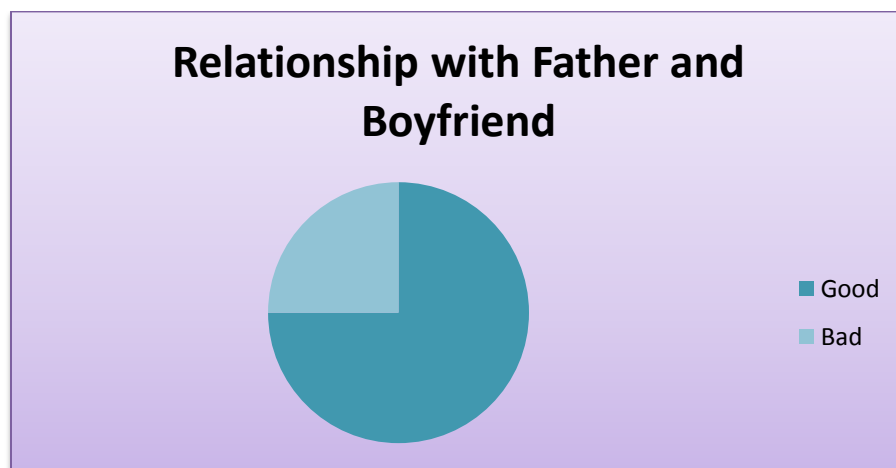
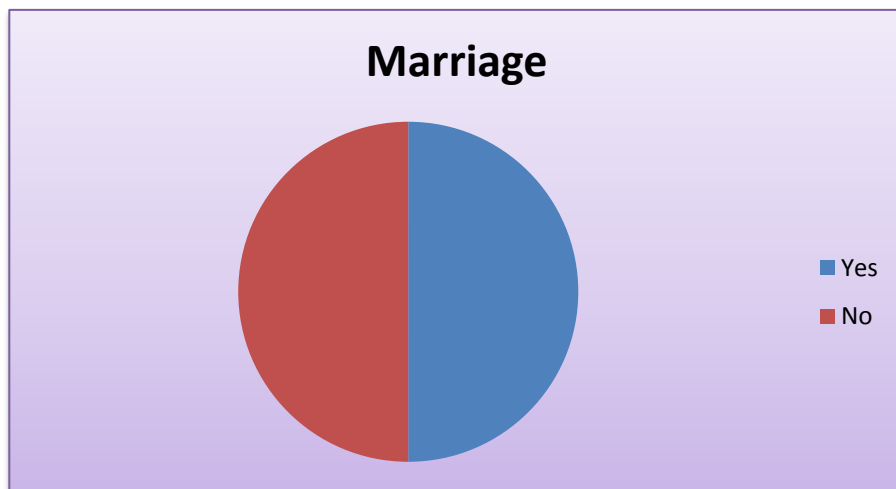
they answered the questionnaires. Some subjects gave such vague answers that they could not be included in the study.

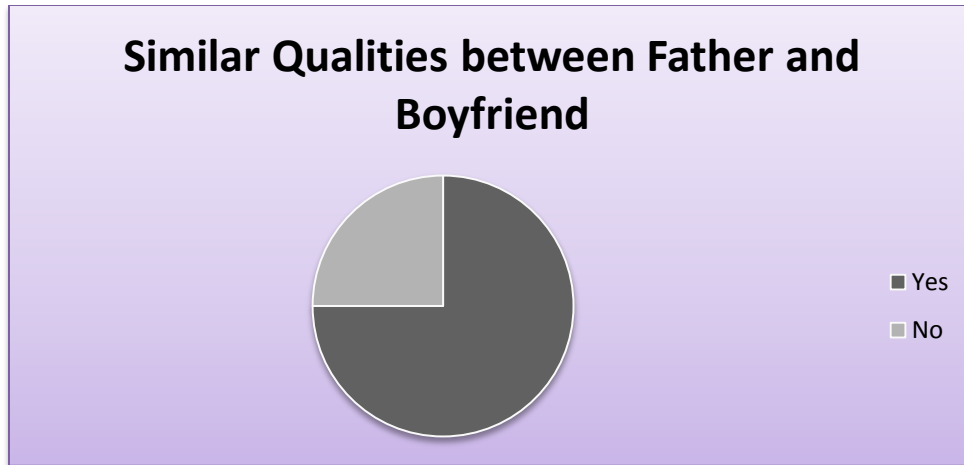
However, despite these methodological difficulties, my research confirms the evidence of previous studies, which have shown that a father's influence does count in a woman's decision of selecting a mate. What I would have done differently in this study is to analyze what set characteristics to women tend to look for within a mate and if those characteristics are set within her father. After that, I would have like to explore whether those set traits are present within most men and if they are present within the boyfriend(s) of the daughter. This study might be categorized as a longitudinal study because this study would require me to observe the daughter from maturity until on. Since this study has not been fully studied in depth, there is not a lot to go by and as a result, this topic is obscure.

Conclusion

The research focused on whether a father can influence his daughter pertaining to her mate selection. Based on the research there is a positive correlation between the two. If there are certain characteristics that are present within a father, it is very likely that the daughter will choose a mate with some similar characteristics in her adulthood.

Appendix A: Tables and Charts





Appendix B: Questionnaire

Hi, I would like to ask you a few questions pertaining to your father and boyfriend.

How did you and your boyfriend meet?

How long did you date

How would you describe the relationship between you and your boyfriend?

Is your boyfriend caring, what attracted you to him?

Is your boyfriend comfortable with you talking to other guys?

Does your boyfriend expect you to do EVERYTHING he tells you to?

Is your boyfriend hot-tempered for example, would he get angry if you do not do something right away for him?

Do you see yourself marrying your boyfriend in the future?

Do you feel that you chose your boyfriend solely on your desires?

Was your father aware of you dating

Is your father a caring figure in your life?

What are some of the traits that you appreciate that is present within your father?

How would you describe the relationship between you and your father?

Is your father comfortable with you talking to other guys?

Does your father expect you to do EVERYTHING he tells you to?

Does your father expect you to tell him EVERYTHING that goes on in your life?

Can you talk to your father about the subject of boys?

Is your father hot-tempered for example if he tells you to do something for him would he get impatient if you do not do it that very second?

What is your father's profession?

Does your father's occupation have anything to do with your relationship with you and your boyfriend?

Can you talk to your mother more easily than you can with your dad?

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Deadlines

August 1 for the Fall issue and February 1 for the Spring issue.

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