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## Occam's Razor Vol. 5 - Full (2015)

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# **OCCAM'S RAZOR**

*2015 | Vol. 5*







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**EDITOR-IN-CHIEF**

*Nathan Moore*

**CONSULTING EDITOR**

*Neil Christenson*

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*Christopher Patton*

**ASSOCIATE EDITORS**

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**WRITERS**

*Marguerite Corrigan*

*Kathryn Cronin*

*Michelle Runyan*

*Bryana Bohl*

*Sara Spitzer*

**LEAD DESIGNER**

*Hannah Stutzman*

**DESIGNER**

*Elise Schalk*

**PHOTOGRAPHY**

*Samantha Neff*

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## INTRODUCTION

As a newly official member of the Student Publications Council here at Western Washington University, *Occam's Razor* is proud to present its fifth volume.

The strengthened relationship between *Occam's Razor* and the University, and the pencil pushing work of our Consulting Editor, Neil Christenson, have given us superb resources which we have gratefully used to publish this volume. Though we would not have had anything to publish without the interest, patience, and hard work of some of Western's finest students; they produced excellent material from departments all over campus, including the English, Sociology, and Biology departments. And so we thank the Student Publications Council, Neil Christenson, and the authors of this issue.



This year was full of surprises – surprises so big that at times we did not know how to proceed. But thankfully we had a determined staff and a determined faculty advisor, all of whom would not rest easy until matters were managed. And so we thank Christopher Patton for his unwavering support.

The MVP award goes to Hannah Stutzman, our designer. She has gained the utmost appreciation of the editors by quickly turning a mess of papers and edits into a clean collection of essays. Thank you, Hannah.

We encourage you to discuss these essays with anyone and everyone so that we may contribute to Western Washington University's reputation for academic excellence. We also encourage you to send your best academic writing to

OccamsRazor@wwu.edu so that you have a chance at publication in our next volume.

Please enjoy.

On behalf of the editors of *Occam's Razor*,

**NATHAN MOORE**  
**EDITOR-IN-CHIEF**





# THE COLLAGE OF PERCEPTION:

William S. Burroughs & Harry Everett Smith

BY MARGUERITE CORRIGAN

06

The 20th century finds humanity in a critical moment between chaos and reconstruction. Situated firmly at a crossroad in history, the 20th century will give rise to such cultural institutions as the atom bomb, the television, and apathy. The general feeling of malaise will travel swiftly as a bullet through Archduke Franz Ferdinand's head and explode into our collective consciousness like the space shuttle Challenger. Perhaps all other subsequent attempts to "challenge" will be doomed to failure as well. Amid this turmoil of antiquated cables and wires that extends from our nervous systems, there is a quiet revolution in our hearts and minds that asks the question, "How?" How can we overcome this malaise? How can we reform ourselves and our understanding of our own identities into a picture of humanity that more closely resembles persons instead of gods? Two men poised at the apex of critical social and political upheaval at the equator of the century will attempt to answer this question in the most ludicrous fashion they can think of: through art.

Deep in the corner of his own addiction and despair, William S. Burroughs came into contact with what he would refer to as “the Ugly Spirit” from which he had no choice but to write his way out. His linguistic and literary innovations informed post-modernist literature in the latter half of the 20th century and created a jarring political and satirical milieu for his deeply autobiographical characters. His interest was the spiritual and radical undercurrents of “reality” is largely influenced by his study of the Egyptian *Book of the Dead* and Mesoamerican philosophies. Burroughs’ sought to reconcile the immensities and absurdities of a composite truth that is packaged and sold to the abject masses in a way that desensitizes us to the true reality of our imminent destruction, self or otherwise. Adapting from the Dadaists of the 1920’s, Burroughs developed a style of textual collage from splicing, or “cutting up” pieces of fully formed, linear narratives and rearranging them in random order to create completely new texts. His “cut-up method” – as it will come to be known – abolished a slavish adherence to narrative structure in such a radical way that he changed the tone of contemporary literary discourse from that day on.

Also dwelling and stirring in the bowels of New York City was Harry Smith, a man who once described himself as “a collagist, as much as anything else” (Moist 117). American mystic, anthropologist, musicologist, and filmmaker, Smith found his hand in a variety of spiritual and artistic pursuits. Like a kind of manic bird, he amassed a holy shrine of art, music, photographs, mystical objects, and other odd material ephemera in his

Hotel Chelsea room, no. 328. Smith two was concerned with the mystical connotations of the universe and the possibility of artistic expression amid chaos. Both men would explore the process of juxtaposition and push the boundaries of an art form, informed by their esoteric philosophies of choice.

Early in his career, Burroughs spent some time studying mystical spirituality as a graduate student of anthropology at Columbia University, where he was first introduced to Allen Ginsberg and Jack Kerouac. Later in Mexico City he studied the Maya at Mexico City College for eighteen months, between 1950 and 1951, under Professor R. H. Barlow. In a letter to Ginsberg, he wrote that he was “learning to speak Mayan, and taking courses in the Codices” (Wild 41). Similarly, in the introduction to *Queer*, he writes that he enrolled in courses on Mayan and Mexican archaeology.

Burroughs’ treatment of the subject is somewhat troubling because, on several occasions, he conflates Aztec mythology with the Mayan and appropriates much of the imagery and subject matter for his own purposes. In

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REPRESENTATION OF CONTROL.**

**ON A FUNDAMENTAL LEVEL, ALCHEMISTS BELIEVE  
THERE IS NO DIFFERENCE BETWEEN SPIRIT AND MATTER,  
OR MIND AND BODY; THEY ARE SIMPLY DIFFERENT  
STATES OF THE SAME BASIC MATERIAL ARRANGED ON  
DIFFERENT LEVELS OF BEING.**

his article for *College Literature*, Paul H. Wild discusses Burroughs' anthropological knowledge of the Maya and compares much of his literary appropriation of the subject to contemporary archeological knowledge:

The name Xolotl appears in 'The Mayan Caper' chapter of *The Soft Machine*, in *Ah Pook is Here*, and in *The Wild Boys*. Xolotl is in fact an Aztec god while Ah Pook is a Maya god of death... 'Mexican' identifies cultures north of the classic Maya regions.... The Aztec being most widely known. Burroughs occasional conflation of Maya and Aztec cultures leaves the reader to wonder if he did actually know the difference, whether the conflation was carelessness or literary license, and [if so] to what purpose? (Wild 41)

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While Burroughs occasional conflation of Mayan and Aztec mythologies could suggest his academic oversight or scholarly indifference, this reading would fail to absorb the allegorical nuance of his work:

Ever dig the Mayan codices? I figure it like this: the priests- about one percent of the population- made with one way telepathic broadcasts instructing the workers what to feel and when... The Mayans were limited by isolation... Now one Sender could control the planet... *You see control can never be a means to any practical end... It can never be a means to anything but more control... Like junk...* (Burroughs 148-49)

This excerpt from *Naked Lunch* encompasses many of the crucial themes of Burroughs' early work. It is a succinct explanation of his Gods of Death motif in which his characters must outwit or outdo the corrupted Mayan priests. This motif reoccurs several times throughout the narrative. In Burroughs' cosmology of the Maya, the priests come to represent the powers that distribute "junk", one of his most powerful metaphors for systems of control. "Junk" is, of course, a reference to Burroughs' personal struggle with opiate addiction, evolving the metaphor to represent all forms of inoculation and sedation. It comes to represent the system of dehumanization that prevents us from realizing our truest form. "Junk" is then expanded to include all forms of domination, the domination of one individual by another as well as political, bureaucratic, economic, media, and linguistic control—the control of the word virus (Wild 40).

Ultimately, Burroughs' Gods of Death motif is not primarily concerned with anthropological accuracy as much as it is with the representation of control. In his fictional universe, the Gods of Death are not controllers of the underworld whose patience must be bought with human sacrifice. Instead, they are the priests who control the populace of living death. Burroughs recognized social control as "one of mankind's irresistible needs; he wrote often of control addicts—including Mayan priests—who repress individual freedoms simply because they can" (Wild 40). In a BBC interview, Burroughs had this to say about mythology: "I may add that none of the characters



in my mythology are free. If they were free they would not still be in a mythological system, that is, the cycle of conditioned action” (Stull 238).

Burroughs’ feelings toward any kind of mythological representation of a higher power are inherently intertwined with systems of control.

Burroughs is obsessed with control systems—from Mayan codices to Scientology—and control and sex begin to fuse more and more in his later novels. A dependence on authority ultimately manifests itself in a dependence on an ultimate authority, the idea of a god. (Stull 228)

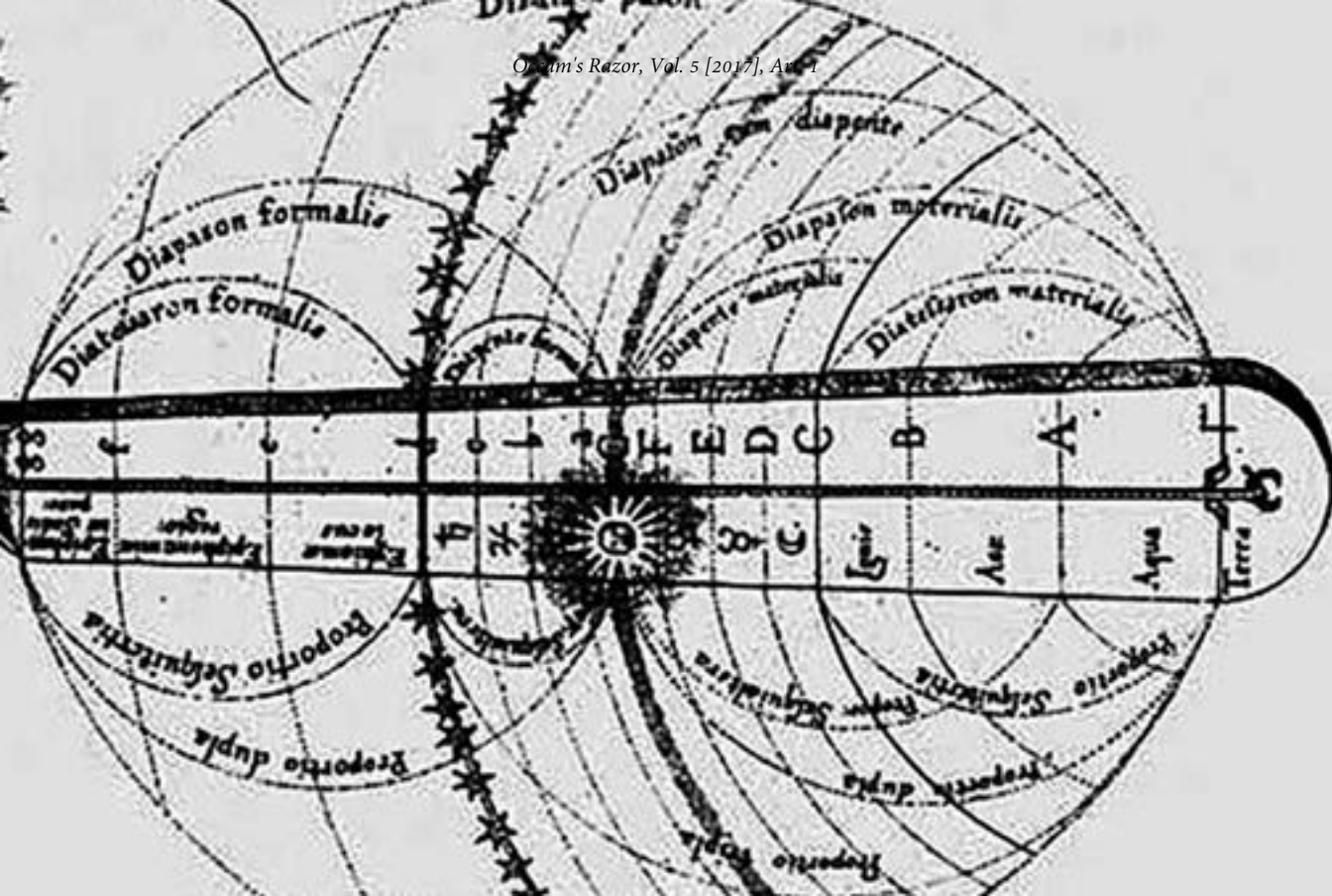
The philosophies of the Mesoamerican cultures that so fascinated him were perhaps epic examples of ancient civilizations grappling with the same abuses of power as our own contemporary society, albeit in a rather romanticized homoerotic fashion.

Harry Smith also finds a way to challenge the traditional narrative of God with his spiritual endeavors and mystical pursuits, ultimately incorporating this into his creative process. One of his first encounters with man’s attempt to commune with the forces of universe are with his observations of the Native Pacific Northwest Tribe,

the Lummi, where his mother was employed as a teacher on the reservation. Later, as an anthropological researcher at the University of Washington, Smith became one of the leading researchers in Native American music and customs where he made frequent trips to visit the Lummi. In the early 1950s, Smith’s massive collection of American folk records was curated into perhaps his most famous work, *The Anthology of American Folk Music*, released by Folkways Records in 1952.

The original cover of the anthology included a drawing by Elizabethan alchemist Robert Fludd entitled “The Celestial Monochord” in which a series of hierarchical spheres are connected and being tuned by the hand of God. The reference would no doubt be lost on the average consumer but the original cover illustrates Smith’s propensity to connect audio-visual recording with nature, alchemy, and the occult. Furthermore, the anthology is organized according to “Ballads”, “Songs”,





and “Social Music,” all of which correspond to an elemental power. For example, “Ballads” has a green cover representing water, “Songs” has a blue cover representing air, and “Social Music” has a red cover representing fire. The organization of the anthology cemented Smith’s cohesive vision of music and nature.

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Smith’s interest in alchemy went further than the *Anthology of American Folk Music*. Both Smith’s parents were theosophists with pantheistic tendencies, which, in a sense, involve the belief in an imminent God who is identical with nature. His interest in hermetic philosophy and the mystical science of alchemy, which he saw as a shadow tradition in Western culture, was an extension of this pantheistic sensibility.

There are two concepts from alchemy that help shed light on Smith’s thought and work. The first has to do with

a philosophy of correspondences, or repeated patterns at different levels of existence. On a fundamental level, alchemists believe there is no difference between spirit and matter, or mind and body; they are simply different states of the same basic material arranged on different levels of being. These levels are usually represented by spheres in a hierarchal nature starting with gross physical matter all the way up to the purest forms of god. This is closely related to the second concept of transmutation, that things from lower levels—if their patterns are properly understood—can be transmuted to higher and purer levels by proper rearrangement (Moist 117).

Both Smith and Burroughs experimented with the cut-up method in a number of ways that served to express something about the nature of their individual concepts of reality and universal connections. The implications of the cut-up method become particularly fascinating

when examined in the context of alchemy for a variety of reasons. When understood in light of the process of transmutation, Smith's approach to collages becomes inherently about the order of the universe.

A student of Harry Smith's was quoted in Stephen Fredman's portion of *Harry Smith: The Avant-Garde and the American Vernacular*:

Harry was always in the process. The one thing he said to me that I particularly remember was the most important thing about reality is the relationship of objects. [He] said what makes everything real is the fact that things are ordered in the present status. In other words, things are set beside themselves and that is what makes reality. Reality is made up of just the placement of objects. (Fredman 226)

According to Smith, since reality is simply made up of the placement of objects, the choice of what to place where in the cosmic collage becomes of dire consequence. If one understood the patterns of a particular object (or the universe as a whole), then one had the power to rearrange them and potentially transmute them to higher power closer to the purest forms of existence. This process could apply to art as well as life because in this conception of reality, everything is sacred. Everything has the potential to be transmuted, and text was only the beginning.

Smith's interest in collage and amassing material objects reveals itself to be much more than a side hobby. On the contrary, Smith saw collaging as an integral part of his creative process, a cultural practice that would become a central part of his other artistic work. He assembled

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symbols and pieces of culture to produce larger meanings that drew from Native spirituality and alchemy. For Smith, collecting was a form of self-creation and a means by which to inform and construct his own identity.

Through his close personal relationship with the poet and mutual friend of Burroughs, Allen Ginsburg, Smith was familiar with Burroughs' work. He was aware of the literary version of the cut-up method that had been introduced to the public domain by Burroughs' and his creative partner, Brion Gysin. Smith wasted no time finding a way to incorporate this radical process of juxtaposition into his own work. He began experimenting with the music in his films believing he could take any piece of music and run it next to any of his films until the rhythm of the images and the music would begin to synchronize, discovering what he called "automatic synchronization" (Chapman 13).

Given his interest in alchemy, Smith was probably attracted to the "magical" properties of bringing two unrelated elements together. Each new piece of musical accompaniment unleashed new elements, a reason for the images to be viewed in a different light upon



**WHERE BURROUGHS AND SMITH  
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MAKE IT SUSCEPTIBLE TO THE  
POSSIBILITY OF CHAOS AND ALL  
OF ITS MYRIAD IMPLICATIONS.**

each viewing. Much of this process can be viewed as part of a longer history of surrealist compositions of Dadaist photomontage and collage which experimented with chance procedures that gave way to automatic drawing and writing, and the collaborative creativity of the “exquisite corpse” technique. Smith was greatly influenced by the American composer John Cage whose great conceptual work of “indeterminacy” as an approach to creativity was based heavily upon his study of Eastern philosophies, particularly Taoism and Zen Buddhism (Chapman 12).

Smith also used the cut-up method to compose the structure of his most famous experimental film *Heaven and Earth Magic or Film No. 12*. Taking file cards and splicing them into random order, Smith compiled a loosely narrative structure for the images to take place, often oscillating between different projectors with various filters and frames. Of course, nothing about the cut-up method is truly random. Smith expressed to his colleagues that he felt there was some “hidden hand” guiding his process and that the laws of automatic synchronization were at work here as well. He strongly felt that the connections he was making were more than a coincidence of perception and that there was a more profound process of exploration at work (Chapman 13).

Similarly, Burroughs also felt the cut-up method useful to exposing the underlying connections of the universe. His approach to the cut-up technique employed the same attitude of joyful juxtaposition to deconstruct our faith in the power of language and the absoluteness of consensus reality. What came to be known as the cut-up trilogy, *The Soft Machine*, *The Ticket that Exploded*, and *Nova Express*, pushed the limits of language to the edge of comprehension. Lacking what could be thought of as a traditional narrative, the characters of Burroughs’ universe drifted in and out of the events being described. Between various depictions of intergalactic sexual escapades and homoerotic fervor, the rebel factions of consciousness fight the powers of inoculation and complacency for control of our collective awareness.

The cut-up method exposes the writer and the reader to a cosmic frontier of possibilities somewhere between space and time much in the same way Smith’s films operate outside of a linear narrative to explore the conventions of storytelling. The cut-up trilogy jumps between past, future, present, and Interzone (that is to say, somewhere in between) with a reckless abandon just as *Heaven and Earth Magic* oscillated between various frames and projections to emphasize the visceral. Seemingly playing on an endless reel in some abandoned movie theater, desolate and ransacked, so do Burroughs’ protagonists rocket through space and time, infinitely.

In essence, Harry Smith took the same approach to cutting up pieces of text and applied it to film, creating a cacophonous marriage of image and sound. The cut-up method became important to both men as filmmakers, artists, writers, and forward thinkers of the 20th century.

A distinctive creative approach, yes, but also as a way of life. Burroughs often described his most important and enduring symbol, “junk”, as a way of life because once exposed to it, you were never the same. I submit that the cut-up method functions in a similar fashion. Once exposed to the political underpinnings of language, you can never apply themselves with the same blind devotion as before.

However, these two particular methodologies came to opposing conclusions. Burroughs’ early themes of note included his discomfort with the human body, dystopian politics, and the early framework of homosexual liberation stained with a political unease that bordered on paranoia. His increasing dissatisfaction with the production and consumption of “reality” by what he referred to as “the reality studio”—of which the word virus he so vehemently fought against was a product of—led him to his deeply jaded and satirical point of view. His characters often fail to break through the cycle of conditioned action their mythologies subject them to, although they try so hard to seek a way out. His philosophy was jaded but not without hope.

**FOR SMITH, COLLECTING WAS A FORM OF SELF-CREATION, AND A MEANS BY WHICH TO INFORM AND CONSTRUCT HIS OWN IDENTITY.**

The preface to *Word Virus: The William S. Burroughs Reader* by Ann Douglas can perhaps best summarize Burroughs’ sliver of optimism:

Burroughs saw that Western man had ‘externalized himself in the form of gadgets ...’ Instead of reality, we have the ‘reality studio’; instead of people, ‘person impersonators’ and image-junkies looking for a fix with no aim save not to be shut out of the ‘reality film.’ But Burroughs believed that a counteroffensive might still be possible, that the enemy’s tactics can be pried out of their corporate context and used against him by the information bandits like himself. (Douglas xx)

Where Burroughs and Smith intersect is in their quest to “deprogram” the mind and make it susceptible to the possibility of chaos and all of its myriad implications. They both would have represented the “information bandits” Burroughs espoused and their work is a seminal stepping-stone towards the frontier of language and consciousness. But Smith’s approach to collage led him to what I believe is a more hopeful conclusion.

Where Burroughs’ use of the cut-up method was to juxtapose pieces of reality and reconstruct them into new and larger meanings, Smith believed the universe was already “cut-up” and put together into random intersections of being. These juxtapositions create patterns and, therefore, his job was to submit these juxtapositions to laborious creative processes in an attempt to understand and recognize those patterns. In trying to comprehend these patterns of existence, he had the power to rearrange them into his own composite reality. This was the significance of the collage. Ultimately,

in Smith's mind, the power to compile and construct our own realities rested in the individual. In essence, you have the choice of what to put where, and this power affords you a limitless number of combinations and possibilities.

The patterns that so concerned Smith concerned Burroughs as well. They both sought to intentionally confuse or scramble the preconceived notions of the reader/viewer relationship based on established conventions of literature and film. As "information bandits" their ongoing mission was to liberate the mind from the forces that seek to sedate and enslave man's potential to look outside of himself.

What we call 'reality' according to Burroughs is just the result of a faulty scanning pattern, a descrambling device run amok. We're all hardwired for destruction, in desperate need of rerouting, even mutation. (Douglas xxi)

Burroughs' notion of mutation and Smith's idea of transmutation are inherently intertwined in that they both seek to transcend the present physical and metaphysical order.

The efficacy of these two approaches is debatable. Burroughs and Smith had opposing views on the victories their creative and philosophical methodologies had won. For Smith, the accumulation of his life's work was validated with his Grammy award in 1991, shortly before his death, for the Chairman's Merit Award for Lifetime Achievement. In his acceptance speech Smith ambled to the stage and said, "I'm glad to say that my dreams came true—I saw America changed by music"

("Harry Smith Acknowledged"). Ideologically, perhaps Smith's victories are in part because Smith's role as a historical archivist allowed him a distance from his own systems of mythology. Like a humble scribe intent on recording the ebb and flow of time, the focus of Smith's work was never to insert himself into the art, but to allow the process of unsolicited juxtaposition to surprise him and guide him towards a higher form of existence.

For Burroughs, however, there is only one character in his fictional universe: himself. As a result, his victories are more difficult to assign. On the one hand, Burroughs admits in his seminal volume *The Western Lands* that we have failed. The word virus continues to plague us as an insidious parasite eating through our brains and polluting everything we try to communicate. The Nova Mob of society, culture, and government continue to disorient our ability to feel the deepest iterations of our emotions and communicate our experiences here, in the present moment. As Burroughs admitted in his BBC interview, the characters of his mythology are never truly free and as a result, Burroughs finds himself unable to dislodge himself from the cycle of conditioned action.

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A man of contradictions, he devoted his life's work to undermining the word virus by writing. He attempted to find the spinal cord of language and snap it. In his same declaration of failure in *The Western Lands*, he writes, "Battles are fought to be won, and this is what happens when you lose. However, to be alive at all is a victory" (Burroughs 254).

The particular mythologies and methodologies of these two men, informed by their esoteric philosophies of choice, connected them on an academic and spiritual level. This is perhaps one of the reasons they both earned the title "Beat." Regardless of the social and political movements, their work became associated with, both men fought to defy labels. Their work could be described as "experimental" and pushed the limits an art form to its very edge beyond what traditional, linear narration can express about the condition of reality. In the abandoned movie theater of perception that comes to define the empirical solitude of the 20th century, William S. Burroughs and Harry Smith lay before us a never ending reel of artistic chaotic order jettisoned between past, present, and future.

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# “WHAT IS LOVE?”

## *The Sounds of Love from William S. Burroughs*

BY KATHRYN CRONIN

16

William Burroughs, his life and works, have a set beginning and end, but the biological and spiritual connections he draws between language, sound, and the human body appear to have undefined points of origin. Sound has always been. Language has always been. To exist outside of language and sound is to exist outside of time and space and thus outside the body. Burroughs' theories on language, the word, and their connection to the body are woven through texts filled with structural and narrative convolutions. The *Nova Trilogy*, especially *The Ticket That Exploded*, as well as the early novel *Naked Lunch*, establish a biological link between sex and sound, both musical, in instances of consumptive love. However, in the later trilogy, including books such as *The Western Lands*, love moves away from the body; despite the continued use of music and sound, the concept of love separates and becomes linked to the image of the cat. This shift demonstrates Burroughs' understanding of society's control system, as projected through morals, economy, and the notion of individuality, and suggests how the fight to escape these systems shaped Burroughs' ideas of what love could or might actually be.

Understanding how William Burroughs perceived sex is vital, since sex is where he begins to flesh out the themes of control and love. His notion of sex is clearly not the normative sex espoused by the general public. His novels frequently conjoin sex with violence, time travel, control, and magic, but distance it from “love” and “affection.” Indeed Burroughs’ concept of love is difficult to define, for it changes frequently depending on context and conversation. He originally agreed to an extent with Bockris-Wylie’s definition as “the point where you start to lose power” (*With William* 47) but confessed to having difficulty defining this term. The connection, love and sex to loss of power is prevalent in his early works, but his idea of love shifts in his later works. Burroughs continues in the same conversation to say:

I don’t know exactly what falling in love for me is. The concept of romantic love arose in the Middle Ages... [T]his separation of love and sex is a western concept, a Christian concept. As to what falling in love means, I’m uncertain. Love; well, it means simply physical attraction and liking a person at the same time. (59)

The connection between sex and love, especially in the courtly love Christian and the medieval traditions, is understood by Burroughs as a way to control how, with whom, and when men had sex. Women, in this case, especially religious women, were enforcers of sexual control. Examples of women as agents of control occur in many of his works, particularly in *The Ticket That Exploded*, where Burroughs theorizes that this control of sex is “a program of systematic frustration...necessary

## THE CONCEPT OF LOVE FOR BURROUGHS IS DIFFICULT TO DEFINE, AND CHANGES FREQUENTLY DEPENDING ON CONTEXT AND CONVERSATION.

in order to sell this crock of sewage as Immortality, the Garden of Delights [G.O.D.], and love” (Ticket 59). Sexual frustration is necessary to decrease the alertness of the subject, thus allowing for easier control and for the acceptance of “love.”

In this context, it is no surprise that the sex acts in Burroughs’ works demonstrate a number of male, animal, or alien sexual partners. Homosexual sex is important to Burroughs’ rejection of the control system, couplings achieve a distance from the normative heterosexual couple. He says, “In homosexual sex you know exactly what the other person is feeling, so you are identifying with the other person completely. In heterosexual sex you have no idea what the other person is feeling” (*With William* 60). Not only does homosexual sex break from a societal norm, it implies a deeper connection and communication with the sexual partner, since one can “identify” with their experience. Since sex is already an act of vulnerability and “provides a point of invasion” (185) the woman as a sexual partner poses more danger than a male one. Sex, as an avenue for invasion, as a force alienating once from one’s body, and as a potential control system for women, is thus one of the deliberate methods used by *society’s* control system. To destroy the control, as he does with word and the cut-up method, one cannot remove themselves from sex. Instead, one must be

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FORGOTTEN OR TURNED  
OFF AND HAVE A POWER  
OF CONTROL PAST A IS  
ORIGINALLY CONSIDERED.**

alert during the sexual connection so that they are not taken by frustration and sentimentality (Ticket 85). The societal controls prevalent in sex are not the only avenues of control, and it becomes apparent through the body of Burroughs' work that sex is only one part of the larger issue at stake.

Word as virus is the constant theme connecting the body of William Burroughs' work. Its association with control, on a biological and social level, make striving for freedom a goal within each novel, whether in the form of the rewrite or demonstrated in the actions of a protagonist. Freedom, from the standards set by society's morality, but carried out in the form of words. The biological control exerted by word is the true cause of any other form of control posed by the word. Word is flesh. Word became flesh. The biological mechanism of the body, especially the subconscious or unconscious function of the brain, allows word to enter and exert its force. Sex, due to its increase of vulnerability, becomes one of the primary ways in which the word parasite can enter and control the body. First, however, there must be a connection, a communication. Sex requires *words* in order to function as a method of control. In *The Ticket That Exploded*, the dangers created by love songs and love confessions become the open wounds that allow the parasite to fully inhabit the body.

Word and image inevitably find themselves joined in creating meaningful language. The mythology of language and word began with image as symbol, and words themselves came into the body, most often through the eyes. However, the origin of words and language do not come from the written page, no matter the imagery Burroughs himself may create. Sound is the origin. Before light has touched the eyes, the ears have been tuned to the sounds of the mother, of the father, to the world outside the womb. As Burroughs and Gysin say, "[T]he sound is in our ears and the image is in our eyes from the very moment of birth and is thus indistinguishable from its contrary silence...and darkness" (Kahn 221). Sound is more invasive than image. One can be inured to the images around them, but it is easy to admit or clue in to optical illusions. One only has to think of the discussion surrounding photo-shopping and auto-tuning. An artist's voice is not as frequently addressed. Consider also Burroughs' statement,

If you are listening to someone, that person's voice is inside your head. It has to some extent invaded and occupied your brain...So voices coming through the right brain that cannot be turned off have a special power. (With William...187)

Image is invasive, but sound is the narrative voice one hears while reading, the persistent presence of lyrics, the shuffle of feet and the tapping of keys. Sound appears to go in one ear and out the other, but as William Burroughs proposes, sound permeates and is inescapably stuck within the body. Sounds, whether the voice of a loved one or the persistent tune of pop culture's romantic love, cannot



be forgotten or turned off, and they have a controlling power greater than what is originally considered.

DJ Spooky, aka The Subliminal Kid, aka Paul Miller, and his book *Rhythm Science* provides a post-Burroughs analysis of sound within today's cultural framework and shows how it shapes the created conscious. The reference to The Subliminal Kid of the Nova Trilogy is not accidental; Paul derives inspiration from Burroughs' work and his cut-up method. Like Burroughs, Paul recognizes the infectiousness of sound for the body. He says:

I don't think we've engaged how much we can hear. We're conditioned to accept the social ramifications of the various technologies as constants in the environment, but they're as open to fluctuation as the societies that generated them. All of which points to the fact that it's not so much new ways of hearing that are needed, but new perceptions of what we can hear. (Miller 17)

This reevaluation of perception is what Burroughs pushes his readership toward with his narrative in *Naked Lunch* and the Nova Trilogy. By using the cut-up method, he forcibly uses the constants in song and culture in ways that throw off conditioning. These constants, originally restricted by societal definition, are then re-imagined in an attempt to identify and resist the control message presented by the language of love. Word is the other that controls instead of being controlled. Thus, sex is violence. Love is consumption. These re-definitions begin with Burroughs' creation of the body and its symbolic sounds.



Douglas Kahn, in the chapter on Meat Voices in his book *Noise, Water, Meat: A History of Sound in the Arts*, expands on the sounds of the Burroughsian universe and their implications for the body. *Naked Lunch* is the focus of his argument, since it was the first book that preceded Burroughs' use of the cut-up method. It is a strange universe to enter into, where the body is no longer an impenetrable force. Kahn tracks sound back to its origin, back to the body itself, and from there demonstrates Burroughs' theories of virus and cancer within the body's sound. He says:

[T]he protoplasmic body and Burroughs's own depicted body, were fused and found a common host in the idea of schlupping bodies, the total osmotic ingestion of fusion of one body by another, first posited imagistically within the sphere of homosexual love – 'to become the other person' – but then quickly pathologized to forms of predation, violence, and destruction. (Kahn 295)

Taking viral and parasitic action to the extreme, the bodies in the Nova Trilogy and in *Naked Lunch* are obsessed with consumption—consumption of junk, of sex, of control. The body, because of this desire, cannot stay within its confines. As this quote indicates, the idea of schlupp did not begin as a violent hunger. Ginsberg

confirms that Burroughs originally considered schlupp as a kind of tender emotional vulnerability towards a lover, connected with the desire to know the person to the fullest extent (298). This desire to know a person, to know them in the most intimate way (as with merging altogether with the partner), becomes the most striking example of parasitic behavior of the word virus and its hosts.

Many examples of parasitic behavior can be found in Burroughs' first novel, *Naked Lunch*. From the beginning, many characters are controlled by their desire to consume. Not all examples are sexual in nature, though the language would suggest otherwise. Willy, a terribly phallic name for a character, and his "blind, seeking mouth" lose control and eat a door when the police come for him (*Naked Lunch* 8). The blindness of this orifice is horrifying to consider, it will eat anything and everything, but it is an erotic image if one thinks of the forbidden dark abyss present in any sexual orifice. Another example, the talking asshole, becomes erotic through its production of un-D.T. or Undifferentiated Tissue. First the asshole talks, then it grows teeth and begins to eat and demand "equal rights" (111). Worse, it forcibly seals over the other mouth in order to take over the body, using un-D.T. that, according to Kahn, "becomes sexualized and produces multiple and mobile orifices...human parts shaken around and poured out any way they fell" (Kahn 311). This cancerous reproduction of skin over the mouth only becomes possible because of the asshole's ability to use language. Language is the opening through which this cancerous reproduction occurs, over-reproduction if one considers how cancer cells multiply without biological safeguarding.

20

**THE BODY, BECAUSE OF  
THIS DESIRE, BIOLOGICALLY  
CANNOT STAY WITHIN ITS  
CONFINES.**

## THE ONOMATOPOEIA OF THE LANGUAGE OF CONSUMPTION, OF THIS SEXUAL ACT OF MERGING INTO THE OTHER, IS AT THE HEART OF BURROUGHS NOTIONS OF VIRUS AND CANCER, OF CONTROL OF THE BODY ON A BIOLOGICAL LEVEL.

With its assertion of the self it merges completely with the “host” and takes over control of the body, but this is not the end of the biological reassessment of the human body and its functions.

Schlupp, or schlupping, is an invaluable sound for Douglas Kahn’s arguments because it symbolizes the connection of sound to the host, and the host to the parasitic. He says:

The sound of the word schlupp is the word made flesh, the sound of soft organs, a protoplasmic sound, a formlessness spoken with a wet wind that inflates and vitalizes the gelatinous body... Schlupp has a cartoon-like onomatopoeic relationship to sounds of saliva, ‘a great big sluppy kiss,’ sweat, semen, and other sexual fluids that accompany the ingestion of penises and fingers and tongues, the full stop plosive p being a vacuum created and released by plunging. (300)

Any mention of schlupp in *Naked Lunch* is sexual, the most common example being the ingestion of the District Supervisor by Bradley the Buyer. This vampiric consumption is an absorption of the other, which ultimately revokes the Buyer’s “human citizenship” and labels him as “a creature without species” (*Naked Lunch* 17). The lead up to the “schlupp” involves the kissing of the D.S. fingers, inserting them into the Buyer’s mouth, the plea saying “I’ll wipe your ass, I’ll wash your dirty condoms” (16). The onomatopoeia of the language of

consumption, of this sexual act of merging into the other, is at the heart of Burroughs notions of virus and cancer, of control of the body on a biological level.

This consumption and assimilation of the other continues in the novels of the Nova Trilogy, particularly in *The Ticket That Exploded*. Examples include the Green Octopus and her “flesh monopoly” (*Ticket* 9), the experiment with the composite of the marine and his girlfriend (94), the viral infection where the victim is “eaten by his invisible partner” (108), and the numerous jungle sex scenes where characters merge together (103), or are forcibly penetrated by their sexual partner (113). Schlupp, though uniquely connected to the biology of the body, is only the beginning of Burroughs’ exploration into this consumptive nature between sex and love.

*The Ticket That Exploded* continues this trend of biological sound, especially in the beginning of the novel. Here is where the language of love is inserted properly into the discussion of biologic control. The sounds of the body become dangerous to the existence of the other. For example, the narrator says:

So that is how we have come to know each other so well that the sound of his voice and his image flickering over the tape recorder are as familiar to me as the movement of my intestines the sound of my breathing the beating of my heart. Not that we love or like each other. In fact murder is never out of my eyes when I look at him. And murder is never out of his eyes when he looks at me. (1)



The merging encouraged by schlupp seems to have occurred with the two characters mentioned by the narrator. One is familiar to him as the other; he is as familiar as the narrator's own body, but not just the body, the sounds of the body. A biologic convergence of the two selves, explained later as the looping of sound tracks of voice and body together, makes these lines all the more important to the novel's explanation and critique of love. The narrator continues, "[M]y body is convinced that my breathing and heart will stop if his voice stops" (3). It is not the narrator's consciousness that feels as if it would stop; it is the body. Despite the lack of "love" in either scene, the language is clearly romantic. Looking into the other's eyes, he is familiar to me as my own body, my heart would stop if his voice stopped. All these phrases have been heard and said before in the context of romantic affection or love. Burroughs satires the language and pits the two characters against each other, both truly wanting to kill each other and be the last image seen by the other, (3) yet there is a terrible familiarity and connection to this person, to the other. The connection is based on sound, the splicing of the voice and the body together on tape, but it is all based on the notion of control. Here is where Burroughs begins his attack on the language of love permeating the air waves. Love language used here is control, the reason the narrator plots murder of the man who has the advantage. Love is an advantage over the other. "Love" as society calls it may not exist in this section, but Burroughs certainly portrays a kind of love that makes the reader uncomfortable.



“Do You Love Me?” is one of the more musical sections in *The Ticket*. The cut-up consists of a number of song lyrics, most of which would have been familiar to a reader during the time of publication. Besides the use of nonsense nursery rhymes, immediately conjuring for the reader the reproductive pictures of baby and mother, there are a number of songs that are picked out and repeated, cut up and thrown out together while sex noises play. The reluctant lover of the young monk is conjured with the sounds of the tape recorder, sex sounds, and the music of love that are played as the monk and his phantom make love. Two song references within the bulk of the section are “Tell Laura I Love Her” and “I’ve Got You Under My Skin.” The first is the story of a young man Tommy, who in an attempt to get his lover a wedding ring, crashes and dies in a car race (Valens). The tragedy itself is easily a horrifying example of the things love can inspire one to do, but the repetition of the line “Tell Laura I love her” and the ghostly presence Laura feels at the church as she prays for her lost love are the truly concerning pieces of the song. Tell Laura I love her, my love for her will never die – these lines cause Tommy to continually manifest his presence. Tommy and his sacrifice, the inherent control Laura had over the course of his life, is reimagined every time we hear him say he loves her. Every time, and here in the context of the cut-up, the ghost of Tommy comes to the reader and reasserts how his love will never die. “Tell Laura I love my blue heaven – Tell Laura oh jelly love you” (Ticket 50). Burroughs continues with other examples to develop a conflicted narrative between love language and music.

The song “I’ve Got You Under My Skin” is the musical embodiment of Burroughs’ concept of schlupp and its ties to consumptive love. Like many of the other song references, this is a song that was written and recorded then later re-recorded by multiple artists. Thus the voices of these artists, if the reader is familiar with any of them, come out to haunt the text. Repetition is dangerous, with

sound, because repetition is how the song, words, and sound, slide in without notice. These are the lines sung at random moments, the words that come tumbling from the mouth when the tune starts to play. For this song, there is very little lyrical change. The song consists of one single stanza along with two repetitions of the chorus, but what a chorus!

I'd sacrifice anything come what might / For the sake of havin' you near / In spite of a warnin' voice that comes in the night / And repeats, repeats in my ear / Don't you know, little fool, you never can win? / Use your mentality, wake up to reality. / But each time that I do just the thought of you / Makes me stop before I begin / 'Cause I've got you under my skin. (Porter, par. 2)

Burroughs only has to say “Got you under my skin on my mind” (Ticket 50) and the connection is instantaneous. Words that were once simply an example of devoted love, now with the reluctant phantom lover of the monk, of the perversion of sex, Bradley laughing and ejaculating in the face of the “parody of love-making” (49), take on new connotations. This is what Burroughs has been showing us all along. These words, taken literally, are horrifying. A man who avoids waking up to reality because his lover

is near, who is warned off by voices in his head, perhaps experiencing a psychotic break, the physical and mental block of control created by the presence of the lover, and a love who exists always near, under the skin. The lover has schlupped into the body of the other and can no longer be removed. This is the mental tone: Burroughs' criticism of a love that demands too much, consumes, and controls, whether through the biological schlupp or the narrative presented in the music of love.

Burroughs begins, in his later works, to shift away from the biological schlupping that is prevalent in the Nova Trilogy. It is already clear that the body is problematic. The body is the avenue for parasitic entrance, especially during the act of sex. However, the later trilogy, particularly *Cities of the Red Night* and *The Place of Dead Roads*, rejects the body altogether and moves into the realm of the spirit, the soul. David Ayers explains this idea in his article when he says, "1. In the beginning was the word. 2. The word was and is flesh'...So flesh itself is the control message, word, virus. The body itself is now written. It cannot be healed of its scars because it is itself the scar" (Ayers 230). Ayers says that the body is the location and source of the invasion, as has been shown in examples from both *Naked Lunch* and *The Ticket That Exploded*. Burroughs comes to the conclusion that it is impossible to throw off the control message

while still trapped within the body. Thus, his mythology in this trilogy has an overwhelming focus on the soul and self outside of the body. In his novel, *The Place of Dead Roads*, Burroughs says that the physical differences present in the body, the ability to differentiate, is the reason why the parasite of control can exist in the body without completely merging (Place of Dead Roads 192). Sex continues to be a theme, and it can be argued that characters still merge together, but the tracks of music, sound, and love begin to deviate from each other.

Music and sound within the *Cities of the Red Night* trilogy occur repeatedly with two specific themes, those of sex and of the cat. Beginning with *Naked Lunch* and its "medley of tunes and street noises, farts and riot yips" (*Naked Lunch* 191) that Douglas Kahn describes as "a pastiche, a sound salad heard on a radio receiver that was ejaculating" (308), the Nova trilogy employs flutes and drums, a phallic instrument, the other that mimics the rhythmic thump of sex, of the heart, of the body. These instruments reoccur in the *Cities of the Red Night* trilogy, specifically present before or during sexual acts. An interesting change is the insertion of poetic sections that function as the cut-up lyrics did in *The Ticket That Exploded*. Sometimes these lyrics have references, consider the sections in *Western Lands* alluding to the national anthem (*Western Lands* 222) and popular Christmas poems (240), but more often than not these made-up songs have no connection to pop culture's music. In *The Place of Dead Roads*, the stick song is symbolic of this deviation from cultural reference. The

character is writing lyrics referring to man and his stick, with lines that parallel the warning Burroughs gives about women and sex. He writes:

A man's best friend is his stick...Pick up your stick on the double / Your chick's a bloody snitch / Ride your stick like a witch / She'll sing you into Sing Sing / Unless you sprout a wing / Fly away on your stick / And fly away quick. (141)

Other than the obvious connotation sticks has to dicks, these song lyrics parallel the conclusions found in *Ticket*. The woman takes the “stick” and uses it to manipulate the man into “Sing Sing.” Much like the connections between love and song, the woman has to bewitch the man with sex and notions of love through song to keep him in place, trapped. These lyrics imply that the way to throw off control is to fly, but it does not mean that sex itself is banned. Instead, sex, or the “stick,” is the implement by which a person can fly away.

With the introduction of the cat as a symbol and a recipient of love, sound and music are once again shown to follow. The mythology of the Cat God Kunuk is one such example. Language or words have not penetrated this “God” since he is relatively unknown, which makes him a stronger force. Burroughs specifically says, “The quickest approach to Kunuk is through his voice” (Western Lands 207), and continues to write a scene where Hassan-i Sabbah, in summoning the god to create an amulet against dogs, both hears and feels the power of the twang reverberating through the metal wires. The cat, in opposition to the dogs who are related to the control system of bureaucracy, becomes symbolic of the fight against the virus. Consider the Deercat and the sounds that precede it being named “the spirit of total revolution and total change” (243). Cat whines and shrieks fill the air as the Deercat, the black hole, consume the word, the image, any attempted system of control. However, these

examples have little to do with love. Control, yes, and the pervasive use and misuse of sound, but what of love?

Love is related to the cat for multiple reasons. Burroughs appreciated the independence of spirit demonstrated by the cat and found through his relationship with his cats, Ruski, Fletch, and Smoker, a refined definition of what love could be. As he says in his autobiography, *The Cat Inside*, “All relationships are predicated on exchange, and every service has its price. When the cat is sure of his position, as Ruski is now, he becomes less demonstrative, which is as it should be” (*Word Virus* 505). The idea of relationship begins to move away from the body and from relation to sex. Cats and sex do not go together; the love of a cat is not a biological need that can be used to control. Instead, as the relationship becomes more established, more independence can be assumed. This love requires, even demands, a degree of separation. Burroughs explains, “The cat does not offer services. The cat offers itself. Of course he wants care and shelter. You don't buy love for nothing” (504). Love in this sense is a kind of exchange, an exchange of Guardianship. The cat gives itself to the human to be taken care of, but can revoke that privilege at any time. A cat's independence is a reassertion that the love they demonstrate is in no way connected to the ways of the control system. He explains

**LOVE IN THIS SENSE IS  
A KIND OF EXCHANGE,  
AN EXCHANGE OF  
GUARDIANSHIP.**

**LOVE AS A PAINKILLER, BUT LIKE JUNK IT IS ADDICTIVE,  
LIKE SOUND IT IS INVASIVE. ONLY A TRUE, PURE FORM  
OF LOVE COULD BE AN EFFECTIVE PAINKILLER.**

this kind of love further in *The Western Lands*, with talk of familiars and descriptions of separation from the body.

The cat as a familiar is perhaps the most important aspect of William Burroughs' reconciliation of love, control, and the body. As discussed previously, the body is the avenue through which the virus attains control. Sex and love sounds are incredibly invasive and can be used to further control the body. Thus, the cat as a familiar, as a psychic companion, is an avenue of potential escape. Burroughs says:

The Familiars of an old writer are his memories, scenes, and characters from his past, real or imaginary...Yes, quite simply and quite literally cats serve as sensitive screens for quite precise attitudes when cast in appropriate roles. The roles can shift and one cat may take various parts. (506)

The cat is now a projection screen for the pervasive memories and images trapped within the writer. This is fleshed out in *The Western Lands* with the writer's projection of the cat, Smoker, and his relationship to him. Two stories emerge, that of the writer, William Seward Hall, and of his friend, Professor William. Both Hall and William recount the discovery of the cat,

but William explains that there was no cat present and Hall was projecting the idea of a cat (*Western Lands* 251). When the cat is lost Hall becomes distressed and, depending on the story, either finds Smoker as blackness consumes him or, in waiting for Smoker to return, suffers a heart attack and dies from exposure to the elements (250). This death scene is vital to fully understanding the conclusions Burroughs was trying to make with reference to the body. Death was, and is, the ultimate escape from the control system. The death of this writer in connection to his re-discovery of the cat is a release from the struggle with writing and the impossibility of escape from control while in the body. It is a strange parallel to Burroughs and his last words before his death: "Love? What is it? The most natural painkiller what there is. LOVE" (*Word Virus* 528). Perhaps this is what makes love such an addiction. Love as a painkiller, but like junk it is addictive; like sound it is invasive. Only a true, pure form of love could be an effective painkiller. Only the pure guardianship love for the cat, for the cat familiar that transcends the body, can be the temporary escape necessary for a man so consumed by the notion of control, both in his fiction and in reality.

Over time, the works of William Burroughs demonstrate the development of themes connected to the body, sound, sex, and love. These larger themes tie together and show a maturation of thought. Sex is no longer the main focus, and the body is dangerous, thus it is necessary to move towards a spirit existence or inevitable death. Sound, though often connected to the control system, is like sex in that it is used in favor of and against control. Ultimately, escape from the control system while in the



body is deemed impossible, though this does not mean a total surrender to the system. Instead, the developing notion of love and its connection to the cat posits a new idea. Love in connection to body, to sex, is consumptive and relies heavily on the control system for its power. In contrast, the love for a cat is forcibly located outside of the body. This guardianship love leads to psychic connection in the form of familiars, an avenue through which the body and the system that tries to control it is subverted. Perhaps this is the only form of escape available while one exists in the world.

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# CORIOLANUS

## *and Early Modern Notions of Self*

BY MICHELLE RUNYAN

“I would dissemble with my nature where  
My fortunes and my friends at stake required  
I should do so in honour.”  
(Volumnia 3.2.62-64)

“I will not do’t,  
Lest I surcease to honour mine own truth,  
And by my body’s action teach my mind  
A most inherent baseness.”  
(Coriolanus 3.2.120-123)

No work is created in a cultural vacuum and Shakespeare was not merely churning out stage versions of stories already told. By comparing Shakespeare's stories to his source material and looking at the historical moment that Shakespeare worked from, readers can understand more about the ideas that the minds of the day wrestled with. Shakespeare's *Coriolanus*, a play inspired by the Plutarch story, is full of conflicting ideas of self, particularly when we look at the presentations of self seen in *Coriolanus* and *Volumnia*, as well as the way in which the passages on religion all but disappear from Shakespeare's version. By examining what elements of Plutarch's story Shakespeare kept and which he modified, and by understanding the shifts in thinking about self that were occurring during the Early Modern era, the reader is able to glean a better understanding of Shakespeare's *Coriolanus* and the ideas of self that emerged during that time.

Beginning with the character of *Coriolanus*, it is apparent that Shakespeare did not notably alter the character from Plutarch's story: *Coriolanus* has no father figure and is raised by a mother whom he has a very close relationship with; formal education is not a priority; his military career begins at a young age; he has a strong dislike of "flattery"; and his personality is one that is quick to anger. There are two major differences between the two versions: in Shakespeare's play, the relationship between *Aufidius* and *Coriolanus* plays a more significant role, and in Plutarch's story, *Coriolanus*'s usual brash speech is mitigated by a somewhat stronger talent for rhetoric.

The choices Shakespeare made with the character of *Coriolanus*—what to keep and what to alter from Plutarch—cause *Coriolanus* to be seen as more rigid and absolute than Plutarch. During Shakespeare's lifetime, philosophy was moving away from ideas of absolute truth and towards a skeptical outlook. So *Coriolanus*'s inability to be flexible with his idea of self and the order of the world is emblematic of the kinds of philosophies of self that were being grappled with in Shakespeare's time.

Examples of the mode of hierarchical thinking and ideas of absolute truth that were prevalent in society at this time can be seen in the language of the official sermon and of religious authority:

Almighty God hath created and appointed all things, in heaven, earth and waters, in a most excellent and perfect order....Every degree of people in their vocation, calling and office hath appointed to them, their duty and order. Some are in high degree, some in low....so in all things it is to be praised the goodly order of God without the which, no house, no city, no common wealth can continue and endure or last. (An exhortation)

Not to delight in assertions is not the mark of a Christian heart....I mean a constant adhering to and affirming your positions, avowing it and defending it, and invincibly persevering in it. (Luther)

In *Coriolanus* there is an emphasis on the Roman ideal of manhood. Plutarch said of this, "Those were times at Rome in which that kind of worth was most esteemed which displayed itself in military achievements; one evidence of which we find in the Latin word for virtue, which is properly equivalent to manly courage. As if valour and all virtue had been the same thing, they used as the common term the name of the particular excellence"

## CORIOLANUS, UNWILLING TO FLATTER, IS AN ALIEN FIGURE IN ROME.

(Plutarch). Coriolanus is aware of himself (in both the play and the story) as manly and virtuous. His struggle stems from his inability to present himself as something other than what he believes he is; he believes that the words and actions of his body are equivalent to his inner self and so is unable to be pragmatic in his dealings with the plebeians and the tribunes. His views on hierarchy and absolutism of self are similar to the Protestant sermons of the 1500s and the arguments of reformers such as Luther, as Coriolanus clearly adheres to and affirms his positions throughout the play, regardless of the consequences.

Coriolanus exists in a kind of liminal state within the play, unable to be a part of either the aristocratic patrician senate, which is built upon the ability to flatter and manipulate the plebeians with clever rhetoric, or the plebeians themselves, whom he abhors on the basis of class and because he considers them rebellious cowards. He refers to them as “dissentious rogues” (1.1.152), “where he should find you lions finds you hares” (1.1.160), “crows to peck the eagles” (3.1.142), and “the multitudinous tongue” (3.1.159). This distinction from the rest of society is due to both his strict adherence to the Roman ideal of manhood, by which he measures

not only himself but all citizens, and to his inability to separate the presentation of his public self from his inner self. Worden (2007) argues that, “Of all the sins of the court, none is more pervasive in Shakespeare’s plays than flattery. His characters condemn it as the enemy to good counsel, or see it in the necessary route to advancement, but those who fail to practise it become alien figures” (10). Coriolanus, unwilling to flatter, is an alien figure in Rome.

When Menenius and Volumnia attempt to convince him to placate the plebeians with flattery, he asks, “Why did you wish me milder? Would you have me false to my nature? Rather I say I play the man I am” (3.2.12-14). Then Volumnia tells him, “You are too absolute” (3.2.40). In every instance that the word “flattery” is mentioned in the play, it is in the negative, perhaps most notably when Coriolanus tell the plebeians that, “He that will give good words to thee will flatter beneath abhorring” (1.1.156-57). Coriolanus’s temperament and limited ability to speak without offending are intensified in Shakespeare’s play because there are so few moments, particularly in the first three acts, when he does not speak from a place of anger or disgust. When Menenius speaks to the tribunes on his behalf he says, “Consider this: he has been bred i’t’ wars / since a could draw a sword, and is ill-schooled / in bolted language” (3.1.322-324); his argument is not that he loves you but cannot express it, but that he is unable to properly hide his disgust of you (as the senators do).

Coriolanus’s problem with rhetoric, while still in evidence in Plutarch’s story, is not as amplified and in fact Coriolanus’s ability to speak is praised on more than one occasion. When Coriolanus leaves Rome and prepares the Volscians for war Plutarch says that, “Marcius was accordingly summoned, and having made his entrance, and spoken to the people, won their good opinion of his capacity, his skill, counsel, and boldness, not less by his present words than by his past actions” (Plutarch). Aufidius and the Volscians who plot Coriolanus’s death are so terrified that his good speech will earn him a pardon from the Volscians that they kill him before he is



able to speak, saying that he was “an admirable speaker” (Plutarch). Further, he willingly goes to the plebeians to beg their loves by “showing the scars and gashes that were still visible on his body” (Plutarch), which he refuses to do in Shakespeare’s play, once again further emphasizing his separateness from the rest of Roman society.

The only man from whom Coriolanus does not feel separated is Aufidius Tullus, and while the time spent on the relationship between the two men is cursory at best in the Plutarch story, Shakespeare spends a great deal of time developing Coriolanus’s relationship with Aufidius, which at times crosses over into the realm of the homoerotic. The first time he mentions Aufidius, Coriolanus says that “and were I anything but what I am, I would wish me only he...He is a lion that I am proud to hunt” (1.1.222-27). His language shows that he considers Aufidius an equal and that he believes Aufidius possesses the same type of manly valor that Coriolanus measures all men by.

When the two meet outside of combat for the first time, after Coriolanus has been banished from Rome and sought out his foe to either fight with or be killed by him, Aufidius tells him, “But that I see thee here, thou noble thing, more dances my rapt heart than when I first my wedded mistress saw bestride my threshold...I have nightly since dreamt of encounters ‘twixt thyself and me -- we have been down together in my sleep, unbuckling helms, fisting each other’s throat -- and waked half dead with nothing” (4.5.114-125). Their



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mutual admiration for each other is stronger than their enmity and the homoerotic tone of the scene in the context of Coriolanus's struggle with his sense of self and his feeling that Aufidius is an equal makes their relationship, or at least Coriolanus's view and need of their relationship, that of a mirror; Aufidius is the only man in which Coriolanus can recognize himself. This equality only lasts a short time, as Coriolanus eventually takes over Aufidius's army and Aufidius plots to betray and kill Coriolanus. In the end, when Aufidius has informed against Coriolanus to the Volscian senate, calling him a "boy of tears" (5.6.104), Coriolanus replies, "Like an eagle in a dove-cote, I fluttered your Volscians in Corioles. Alone I did it" (5.6.115-17), once again affirming his liminal presence within society.

The addition of this more developed relationship to the play emphasizes Coriolanus's struggles with himself, which in turn heightens the tragic aspect of the play. The fact that Aufidius survives and does not engender hate among the Volscian plebeians implies that Aufidius does

not exist in the same liminal state as Coriolanus. Rather than a mirror, Aufidius is actually a foil for Coriolanus, meant to show the reader that it is Coriolanus's choice to hold up the ideal of Roman masculinity as the standard he must live by without surcease, regardless of the consequences. Anne Barton argues that "the Volscian lord is reflective and intelligent as his rival is not... Aufidius is adaptable. Like Machiavelli, he understands the importance of accommodating one's behaviour to the times. He has also divined...that his rival is fatally inflexible...In this judgement, Aufidius is almost, if not entirely, right. Coriolanus in exile is a man haunted by what seems to him the enormity of mutability and change" (Barton 84). Coriolanus's unwillingness to give the appearance of being something other than what he is, while making him the most honest character in the play, ultimately leads to his inability to exist within any society successfully.

Additionally, the relationship between Aufidius and Coriolanus can be seen through the lens of the Hegelian master-slave dialectic, in which both (but especially Coriolanus) struggle to be recognized by the only other person they consider worthy. However, because Aufidius relinquishes his army to Coriolanus and then betrays him out of desperation (as Coriolanus has already proven more than 12 times that Aufidius cannot beat him in a fair fight), Coriolanus "wins" and no longer sees Aufidius as an equal, and rejects their equality with the metaphor of the eagle and the dove in his final scene. Having no equal, he is then vanquished (though not by Aufidius directly), because he no longer has anyone worthy of recognizing his self.

The militaristic kind of manliness that Coriolanus subscribes to can also be seen in his upbringing, which we can assume was fairly similar to his son's as his family continues to live with his mother because of their close relationship. Volumnia says that his son "had rather see the swords and hear a drum than look upon his schoolmaster" (1.3.52-53). Valeria comments that she

“saw him run after a gilded butterfly...he did so set his teeth and tear it! O, I warrant, how he mammocked it!” (1.3.56-61), and this allusion to violence is echoed later in the play when Cominus says that Coriolanus “leads [the Volscians]...against us brats with no less confidence than boys pursuing summer butterflies, or butchers killings flies” (4.6.94-98). Coriolanus’s upbringing is important because while he is generally unable to modulate his expression of the Roman manly ideal, the few times he does soften are in the presence of the women of the play. Plutarch says that

[Coriolanus] had always indulged his temper... and [was] possessed with the idea that to vanquish and overbear all opposition is the true part of bravery, and never imagining that it was the weakness and womanishness of his nature that broke out, so to say, in these ulcerations of anger.

Plutarch also circumscribes the role of women in a way that Shakespeare does not. In particular, there is a very large difference in the number of lines given to Volumnia in Plutarch’s story, where we don’t hear her speak until the very end, versus Shakespeare’s play in which Volumnia has a prominent role. Shakespeare provides the reader with many opportunities to hear from the women, in particular Volumnia, who stands as a stark contrast to

Coriolanus. The reader might then wonder: if Plutarch believes Coriolanus’s outbursts are “womanishness” then how do the women, who play such an important role in his life, behave?

Unlike Coriolanus, Shakespeare’s Volumnia does not struggle with rigidity of self that implicates a mode of being that relies on absolute truth. She comes much closer to the Early Modern idea of self, which “implies a fixed self operating behind the facade [of the presented self]” (Burke 18). She also exhibits a stronger self-control, unlike Coriolanus’s personality which resembled the “emotional instability [that] was characteristic of Europeans in the late Middle Ages, a ‘perpetual oscillation between...‘cruelty and pious tenderness’” (Burke 19). This instability is visible nearly every time he is near his mother when he turns from anger towards the plebeians to deference in a matter of lines. Volumnia exhibits the ability to be pragmatic and to play a strategic political game by sacrificing a superficial presentation of self for greater gains later. She tells Coriolanus that,

I would have had you put your power well on before you had worn it out....I have heard you say, honour and policy, like unsevered friends, i’t’h’ war do grow together. Grant that, and tell me in peace what each of them by th’ other lose that they combine not there. (3.2.16-17, 42-46)

Volumnia pushes Coriolanus to be strategic with his presentation of self, to be insincere when it is strategically useful.

## THE CONCEPT OF ‘SINCERITY’ WAS JUST BEGINNING TO TAKE HOLD IN THE EARLY MODERN WAY OF THINKING.

The concept of 'sincerity' was just beginning to take hold in the Early Modern way of thinking.

Shakespeare used the terms 'sincerity', 'sincere', and 'sincerely' thirteen times in his printed works...(while Milton, by contrast, used them forty-eight times in his prose works alone)...suggest[ing] that people were becoming more aware of the difference between an inner and an outer self. (Burke 19-20)

Further, that the presented outer self could be inauthentic; the concept of sincerity assumes the concept of insincerity. Volumnia uses this insincerely presented outer self, as do all of the patricians, when they are in public because they recognize that with the growing power and size of the plebeian population it is in their best interest to at least appear to be sympathetic. Coriolanus wonders why his "mother does not approve [him] further, who was wont to call them woollen vassals, things created to buy and sell with groats" (3.2.6-9), because he cannot conceive of choosing to be "false to [his] nature" (3.2.13); this is the ultimate difference between them and it is what leads to his tragic downfall.

While the relationship between Coriolanus and Volumnia is portrayed as close in both Plutarch and Shakespeare versions of the story, Volumnia is never seen counseling Coriolanus in Plutarch and her only real role is her speech of supplication at the end. In fact, her success is attributed at least in part to divine intervention, rather than the pragmatism and rhetorical skill she exhibits in Shakespeare's play.

In Plutarch there are two key passages that imply divine intervention was needed to save Rome from Coriolanus. The first is just after Coriolanus makes his deal with Aufidius, in which,

[Roman] soothsayers and priests, and even private persons, reported signs and prodigies not to be neglected.... [The priests] plac[ed] their hopes chiefly in time and in extraordinary accidents of fortune as to themselves, [and] they felt incapable of doing anything for their own deliverance. (Plutarch)

The last line takes the story out of the realm of the tragic because it hints that the real actor is divine intervention, rather than human agency. The second passage is specific to Volumnia, who in both versions is the ultimate savior of Rome, but who in Shakespeare shows up at Coriolanus's tent with the other women and young Martius in tow. Plutarch sets the scene a bit differently, with a long introductory passage on divine intervention as a way to "prompt the human will...[with] thoughts suggested to the mind, such either as to excite it to, or avert and withhold it from, any particular course. In the perplexity which I have described, the Roman women went...to the altar of Jupiter Capitolinus...[Valeria], suddenly seized with the sort of instinct or emotion of mind which I have described...not without divine guidance...went directly with them to the house of Volumnia" where she then tells Volumnia that "the divine being himself, as I conceive,



moved to compassion by our prayers, prompted us to visit you in a body...[to] join in our supplication" (Plutarch). By eliminating these passages from the play, and making Volumnia's strategic human action rather than Valeria's divine inspiration the force that saves Rome, Shakespeare bolsters the tragic elements of the play.

While Plutarch describe Coriolanus's outbursts of anger as "womanishness," Volumnia, the most important woman in Coriolanus's life and in Shakespeare's play, exhibits self-control and reasoned, strategic responses which were considered more masculine traits, and indeed, Sicinius engages her in a bit of wordplay when he asks her, "Are you mankind?" (4.2.18). Her language is martial when it is not strategic: "[Blood] more becomes a man than gilt his trophy. The breasts of Hecuba when she did suckle Hector looked not lovelier than Hector's forehead when it spit forth blood at Grecian sword, contemning" (1.3.36-39). Her speech of supplication to Coriolanus takes much different tact, from her opening curtsy to her disavowal of him, when she says, "This fellow had a Volscian to his mother. His wife is in Corioles, and this child like him by chance" (5.3.179-180). Volumnia is more "mankind" than Coriolanus.

Plutarch said that "humanizing and civilizing lessons, which teach our natural qualities to submit to the limitations prescribed by reason, and to avoid the wildness of extremes" were of greater benefit than even "the favours of the muses". Coriolanus is unable to take to heart the lesson that his extreme and obstinate attachment to the ideal of Roman masculinity goes beyond the limits of reason. Volumnia works within the limits, adapting her presentation of self in order to overcome what others cannot. Shakespeare's adaptation of Plutarch's story emphasizes this difference in their characters, thereby modeling and working through the differing philosophies of self that were circulating in his time.

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# SOCIAL MEDIA USAGE

## AMONG UNIVERSITY STUDENTS IN CHINA

BY BRYANA BOHL

### INTRODUCTION

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Social Media is connecting the world in a way no other technology has before. People around the world are connected to one platform or another, and check in or post almost every day.

From the birth of a royal baby to what's happening on the ground in Syria, we can receive live updates from next door to half way across the planet. As a subcontinent where over 513 million people use the Internet and 300 million are using social media sites, China has the most active Internet users in the world (Chiu, Ip, and Silverman, 1). The people in China spend about [40%] of their time online using social media, playing games, for academia, for business et cetera (Chiu, Ip, and Silverman, 1). Subsequently, Chinese and United States' social media users occupy their own space on the Internet because each sub continental country has their own platforms, media coverage, language, interests, beliefs, and identities. In that regard, each country's social media conception and growth have mostly been separate and largely unknown to outside users despite the fact that each sphere shares similar digital-age experiences.



The research question I investigated while in China was: how do college-aged Chinese citizens use social media and what are their current interests and/or concerns with social media use, if any? There is importance in this research question because of how many young adults around the world are immersed in social media. Additionally, there may be issues linked with intensive social media use among youth, such as addiction, which is a significant concern among parents and teachers that still appear to be misunderstood outside academia. The ethnographic emic perspective of young adults regarding social media has not been collected or studied. Meanwhile, we are all part of this expanding era of “digital natives” (Schwartz et al., 2006). Young people, myself included, are people of the future. How will we continue to explore the bounds of technology with social media? How will we explore the potential of social media and the present and future concerns associated with it?

When studying such a topic, it is important to familiarize oneself with the history and current events of the topic. The United States Social Media Networks (SNSs) have come a long way since their conception in the early 2000s (Boyd and Ellison, 2014). Many of the initial sites began as simple instant messaging platforms without the profile-centric and friend network-centric

faculty that SNSs are famously known for today (Boyd and Ellison, 2014). Similarly, a popular SNS in China called QQ “started as an instant messaging service” before it had SNS features such as personalization and “friending” capabilities; “QQ instant messaging service instantly became the largest SNS worldwide when it added profiles and made friends visible” (Chiu, Ip, and Silverman, 1). Once these capabilities became prevalent on social media sites in the United States, new sites such as Facebook were designed with “identity driven categories in mind” (Boyd and Ellison, 2014). There are now sites for specific religious sects, dating sites for certain age groups, and SNSs created for specific ethnic user populations. Contemporary SNSs offer personal, professional, and dating profiles. More popular sites like Facebook, which began as a site exclusively for Harvard students, eventually branched out to include practically anyone and everyone. Parents and teachers use Facebook now, potentially making the site “less cool” to many teenagers and young adults. From what I have heard from friends my age, the latest trend for students today is to join new SNS platforms that are widely unknown to the adult SNS demographic; one such platform in the US, and now at Western Washington University, is Yik-Yak.

## **THE INTEREST IN STAYING CONNECTED AND KEEPING UP WITH THE DAY-TO-DAY ACTIVITIES OF THEIR ONLINE FRIENDS HAS BECOME ICONIC OF AMERICAN YOUTH CULTURE.**

Every day SNSs are unfolding new and innovative ways to connect people unlike never before and college students are just one demographic of Internet and SNS users. My literature review includes information from contemporary literature about international college student social media use as well as literature focusing on China's young social media generation. Through contrastive research of American social media use, I will create comparisons with the findings from China.

### **LITERATURE REVIEW**

Present-day college-aged adults are known as “digital natives”; they are those who have grown up around digital communication (Schwartz et al. 2014). As such, modern college-aged adults are highly involved in social media. Studies done by the Pew Internet and American Life Project show that between 67% and 75% of college-aged young adults (who may not necessarily be enrolled in college) use social networking websites (Junco. 2014). The interest in staying connected and keeping up with the day-to-day activities of their online friends has become iconic of American youth culture. However, the important issue is not just that they are involved but how they are involved in social media. In a research study conducted by an American university on the east coast, researchers found that the most popular social

media platform among the college students is social networking and the most popular provider is Facebook (Williams et al. 2014). Though the results may not be surprising, it reveals that Facebook is a network where every college student is or could be connected to friends from practically anywhere across the nation. Connection via technological social networks appears to be the theme of this generation. The Higher Education Research Institute in the United States, reported that on average students in American higher education institutions are using nine different social media platforms and twelve different providers, which imply that students connect over various platforms for various interests (Williams et al. 2014). There are five social media behaviors that this study tested for: Spectator, Creator, Joiner, Collector, and Critic (Williams et al. 2014). Seventy three percent of students consider themselves to fit into more than one of the social media personalities (Williams et al. 132). The concept of having multiple social media personalities is fascinating because it demonstrates how students interact with social media: they watch, produce, connect, share, and critique. This concept also expresses the autonomy of social media. Students are able to express various personal interests and behaviors among the hundreds of social media platforms available.

Social media is a particularly popular facet of college students' lives in the United States. From keeping up with hometown relations and adding new friends to following their favorite celebrities, students consistently keep up with social media. One study aimed to show how Facebook influences “real world engagement” of college students (Junco. 2014). In the study, conducted with 5,414 college students, which tested the relationship

between the frequency of “Facebook use and student engagement” and the frequency of “Facebook activities and student engagement”, it was found that “students participated in a variety of Facebook activities...viewing photos, commenting on content, and checking in to see what others are doing being the three most popular activities” (Junco. 2014). While there was an overall negative correlation between Facebook use and student engagement, there was positive predictability of student engagement when “commenting on content and creating or RSVP’ing to events” on students Facebook profiles (Junco. 2014). Depending on how Facebook is used by the student, student engagement can be positively linked. Only certain activities were predictive of student engagement, especially when online participation puts students in a position to socialize offline, such as how RSVP’ing to an event leads to a higher likelihood of their attendance.

Faculty members in higher education have also noticed the use of social media like Twitter among their students. A few of my professors at Western Washington University appear eager to latch on to students social media use and incorporate it into academic discussion. Be that as it may, among the various courses I have taken in the last three years, there has been little to no action taken by professors toward incorporating social media into the classroom. Withal, the lag in educational use of social media does not necessarily mean that there is no interest in the subject at all. Professors may be wary of testing out a current and somewhat distracting extra-curricular activity in the context of academics. They may query how a microblogging site like Twitter could affect their students’ learning in class, or how Twitter

would influence their grades when used between the professor and the students. Such questions have been tackled in a study published in the *Journal of Computer Assisted Learning*, yielding conclusive results about the engagement of students when involved in social media conversations outside the classroom with “educationally relevant purposes” (Junco et al. 2014). The study had many positive effects on the students in the test group. Among these benefits were a greater increase in engagement scores, positive effects on grades, and interpersonal connections created using Twitter (Junco. 2014). Additionally, the Higher Education Research Institute found that Twitter created a “culture of engagement” between the students and their instructor (Junco, Heiberger, and Loken, 129). While on the surface Twitter appears to be a phenomenal technological education tool, it is actually simply the infrastructure for a comfortable space that breaks free of “traditional classroom discussion boundaries”, such as time limits, specified topics, and rewarded extraversion (Junco. 2014). Students in the test group experienced greater benefit from a democratized platform of communication. However, despite the positive results, this study is not representative of the entire American higher education system or of international higher education. This study used self-response methods, which is why there should be more ethnographic research into technology use for educational purposes.

**HIGHER EDUCATION  
RESEARCH INSTITUTE FOUND  
THAT TWITTER CREATED A  
“CULTURE OF ENGAGEMENT”  
BETWEEN THE STUDENTS  
AND THEIR INSTRUCTOR.**





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At this point in my research I have not come across any scholarly work about the use of social media in China for educational purposes. The information that I found regarding Internet usage and social media is focused on Internet addiction and how to lessen usage in the urban schools where kids have plenty of new media exposure. However, the educators at one middle school in an impoverished rural village hours outside of Lanzhou, China are eager for students to get exposure to the Internet since they are in such a rural area. The school does not have many technological resources ergo they encourage any chance for the students to experience the resources provided on the Internet. Even computer classes, which the students enjoy immensely, are not offered in this district. Despite scholarly enthusiasm, even if educators have considered implementing social media into the classroom, there seems to be no observable momentum for China or the United States in this regard. Perhaps the reasoning is due to several realities about social media incorporation: it is considered a distraction by many, it is not mainstream education, it is not widely established to improve the educational atmosphere, and, in some cases, it may require major revamping of the curriculum. This widespread discomposure may resonate

within Chinese academia as well. New media has yet to be harnessed by any breadth of educators at major universities in China or the U.S.

In China, Facebook, Youtube and Twitter are all banned by the government (China Blueprint Online 2014). However, China has achieved near “information sovereignty” by creating domestic email systems, search engines, and versions of social media for the nearly one and a third billion people who inhabit China (Diamond and Plattner 2012). These resources are set up specifically to serve a large Chinese population with distinctively Chinese platforms. By the same token, the Chinese social media sector has limited Western infiltration and Western countries have scarce information regarding social media in China.

Media coverage of China’s social media and Internet rights is consistently about censorship and government control. A recent article published in *China Digital Times* was titled “Censors Keep Mainland in the Dark About HK Protests.” It appears to be widely known outside of China that the Chinese government is censoring their information and blocking information from the rest of the world. According to a new media

professor Clay Shirky (2014) who teaches at New York University, “Authoritarian governments [like China] stifle communication among their citizens because they fear, correctly, that a better coordinated populace would constrain their ability to act without oversight”. Periodically the Chinese government preforms in-person “crackdowns” at Internet cafes, not necessarily for concern of “access to Western ideas” but because of a concern for leaking of government information (Dillon, 2009). For whatever reasons the government may have to block access and censor, it may not have a huge effect on the interests and concerns of Chinese college aged students who are using social media; because such a small portion of the population is affected by censorship. The ultimate question that keeps reoccurring in the democratic developed world is: “do digital tools enhance democracy?” (Shirky 2014). Events such as the fall of the communist party in the Republic of Moldova, the Million People March in the Philippines, and protests in Spain were all organized via social media. Likewise, Chinese citizens could obtain social media power to mobilize against the government (Shirky 2014). Therefore, it is important to be prepared to ask questions that concern the Internet rights of Chinese citizens, but not expect to get responses of concern equivalent to those of the U.S. media. The U.S. media tends to use a democratic paradigm when analyzing and reporting on China. Students may be more concerned with more tangible and observable topics regarding social media usage among their demographic.

China’s large population has experienced great increases in social media access and in turn social media use. In the past decade, researchers have investigated a tendency

## **MEDIA COVERAGE OF CHINA’S SOCIAL MEDIA AND INTERNET RIGHTS IS CONSISTENTLY ABOUT CENSORSHIP AND GOVERNMENT CONTROL.**

of addictive traits among young adults who use social media (Wu et al. 2011). However, the research of college students has occurred in the Republic of China and Taiwan yet not among college students in the People’s Republic of China or Mainland China. In Taiwan, there is a word that means “room-bound male”; “Chai-nan” is someone who spends much of his waking hours on the Internet engaged in social media, games, and other non-academic Internet activities (Wu et al. 2011). At the National Chiao Tung University researchers are interested in the emergence of RBMs (room-bound male) and especially how other students perceive them. At four universities, surveys were given to both male and female students from each year as well as graduate students. The surveys were composed of statements, which had the students answer on a scale of 1 to 5 (Wu et al. 2011). The statements included self evaluation and evaluation of others (Wu et al. 2011). In the results section, the researchers claimed that professors and student-affairs officers have observed specific behaviors where RBMs “spend most of their time in their residence” and have the leisure to do so since Taiwan campuses now have food delivery services in place (Wu et al. 2011). They also tend to avoid face to face communication and prefer Internet mediated communication when interaction is necessary (Wu et al. 2011). While the idea that someone appears to be confined in their dorm room for most of their college experience may seem dire, the researchers acknowledge that RBMs may find solace in the social communities

## **RESEARCHERS FOUND THAT SOCIAL MEDIA ADDICTION SYMPTOMS ARE CONSISTENT WITH SUBSTANCE DEPENDENCE ADDICTION.**

and interactions that they have over the Internet (Wu et al. 2011). Researchers also acknowledge the results showing that “respondents tended to assign negative connotations to the term ‘room bound male’” and use of that term could be harmful to those considered to be an RBM (Wu et al. 2011). Besides this study, there is a lack of information and understanding about RBMs and their Internet mediated social experiences among researchers. Despite showing signs of new media addiction they appear to have developed a personal social sphere in the digital world in which they can thrive (Wu et al. 2011).

The most prominent study on social media addiction in China was conducted with middle school students as subjects. It is likely that the study intended to uncover information in time for parents and teachers to discuss and stage interventions with children found to have a social media addiction. Since there have been perceived dependence issues with social media, “both researchers and the Chinese government have paid a great deal of attention to internet addiction problems among adolescents in China” (Huang 2014). Researchers found that social media addiction symptoms are consistent with substance dependence (Huang 2014). The symptoms that are usually seen among adolescents who are considered addicted are “more emotional symptoms, conduct problems, hyperactivity, and less pro-social behaviors than the normal group” (Huang, 24). Although only about fifteen percent of the middle school students in the study were found to be addicts, social media is on the rise and electronic devices are getting cheaper.

From my own experience observing other American college students, I find that there are American counterparts to the Taiwanese and Chinese room bound male (Wu et al. 2011). I knew people in my freshman dorm that would play video games constantly; they lived above me and their victory celebrations were usually quite loud. Consequently, it is not just the RBM types that appear to need constant connection. On an average day walking campus, I observe students using their smart phones, laptops, or other Internet compatible devices. Wherever I go, whether travelling to someone’s house or a new location, I find myself asking if there is free wifi. I know of friends who will have to delete their Facebook profiles in order to get through finals week without procrastinating. What is more, I know many people who share their life almost exclusively via Snapchat stories. It is the age of social media and the capabilities that are available merely foreshadow the wave of social media technology to come. I am part of a generation that can text faster than it can type and promotes its political views on Facebook. I believe that this generation of Americans has much in common, as far as social media, with its Chinese counterpart; we are the netizens, the bloggers, the friend ‘adders’ and ‘followers’, of the world. Our parents and educators may believe we are the generation of Internet addiction, but perhaps we are simply the forerunners of a new way of life.

## RESEARCH METHODS

While in China, I collected most of my data via interviews and observations of twelve individuals. Three interviews were done with café workers where our research advisor, Elena, aided as a translator. The other nine interviews were done with graduate students: two of the interviews were conducted on pairs of students and the seven others were done individually. The demographics of my interlocutors, to my knowledge, were: eleven raised in China and one raised in India, nine graduate students (two students from Renmin University of China, four students from Zhejiang University, and three students from Lanzhou University), one international student, three café workers, six male identifying and six female identifying, all of whom appeared to be in their twenties. The interviews ranged from about five minutes of impromptu conversation with the café workers to arranged interviews of an hour with the graduate students. I also interviewed the students over WeChat after returning to Washington state. WeChat proved to be a valuable research tool for me, not only giving me the opportunity to add students and chat with them while in China, but also to continue the conversation from the United States. Everyone I interviewed was interested in conversing with me and voicing their thoughts when I asked them questions. Notably, the difference I observed between Lanzhou university (LZU) and Zhejiang university (ZJU) is their English abilities. ZJU students were able to understand and respond with much more comprehensive English than the LZU students, therefore the interviews went much more smoothly for



both parties with the ZJU students than with the LZU students. Two of the students I interviewed are from Renmin University, and I happened to meet them at a café in Lanzhou. They were in town because they had just taken a major college exam at LZU. I was lucky to meet them and just as lucky that they spoke fluent English. Understandably, the interviews with the better English speakers proved to be more comprehensive than the interviews with those who understood very basic English.

In my research proposal I intended to do more in-depth examinations than I made in reality. The interviews were decidedly helpful for my research, hence I did not focus on observation as much as I had originally planned. The information I observed, however, I have as headnotes. Headnotes is the anthropological term for notes that are not written down but remain in memory. On LZU and ZJU campuses I noticed that many people whom we met had smartphones and almost all of them had WeChat, a popular Chinese multifunctional messaging app similar to Facebook Messenger. Since only one of us American students had phone data capabilities while in China, WeChat was a valuable way for us to connect with the graduate students on a day-to-day basis. It proved to be a valuable tool for us, now back in the United States, in order to continue communication with the students in China. Additionally, I observed that many of the middle school students whom we met in Suichang were eager to

add us on QQ, another major social media application in China; these students were excited to connect with us over social media. I think it is the culture of youth today, Chinese and American alike. Another observation I made at ZJU is of an institution near the university campus where students go to play virtual reality computer games. The building had about 50 computers mostly occupied by male students. Perhaps this is a way to institutionalize the room bound male community in a physical space. Despite there being an abundance of predominantly male players there was female presence as well. I think this observation could undermine some aspects of the room bound male phenomenon being studied by researchers because there are situations, as I observed, where students are not isolated in their rooms when playing these virtual reality games.

## FINDINGS

I went into my data collection with the intent of learning about the use of social media by Chinese students. Via my supportive interlocutors and further research my questions for university students on Chinese social media were answered. Social media connects many people in China from the cities to the remote rural areas; social media is social connectivity.

WeChat, QQ, RenRen, and Sina Weibo are among the most popular social media sites in China. QQ is an older platform, starting up in 1999 that still maintains popularity among young social media users today. QQ offers many options for users including, but not limited

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## WITH SOCIAL MEDIA SITES AND THE PROFILES OR AVATARS THAT CAN BE CREATED, THERE SEEMS TO BE A NEW WAVE IN DEFINING PERSONAL IDENTITY.

to, “text messaging, high-definition video calls (one-on-one and group), online and offline file transmission, customizable avatars, online games, [and] massive chat rooms” (QQ 2014). WeChat is like the younger sibling of QQ; WeChat is a newer platform that was launched by Tencent Inc., which is the same Internet provider that founded QQ. The platform launched in 2011 as Weixin but was later changed to WeChat in 2012, broadening its service to international users (Chao 2013). I would describe WeChat as Facebook messenger site with additional features like a newsfeed, games, and “people nearby”. RenRen launched in 2005 under the title “Xiaonei” before its current name was established. This platform allows users to create a profile much like that of Facebook. Individuals can create photo albums, upload videos, play games, listen and share music, all under the philosophy of “staying connected with old friends and making new ones” (RenRen 2014). Last but not least, Sina Weibo is a micro-blogging site similar to Twitter that launched in 2009 (Custer 2014). Its user-ship has been rocky over the past few years but some students whom I spoke with still use this platform (Custer 2014). These make up the widely used platforms that are well

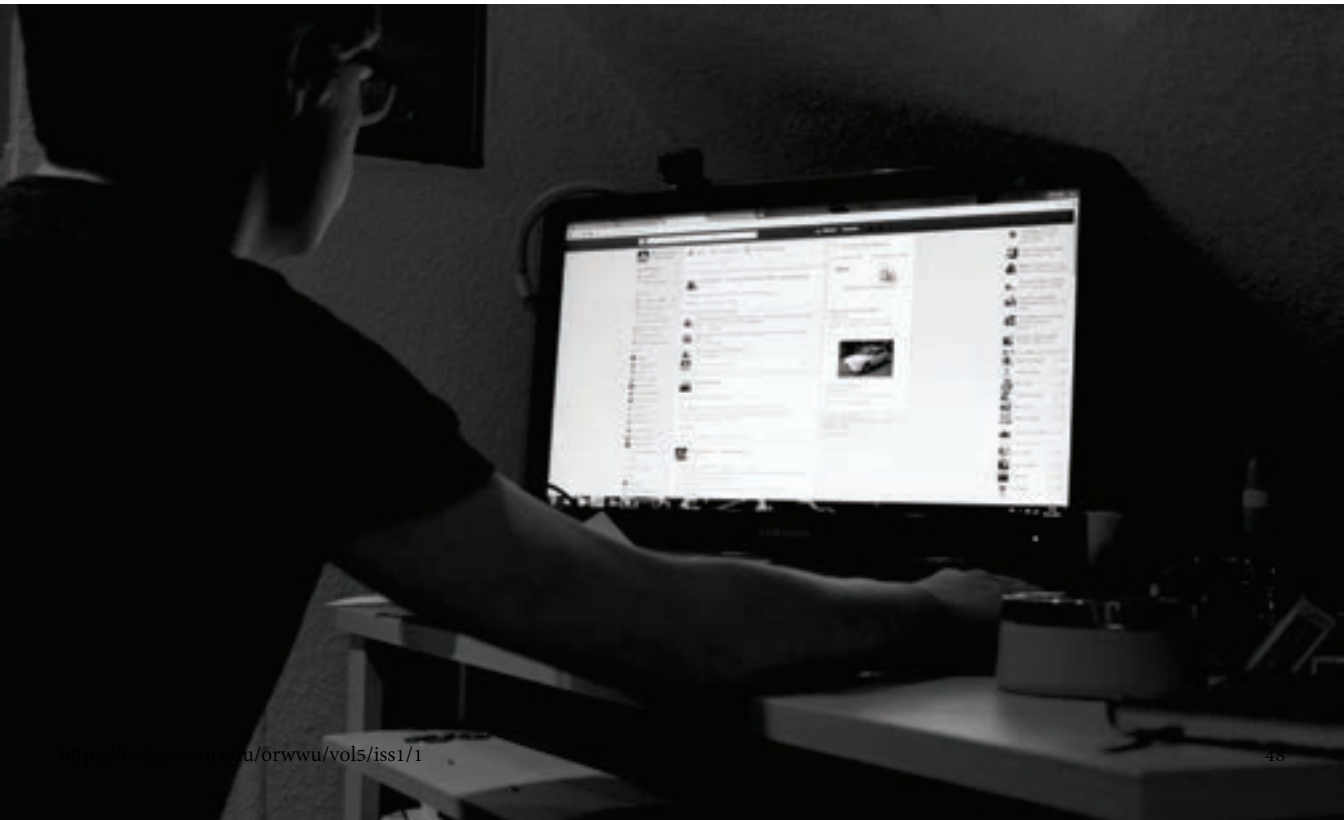
established among university students in China. Out of the four, QQ and WeChat seem the most popular among my interlocutors as they are fresh new media sites that offer the latest in social media technology. With such trending technology, students in China are not likely to pass up the chance to use platforms like these.

Initial inquiries to my interlocutors were circled around what they like to post on specific social media sites as well as what their friends like to post. The answers to this question give a sense of how people interact with their friends and followers on the various platforms. I received answers like “career plan” and “life philosophy”, “jokes [from] the internet”, “news”, things that “happen to me” or “my feelings”, when “something embarrassing happened” to them. Friends who are Ph.D. students post links to studies related to their research, articles and videos, and there are advertisements from friends promoting their products. There is a wide range of what people will post but it appears that all these things are about profiling oneself among others and staying connected to others via forwarding or sharing things that other people will like. In this way, university students maintain their friendships, “staying connected

with old friends and making new ones” as the RenRen philosophy proclaims. These students form their Internet identities, posting about career plans, life philosophy, and advertisements for their products. They create a sense of self with their personalized avatar as a social media profile. This idea of identity sparked the question of whether these students feel that people are narcissistic on their social media profiles. When asked this question there was some agreement among the students that there are “so many people” who are self-important supported by the statement that “lots of people like to post their selfies” on social media sites. Hu explains why he agrees that there is narcissism on social media: “so many people believe themselves are very important and they think others will pay more attention...[to their] feelings or ideas” on social media sites. As Jie pointed out, “too [many] selfies” seem to be the pinnacle of narcissism. This seems to be true on social media all over the world. Selfies are a worldwide trend, although according to Joy, another student, she refrains more than her friends. Just as in the United

States, students tend to want to express themselves in the best light possible over social media, either through their humor, achievements, knowledge, or their physical beauty. I think there may be a particular interest in defining yourself from the rest in China, contrasting with the older generation which had been more interested in collectiveness and the nail that sticks out gets pounded down type of mentality. With social media sites and the profiles or avatars that can be created there seems to be a new wave in defining personal identity. Although, as is made clear by these students, there are boundaries, such as posting too many details that are seen as adverse and narcissistic.

With all the excitement Chinese students feel toward these platforms, the topic of social media addiction is raised. How do the students view the amount social media their generation consumes? I asked the students whether they think there is social media addiction among university students. They were consistently in the



affirmative about social media addiction among students and were quick to use themselves as examples. Checking their social media platforms “often” and “every hour” is common, as Hu told me about his own use. Sherry explained to me that “students count on [social media] contact and communicate and [for] sharing”. There seems to be a growing reliance on social media like never before because it is the new media way to involve oneself socially. The students even feel that social media is replacing text messaging and talking on the phone. Jie expressed her regret that her and her boyfriend spend time on social media while waiting for food at the restaurant. She confessed, “that’s bad” and that she is “working on it” when it comes to her addictive behaviors toward social media. The many new applications on social media in China today perpetually raises a sense of urgency to know what is happening even when there are no notifications. Four of my interlocutors described themselves as “frequently” checking their social media, one of the main occasions being when they are bored. For students social media serves the purpose of entertainment as well as communication since many of the students look at their sites even when they were not prompted by notifications or any desire to post for themselves. They check their sites during downtime to see if there is something “funny” or “interesting” happening. It appears that these students are quite aware of their social media usage and the usage of other students.

When asked if something should be done about student social media usage in China, the students had a variety of answers. Sherry replied that “social media is everywhere in [their] life” and that social media brings

convenience, which is a positive outlook on its prevalent usage. She also suggested that students should avoid becoming addicted to social media by not counting on it for all communication, and perhaps people should be encouraged to meet in person and do more activities with friends and classmates. Her approach is to not avoid social media altogether, but to self-monitor one’s social media use and to encourage others to be physically social. Joy and Jie reflected on their own social media use and described the amount of social media use as a way in which people choose to “spend their time”. Joy blames social media addiction on people rather than the fact that social media is ubiquitous. Jie perceives that those who spend so much time on social media have little else to do, unlike her. Students seem to think that social media usage is to be controlled by the individuals themselves, although Sherry did have one suggestion. Social media has become a natural part of life and monitoring social media usage could be compared to monitoring your diet—everything in moderation. Jie acknowledged that social media can be distracting at times and she shared her method of “[putting] her phone away” when she needs to work or study. University students do not seem to be complacent about their social media usage but the desire to stay connected in the era of new media remains.

Social media platforms are widely used by university students in China, so I figured that students were likely to have opinions about censorship of social media. The further I delved into the topic of censorship the more I discovered about the relationship between the people and their government. What is important to know about this relationship between the people and the government is that it is not one of hatred; the Chinese students do not hate the government but given they are not completely satisfied, they are not interested in complete overthrow of the government as westerners may think. One student

from Zhejiang University told me that “western media simplifies the situation in China” in regard to the people-government relationship. It is not surprising that American media would sensationalize a complicated issue such as this seeing as the issue of freedom of speech is one that westerners hold dearly and are strongly opinionated about.

According to a journal article done by researchers at Harvard, “the Chinese censorship effort is designed to limit the freedom of speech of Chinese people” (King et al. 2014). Nevertheless, the more likely scenario is that “the Chinese censorship effort is designed to...reduce the probability of collective action” and incidentally “limits the freedom of speech of the Chinese people” as well (King et al. 2014). It is evident that one main goal of the Chinese government is to quell any collective uprising or demonstrations, which results in limited freedom of speech amongst the Chinese people. Still, I do not have the impression that the government wants to oppress their citizens into silence when it comes to political issues, rather they want to maintain a harmonious nation and maintain the one party government by defusing protest. The amount of people who are affected by censorship on social media sites is negligible.

Americans have freedom of speech, some of which have a tendency to abuse their right. Over social media, there is a continuous slamming of the president and the government in every way possible that is seems the important issues are not always addressed. As with the Affordable Care Act, people and the media were more focused on how the new healthcare bill is so thick in volume and about the website accessibility rather than what the act says and provides U.S. citizens. It seems that in some cases freedom of speech can create more drama than public action. Some Americans will talk constantly over social media about government but not always step forward and contribute time or money to any public cause.

From the perspective of Chinese students like Jie, social media is not a political platform but one where she can post funny cat videos and keep up with her friends on the “moments” feed of WeChat or the Qzone feed on QQ. She commented, “most ordinary people don’t express politics on SNS”. Jie herself would not express her political voice on social media as she believes “it is too hard to be neutral”. Her use of social media, like many American students, is to keep up with friends and sharing her non-political interests with them.

Another major question that I had for the university graduate students whom I interviewed was whether their professors use social media to interact with students and for what purpose(s) they use it to interact. From the literature review, I gathered information about a handful of universities in the United States that have tested social media such as Twitter as an educational application, creating a autonomous setting in which all students would

## **THE INTEGRATION OF SOCIAL MEDIA INTO THE CONTEXT OF EDUCATION SEEMS TO BE EMERGING IN AT LEAST TWO UNIVERSITIES FOR SOCIAL PURPOSES AND ONE FOR AD HOC EDUCATIONAL PURPOSES.**

get equal opportunity to participate beyond the hour to two hours allotted for a class session. However, I did not find any academic writing regarding Chinese students that focus on social media correspondence between professors and students. I asked my student interlocutors whether their professors use social media and if so, how they use it to correspond with students? The response I received from three of my interlocutors is their professors did use social media to correspond with students, and a fourth interlocutor said that they have never experienced inclusions of social media in the classroom. Sherry told me that “especially some young professors” use social media to communicate with students but for social purposes, not educational. However, when Jie responded to my question she said that her professors will “answer questions” including “math questions” over social media. She has experienced professors who use social media platforms for both social and educational purposes. The integration of social media into the context of education seems to be emerging in at least two universities for social purposes and one for ad hoc educational purposes. What is not happening, according to the information from my interlocutors, is the purposeful integration of social media by professors into the curriculum. Using

social media to spark academic discussion and to foster an academic community for university courses could be a very good thing. What does appear to be happening in China are ad hoc social and academic conversations between a few professors and students.

### **DISCUSSION**

Compared to the studies in the literature review for this research paper, the data collected for my research question are dissimilar in two main ways: the data were collected from interviews and by a university student versus by professional researchers. In my initial research of peer reviewed journals online I did not come across literature where an American university student collected data on student counterparts in China; a faculty-led study abroad creates unique circumstances and opportunities in and of itself. The literature focuses mainly on the perspectives of educators and researchers due to the fact that they are conducting the research. The data I collected are important additions to the current literature because the information is from the perspective of the users themselves. To compare the results from my data and that of the scholarly work mentioned in my literature review, there are very different focuses. The university student interlocutors have different interests than the educators who teach them. Moreover, the reality of the matter is that students, myself included, have different priorities than educators when it comes to social media.



## **PERHAPS THERE CAN BE A MERGER OF STUDENTS' SOCIAL MEDIA USE AND EDUCATIONAL POTENTIAL.**

In researching my question about social media in China, I found value in researching this topic from the perspective of a “digital native”. I do not know Mandarin, I do not know if I ever will, but I connected with students over social media. I can see students’ pictures, and I can translate their postings if it is not in English. Social media has features that allow people to transcend language barriers, especially with other “digital natives”. I realize that my research also has its limitations. Being in China for only a month is a limitation in and of itself, and I visited only two Chinese universities and a vocational college for less than a week. The time limitation means that I met with a limited number of interlocutors and because of the language barrier it was difficult to convey some ideas and questions. It worked well to write down my inquiries or to transcribe them over WeChat because Chinese students are highly capable of reading and writing in English. If I had done surveys perhaps I would have had a much higher quantity of responses but I felt from the beginning of my research that conversational interviews would create comprehensive and valuable data. I do not believe that my research is all encompassing by

any means. What it does is shed light on answers from a small portion of the human experience within China.

I think my data could benefit the future of social media and how it is designed to work for students as well as educators. Currently, Chinese educators and researchers are discussing issues with social media use (i.e. social media addiction). Perhaps there can be a merger of students’ social media use and educational potential. I think that future research could be spent examining the effect of social media on student participation in academic and extra-curricular activities. It would be compelling to see a new model in Chinese higher education integrating social media into the curriculum and for professor-student correspondence to promote further academic discussions and participation. Research on social media could help educators and students interact in the new media world by integrating social media into academia and steering conversations online. This discussion gives one contemporary perspective on social media and how it can be used for liberating controlled peoples. For my purposes, the article gave valuable information regarding China’s government and its future interests in social media.

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# AN ANALYSIS OF DIATOM GROWTH RATE

## AND THE IMPLICATIONS FOR THE BIODIESEL INDUSTRY

BY SARA SPITZER

### ABSTRACT

The need for an economically-feasible, carbon-neutral fuel source rises as rates of carbon emissions increase and climate change persists. Diatom biodiesel is currently being researched as a carbon-neutral alternative to petroleum. Biochemical engineering, a method utilized to increase lipid accumulation in microalgae for harvest, works by stressing algal cultures in order to bias their metabolism towards lipid (fat) production. Although Nitrogen (N) is the most common limiting-nutrient in research, Silicon (Si) is also vital to diatom cell growth and division, and therefore its limitation would also cause an accumulation of lipids in cells. In fact, Si-limitation has yielded higher lipid content in diatoms than N-limitation without any of the severe physiological damage, making it a prime candidate for biochemical engineering of microalgae biodiesel. Two different species of diatom, *Thalassiosira rotula* and *Coscinodiscus radiatus*, were cultured and grown in a silicon-deficient media (20 $\mu$ M-Si) and in a silicon-rich media

### BIOCHEMICAL ENGINEERING

A method utilized to increase lipid accumulation in microalgae for harvest. This involves limiting nutrients or manipulating environmental factors, such as salinity, temperature, pH and light intensity in order to bias the metabolism of the cells towards lipid production.

(80  $\mu$ M-Si) to observe how differences in environmental Si affected frustule1 size, diatom growth rates, and lipid accumulation. We also stained the cells with dyes to observe Si frustules and lipid content, then took photographs with a fluorescent microscope for qualitative analysis. Our results suggested that diatom species had a greater impact on growth rate than Si treatment. Since all diatom species have different rates of growth, Si uptake and metabolism, it could be more prudent to focus on which species of diatom, rather than which nutrient-limitations, are best suited for biodiesel production.

## INTRODUCTION

The combustion of fossil fuels has released more than 350 billion metric tons of carbon into the atmosphere since the beginning of the Industrial Revolution, and about 36% of that is a direct result of burning petroleum for transportation purposes (Levitan et al. 2014). This high input of carbon dioxide into the atmosphere over a relatively short period of time has had unintended negative consequences, such as global climate change, which has drastic effects on the world. We must develop an economically-feasible, carbon-neutral fuel to commercially replace petroleum (Levitan et al. 2014) in order to mitigate future effects of climate change. The production of biodiesel has been successful worldwide and is currently a hopeful source of renewable transportation fuels (Courchesne et al. 2009; Yang et al. 2014; Chisti 2008).

Although there is ongoing research regarding biodiesel, microalgae biodiesel is considered the only known option with the potential to completely replace petroleum-derived transportation fuels (Chisti 2008; Courchesne et al. 2009). It is noteworthy that algal lipids are a major contributor to the formation of petroleum (Levitan et al. 2014). Since our current fuel sources are partially derived from ancient algae, it stands to reason that an attempt to harvest the energy from lipids in living algae may be very successful (Levitan et al. 2014).

Biochemical engineering is a method used to maximize the accumulation of lipids in microalgae for harvest (Courchesne et al. 2009). This involves limiting nutrients or manipulating environmental factors, such as salinity, temperature, pH and light intensity in order to bias the metabolism of the cells towards lipid production (Courchesne et al. 2009; Coombs et al. 1967; Pal et al. 2011; Znachor et al. 2013). When the photosynthetic capacity of cells under stress is exceeded by the carbon supply, algae will synthesize energy-rich molecules (often lipids) in order to survive nutrient starvation or other growth-limiting conditions (Pal et al. 2011). Thus, the excess energy that would normally be used for growth or other metabolic processes is stored for later use during more favorable conditions (Pal et al. 2011). However, biochemical engineering is not without its drawbacks.

## THE PRODUCTION OF BIODIESEL HAS BEEN SUCCESSFUL WORLDWIDE AND IS CURRENTLY A HOPEFUL SOURCE OF RENEWABLE TRANSPORTATION FUELS.

Nitrogen starvation, the most popular experimental nutrient limitation, yields higher lipid content, but also severely limits cell growth and division (Yang et al. 2014; Pal et al. 2014; Coombs et al. 1967; Flynn and Martin-Jézéquel 2000; Levitan et al. 2014; Courchesne et al. 2009; Znachor et al. 2013). When it comes to nutrient starvation, the very mechanism that initially stimulates lipid production in cells will eventually lead to an overall decrease in lipid productivity due to severely impeded photosynthesis and cell growth (Pal et al. 2011; Coombs et al. 1967; Courchesne et al. 2009). In order to successfully produce microalgae biodiesel on a large scale, optimal growth rate and lipid accumulation must be attained. To achieve this end, and to produce biodiesel in a manner that is economically competitive with oil, less severe nutrient-limitation options must be explored across multiple algal genera to identify the best strains for biodiesel production (Levitan et al. 2014; Courchesne et al. 2009).

Diatoms are successful in oceans, have a relatively high resistance to pathogens, and tend to out-compete other algal species in cell cultures, giving diatoms favorable

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### FRUSTULE

The hard, silica-derived exoskeleton unique to diatoms (a type of algae).

## DIATOMS MAY BE HIGHLY FAVORED FOR BIODIESEL PRODUCTION BECAUSE THEY HAVE RELATIVELY HIGH LIPID CONTENT UNDER NORMAL GROWTH CONDITIONS

characteristics for the biodiesel industry (Levitan et al. 2014). Furthermore, in the 1980s, 3000 species of microalgae were screened for their potential to produce lipids, only 50 were deemed potentially fit for biodiesel production (Levitan et al. 2014). Of those 50 species, about 60% were diatoms (Levitan et al. 2014). Diatoms may be highly favored for biodiesel production because they have relatively high lipid content under normal growth conditions: about 15-25% of their cell biomass (Levitan et al. 2014). With nutrient and environmental manipulations, this percentage can be pushed as high as 61% dry weight (Levitan et al. 2014).

The hard, Si-derived exoskeleton unique to diatoms, known as the frustule, may be the key to their high lipid accumulation under stress (Annekov et al. 2013; Znachor et al. 2013; Leblanc and Hutchins 2005; Coombs et al. 1967; Martin-Jézéquel et al. 2000; Flynn and Martin-Jézéquel 2000; Levitan et al. 2014). Silicon must be absorbed from the surrounding seawater in order for it to be incorporated into diatom frustules (Annekov et al. 2013; Znachor et al. 2013; Leblanc and Hutchins 2005; Coombs et al. 1967). Therefore, silicate metabolism in diatoms is undisputedly linked to cell growth and division, making silicon a major controlling factor in lipid productivity (Coombs et al. 1967; Martin-Jézéquel et al. 2000; Flynn and Martin-Jézéquel 2000; Levitan et al. 2014). Interestingly, diatoms often accumulate more total lipids under Si-starvation than they do under N-starvation (Levitan et al. 2014). While Si-starvation disrupts the diatom cell cycle and reduces growth, the physiological damage is not nearly as severe as N-limiting conditions (Levitan et al. 2014). More experimentation with Si-limitation in diatoms must be completed in order to gain full insight into the extent to which biochemical engineering can be utilized for biodiesel production.

Again, two different species of diatoms, *T. rotula* and *C. radiatus*, were separately cultured and grown in both a silicon-poor media (20 $\mu$ M-Si) and a silicon-rich media (80 $\mu$ M-Si). We predict (1) that growth rates for cells in the 80 $\mu$ M-Si treatment will be significantly higher compared to the 20 $\mu$ M-Si treatment, independent of species, (2) that there will be a significant difference between the growth rates of *T. rotula* and *C. radiatus*, independent of Si treatment, and (3) that the difference in diatom growth rate observed between the 20 $\mu$ M-Si and 80 $\mu$ M-Si treatments will be significantly different between the two species. We also predict that cellular lipid content will be greater in the 20 $\mu$ M-Si treatment than in the 80 $\mu$ M treatment, independent of species. However, the overall lipid content will be higher in *C. radiatus* because it is much larger than *T. rotula*. We will first test each of the above hypotheses for equality, or as a null hypothesis. If we find that the data are statistically significant, then we will reject the null hypothesis and will note how each of the variables is statistically different, therefore accepting the above alternative hypotheses.

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**NULL HYPOTHESIS:** This is a hypothesis of equality used for statistics that postulates no statistical significance among given sets of data. In other words, the variation observed in a set of data is due to chance events rather than actual differences among the variable being studied. If the null hypothesis is accepted (or not rejected) then we are assuming that the data being compared are the same. If the null hypothesis is not supported by statistics (in this case, if there is a greater than 5% chance that the differences are NOT due to chance), then we reject the null hypothesis and move on to an alternative hypothesis.

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MATERIALS AND METHODS

Experimental Set-up

We inoculated six bottles with *T. rotula* (three replications for each Si media) and six other bottles with *C. radiatus* (3 reps for each Si media).

Data Collection

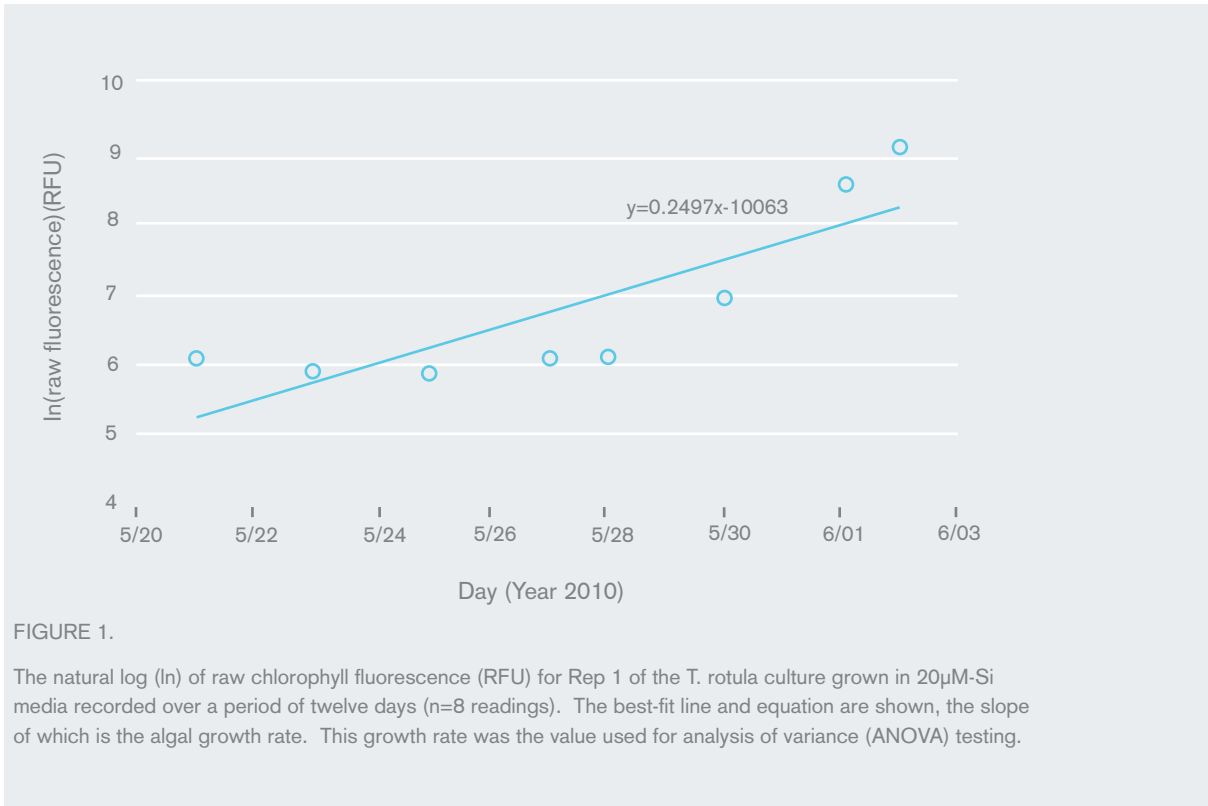
After each bottle was inoculated with cells, we took fluorescence measurements every one to two days for twelve days in order to observe the lag and exponential growth stages. Around day 10, the PDMPO stain for Si was prepped and added to the cultures on day 11 (Spillane 2014). Photographs were taken with a fluorescence microscope for each species/Si treatment combination.

RESULTS

We failed to reject our null hypothesis regarding growth rate observed in the 80μM-Si treatment compared to the 20μM-Si treatment, independent of species (Table 1). There was no significant difference in the growth rates observed between the 20μM-Si treatment and the 80μM-Si treatment alone (Table 1).

However, we rejected our null hypothesis regarding the difference between the growth rates of the two species (Table 2). The growth rate of *T. rotula* is significantly higher than that of *C. radiatus*, independent of treatment type (Table 2).

We rejected our null hypothesis regarding the differences in growth rates between the two species, dependent on treatment type (p-value=0.042) (Figure 2). The difference in diatom growth rate observed between the two treatments



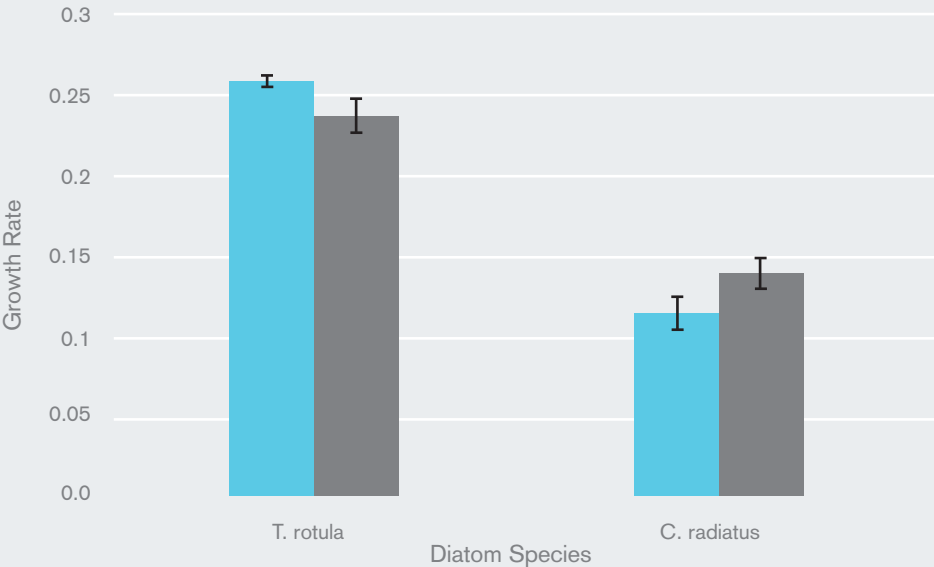


FIGURE 2. The observed mean diatom growth rate of *T. rotula* and *C. radiatus* cultured in 20µM-Si and 80µM-Si media with error bars indicating SE for n=3 replicates of each species/treatment combination.

	Treatment	Growth Rate
TABLE 1. The diatom growth rate (mean±SE) observed in n=6 replicates of the 20µM-Si treatment and n=6 replicates of 80µM-Si treatments, independent of diatom species. Analysis of variance (ANOVA) test results (indicated by lowercase letters) are shown.	20µM-Si	0.257±0.004 a
	20µM-Si	0.113±0.012 a
	80µM-Si	0.238±0.011 a
	80µM-Si	0.139±0.009 a
	ANOVA p-value	0.712

	Species	Growth Rate
TABLE 2. The diatom growth rate (mean±SE) observed in n=6 replicates of species <i>T. rotula</i> and n=6 replicates of species <i>C. radiatus</i> , independent of Si-treatment. Analysis of variance (ANOVA) test results (indicated by lowercase letters) are shown.	<i>T. rotula</i>	0.257±0.004 a
	<i>T. rotula</i>	0.238±0.011 a
	<i>C. radiatus</i>	0.113±0.012 b
	<i>C. radiatus</i>	0.139±0.009 b
	ANOVA p-value	p<0.001

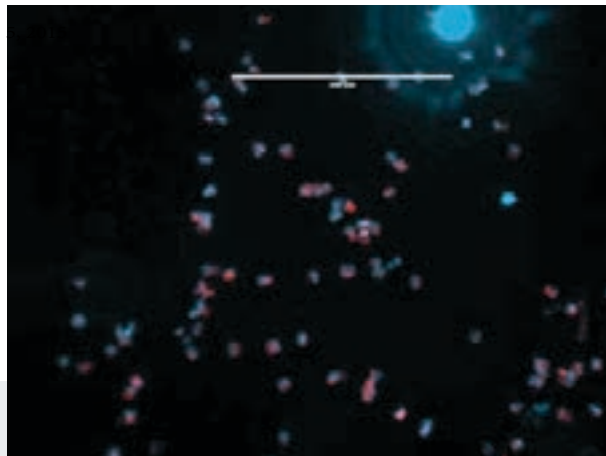
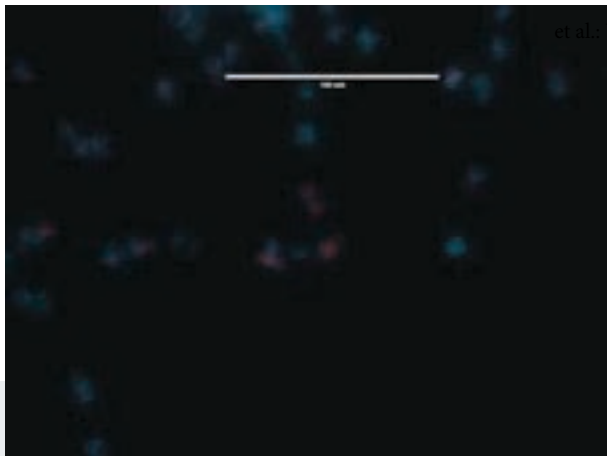


FIGURE 3.

Fluorescence microscopy photographs taken at 40x (left) and 20x (right) magnifications of natural chlorophyll fluorescence (red) and silicon frustules stained with PDMPO (blue) in *T. rotula* cultured in 20μM-Si media (left) and 80μM-Si (right). The scale bar indicates 100μm (left) and 200μm (right).

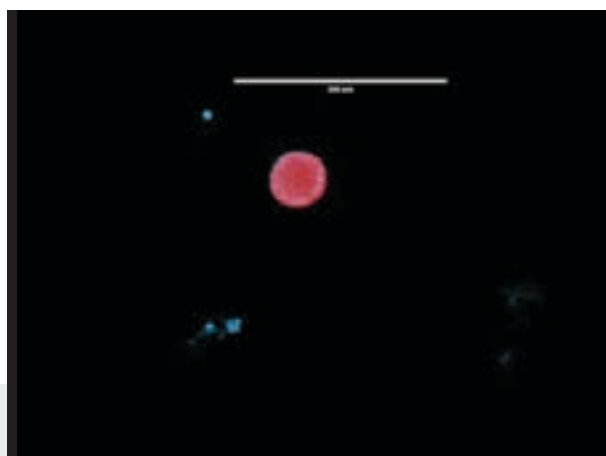


FIGURE 4.

Fluorescence microscopy photographs taken at 20x magnification of natural chlorophyll fluorescence (red) and silicon frustules stained with PDMPO (blue) in *C. radiatus* cultured in 20μM-Si media (left) and 80μM-Si (right). The scale bar indicates 200μm.

in *C. radiatus* was significantly higher than difference in growth rate observed between the two treatments in *T. rotula* (Figure 2).

It appears that there is less silicon present in *T. rotula* frustules grown in the 20μM-Si media than those grown in the 80μM-Si media (Figure 3). It also appears there is less chlorophyll fluorescence in *T. rotula* cells grown in the 20μM-Si media than those grown in the 80μM-Si media (Figure 3).

Similarly, it is difficult to say whether the growth of the diatom frustule in *C. radiatus* was reduced in the 20μM-

Si solution compared to the 80μM-Si (Figure 4). However, it appears that there is reduced PDMPO fluorescence, and therefore less silicon present, around the exterior of *C. radiatus* frustules grown in the 20μM-Si media than those grown in the 80μM-Si media (Figure 4). Nothing conclusive can be said about chlorophyll fluorescence in either treatment (Figure 4).

There is a higher lipid content in *T. rotula* cells grown in the 20μM-Si media than those grown in the 80μM-Si media (Figure 5). It also appears that there is less chlorophyll fluorescence in *T. rotula* cells grown in the 20μM-Si media than those grown in the 80μM-Si media (Figure 5).

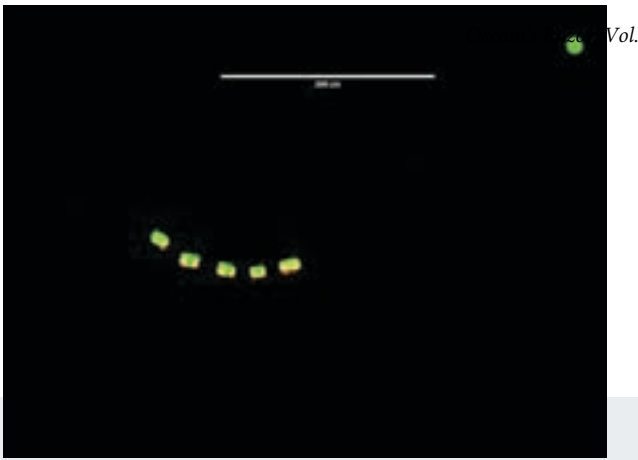


FIGURE 5.

Fluorescence microscopy photographs taken at 20x magnification of natural chlorophyll fluorescence (red) and lipids stained with bodipy (green) in *T. rotula* cultured in 20µM-Si media (left) and 80µM-Si (right). The scale bar indicates 200µm.

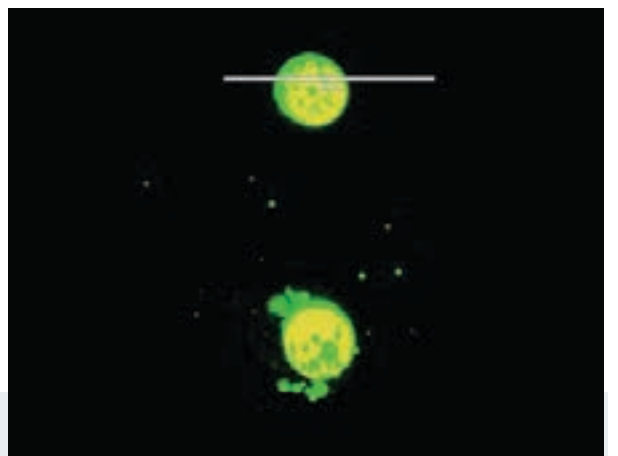
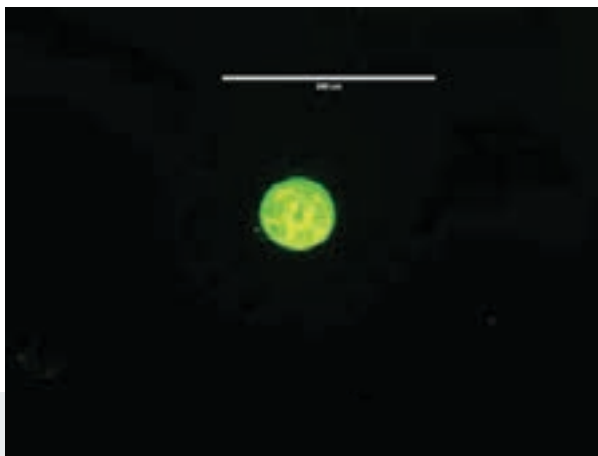


FIGURE 6.

Fluorescence microscopy photographs taken at 20x magnification of natural chlorophyll fluorescence (red) and lipids stained with bodipy (green) in *C. radiatus* cultured in 20µM-Si media (left) and 80µM-Si (right). The scale bar indicates 200µm.

It is difficult to say whether there is higher lipid accumulation in *C. radiatus* grown in the 20µM-Si solution compared to the 80µM-Si (Figure 6). Nothing conclusive can be said about lipid content in either of the treatments (Figure 5). It does appear, however, that there is less chlorophyll fluorescence in *C. radiatus* cells grown in the 20µM-Si media than those grown in the 80µM-Si media (Figure 5).

The overall lipid content of *C. radiatus* seems higher than the overall lipid content of *T. rotula* (Figures 5 and 6). However, we were unable to determine the magnitude of this difference and whether or not it was significant.

## DISCUSSION

We evaluated changes in growth rates as well as visual differences in diatom frustules, chlorophyll content, and lipid content between both species type and the growth limiting (20µM-Si) or non-limiting (80µM-Si) Si treatments. Unexpectedly, there was no difference in growth rate based solely on Si content. This means that, considering the Si media alone, all diatoms grew at the same rate, even though one treatment was supposedly growth-limiting while the other was not. This result is inconsistent with current literature, which states that Si is a major limiting

## ALL DIATOMS GREW AT THE SAME RATE, EVEN THOUGH ONE TREATMENT WAS SUPPOSEDLY GROWTH-LIMITING WHILE THE OTHER WAS NOT.

factor in diatom growth, especially when it comes to cell division (Coombs et al. 1967; Martin-Jézéquel et al. 2000; Flynn and Martin-Jézéquel 2000; Levitan et al. 2014). Martin-Jézéquel et al. (2000) observed a large uptake of Si in diatoms immediately preceding cell division in order to adequately form new frustule valves. In fact, all components of the frustule are deposited around the time of cell division (Martin-Jézéquel et al. 2000). This suggests that diatoms may not be able to divide as often without sufficient Si for frustule formation. Research conducted by Coombs et al. (1967) supports this idea, as they observed a reduced growth rate in Si-starved cells. Although most literature agrees that nutrient deficiency decreases microalgae growth rates, including Si in diatoms, Levitan et al. (2014) declares that Si-starvation is not nearly as physiologically damaging to diatoms as other nutrient deficiencies, namely N. We may not have observed differences in growth rates based solely on Si treatment because Si-starvation did not affect diatom growth rate as much as anticipated. If this is true, even though 20 $\mu$ M-Si is considered growth-limiting and 80 $\mu$ M-Si is considered non-limiting, there may not have been enough of a discrepancy in the Si treatments to observe clear differences in diatom growth rates. Another potential reason we may not have seen a difference was because our method of gathering data was not sensitive enough. For example, if we had analyzed cell count data over time we may have seen different trends. In addition, it is a possibility that differences in growth rates would have been observed if we had recorded data over a longer period of time, potentially until cells hit their deceleration or stationary growth phase.

Either way, *T. rotula* grew twice as quickly as *C. radiatus*. *T. rotula*'s smaller cell size, about 25 $\mu$ m in length compared to *C. radiatus*' 75-100 $\mu$ m diameter (Figures 4 and 5), may allow

it to divide at a higher rate. These results suggest that the Si treatment may not be as important in determining cell growth and metabolism as the specific species of diatom. The individual cell cycle, metabolism, and Si needs of each diatom species may have more of an impact on growth rate than the Si available in the environment. Consistent with this supposition is our finding that the change in growth rate between the 20 $\mu$ M-Si and 80 $\mu$ M-Si treatment was higher in *C. radiatus* than in *T. rotula*. Potentially, this difference is due to the large cell size of *C. radiatus*, which may require more Si than the smaller frustules seen in *T. rotula*. Martin-Jézéquel et al. (2000) observed that cell size as well as frustule thickness can contribute to the extent of silicification in diatoms and Levitan et al. (2014) observed variations in diatom metabolism, such as cellular lipid content. This result further supports the idea that the species of diatom, and the specific metabolic needs associated with that species, has more of an influence on growth rate than does Si availability. If this is so, it has important implications for the biodiesel industry, which will be discussed in the conclusion.

In the fluorescence microscopy photographs of *T. rotula*, we observed a reduction in the Si frustule and chlorophyll content of the cells cultured in the Si-limiting treatment; while cellular lipid content seemed to be higher in the limiting-treatment compared to the non-limiting treatment. This was expected and is consistent with the literature. When diatoms are grown in unfavorable conditions, such as a Si-limited media, reduced rates of growth and photosynthesis are observed as well as a negative net synthesis of chlorophyll, while lipid production increases as a means of storing excess energy for later use (Coombs et al. 1967; Yang 2014; Pal et al. 2011; Martin-Jézéquel et al. 2000). Reduced Si frustules were observed because there was less Si in the media for



the cells to absorb. We observed reduced chlorophyll in the Si-stressed cells because their photosynthesis rates decreased, rendering a positive net production of chlorophyll unnecessary. Since the cells could not grow or perform normal metabolic processes, they stored the unused energy as lipids, resulting in the higher lipid content observed in the 20 $\mu$ M-Si treatment. It would have been preferable if both of these photographs had been taken at the same magnification with similar resolutions so that more accurate comparisons could be made between them.

In the fluorescence microscopy photographs *C. radiatus*, we observed a reduction in the exterior edges of the Si frustules and chlorophyll content of the cells cultured in the Si-limiting treatment, but were unable to draw any conclusions about the differences in lipid content between the two treatments. The reasoning for the reduced frustule and chlorophyll are the same as stated above. Since reduced frustule and chlorophyll content is indicative of reduced cell growth, we can infer that the lipid content of the cell in the Si-limiting treatment was higher than that of the non-limiting Si treatment. It is important to note that all of the above interpretations regarding the fluorescence microscopy photographs are based off purely visual, qualitative data and therefore are not backed by statistics. The diatoms in this study are three-dimensional cells. Since the photographs taken by the microscope only offer a two-dimensional view, they will not be an entirely accurate representation of the cells; we hope this has not altered our results severely. Our data would have been more concrete and conclusive if we had been able to perform a quantitative analysis, such as mass spectrometry.

## CONCLUSION

Perhaps the most important conclusion drawn from our data is that the diatom species has more of an influence on growth rate than does Si limitation. As mentioned above, this has important implications for the biodiesel industry.

## SI TREATMENT MAY NOT BE AS IMPORTANT IN DETERMINING CELL GROWTH AND METABOLISM AS THE SPECIFIC SPECIES OF DIATOM.

If different morphologies and metabolic rates are unique to each diatom species, then it stands to reason that maximum lipid accumulation is also unique to each species. Therefore, it is more prudent to focus research efforts on determining which diatom species are most suitable for commercial biodiesel production rather than which nutrient-limitation will produce the highest lipid content (Levitan et al. 2014).

Currently, biodiesel is not competitive with oil in terms of cost-effectiveness; significant economic challenges must be overcome before the large-scale production of biodiesel becomes feasible (Levitan et al. 2014; Courchesne et al. 2009). However, the benefits of a successful biodiesel industry, such as a carbon-neutral fuel source, carbon dioxide mitigation, waste heat utilization, and other novel bioproducts, make this a worthy cause (Courchesne et al. 2014). To overcome these economic obstacles, other methods of increasing lipid accumulation must be identified and extensively researched. In this experiment, we focused on biochemical engineering as a method of increasing lipid production in diatoms, but there are two other methods currently in their infancy. The first, genetic engineering, involves altering the algal genome to achieve the overproduction of lipids (Courchesne et al. 2009). While only a few studies have been published

using this method, genetic engineering has been shown to successfully increase lipid production in diatoms (Levitan et al. 2014). The second method is transcription factor (TF) engineering. TFs are proteins that recognize specific DNA sequences and can either cause or prevent the expression of the gene(s) with which they are associated (Courchesne et al. 2009). The concept of TF engineering involves overexpressing TFs known to up- or down-regulate the pathways involved in the production of lipids (Courchesne et al. 2009). This approach has had success by demonstrating improved production of valuable metabolites (Courchesne et al. 2014). Both genetic engineering and TF engineering are promising methods of lipid overproduction in the long-term perspective (Courchesne et al. 2009; Levitan et al. 2014). The next step in microalgae biodiesel research is to determine which diatom species and methods yield the highest cellular lipid content. It may be valuable to attempt to combine methods in order to efficiently produce the highest lipid yield possible. A combination of two or three of the above methods could potentially be the most productive way to continue biodiesel research. The more methods we test, the closer we come to replacing petroleum transportation fuels on a large scale.

### ALTERNATIVE HYPOTHESIS

This is a hypothesis of inequality used for statistics that postulates a statistical significance among given sets of data. In other words, the variation observed among a set of data is not due to chance events, but rather is due to actual differences among the variable being studied. If the alternative hypothesis is accepted (or not rejected), then we are assuming that the data being compared are statistically different in some way.

### LAG PHASE

A stage of bacterial growth where no apparent cell division is occurring, but the bacteria are undergoing physiological changes to promote cell growth due to favorable conditions.

### LOG PHASE

A stage of bacterial growth in which favorable conditions result in exponential colony growth via cell division.

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