

OUR Journal

Oregon Undergraduate Research

Volume 8, Issue 1, Spring 2014





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Cover Art—“Skull Print”

Kathleen Darby, Digital Arts

Much of my artwork implements fine art techniques with scientific themes. Growing up with scientist parents I was exposed to artifacts and scientific tools as a child. I try to incorporate these themes into my regular artwork. I feel that doing so bridges the gap between the scientific and the art worlds. This skull drawing was created with colored pencils.





Letter from the Editor

Charlotte Rheingold, Comparative Literature*

Welcome to the eighth issue of the Oregon Undergraduate Research Journal. As a graduating senior, I could not be more proud to have been a member of *OUR Journal* for the past three years and to advocate for the rich undergraduate research activities at the University of Oregon. My time working on the Editorial Board has shown me the importance of undergraduate research and the vital role it plays in the educational journey of students. I never tire of seeing the immense creativity and dedication shown by student researchers like the authors featured in this issue, whose exceptional work represents disciplines as varied as Economics, Creative Writing, Comparative Literature, History, Astronomy, and Environmental Studies.

However, the most rewarding aspect of being part of *OUR Journal* has been working with the Editorial Board, which is where I have learned the most about the power of collaborating with my peers. Our eight graduating seniors this year will be greatly missed as each of them has contributed immensely to our work. I would like to specially recognize Mari Saif and Janelle Croy for their three years on the Editorial Board and the initiative they consistently showed. In addition, I would like to thank Michelle Nguyen, Gavin Cronkrite, Nayeon Kim, Ben Leamon, Macey Davis, and Andrew Swift for the commitment they have shown to both *OUR Journal* and to supporting undergraduate research during their time on the Editorial Board.

Beyond the Editorial Board, *OUR Journal* receives generous support from across campus. I would like to personally thank our faculty advisors Barbara Jenkins and Kevin Hatfield for their continuous guidance and their invaluable mentorship. I would also like to show our great appreciation for the Dean of Libraries, Adriene Lim, who graciously wrote our guest editorial.

I am excited for you to delve into this issue so that you can see for yourself the exceptional research conducted by University of Oregon Students. Enjoy!

*Charlotte Rheingold is a senior Clark Honors College student graduating with a degree in Comparative Literature, with minors in French and Economics. She has been on the Editorial Board since Winter 2013 and served as Chief Editor since Spring 2014. After graduation, she will work abroad as an *assistante de langue* with the Teaching Assistantship Program in France (TAPIF).



Guest Editorial

Adriene Lim, Ph.D., Dean of Libraries and Philip H. Knight Chair

“Knowing is not enough; we must apply. Willing is not enough; we must do.”

~ Bruce Lee

Some of us have read by now the scathing critique of Cornel West, published this year by Michael Eric Dyson in *The New Republic*. In his article, Dyson, a best-selling author and a professor of sociology at Georgetown University, characterizes West as having undergone a “pronounced and decades-long scholarly decline.” Among other factors, Dyson points to the arguable paucity and lack of originality of West’s written output since his book *Race Matters* was published in 1993, and he presents this as evidence of West’s diminished impact as an intellectual. According to Dyson, West recycles his old ideas in bouts of impassioned oratory. Yet, it is the writing that matters in scholarly discourse and there is far too little of it coming from West these days, in Dyson’s view.

There are many reasons to be both intrigued and troubled by Dyson’s polemical essay, but I believe at least one of his points rings true: “Writing demands a different sort of apprenticeship to ideas than does speaking.” In my opinion, excellent research and scholarship require a deep commitment to the arduous practice of writing, a dedication to the distilling of ideas and crafting of words. This can be intimidating even for the most experienced among us. The written works we produce can carry more weight in the scholarly world than other forms of communication. This in turn demands a high standard of academic integrity and honesty to which we must adhere. Scrutiny and criticism should be expected and welcomed in this exchange; yet it does take courage to make one’s ideas so vulnerable in the real world.

Every time I write, I face the blank page in front of me with humility and wonder. How can I convey my thoughts in the most cogent, meaningful, and effective language possible? As Dyson affirms, the act of writing compels us to revisit our concepts, hone our words, revise and repeat this process again and again in order to communicate ideas worthy of the endeavor. The process can be difficult and frustrating, yet many are compelled to participate in it anyway, despite the risks. Why is this the case? I suspect that contributors to *OUR Journal* will agree with my take, that what keeps us engaged are the exhilarating effects that come from the practice of writing when it is fruitful. It can lead to joyful discovery, the thrill of producing a beautiful new piece, the headiness of generating an original theory. Learning how to share our experiences and ideas successfully with others seems to make the endless hours of practice worth it.

The inscriptions over the east and west doors of the University of Oregon’s Knight Library read: “Ye shall know the truth” — “And the truth shall make you free.” These are lofty statements, but we cannot realize them without hard work and perseverance. We join a “conversation” within

our disciplines and professions when we contribute to the scholarly literature. The voices in that discussion are represented in seemingly countless articles, treatises, and books available within and beyond the library. Thus, the act of writing requires the companion act of critical reading, in my perspective. Copious reading inspires, informs, and nurtures the strenuous practice of writing. When we aim to create new knowledge and contribute to the discourse, I believe we must deliberately invest in more time for reading and contemplation to understand the contexts in which we think, make connections, and see new relationships. There is pleasure and satisfaction in this practice of reading, in strengthening our intellectual capacity, just as a marathon runner endures rigorous training to prepare her mind and body for the next race.

The written word, once contained in the scholarly literature, helps us expand our stores of knowledge for humankind. As a librarian, I value all parts of this fascinating ecosystem, the process and the products, and I welcome the opportunity to add your scholarly works to our collections one day. I hope you think of librarians as your partners and guides as you navigate this complex world, now and in the future. The library writ large can be a catalyst for your reading and writing practice; it can serve as your intellectual home in the many days of exciting inquiry still ahead.



Art Feature—“Cryographics Series”

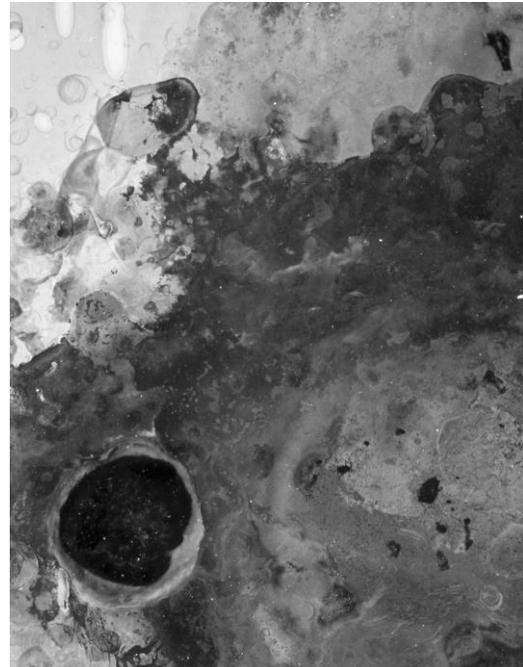
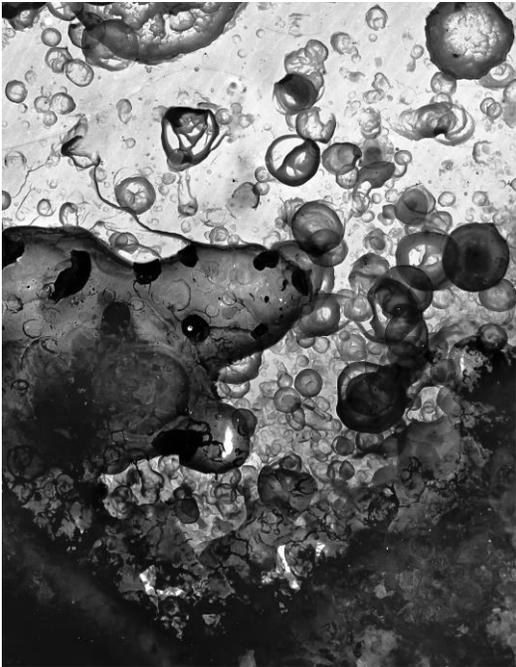
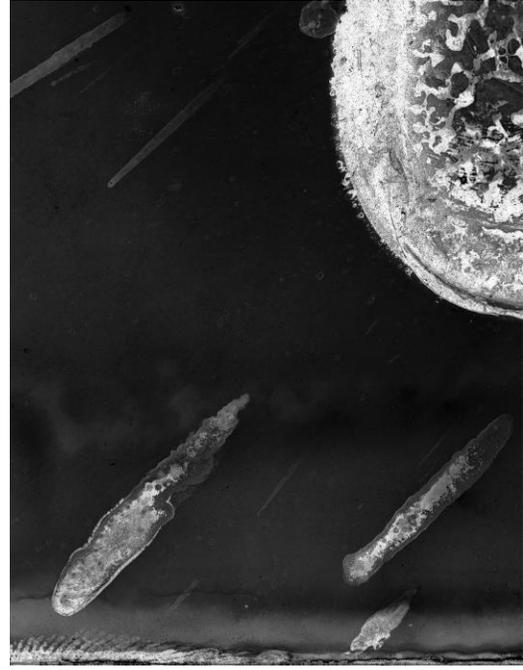
Katherine Carlson, Photography*

In my work I explore different routes of visualizing information and investigate the nature of how we see, integrating my scientific education into my fine arts practice. I question the way in which a photograph can operate, focusing on the potential interaction between the observer and the image. The act of seeing has as much to do with the past as the present; memory can command what an individual might perceive, subtly directing present thought.

In my Cryographics series, I consider the phenomenon of pareidolia and how it affects our interpretation of abstract visual information. It manifests in our ability to recognize faces and important information, leading us to view things such as electrical sockets as small, surprised faces. Operating through memory and genetic predisposition, it allows us to see similarities between random stimuli and things that are familiar; if, however, an individual is presented with abstract imagery, what might they see? I select small portions of visual information created through manipulating the surface of wet-plate photographic emulsions. By confounding scale and reference for the viewer, these photographs transcend what they actually depict: the play of ice, light, and air upon a pane of silvered glass.



*Katherine Carlson is an artist living in Eugene, Oregon. Currently pursuing a BFA in Photography at the University of Oregon, she also holds a B.S. in Biology and a B.A. in General Art. She specializes in alternative photographic processes, but also engages with text, performance, and any other medium that best illustrates her ideas. Fascinated by the many facets of vision, memory, and illusion, she uses art to explore the divide between physical and mental experience. Her work can be found online at www.katherineanncarlson.com.





Meet the Editorial Board

Members of 2014-2015 Academic Year

GAVIN CRONKRITE

Gavin Cronkrite is a graduating senior studying History with minors in Spanish, Business and Rhetoric. Upon graduation he will be following the Grateful Dead around the country.

JANELLE CROY

Janelle is a Senior and UO Presidential Scholar with majors in Accounting, Mathematics, and Economics. An editor for the Oregon Undergraduate Research Journal since Spring 2013, she also volunteers for the Prefontaine Classic premier track meet in Eugene, has worked as an Economics research assistant, and was selected as the UO Top Accounting Student of 2015. Janelle enjoys being a part of *OURJ* because she gets to read, review, discuss, and help showcase excellent undergraduate research at the UO.

MACEY DAVIS

As a Psychology and Religious Studies, senior, Macey has worked in psychology research for the past few years, and finds it important to explore the connections between internal reasoning and behavior. She thinks *OURJ* is great because it gives students a lens into the world of research writing in a supportive, helpful, and fun way. It is important to be able to have this kind of academic outlet because it provides a bridge between student research and higher level academic work for those who want the experience and have goals towards higher level research.

SANDRA DORNING

Sandra is a sophomore majoring in Marine Biology primarily interested in the field of marine conservation ecology. She is currently developing a research project in which she will study the ecology of a specific hydroid (sessile jellyfish) species in the Coos Bay. Sandra finds that the most special thing about *OURJ* is how it turns undergraduate research projects into published, public information. She believes that the true value of research comes from how newly discovered or synthesized information is shared with others, because from there that information can be used to make decisions, change perspectives on history, or even save lives.

AIDAN GREALISH

Aidan Grealish is a sophomore Digital Arts major and Organic Chemistry minor in the Clark Honors College. She is interested in new media and communication design in health care applications, and hopes to pursue an MD/PhD degree after her time here at the UO. In her free time Aidan likes to read comics, listen to podcasts, and whenever possible, play with her dog.

She is excited to celebrate interdisciplinary research and promote accessible scholarship as part of the *OURJ*.

NAYEON KIM

Nayeon is a senior graduating with majors in Romance Languages and History, with a minor in political science. Her research interests include Latin American dictatorships, mass incarceration and racial injustices. She thinks undergraduate research is important because it encourages students to collaborate intellectually, engages our unique perspectives, and keeps us thirsty for knowledge.

BEN LEAMON

Ben is a graduating senior in the Clark Honors College majoring in Geography. His research interests include Asian foodways and Japanese language. After graduation, Ben will teach English in Japan with Interac for the 2015-2016 school year.

MICHELLE NGUYEN

Michelle graduated in Winter 2015 cum laude with departmental honors with a B.S. in Human Physiology. She is currently traveling around Vietnam visiting family, and she is in the process of applying to medical school.

MARI SAIF

Mari will graduate this spring with a post-bachelor's degree in Chemistry. Her research interests focus on Spectrometry (Physical Chemistry). As part of the Marcus Group, Mari studies the structure and dynamics of macromolecules in biological environments. These include the diffusive motions and internal structural changes of proteins in membranes and in living cells, as well as the conformational fluctuations of macromolecular machines that interact with and manipulate DNA. She thinks that the *OURJ* plays an important role in helping undergraduate researchers publish their independent, in-depth research. It is a significant achievement and it provides me a means to help celebrate their hard work.

ANDREW SWIFT

Andrew is a graduating senior majoring in sociology and psychology. After graduating he will be selling his labor power as a research assistant, but eventually hopes to find work as an underpaid graduate student. He would describe being an editor for the *OURJ* as "pretty great".



A Reality in Question: Negotiating Realism and Storyworld Construction in James Ward Byrkit's *Coherence*

Valtteri Leinonen, Comparative Literature*

ABSTRACT

This paper examines how the film *Coherence* (2013), directed by James Ward Byrkit, challenges foundational conceptions of its diegetic reality as held by the film's viewer. The discussion centers around a cognitive narratological analysis of the events that help define the storyworld constructed for the film. Included in the analysis is consideration of *Coherence's* realist aesthetic which is used as a contrasting plane to the film's unfurling science-fiction premise of parallel universes. It is posited that realism is a mode which can be applied in a variety of ways, regardless of a film's genre, subject matter, or sociopolitical motivation. In *Coherence's* case, the mode is used to complicate storyworld construction for the viewer and thus engage him/her more closely in the viewing experience. The paper's principal contention involves cognitive frame systems which the viewer uses to process *Coherence's* diegetic reality. By negotiating opposing theories of Manfred Jahn and Marina Grishakova, the paper argues for a frame system which is defined by a single primary frame, allows multiple conflicting frames, and is generally respectful of the comprehension needs of a narrative. Agreement in frame systems and the basics of narrative comprehension, it is concluded, grounds interpretation and discussion of film altogether in a necessary way.

INTRODUCTION

In James Ward Byrkit's *Coherence* (2013), a group of middle-aged friends gathered for a dinner party are forced to deal with an inexplicable phenomenon of parallel universes appearing to intersect. With the amount of affirming evidence and strange occurrences increasing, the group goes about figuring out the nature of the phenomenon in unison. This paper looks at the way *Coherence* draws its viewer into a comparable state of speculation and eventually into revising his/her understanding of *the diegetic reality* – the fictional world presented by the narrative.

The two opening sections of the paper serve to establish the key discursive threads to follow. The first section investigates how *Coherence*, even though a science-fiction film, relates to the category of *realism* through its aesthetic approach. At its most concise, realism in film strives for a "direct and truthful view of the real world" (Hayward 298; Konigsberg 285). The establishing contention is that *Coherence* is disinterested in presenting such a view but still utilizes a realist

*Valtteri Leinonen has been studying at the University of Oregon as an exchange student for Fall Term 2014. For the rest of the school year, he returns to his native Finland to complete his bachelor's degree in Comparative Literature at the University of Tampere. He is considering applying to graduate school to study film. Please direct correspondence to leinonen.valtteri.e@student.uta.fi.

aesthetic of its own. The second section introduces the cognitive method used later in an analysis of *Coherence*'s narrative structure. Adapted from Menakhem Perry's literary dynamics, the method involves speculation of hypotheses and basic mental models – *frames*, which bundle and explain information – constructed based on narrative events.

The following two sections, in turn, are built around said analysis. The analysis focuses on the narrative events which most forcefully prompt a re-evaluation of the diegetic reality, a change in *storyworld*. Storyworld refers to the viewer's attempt to explain the nature of the diegetic reality with a cognitive frame as effectively as possible. *Coherence* complicates storyworld construction with its emerging, parallel universes. To comprehend the film, the viewer is even required to form two conflicting storyworld frames at once, a "reality frame" and a "supernatural frame." Interwoven with this analysis will be discussion of the realist aesthetic and its role in storyworld construction. On the matter, this paper posits in culmination that realism is a mode which can be evoked regardless of a film's subject matter or degree of social involvement. *Coherence* is exemplary of the mode's unrestricted possibilities: its realist aesthetic tries above all to engage the viewer's cognitive processing, rather than enforce a "truthful view" of any kind.

The paper's main theoretical conclusion will be explored in the fifth and final section. Based on processing a challenging storyworld like *Coherence*'s, it is argued that a flexible *frame system* is needed – one that allows conflicting frames and adheres to the comprehension needs of a given narrative. A frame system describes the manner with which frames exist and relate to one another in the viewer's mind. Frame systems proposed by Manfred Jahn and Marina Grishakova will be introduced in the analysis sections and negotiated in the final section. The negotiation and subsequent conclusion strive to ground interpretation in general, as it is in essence built on narrative comprehension and related cognitive processing.

CONTENDING A REALIST AESTHETIC FOR A FUNHOUSE FILM

Associating *Coherence* with realism might seem grossly counterintuitive. Best described as an independently produced science-fiction mystery, the film's mere genre tag seems to suggest an indifference to depicting *the material reality* as it is. According to Ira Konigsberg, representations of the material reality, the outside "real world" (Konigsberg 285), should "heighten... consciousness" (285) and explore social problems (286). These are some basic tenets of realism in film, and they largely do not align with the specific aims of *Coherence* that are shaped by the film's genre. With a mystery story comparable to a "funhouse" (Tobias) in the words of its director James Ward Byrkit, *Coherence* fits neatly into the relatively recent wave of low-budget American science-fiction films. These films include titles such as Shane Carruth's *Primer* (2004) and *Upstream Color* (2013) as well as Mike Cahill's *Another Earth* (2011). Applicable to all the films in question are Byrkit's production goals of "making the most of simple locations" and "giving a very cosmic feeling to the most mundane circumstances" (Tobias). Inspiration for the goals and *Coherence*'s story is assumed in particular from the classic sci-fi television series *The Twilight Zone* (1959-1964) (Tobias). In their foundation of simple locations and mundanity, the production goals do in fact approach a kind of utilitarian relation with the material reality. Indeed, by taking a closer look at *Coherence*'s production history, it may become apparent as to why a designation

of realism, or at least one that describes the surface-level of film style, might be relevant in discussing the film.

Coherence was conceived by Byrkit and his creative partner Alex Manugian with an improvisational concept in mind. The film was to be shot with a small crew and in sequence over five days at Byrkit's house. Its cast of eight actors (minus Manugian who plays the character of Amir) was not made aware beforehand of the plot's carefully thought-out trajectory involving alternative universes. Instead, the actors were prompted to react to their surroundings and to each other with only an outlined knowledge of individual character motivations (Tobias). Of shooting with such an unconventional approach, Byrkit has said:

You're improvising along with the actors as a director, and cameraman. My DP, Nic Sadler, and I told them, "You can go anywhere you want in the house and we'll follow you. We're not going to rehearse it or block it." We just treated it almost like a documentary unfolding in front of us. (Lattanzio)

The improvisational concept described by Byrkit suggests an accentuated presence of the film crew in the middle of the filmed action. Such a presence has a stake in *Coherence*'s realist aesthetic which will be outlined in this section by means of close watching a scene from the film.

Before advancing to the stylistic analysis of *Coherence*, however, it is necessary to cover better the theoretical foundations regarding realism in film. This means referring to the widely influential 1945 essay "The Ontology of the Photographic Image" by André Bazin. In his essay, Bazin confluences the mediums of photography and film, as they are related by overlapping histories of technology and innovative thought. Bazin claims that together the mediums "satisfy, once and for all and in its very essence, our obsession with realism" (*What is Cinema* 12). According to Bazin, it is the automatic production method which affords photography an unparalleled credibility compared to other visual arts. Free from subjective human intervention, "we are forced to accept as real the existence of the object reproduced" (13). Cinema repeats the same act of undeniable reproduction but, unlike photography, does it spanning time (14). Here, regardless of the language inclusive of the observing subject ("our obsession" and "we are forced to accept," respectively), Bazin accounts realism to be an inherent quality of the image itself.

In another essay, Bazin makes it a point for his theory to accommodate technological advancement, venturing that each new development takes film closer to its realist ideal (21). In fact, he wrote "Ontology" only a few years after the popularization of one such development, that of *deep focus photography* in Orson Welles' *Citizen Kane* (1941). To Bazin, the comprehensive clarity Welles brought to his shots "restored to reality its visible continuity" (*Italian Neorealism* 40). The implicit accomplice to depth of focus, in Bazin's eyes, is the *long take* (*What is Cinema* 34). The "long" in long take refers to the unusual temporal length of a shot; it is the result of refusing to disturb filmed action by cutting (34). When these means are taken together, Bazin's ideal of realism amounts to presenting *spatiotemporal continuity* in the most untampered manner possible – fluid action without patent manipulation of time and space. The lack of guidance in this type of realist presentation, Bazin further argues, encourages pronounced and more independent mental activity on the viewer's part when deriving meaning from film (35–36).

Coherence frequently guides the viewer and plays with spatiotemporal continuity, but I argue that it also evokes a realist mode. To better understand how the film does that, the following takes a closer look at the first few shots of the film's second scene. I take *Coherence* to establish many of its key realist means early on and to subsequently enforce them throughout its running time – even when the film's science-fiction premise eventually reveals itself.

To synopsise *Coherence*'s "funhouse" story briefly: The film depicts four couples having dinner together during the night of a prominent comet sighting. Slowly the night escalates into a series of strange, supernatural occurrences. The occurrences cause the characters to fearfully remain at the house where the dinner party is held, or nearby it, as they try to make sense of what exactly is happening. The film's second scene is set in the kitchen of the main house, before anything truly supernatural has occurred. The scene opens with a close view of a canister of olive oil, an *extreme close-up*. The shot already displays a constant tinge of movement afforded by handheld camerawork. Both close-ups and the handheld camera are omnipresent in *Coherence*, providing the film an aesthetic signature. Both also enforce the realist mode, as later will be argued. The following shot cuts to yet another extreme close-up, this time of one of the present characters, Beth. Shot at a near right angle, the left side of the character's face defines the frame briefly but emphatically. Coinciding with the image of Beth, there is another character, Lee, asking pointedly in the shot's background, "See how you're slipping?" The words are not directed at Beth though, as the proceeding reorientation of the camera's interest displays. To start, there is a slow horizontal turning of the camera, a *pan*, to the left which casts Beth to the right edge of the frame. Then, there is an equally slow adjustment of lens focus, a *rack*, which brings forth into clarity a figure now defining the image, Mike. Via the one-two of the panning and the racking, attention is guided from Beth to Mike in a single shot without cutting needed. The camera manipulation imparts a fluidity to the action while still being very controlling of the viewer's gaze.

The two shots that follow are once again associated with food and involve Mike asking Beth about her new diet. The shots are also close-ups which mean the scene continues to withhold information about the real physical space it utilizes, the kitchen space existing in the material reality. The exact dimensions of the kitchen and the characters' placement within it are not made known until a *medium shot* from the waist up establishes spatial relations for the first time. In the medium shot, the inquisitive Mike is placed on the left side of the frame facing Beth who occupies the right. As Beth starts to answer him, Mike suddenly exits his side of the frame. Once off-frame, Mike gives a garbled response which, to further muddle the conversation, is instantly cut off by Beth. This kind of overlapping dialogue is very prevalent in *Coherence* and a symptom of what Byrkit calls "naturalistic performances" (Tobias). But as Byrkit indicates in the prior quoted passage, when the cast is acting and reacting in such a free manner, the crew has to follow suit. Thus when Mike walks off-frame and is heard saying something, the camera instinctually starts panning to the left to follow him, to follow where the action seems to be heading. Yet since Beth is the one that resumes control of the conversation, the camera movement ends up appearing somewhat misplaced, even if very present in the moment.

In lieu of Bazin's favored deep focus compositions and long takes, *Coherence* seems to introduce fluidity to the action through racking focus and pans. These are some of the main means

of the film's realist aesthetic. With focus racks, the film is able to discreetly direct attention from one subject to another and suggest meaningful connections without sacrificing temporal continuity. Panning the handheld camera, in turn, maps out continuous spatial relations and accommodates the actors' unplanned movement. Regardless, it is evident that neither device promotes the type of increased mental activity on the viewer's part which Bazin championed. Both involve markedly more guiding of the viewer's attention than the Bazinian ideal. Yet it is a guidance born out of reactivity and of presence. Here, the handheld camerawork and close-up framings prove themselves essential to the film's realist aesthetic. The chronically unsteady image acts as a constant reminder of the camera's presence in a physical space of some kind. Close-ups, on the other hand, denote the camera's proximity to the action within that space. The handheld camera in particular consistently flavors the aforementioned camera manipulations which attempt to introduce continuity to the proceedings. In the discussed cases of pans and racks, the camera strives to follow a conversation and to react to its flow. This reacting to the moment is felt even more when the film's central science-fiction mystery starts to unfurl, leaving the alert camera still at the mercy of the unaware and improvising actors. In my view, it is this pronounced situating of the camera in the space being filmed and amid the action which – regardless of the degree of viewer guidance – results in a palpable realist aesthetic.

CINEMATIC DYNAMICS AND STORYWORLD

In the previous section, I suggested that *Coherence's* realist aesthetic is “felt more” as the story progresses. I say “felt more” because, along with the aesthetic, *Coherence's* realism involves the viewer experiencing the film. The aesthetic is responsible only in part as to why the film could be seen as dealing in realism. The mode of presentation must naturally be collated with what is being presented. The ensuing, entangled interplay of form and narrative content must subsequently be processed by a viewer in order to understand, how *Coherence* relates to realism and what the functions of the aesthetic are in this relationship. Discussion of the viewer's processing requires terminology derived from cognitive psychology. Accordingly, the aim of this section is to introduce the key cognitive terms used in this paper and thus lay the foundation for an analysis of *Coherence's* narrative structure which will follow.

As a means of processing the information presented by a film, the viewer constructs cognitive frames. Frames are knowledge structures that are used to understand all types of everyday actions and situations. Their main goal is to explain whatever phenomena at hand as efficiently as possible. David Bordwell associates frames as being “organized, selective, and simplified bodies of knowledge” (Bordwell 136). Frames are simplified in the sense that they consist of a bedrock of knowledge, a basic understanding of a phenomenon. This basic understanding can be elaborated on by gathering new information in a concrete situation (136). In gathering new information about a phenomenon, frames prove themselves organized and selective. In varying degrees, some information is classified as relevant to the frame, while other is relegated to low importance (136) or even discarded. By gathering incoming information and constructing hypotheses around it, frames continuously test their own relevance in explaining a phenomenon – they strive to sustain themselves, but at times they fail and are replaced (Jahn 448).

With regards to fiction, frames and hypotheses are commonly constructed around questions such as “What is happening? What is the state of affairs? What is the situation?” (Perry 43). Extensive application of frames to fiction is done by Menakhem Perry in his pioneering 1979 essay “Literary Dynamics: How the Order of a Text Creates Its Meanings.” Perry begins the essay with a defining statement for his theory of literary dynamics:

The ordering and distribution of the elements in a text may exercise considerable influence on the nature, not only of the *reading process*, but of the *resultant whole* as well: a rearrangement of components may result in the activation of alternative potentialities in them and in the structuring of a recognizably different whole. (Perry 35; italics original)

By referring to elements and components, Perry means the successive verbal elements of a literary text, and also semantic complexes (scenes, characters, plot etc.) (35). The latter are built up in a similarly cumulative fashion with any type of fictional text and are thus easily transferrable to discussion of film. Hence I make the distinction of *cinematic dynamics*, the study of element distribution in a filmic text and the hypotheses/frames evoked by the distribution. Here, I take what Perry regards as “the reading process” to largely correspond with what Bordwell would deem as acts of comprehension. These acts include constructing a spatiotemporal world on the basis of the narrative as well as assigning more explicit meanings to the story (Bordwell 8–9). In this light, the reading *process* implies the step-by-step construction of such elements. Perry’s distinction of “the resultant whole,” then, would introduce interpretation in addition to the process of comprehension. In Bordwell’s terms, interpretation denotes the construction of implicit and veiled meanings (9). While Perry’s method spans both modes of making meaning, this paper limits itself mostly to matters of comprehending *Coherence*.

Frames figure into the discussion as Perry develops further his system for investigating the order of textual elements. He outlines two possible ways of justifying the structure of a text and the placement of elements in that structure: *model-oriented motivation* and *reader-oriented motivation* (Perry 36). The former approach seeks to identify the frames of a given text, whereas the latter is interested in the reader’s process of forming them (42). As Perry mainly focuses on the reader and his/her cognitive processes in his analysis of William Faulkner’s “A Rose for Emily,” so does this paper concern itself with the viewer. The underlying assumption is that the filmic text, *Coherence*, strives to guide the viewing process to “desirable directions” (40). In other words, the viewer is prompted to form some frames more so than others. By constructing the frames and related hypotheses, the viewer seeks to effectively explain in his mind various narrative phenomena like, for instance, the diegetic reality – the presented fictional world and the focus of this study. My contention is that *Coherence* guides its viewer, in particular, towards actively forming frames for the diegetic reality.

The following section of this paper, then, begins a viewer-oriented cognitive analysis of *Coherence*’s narrative structure, borrowing some from Perry’s method of literary dynamics and shaping it into a cinematic one. More precisely, what will be examined in the analysis are the events that define and challenge the storyworld. Storyworld is characterized by David Herman as an interpreter’s “attempt to reconstruct not just what happened but also the surrounding context

or environment [of a narrative]" (Herman 569–570). Thus what is reconstructed is in essence the diegetic reality, an understanding of it. Compared to a cognitive frame by Herman, a storyworld is constructed by gathering information on characters and settings, their attributes, and relevant actions and events (569–570). Accordingly, in the following, storyworld is seen as corresponding with the viewer's "frame for the diegetic reality." Storyworld is thus a concept more rooted in cognition than the diegetic reality, which makes it a remarkably useful shorthand in the analysis to follow. The umbrella concern of the narrative analysis is to discover, how *Coherence* prompts a shift in the storyworld the viewer constructs. This interest splits into three specific strands of discussion and eventual argument, which this paper will interweave. They are: (1) What is the nature of the frame system used to negotiate the shift in storyworld? Different frame systems will be elaborated on as the analysis progresses. (2) What are the various functions of the realist aesthetic in storyworld construction? (3) To a much lesser extent, what is the relevant patterning for the events that define the storyworld in *Coherence*'s narrative structure? The instigating influence for the events, and for the storyworld shift which I take as a given, are the parallel universes that slowly emerge in the course of the film.

The analysis presupposes making observations about film style that necessarily exceed in amount those possibly made during a regular viewing process. In light of this stipulation and as a final note before advancing to the analysis, it is best to clarify how the term "viewer" is used in the context of this paper. Here, the term does not denote any particular person or an ideal viewer that covers all of the possible interpretive bases of a film. Rather, the viewer is a construct established for and by the particulars of this research; its constructed nature is already apparent in my limiting of the examined cognitive processes to matters of storyworld. Thus, in the context of this paper, the viewer is a less-than-objective platform from which to argue about viewership in general. In analyzing the events that are the most likely and generic points of storyworld revision for *Coherence*'s viewer, my approach most closely evokes the concept of the general reader defended by Manfred Jahn in his discussion of James Joyce's "Eveline" (Jahn 461–464). Unfortunately, the general reader/viewer construct, while considerate of cognitive resources, is prone to not noting certain textual qualities (Mäkelä 37) like, say, the presence of focus racking. This can be a harmful and regressive assumption by the researcher which I hope to mend in part by suggesting that the viewer of *Coherence* is still *affected* by stylistic guidance, even if he/she does not consciously mark it at all times. Thus, when the influence of the film's aesthetic on the viewer is unpacked through the unnatural practice of close watching, it is in service of constructing a relevant and hopefully revealing viewing process.

OPENING PUSH: REALITY FRAME AND AESTHETIC DISRUPTION

In "Literary Dynamics," Perry suggests that the tension involved with reconciling the initial stages with the later stages of a text is usually present from the start (Perry 57). So it is with the opening scene of *Coherence*. The scene features the character Emily on the phone with her boyfriend, Kevin, and driving towards the house where the pivotal dinner party will be held. In the two extreme close-ups comprising the scene, Emily oscillates in and out of both focus and the left side of the image. Oscillation is also apparent in the poor signal reception on Emily's phone. Once Emily is finally shot firmly in focus, her phone completely loses its signal. Then suddenly,

the screen of the phone cracks out of nowhere. The screen cracking is the very first inexplicable event in the world of the film, the first mystifying incident. Yet the event and the scene are presented with the realist camerawork already in place. The prevalent focus racks and out-of-frame handheld compositions suggest an active adjustment to the ebbs and flows of Emily's phone call. Similarly reactive is the pan which forsakes Emily in favor of introducing the cracked screen. While more information is needed to process the event in a discrete frame, its reverberations are still felt later on in the viewing process. It acts as a key piece of contradictory data – an initial hint of the supernatural – once the storyworld is better established after the first few scenes. It is presently striking that the incident breaks up the characters having a rather ordinary conversation and thus acts as an intrusion of a kind. This is the central tension that comes to define the film, the ordinary intruded by the inexplicable.

The next event to foster this tension directly recalls the opening scene. Emily is alone in believing that her phone breaking might have something to do with a comet that is scheduled to pass Earth that night. It is only after a quarter-hour into the film and after the dinner party is well underway that she gets an ally. Another character, Hugh, discovers his phone is similarly splintered in the middle. In the scene with Hugh, the previously outlined visual style is again quite consistent, with unstable camera manipulations tracking the characters' puzzled reactions. Sparked by the scene, hypotheses about the connection between the comet and the phones breaking may be constructed by the viewer, even if most of the characters still laugh off the idea. Such hypotheses imply a previously unsuspected supernatural quality to the diegetic reality. But even with two phones inexplicably broken, the storyworld is not yet disturbed enough to make its construction a conscious priority for the viewer. Still at this point, the understanding of the diegetic reality is assumed under a rather automated frame, which is shaped by information the viewer supplies from prior experience. This experience is not *per se* related to the film itself, but rather draws heavily on the material reality as well as other artworks and films (Perry 45). That said, the realist aesthetic does also inform the frame. The realist camera has so far been content simply to observe and to react alongside the characters as mysterious occurrences emerge. Doing so, the aesthetic avoids drawing attention to itself, and thus the viewer may passively consider the diegetic reality unmanipulated.

After approximately 25 minutes into *Coherence*, the viewer is first pushed to seriously assess the diegetic reality. Following the scene with Hugh's phone, the lights go out throughout the neighborhood of the dinner party, except for one house. Hugh and another character, Amir, subsequently decide to go to the house to use their phone, seeing as phone service is down as well. They return dazed with Hugh brandishing a bizarre account of what he saw: the exact same dining room which the characters currently inhabit. Hugh is quickly called a liar and also accused of an earlier disturbance, namely, banging on a side door. Hugh's follow-up plan is to write a polite note and deliver it to the other house. Before he can go deliver the note, however, a verbatim copy is posted on the front door of the house where the dinner party is taking place. A shot of the characters realizing the connection between the two notes is the first instance of subjective experience displayed in the film. The shot features most of the characters in medium framing and brought into clarity by sudden racking of focus. The camera trembles forcibly and there is a tense zoom-in before the shot cuts to black. Together these devices serve a function of both conveying

the characters' shock and rousing the same in the viewer. The presentation is still reactive certainly, but it also reflects character psychology in a so far unseen way. Due to the little-used devices and the implied subjectivity, the shot is the clearest break in the film's aesthetic until now. The break is made more prominent by the familiar mode of reactive, non-subjective presentation quickly resuming afterwards.

The scene evokes various hypotheses. Since all of the primary characters are present in the dining room when the note is posted, a likely hypothesis is that someone outside the group of eight is behind the different disturbances. Another possibility is that a group member is somehow indirectly involved. This notion leads easily to Hugh as he first posits that something truly inexplicable, threatening even, is happening with his story. Also contributing to said hypothesis is Hugh's absence during the banging on the door – then again, a similar fact would incriminate Amir as well. A hypothesis flirting with the supernatural is that somehow Hugh himself, possibly another Hugh from the replica house he reportedly saw, posted the note. The same assumption does not seem acceptable for the characters to speculate about out loud until, in a later scene once the tense situation has defused itself, Mike suggests they go see the house again, "I'm gonna go over there and, theoretically, let's go see if our theoretical selves are there." Much along the lines of Mike's hedging, the hypothesis of parallel characters/universes is very tentative for the viewer at this point as well.

The emergence of the supernatural hypothesis is integral in making the viewer aware of the process of storyworld construction. The hypothesis contradicts much of what has been taken as a given about the diegetic reality so far. In fact, I argue that, primarily based on this scene, the viewer actively constructs a "reality frame" for the storyworld. An initial echo of the larger cognitive shift about to happen, this is done to help explain the most amount of data conveyed about the diegetic reality so far. The frame is retooled from the previously automated understanding that *Coherence's* reality largely resembles the material reality. Newly awakened, the reality frame is deemed strong enough to account for the present scene's information, even the extremely inexplicable data of the two notes and the replica house.

In a word, the reality frame asserts what Manfred Jahn would describe as its *primacy*, which refers to the phenomenon of a cognitive frame trying to "retain [itself] for as long as possible" (Jahn 457). A frame that has primacy, a primary frame, tries to explain as much incoming data as it can and stay relevant in explaining the data it already does. It tries to "maximize its scope" (457). Primacy is, alongside *recency* which will be discussed later, one half of Jahn's preference rule system for frames. The preference rule system assumes that one frame is always dominant in accounting for received data, as opposed to multiple frames governing concurrently. In an effort to preserve itself, the dominant frame may even accommodate minor contradictory data when faced with unfamiliar situations (457). What contradicts the storyworld constructed for *Coherence* is the implication that there are impossibly two incarnations of the character Hugh. The reality frame thus prefers the non-supernatural hypotheses of outside influence and/or Hugh conspiring to preserve its primacy. Yet, as the characters are slowly starting to believe in the supernatural, the opposing hypothesis of parallel characters is provided with some more credibility in the viewer's eyes. As will be seen, this tension of the real and the supernatural, the

ordinary and the inexplicable, is exacerbated as the narrative progresses. The following two sections will take a look at how the viewer's frame processing handles the tension and an increasing amount of contradictory data.

At this point, what additionally challenges the notion of a reality-based storyworld is the disruption in the realist aesthetic. This is because, via the disruption, manipulation of the diegetic reality through camera effects becomes more apparent. Based on the discussed shot, the viewer may deduce that the reality *Coherence* presents is in fact more illusory and affected than previously thought. Even without overt alertness to every presentational detail, the shot still acts as a recognizably heightened and intensely felt moment of revelation for the viewer – a clear departure in the narrative. The break in aesthetic is thus an essential part of the opening push to examine the diegetic reality with a new awareness and scrutiny. But as indicated earlier, the break is very brief. The original mode of presentation returns immediately and stays more or less consistent for the rest of the film. However, I argue that following this scene the function of the realist aesthetic starts to morph. I propose that the aesthetic switches from being a subtle enforcer of the initial storyworld to acting as a resistant foil to the eventual storyworld shift. For the viewer, the aesthetic's unwillingness to adapt to the supernatural mystery produces engaging ambiguity. The new resistant function and its effects will be explored further in the next section.

ENGAGEMENT BY WAY OF AMBIGUITY

The storyworld constructed for *Coherence* is truly challenged when Mike's suggestion to go see the other house is undertaken by Mike, Emily, Kevin, and a fourth character, Laurie. Once already on the way back, mirrored on the opposite side of the street, the group is confronted with what appears to be themselves – four figures differentiated only by the color of their glow sticks, red instead of the established blue. There is a prolonged moment of shock during which the film's presentation consists of rapid shots which approximate the vantage point of the original four, thus utilizing *point-of-view shots*. In between these shots, there are brief close-ups that color in the alarmed reactions of the group. In the shot that introduces the other group, the desired point of view is implied through framing the "others" in a *long shot*, physically in full view. The long shot is used to convey a physical distance between the two groups – the camera stays with the original characters and shows the others as being "far away." The shot is defined by its profound lack of lighting. Crucially, the faces of the others are not distinct in the darkness of the street. They are recognizable as the familiar characters mostly through certain articles of clothing as well as the glow sticks.

As the shock lingers, there are two more point-of-view shots. In both shots, the distance of the camera to the other group is greater than before and the level of visual detail is further reduced. The shots do not completely assume the subjective perception of the original characters, which point-of-view shots often do, but rather the camera is placed beside the characters. The camera's spatial positioning is indicated by the back of Emily's head, which is visible, but blurred on the left side of the image. Throughout the scene, the point of view of the others is never assumed. As per its realist presence in the filming space, the camera opts instead to remain nearby the originals, show their reactions and experience with them. It is my contention that the realist

aesthetic is used here in service of instilling ambiguity: The first shot, despite its scant lighting, conveys quite clearly the idea that these are the same characters, yet different incarnations. This is new information to both the original characters and the viewer, the first time coming into contact with suspected doppelgängers. However, the shots that follow let that impression erode somewhat by presenting only vague point-of-view glimpses. By remaining with the original characters, the realist camerawork denies both a closer look at the others and their point of view, thus making the confirmation of their presence impossible.

Processing the scene, the earlier hypothesis that somehow parallel characters and/or worlds are colliding becomes relevant again. Yet the hypothesis cannot be constructed with full certainty because of the pointed ambiguousness of the scene's presentation. At this junction, Marina Grishakova's proposed frame system proves useful. In analyzing modernist and postmodernist works of fiction with similarly unfurling premises as *Coherence's*, Grishakova suggests that an initial understanding of a textual universe may be challenged by an emerging, opposing *subworld*. The term "subworld" is more or less synonymous with cognitive frame, which I will use henceforth in discussing Grishakova's ideas. Rather than subscribing to Jahn's system of one dominant frame, Grishakova proposes a multi-tracking system which would allow for competing frames to fluently co-exist (Grishakova 191). She asserts that such fluency can "free up additional cognitive resources" (191). By this she means that more data can be processed and made relevant in reading/viewing – specifically, data which would normally be inconsistent with a single primary frame (191). Seeing characters who are of exact likeness with already known characters is inconsistent with the reality frame established for *Coherence*. The information is inconsistent with the frame, because the frame is largely based on experience of the material reality. Knowing perfect physical copies of human beings cannot be produced in the material reality, the appearance of the doppelgängers is made unaccountable for the viewer. However, the information of parallel characters can be motivated with a wholly new frame – a conflicting "supernatural frame." In this case, the reality frame need not be discarded even if the supernatural frame is introduced to storyworld construction. This division in frames recalls the characters trying to solve the mystery of the parallel universes following the run-in on the street. Contributing to the designation of the film as science-fiction, the characters speculate about "decoherence" – a term used in quantum physics to refer to two possible realities existing simultaneously. "Coherence," in turn, would imply the separate realities collapsing into one which I suggest will more or less happen with the viewer's frames for the diegetic reality. Still, at this point, the two frames can coincide and compete for "maximal relevancy" (Perry 43) in storyworld construction. Thus my formulation both adopts and goes against Grishakova's: several conflicting frames are allowed, but one always retains an upper hand, primacy. This distinction will be expanded on in the last section.

The discussed four events that define the storyworld (Emily's phone breaking, Hugh' phone breaking, the note being posted, and the group of four meeting their counterparts) all serve as mystifying intrusions into the characters' otherwise normal existence – the key tension of *Coherence*. With the amount of analyzed events, this tension can be extended to form structural patterns in the narrative. Starting from the beginning, the phone incidents are first to indicate that the diegetic reality is somehow off. The incidents act as small intrusions and are easily

explained away. They are motivated retroactively once the supernatural frame is formed. By being the first events of their kind, they help define the eventual storyworld frame, even if they do not challenge the initial one. The events that truly challenge the storyworld, in turn, are the ones involving parallel characters in some way. With these events, the intrusion pattern seems to pertain to the proximity and visibility of the implied characters. First, a parallel Hugh is not seen but assumedly posts a note; his presence is demarcated only by a door. Second, some of the characters run into “themselves” on the street. This time the parallel characters are seen, but they are only visible from a distance and in the dark of the nighttime. The presence of the other incarnations seemingly becomes more uncontested with each event. Sketching these patterns helps illustrate how *Coherence* plays with the viewer’s cognitive processing. Based on all the events so far, the film appears to be feeding more and more assuring data about supernatural phenomena as it progresses. At the same time, it avoids providing anything truly conclusive about the diegetic reality, choosing instead to present events with enough ambiguity. This act of withholding keeps the viewer wondering and actively trying to construct the most apt storyworld frame.

The pattern of proximity is continued by a narrative event which, in my view concludes the gradual storyworld shift from the real to the supernatural. The first four analyzed events occur at roughly ten minute intervals, with the run-in on the street taking place close to 35 minutes into *Coherence*’s running time. The conclusive event, then, takes place much closer to the end, well over an hour into the film. In the meanwhile, minor cues pointing towards a supernatural storyworld are presented. Still, during the wait, the narrative structure’s main goal is to let uncertainty about the diegetic reality build. Two separate storyworld frames are needed, but the reality frame continues to hold a slight upper hand. The event that strips the frame of its primacy involves the character Mike getting violently beaten by an incarnation of himself. The other Mike breaks into the main house and simply attacks, presumably in an effort to avoid a similar fate. The violent confrontation is carried out quickly in only a few shots. These shots display some of the trademarks of the film, including out of focus close-ups and haphazardly reactive camera movement. The effect of the presentation is such that the viewer cannot make out the distinct features of the two Mikes simultaneously. Rather, the two are recognizable intermittently. This leaves some doubt in the viewer’s mind as to how to explain the scene, but only some. Regardless, I argue the unprecedented physical proximity of a parallel character is decisive enough for the viewer to start favoring the supernatural frame.

Disregarding its slight ambiguity, the scene’s presentation still has much to do with the storyworld frame changing. *Coherence*’s overall presentation is, to a great extent, made possible by shooting with very mobile digital cameras (Lattanzio). Crucially, the scene at hand shuns digital postproduction in favor of practical effects, namely, a body double of Mike. In the introduction to *Realism and Audiovisual Media* (2009), Cecília Mello and Lúcia Nagib refer to arguments that the rise of digital film production has been at the expense of André Bazin’s ideas of realism (Mello and Nagib xx). Bazin’s realism is often associated with *indexicality* in photography – the notion that an image is in a direct relationship with its *referent*, the actual object represented. This relationship implies an inherent truthfulness and realism to the image or film. The aforementioned criticism targets the ability to digitally produce film without relying on an actual

referent in the material reality, leading to lesser realism. Mello and Nagib counter this notion, saying that Bazin himself considered each new technological innovation to actually reinforce realism (xx). For its part, *Coherence* seems somewhat undecided on its stance on digital. Its realist aesthetic owes some to the introduction of digital shooting technology – light, high-resolution cameras which can be moved freely among the action. Then again, in the scene of Mike getting beaten, the film goes to lengths to retain a physical referent in the form of the body double. At a time when digital manipulation in science-fiction film is a given, *Coherence* defies expectations and enhances its presentation in a much simpler way. Besides most likely for budgetary reasons (Lattanzio), I would argue the practical effect of the body double is used to shock the viewer into revising the storyworld. As in the scene on the street, the presence of a parallel character clashes with the reality frame; it is a brazen physical impossibility. Yet this time there is much less ambiguity in the presence. It clashes harder due to the proximity and recognizability of the other Mike. Even so, the parallel character is still presented as if occurring like anything else in the diegetic reality, with realist means. When the other Mike enters the house, the camera reacts to an actual presence in the filming space instead of a digital reproduction. This distinction is discernable and felt. Seeing the governing storyworld frame so directly contradicted, the viewer is compelled to abandon it and promote a new one, i.e. the supernatural frame.

Despite its consistent aesthetic, *Coherence* is not a traditional realist film for certain obvious reasons. With a story featuring parallel characters from parallel universes, it can hardly be labeled a “direct and truthful view of the real world” (Konigsberg 285; Hayward 298). The film does not particularly strive to address social issues either, as it is much too intent on developing its mystery narrative. However, *Coherence* does involve itself intimately with a realist aesthetic and thus, in its own way, with realism. At its heart, realism is a mode evoked by a film and ultimately constructed by a viewer. It is not tied to any one use or goal of representation. In fact, I take *Coherence*’s realist aesthetic to be a means to the greater end of engaging the viewer in storyworld construction. Throughout the film, the aesthetic argued here remains much the same. Familiar close-ups, handheld pans, and focus racks are used to suggest an exceedingly reactive camera presence in the filming space. Even with this consistency, the realist aesthetic complicates storyworld construction in multiple ways during *Coherence*’s running time. Early in the film, the aesthetic acts as subdued enforcer of a storyworld based on material reality. The effect on the viewer is a lulling one, before anything truly supernatural has occurred in the narrative. This initial, understated function makes it all the more engrossing when something supernatural does eventually happen. Similarly exhilarating is when the aesthetic is briefly disrupted (the scene with the note), which has an indirect function of making the viewer aware of storyworld construction. Later supernatural events are presented as ambiguous, so as to force the viewer to seek resolution for the storyworld more actively. In my view, instigating this kind of cognitive activity is *Coherence*’s most primary objective; it is the reason why “viewer engagement” is so necessary in discussing the film. Finally, in the last analyzed event, the aesthetic is jarring in its consistency to the degree that the viewer changes storyworld frames. Thus in part, the presentation helps prompt a fundamental change in the understanding of the diegetic reality. Throughout all the events, the realist aesthetic is an even plane. Against it, the curvature of storyworld distortion becomes more

apparent and more intensely felt. A regular mirror, when contoured right, makes for a funhouse one.

FLEXIBLE ENOUGH FRAME SYSTEM

The supernatural frame gaining primacy at the end of *Coherence* means that the concurrent frames assumed from Grishakova cease their competition to a great extent. The effect of a frame gaining primacy over another is, in Jahn's preference rule terms, recency. Recency occurs when data that is contrary to a governing frame's essence becomes undeniable. The effect then is to replace the frame with a more pertinent one (Jahn 457). In her dismissal of primacy and recency, Grishakova speaks of the cognitive load of fiction being at times too complicated for such a two-part system to process (Grishakova 191). In the same breath, Grishakova champions her multi-track system of frames for its ability to "recuperate inconsistencies" (191). In her view, preferring single primary frames produces cognitive entropy when sustained, because data which is inconsistent with the frame is too often dismissed (197). Grishakova's language of cognitive entropy and data recuperation suggests a value of dynamism in narrative comprehension for its own sake. A film like *Coherence* furnishes the potential for dynamically constructing coinciding frames, but ultimately its storyworld is not best defined with such division. The preceding analysis of *Coherence* indicated a gradual but definite revelation of the supernatural. With a processing system which attempts to motivate as much data as possible, like Grishakova's, one easily loses sight of what a given work of fiction is predominantly striving to accomplish vis-à-vis its comprehension. *Coherence's* viewer is guided towards experiencing an immense and elongated shift in storyworld frames – an engaging recency effect.

This designation of recency does not change the fact that Grishakova's co-existing frames are a useful tool for cognitive analysis of narrative. Even with *Coherence*, there is clearly a need for stretches of very dynamic processing, when it is unclear what the exact parameters of the diegetic reality are. It is precisely in this type of micro-level examination, analyzing narrative data piece by piece, that the flexible multi-track system proves beneficial. Jahn's concepts of primacy and recency, in turn, fare better describing major, macro-level cognitive shifts. Yet I see no great barrier to reconciling Jahn's preference rules and Grishakova's multi-tracking. Jahn's theory does preclude two frames governing concurrently, but it is also open to flexibility within the frame system it proposes. The proposed system may indeed gather multiple "related, similar, or partially identical" (Jahn 447) frames together. It does this to account for possible variation in a narrative situation, while continuing to hold one of the frames as the stable primary one (447–448). I submit my middle ground for the two frame systems: When comprehending and constructing some basic element of a narrative, such as the diegetic reality, one cognitive frame must always remain dominant to a degree. It must retain primacy, even if slightly. At the same time, however, cognitive processing must accommodate other frames as well, if deemed necessary based on the narrative information. This includes competing and conflicting frames, not merely similar ones. One of these other frames may eventually replace the dominant frame and thus have recency occur – again, if the narrative occasions it.

There needs to be, for the sake of dynamic enough comprehension, room for multiple competing frames – but why is a dominant frame required at all times? Jahn clarifies the issue when he justifies the general function of frame replacement, “[A] recency effect... provides a better (more consistent, more natural, less contrived) interpretation of the foregoing as well as the ensuing data” (457). The single primary frame thus vitally structures the meaning-making process by gearing it towards truly relevant information, past or future. Jahn does not make the same distinction Bordwell does between comprehension and interpretation, but here he still offers an insight as to why the two frame systems need negotiation. The same insight can be extended to the matter of why discussion of comprehension processes is necessary in the first place. It is because comprehension via cognitive frames forms a basis for the interpretation and valorization of a given film or narrative. Agreement in the basics of comprehension grounds the eventual discussion between differing interpretations, keeps it from travelling down paths of irrelevance. Comprehension discourse is empowered in such a way by being able to discuss film viewing before viewer-specific factors have figured in too greatly (Bacon 48). Although admittedly, narrative comprehension cannot be fully naturalized in cognitive terms. In *Coherence*’s case, interpretation is guided by the film’s undeniable interest in complicating storyworld processing. Indeed, *Coherence*’s priorities are clear: It is first and foremost a funhouse of a narrative film, where information about the nature of the diegetic reality is fed enticingly and intermittently. It more or less shuns other common objectives film may have, such as cultural critique, overt political contextualization, or even the presentation of psychological depth. To its benefit, *Coherence* focuses rather on providing an engaging viewing experience, spent constructing enthused hypotheses about its diegetic reality. Any and all interpretations of the film must reflect and respect this goal of comprehension to assert their relevance.

CONCLUSION

This paper has involved itself in great extent with James Ward Byrkit’s *Coherence*. Analysis of the film produced two main assertions: It was argued that realism is a mode to be utilized without preconceptions. It may even extend to films with storytelling ambitions reaching beyond the material reality and without glaring social or political motivations. These stipulations stem from and are illustrated by *Coherence*, a sci-fi mystery with a defining interest in narrative games. For its part, the film employs a distinct realist aesthetic to influence storyworld construction and engross the viewer. Thus, in its own way, *Coherence*’s realism does in fact strive to “heighten... consciousness” (Konigsberg 285), but about the fictional world at hand rather than the real one. My hope is that, in future research, the category of realism could be more fearlessly subjected to as improbable films as *Coherence*.

The more theory-minded assertion concerns frame systems, as upheld by the viewer’s cognition and applied here to *Coherence*’s storyworld. Derived equally from Manfred Jahn and Marina Grishakova, the frame system I propose favors a dominant frame while allowing multiple conflicting frames to flourish at once – an appropriately flexible intermediate. The system skirts unnecessary dynamism in cognitive processing and is respectful of the comprehension needs of a narrative. The assertion, and the discussion of narrative comprehension in general, seek to avoid too associative readings – ones too removed from a basic manner of constructing film. Such

interpretation simply cannot be afforded, as discussing film would bleed relevant meaning and vital precision in consequence.

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Ecuador's Yasuní-ITT Initiative: A Case Study on International Climate Change Mitigation Narratives

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ABSTRACT

In 2007, Ecuador's president Rafael Correa presented an audacious climate change mitigation plan to the world: Ecuador would leave 846 million barrels of crude oil untouched beneath the Amazon if the global community reciprocated with a contribution of 3.6 billion dollars - half of the oil's market value (McAvoy 27). The Yasuní-ITT Initiative, named after the area it sought to save, vowed to preserve immense biodiversity, protect indigenous groups, and prevent the emission of 410 million tons of carbon dioxide (Permanent Forum on Indigenous Issues). In 2013, Correa abandoned the initiative, lamenting the lack of international support, and approved oil drilling in the Yasuní (Correa, "Anuncio a la Nación" 3). The purpose of this investigation was to identify and examine the various narratives employed in the Yasuní-ITT Initiative, with the hope of discovering transferrable conclusions for other global mitigation efforts. This project relied heavily on speeches, government documents, and media accounts in both English and Spanish to identify common narratives, while secondary scholarly articles were used to frame the analysis. The narratives deployed in Ecuador's Yasuní-ITT Initiative common but unequal responsibility for climate change, a reconceptualization of value, and Ecuador as martyr and revolutionary - reflect a framework that simultaneously criticized and sought authority from the capitalist ideal. The failure of the Yasuní-ITT Initiative to capture the hearts and wallets of the world provides insight into the dominant global forces and perspectives on climate change mitigation policy.

INTRODUCTION

The Intergovernmental Panel on Climate Change (IPCC) defines mitigation as "the effort to control the human sources of climate change and their cumulative impacts, notably the emissions of greenhouse gases" (Intergovernmental Panel on Climate Change 114). Mitigation efforts ranging in scale from local to international encounter obstacles related to prioritization, economics, technological capacity, and political tensions (IPCC 137). Internationally coordinated attempts to reduce emissions arguably experience these challenges most acutely. Consequentially, global policies and agreements that have the greatest power to effect change are also the most

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difficult to develop and implement. The United Nations Framework Convention on Climate Change (UNFCCC) was established in 1992 to navigate this challenging process, but its achievements have been limited. Given the rapid and often disastrous climate change occurring worldwide, innovative and impactful mitigation strategies are desperately needed. Ecuador's 2007 Yasuní-ITT Initiative, examined as a case study in global mitigation, offers valuable insight into the dominant forces and perspectives that dictate such internationally coordinated mitigation efforts.

In 2007, Ecuador's president Rafael Correa presented the Yasuní-ITT Initiative to the United Nations (UN). The initiative pledged to leave 846 million barrels of crude oil untouched in the Ispingo, Tambococha, and Tiputini oilfields (ITT) located within Yasuní National Park. In exchange, Correa asked for \$3.6 billion in global contributions, half of the oil's 2007 market value (Espinosa 27). The proposal anticipated three benefits. First, the initiative vowed to protect two indigenous groups living in voluntary isolation in Yasuní National Park (Permanent Forum). Second, the proposal sought to preserve immense biodiversity within the park – a UNESCO World Biosphere Reserve home to 600 bird species and more tree species than all of the United States and Canada combined (Permanent Forum; McAvoy 27). Third, the plan pledged to prevent the emission of 407 million tons of carbon dioxide emissions from the burning of fossil fuels (Permanent Forum). While the UN and many powerful individuals lauded the plan, supporters of the oil industry and many media outlets characterized it as “rain forest for ransom” (Achtenberg; Walsh). Ultimately, the Yasuní-ITT Initiative did not receive the global financial support it sought, and in 2013 Correa abandoned the proposal and approved oil drilling in Yasuní National Park (Correa, “Anuncio a la Nación” 7).

This analysis identifies and examines the principal environmental narratives employed in the Yasuní-ITT Initiative by Rafael Correa and his government. Environmental narratives are often referenced in scholarly discourse on climate change, but a clear definition of “environmental narrative” is rarely offered. One definition, proposed in a 1996 book titled *The Lie of the Land*, is a “convenient yet simplistic belief about the nature, causes and impacts of environmental problems, which also influences the generation of further environmental research and proposed solutions” (Forsyth 3). While this definition encompasses many aspects of current environmental narratives, the content and form of contemporary narratives are extremely varied. In this analysis, the term “narrative” loosely describes the discourse and strategies used to present the Yasuní-ITT Initiative to the global community. The narratives often drew on established environmental concepts, and also introduced complex and controversial perspectives to the international discussion.

Narratives were identified by examining Correa's speeches and other government documents, and primary narratives were selected based on their importance to the overall framing of the initiative. Research was conducted in both Spanish and English, but Spanish sources have been translated to English for inclusion in this analysis. The principal narratives identified are: common but differentiated responsibility for climate change, a reconceptualization of value, and Ecuador as martyr and revolutionary. These were not the only narratives deployed during the six-

year campaign, but they were the most enduring and fundamental. Further, these narratives were not static; in fact, the way in which they evolved is an important element of this analysis.

The limitations of the current study should be recognized. While this analysis accurately represented the narratives present in the Yasuní-ITT Initiative as advanced by Rafael Correa and his government, it did not attempt to address the complexities surrounding the initiative. Myriad other factors, including political tensions and economic situations, played into the initiative's defeat. Further, responses to the initiative – both locally and globally – ranged from effusive praise to passionate dissent. This analysis deliberately avoids evaluating the merits of the initiative. Instead, the goal is to objectively examine the principal narratives employed in the six year Yasuní-ITT campaign with the hope of encountering transferrable lessons for other global climate change mitigation attempts.

The narratives utilized in Ecuador's Yasuní-ITT Initiative – common but differentiated responsibility for climate change, a reconceptualization of value, and Ecuador as martyr and revolutionary – challenged capitalist ideals of value and self-interest, although the initiative itself worked loosely within the capitalist system. As a case study in global climate change, the initiative confirms the seemingly inevitable and requisite role of capitalist inspired market solutions. This analysis proposes that the unique narratives advanced in the Yasuní-ITT Initiative, though proven ineffective in garnering global support, are perhaps better suited to small scale, local proposals.

COMMON BUT DIFFERENTIATED RESPONSIBILITY

The Yasuní-ITT Initiative was founded on the concept of common but differentiated responsibility (CBDR), an established climate change narrative. CBDR first appeared in the Rio Declaration on Environment and Development, a 1992 UNFCCC document. Principle 7 of the declaration says, “In view of the different contributions to global environmental degradation, States have common but differentiated responsibilities” (Rio Declaration). In other words, every country contributes to climate change, but relative responsibilities vary. A 1995 UNFCCC conference further developed the idea into a guide for mitigation efforts, saying, “the developed country Parties should take the lead in combatting climate change and the adverse effects thereof” (Framework Convention on Climate Change). Subsequent UNFCCC mitigation policies have invoked CBDR to establish country specific expectations that correspond to their differentiated responsibilities (Harris 34). Specifically, developed countries have extended varying degrees of financial and technological support to developing countries in UNFCCC agreements (Bushey 8).

The Yasuní-ITT Initiative catapulted the CBDR narrative – originally conceived as a guide for mitigation expectations and international cooperation – into a new role to justify Correa's demands for financial compensation. Correa demanded “compensation for the damages caused by the out of proportion amount of historical and current emission of greenhouse gases by industrialized countries” (Correa, “Speech of the President” 2). With this request, Correa appealed to CBDR in an accusatory and aggressive manner generally absent from diplomatic UNFCCC negotiations. While most developed countries have accepted their disproportionate responsibility and burden in regards to climate change, Correa's somewhat tactless application of CBDR likely

deterred some potential supporters and may have precipitated responses characterizing the initiative as “rain forest for ransom” (Walsh). The aggressive application of CBDR alienated many potential supporters of Correa’s campaign and converted a collaborative concept into a combative tool.

Regardless of Correa’s methods, his appeal to the CBDR narrative critiqued capitalism and sought to create a universal mindset to approach climate change. By singling out “industrialized countries” and noting that “there are countries that pollute a lot more, there are sectors that pollute a lot more,” Correa implicitly critiqued capitalism (Correa, “Speech of the President” 2; Correa, “La Iniciativa Yasuní-ITT” 8). Correa’s critique of capitalism targeted the “individualist logic” it employs and, in accordance with the ideals of CBDR, instead asked that the global community accept “joint responsibility” and support the Yasuní-ITT Initiative (Correa, “La Iniciativa Yasuní-ITT” 12; 19). With his calls for joint responsibility, Correa invoked CBDR to elevate climate change mitigation – and his initiative specifically – above the fray of global relations in the interest of “a sustainable future for all” (Correa, “La Iniciativa Yasuní-ITT” 5). Correa’s attempt to create a universal mindset with a global goal represented a challenge to the capitalist value of self-interest.

RECONCEPTUALIZATION OF VALUE

The Yasuní-ITT Initiative also called for a reconceptualization of value. In his 2007 proposal to the UN, Correa explained that the Yasuní-ITT Initiative sought “to transform the old conceptions of the economy and the concept of value” (Correa, “Speech of the President” 3). Economic value, in large part, is based on “on what people want – their preferences” (Basic Concepts). Therefore, Correa’s attempt to redefine value, at its core, demanded a change in global priorities. Ecuador’s proposal to sacrifice half of the monetary value of its oil, instead valuing ecological and environmental wellbeing, modeled this ideological shift. This narrative interacted with Correa’s discussion of Buen Vivir and the Kyoto Protocol, and it evolved immensely during the six-year campaign.

Correa’s attempt to redefine value drew inspiration from the Buen Vivir movement in Latin America. Buen Vivir, or “Living Well,” is “a development concept...that attempts to incorporate the perspectives and views of indigenous peoples” (Cunningham 89). The concept implies living in harmony with “Mother Earth’s cycles, with cosmic cycles, with history’s cycles, with all life’s cycles, and in complementary balance with all forms of existence,” and it is frequently framed simply as a “pro-Mother Earth” movement (Cunningham 92; Jaramillo 61). Buen Vivir has recently been incorporated into constitutional reforms in Ecuador and Bolivia, and the movement has a growing presence in Colombia and Peru as well (Jaramillo 61). A key aspect of Buen Vivir is its criticism of capitalism as a major contributor to the destruction of the planet (Jaramillo 62). Alberto Acosta, the former Ecuadorian Minister of Energy and one author of the Yasuní-ITT Initiative, wrote that Buen Vivir is “a distinct alternative to capitalist logic” (Acosta 3).

Buen Vivir’s incorporation into the Yasuní-ITT Initiative demanded a shift away from capitalist conceptions of value. Correa rarely referred explicitly to the Buen Vivir movement, but

in one public speech he characterized the Yasuní-ITT Initiative as a step towards “our ancestor’s concept, Buen Vivir, satisfying needs and rights, but living in harmony with nature, with other humans being” (Correa, “La Iniciativa Yasuní” 12). Harmony – a fundamental concept in the Buen Vivir paradigm – was incorporated into Correa’s speeches for the duration of the Yasuní-ITT Initiative. Correa’s invocation of harmony and Buen Vivir can be traced back to criticisms of capitalism, but Correa also offered his own explicit critique. He said the Yasuní-ITT initiative “proposes a change from economic logic, from individualist logic, to a logic very difficult to achieve in these times, of justice” (Correa, “La Iniciativa Yasuní” 12). Replacing economic logic with justice required a reconceptualization of value, among other attitude changes. Correa asked the global community to value “environmental goods...that generate great value, are a great benefit to humanity” (Correa, “La Iniciativa Yasuní-ITT” 11). By challenging the capitalist ideal of value and alternatively asking the global community to compensate environmental wellbeing, Correa firmly situated his initiative as a product and representation of the Buen Vivir movement.

Correa’s attempt to redefine the capitalist ideal of value was initially accompanied by a criticism of the Kyoto Protocol. Early in the Yasuní-ITT campaign, Correa called the flexible mechanisms of the Kyoto Protocol “absurd” and specifically critiqued carbon markets, saying they “give countries incentives to cut their forests, sell the wood and then receive compensation to plant again” (Correa, “La Iniciativa Yasuní-ITT” 9). The Yasuní-ITT Initiative was originally framed as a moral alternative to the problematic Kyoto Protocol, instead asking the global community to work outside of capitalist inspired carbon markets to prevent emissions in the first place. As a “Post-Kyoto” option, it required a reconceptualization of value to rationalize financial compensation for inaction (Martínez). Correa argued that his proposal was, in the end, a measure to reduce emissions, equivalent to the Kyoto Protocol. However, the Kyoto Protocol lacked the “integral concept” of “Net Emissions Avoided,” instead recognizing only positive emissions (Correa, “La Iniciativa Yasuní-ITT” 10). This argument reveals the key assumption in Correa’s attempt to redefine value. In assigning value to environmental and ecological wellbeing, Correa asked that inaction – avoided emissions and avoided ecological destruction – receive the same financial recognition as action. The Yasuní-ITT Initiative, as it was initially conceived, stood as a moral alternative to the Kyoto Protocol’s limited view.

Correa’s criticism of the Kyoto Protocol was contradicted by his government’s actions near the end of the campaign in 2012. With little financial support after five years of campaigning, Ecuador sought to enter the carbon market with “Yasuní Guarantee Certificates” as equivalent units to carbon units. This proposal used the same logic of “Net Emissions Avoided” that Correa had advanced early in the campaign, but the argument was transformed from a critique into a plea for inclusion. The European Union Environmental Trading System (EU ETS), the largest global carbon market, denied Ecuador’s proposal on the grounds that it would lead to carbon leakage (Del Hierro). Carbon leakage is an increase in carbon dioxide emissions by one country to compensate for emission reductions in another country (IPCC 1028). In the case of the Yasuní-ITT Initiative, the EUETS presumed that Ecuador’s reduction in oil extraction would be offset by increases elsewhere that would maintain global oil use at the same levels and lead to no net environmental benefit.

The evolution of Correa's attitude towards the Kyoto Protocol added complexity to his campaign to redefine value. While his strong criticism of capitalism and carbon markets faded away with his attempt to enter those same markets, Correa's alternative definition of value was consistent. His campaign to place financial value on inaction and environmental wellbeing was a hallmark of the Yasuní-ITT Initiative, perhaps most importantly when appealing to the EU ETS for recognition in carbon markets. Whether Correa's evolution with respect to the Kyoto Protocol was driven by hypocrisy or a desperate desire to fund his initiative, the result holds the same significance. The global community did not respond to Correa's attempts to redefine value and compensate inaction for the sake of environmental wellbeing.

ECUADOR AS MARTYR AND REVOLUTIONARY

The final narrative identified in the Yasuní-ITT Initiative is Ecuador as martyr and revolutionary. This narrative, like Correa's attempt to redefine value, evolved through the campaign. Correa initially employed this narrative as a strategy to garner international support and build a global mindset, but it eventually transformed into an explanation for the initiative's failure. In parallel with this evolution, Correa shifted his emphasis from martyr to revolutionary.

Throughout the campaign, Correa's presentation of Ecuador as a martyr and revolutionary served to assert Ecuador's agency and foster a universal mindset. Correa frequently emphasized that Ecuador was renouncing its most beneficial option – extracting the oil – and was therefore “the principle contributor” to the initiative's financial goal (Correa, “Discurso Yasuní ITT” 7). Correa and his government characterized the initiative as an “enormous [sacrifice],” “an act of generosity,” and “an innovative, forward-looking, revolutionary idea” (Correa, “Speech of the President,” 2; Garcés 2; Correa, “Discurso Yasuní ITT” 5). Correa's characterization of Ecuador as a martyr and revolutionary established his country's agency and insisted that the Yasuní-ITT Initiative represented a measured proposal by a generous country, not a desperate plea for charity. Indeed, Correa frequently clarified this important distinction, saying, “We are not asking for charity, we are asking for joint responsibility” (Correa, “La Iniciativa Yasuní-ITT” 19). Further, this narrative attempted to foster a unified universal mindset, similar to Correa's application of CDDR. As presented by Correa and his government, Ecuador's martyrdom was intended to serve as a foundation for similar, but smaller, international contributions. This narrative bolstered the Yasuní-ITT Initiative's underlying, consistent campaign to challenge and overcome capitalist ideals of value and self-interest.

Correa's characterization of Ecuador as martyr and revolutionary eventually evolved into an explanation for the Yasuní-ITT Initiative's failure. In his speech announcing the initiative's defeat, Correa said, “the initiative was ahead of the times, and those responsible for climate change could not or did not want to understand it” and declared, “history will judge us” (Correa, “Anuncio a la Nación” 4). Whether or not Correa's assessment of the initiative's failure was correct, his righteous, superior tone emphasized Ecuador's role as a revolutionary. In fact, Correa's final speech on the Yasuní-ITT Initiative placed the blame for the proposal's failure with the global community that “could not or did not want to understand it” while characterizing Ecuador as a forward-thinking, honorable country unable to convince the world of its benevolence. While

Ecuador's characterization as martyr and revolutionary initially served to capture global support and cultivate a universal mindset, the narrative eventually transformed into an explanation for the initiative's defeat.

CONCLUSION

Although the three primary narratives employed in the Yasuní-ITT Initiative – common but differentiated responsibility, a reconceptualization of value, and Ecuador as martyr and revolutionary – challenged capitalist ideals of value and self-interest, the initiative itself worked loosely within the capitalist framework. Ecuador's pursuit of financial compensation in exchange for protection of environmental wellbeing sought to insert an alternative definition of value into the existing capitalist framework. Even while criticizing fundamental aspects of capitalism and its environmental effects, Ecuador attempted to enter capitalist inspired carbon markets. Interestingly, Ecuador's efforts to gain recognition for "Net Emissions Avoided" mirrored the inception of carbon markets when "the market narrative was used to establish a new commodity in carbon reductions" (Liverman 295). The Yasuní-ITT Initiative attempted to create a new commodity – avoided emissions – within the capitalist framework, but the narratives employed in the campaign challenged fundamental aspects of capitalism.

As a case study, the Yasuní-ITT Initiative provides evidence for the seemingly unavoidable role of capitalist inspired market solutions in international climate change mitigation. Erik Swyngedouw writes about the "post-political frame" of climate change, marked by "the perceived inevitability of capitalism and a market economy as the basic organizational structure of the social and economic order, for which there is no alternative" (Swyngedouw 215). Unfortunately, the fate of the Yasuní-ITT Initiative seems to support this analysis. The narratives employed in the initiative – common but unequal responsibility, a reconceptualization of value, and Ecuador as martyr and revolutionary – challenged key characteristics of capitalism and demanded a global ideological shift, but the initiative itself sought to operate within the capitalist system. The global community rejected Ecuador's attempts to redefine value and foster a universal mindset to approach climate change. When it comes to international mitigation efforts, it may indeed be true that "only policies which offer mutual self-interested gains...stand a chance of succeeding" (Pearce 10).

The narratives deployed in the Yasuní-ITT Initiative failed to attract global support, but they nevertheless could serve an important role in climate change mitigation, albeit on a different scale. The Yasuní-ITT Initiative ambitiously called for "a major discursive shift...across local, national and global arenas" (Espinosa 34). It removed place and culture specific concepts like *Buen Vivir* from their context and asked the global community to embrace their values. It challenged wealthy countries with strong ties to the oil industry to pay for crude oil to be left untouched. In short, the Yasuní-ITT Initiative may simply have been too ambitious. However, its narratives should not be discarded. Instead, the alternative narratives discussed here should be applied on a smaller, local scale to achieve climate change mitigation. The results will likely be less profound than 846 million barrels of crude oil and 407 million tons of carbon dioxide, but progress is progress.

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Rotational Properties of the Extraordinary Multi-tailed Asteroid P/2013 P5

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ABSTRACT

Observations made with the Hubble Space Telescope in September 2013 revealed that the asteroid known as P/2013 P5 appeared to have six comet-like tails. Jewitt et al. (2013) concluded that this extraordinary structure and activity could not be explained by traditional near-surface ice sublimation or collision events ejecting particles from the asteroid's surface. Instead, the most likely explanation is that this unusual object has been spun-up by solar radiation forces to a critical limit which has resulted in the rotational disruption of the asteroid causing the unique six-tail structure. This interpretation predicts that the nucleus of this comet-like asteroid should be in rapid rotation. In November 2013, broadband photometry of P/2013 P5 was obtained with Lowell Observatory's 4.3-meter Discovery Channel Telescope using the Large Monolithic Imager to investigate the possibility of rapid rotation. While the variation in the rotational light curve from these data was too small to be justifiable, morphological changes in the nucleus-coma system were observed.

1. INTRODUCTION

To date, there are twelve known celestial bodies in the Solar System, labeled Main Belt Comets (e.g. Hsieh & Jewitt, 2006) or Active Asteroids (Jewitt, 2012). These are objects that exhibit both asteroid and comet-like properties, typically with a circular, asteroid-like orbit and a comet-like dust tail. Among them is P/2013 P5, a comet-asteroid transition object discovered by the PAN-STARRS telescope in August 2013. Jewitt et al. (2013) further investigated this object in September 2013 with the Hubble Space Telescope (HST). The high-resolution camera revealed the unique six comet-like dust tails of asteroid P/2013 P5 (Figure 1). Jewitt et al. (2013) observed the object on both September 10, 2013 and September 23, 2013. In this two-week time span between observations, P/2013 P5 displayed many differences in the appearance of its six tails. Tail A changed the least in length and brightness, while Tail F increased in both length and brightness. By performing a comet tail modeling technique called synchrone modeling, Jewitt et al. (2013) used a range of particle sizes and positions to conclude that each tail of P/2013 P5 was the result of an individual event. From the synchrone modeling, they determined that the first tail (Tail A) originated April 15 ± 2 days and the sixth tail (Tail F) originated on September 4 just days before Jewitt et al. (2013) observed the asteroid on September 10, 2013. With tail activity evident over a

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five-month period between April and September, the object has sustained consistent mass loss, and therefore, exhibits a comet-like appearance. The unique six-tail feature makes asteroid P/2013 P5 of particular interest to the study of asteroid-comet transition objects.

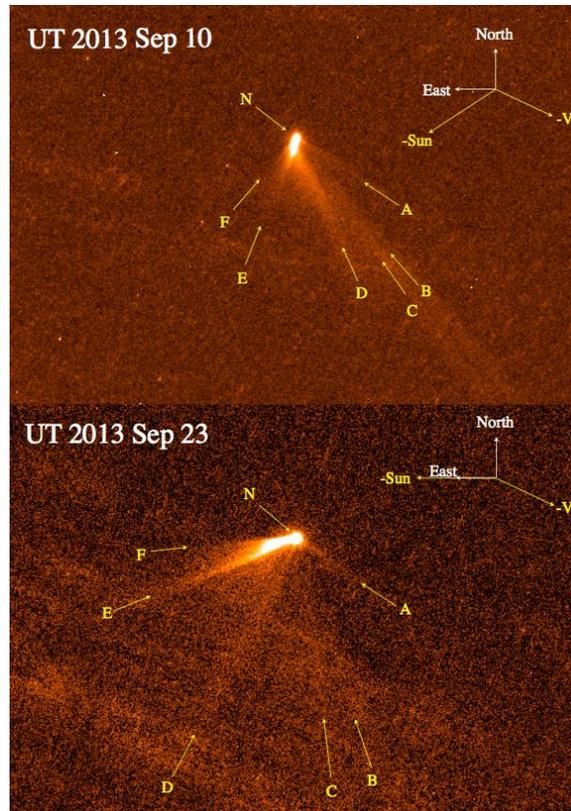


Figure 1: Hubble Space Telescope Image of P/2013 P5 taken on September 10, 2013 (top) and September 23, 2013 (bottom). The appearance of the object changes between the images with its six unique tails (A-F) growing both in length and brightness from the top image to the bottom image. The width of the image is 23,000 km, equivalent to 28 arcseconds (28") in astronomical units, with the tails extending approximately 25" (Jewitt et al., 2013).

2. PURPOSE

The purpose of this research is to study the unique comet-like properties of asteroid P/2013 P5 and to search for a mechanism to explain such activity for an object that is traditionally inactive. Data were taken by Dr. Stephen Levine at the Discovery Channel Telescope (DCT) in November 2013 using the Large Monolithic Imager (LMI). The findings will contribute to the field of active-asteroid research by furthering the understanding of the evolution and possible disruption mechanisms of asteroids. As a result, this research will also ultimately advance our understanding of the formation and evolution of the Solar System because asteroids are direct remnants of the formation.

3. BACKGROUND

3.1 PLANET FORMATION

Current hypotheses about the origins of the Solar System suggest that our sun formed from an over-dense molecular cloud which collapsed approximately 4.56 billion years ago. Once a molecular cloud collapses, it becomes the birthplace for stars. Through conservation of angular momentum, the cloud of gas and dust surrounding the new star flattens and becomes an accreting disk called a protoplanetary disk. Over time, the protoplanetary disk loses its gas cloud and becomes a debris disk composed of dust grains that may combine to form small celestial bodies called planetesimals. Some of these planetesimals merge and continue to accrete material to form planets, while other planetesimals that do not accrete enough dust or do not fuse together with another planetesimal, form asteroids and other small bodies in the Solar System. These planetesimals now occupy the Asteroid Belt, Kuiper Belt, and Oort Cloud (Figure 2).

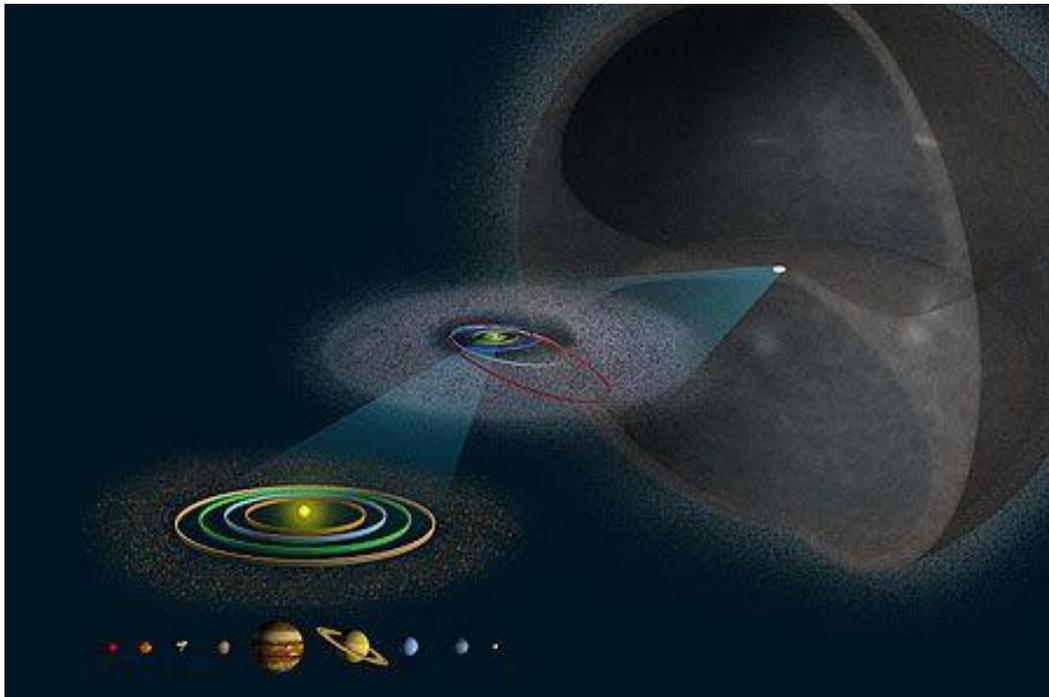


Figure 2: The Asteroid Belt (left) resides between Mars and Jupiter in the inner solar system. The Kuiper Belt (center), which lies just beyond Neptune, is home to many short period comets. The Oort Cloud (right) is mysterious in that it is predicted to be a giant cloud outside of the planets surrounding the sun. It houses icy objects with less regular orbits, longer periods, and higher eccentricity, or ellipticity, than objects in the Asteroid Belt and Kuiper Belt.

3.2 SMALL BODIES

Small bodies consist of asteroids, comets, Oort Cloud objects, Kuiper Belt objects, and small planetary satellites in the Solar System. These bodies are classified as outer and inner small Solar System bodies based on their distance from the Sun. Objects beyond Neptune are referred to as outer small Solar System bodies and consist of comets, Kuiper Belt objects, and Oort Cloud objects. The inner small Solar System bodies, falling within the orbit of Neptune, consist of Main Belt asteroids and Jupiter Trojans.

Comets and asteroids are identified based on both their physical and dynamical properties. Physically, comets are icy bodies that reside in the outer solar system, typically in the Kuiper Belt and Oort Cloud. Comets are often icy because they were formed beyond the “snow-line”, an imaginary line in the solar system that separates the terrestrial planets from the gas and ice giants. As a result, comets contain a large amount of volatile material. Hsieh et al. (2004) states that observationally, comets have a gravitationally unbound atmosphere called a coma and an accompanying tail, while asteroids do not. This is usually the result of near-surface ice sublimation where the comet is turned on and off as it goes through perihelion and aphelion, closest approach to the sun and furthest approach from the sun. As volatiles sublimate from the surface, gas and dust from the comet's interior are excavated and ejected due to the very low surface gravity of a typical cometary nucleus. Because asteroids contain much less volatile material, these physical properties are not usually observed. Asteroids and comets also have very different orbital properties. While comets have highly elliptical orbits, asteroids have much more circular orbits (Figure 3). This distinction is quantified using a parameter called the Tisserand parameter (T_J)

$$T_J = \frac{a_J}{a} + 2 \left[(1 - e^2) \frac{a}{a_J} \right]^{1/2} \cos(i). \quad (1)$$

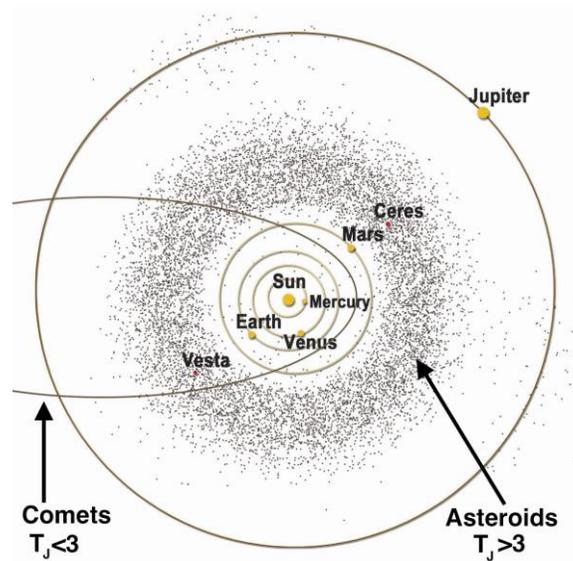


Figure 3: Comets and asteroids have very different dynamical properties. Comets have highly elliptical orbits quantified by a $T_J < 3$ while asteroids have more circular orbits with a $T_J > 3$.

The Tisserand parameter is a measure of small body orbital elements including semi-major axis (a), inclination (i), and eccentricity (e) of a small body and a larger perturbing body (a_J), which, for comets and asteroids, is Jupiter (Eq.1). Most comets have a $T_J < 3$, while asteroids have a $T_J > 3$. P/2013 P5 has a T_J of 3.66 (Jewitt et al., 2013), placing it in the category of asteroids ($T_J > 3$) due to its asteroid-like orbit.

Below, Figure 4 shows nine of the eleven active asteroids that have been discovered as of March 2012 (Jewitt, 2012). All of these objects, including P/2013 P5, resemble comets in their appearance, making the asteroid-comet categorization more complex.

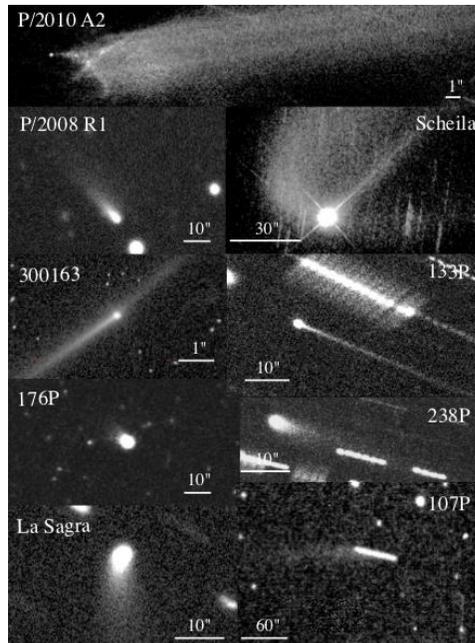


Figure 4: Eleven active asteroids have been discovered since 2004 including the nine shown above where the tail can be spatially resolved (Jewitt 2012).

3.3 ACTIVE ASTEROIDS

It was not until after the discovery of 133P/Elst Pizarro (Figure 5) in 1996 that astronomers began focusing on the comet-asteroid transition and studying objects that fell into a categorical grey area. Elst Pizarro was the first asteroid discovered with comet-like activity. When it was initially studied in 1996, the tail was deemed the result of a chance impact, and thereby predicted to extinguish. However, this conclusion was disproved when the comet-like activity was observed again by Hsieh et al. in 2004. Hsieh et al. (2004) studied the asteroid for several months and observed changes in the structure and brightness of the dust tail. As a result, they concluded that the tail was not the product of a one-time impact, but instead that it was actively generated over long periods of time revealing that the asteroid was in fact losing mass. The cause of the mass loss, however, was unclear.

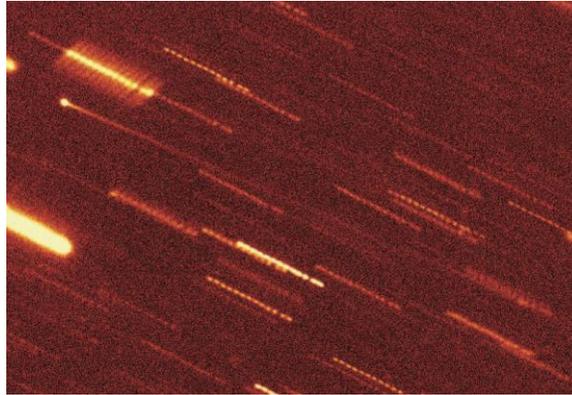


Figure 5: Elst Pizarro (upper left corner) was the first active asteroid discovered in 1996. The activity was eventually deemed the cause of near-surface ice sublimation by Hsieh et al. (2004).

3.4 REASONS FOR MASS LOSS

Mass-losing asteroids are now referred to as Main Belt Comets or Active Asteroids. Historically, near-Earth asteroids (NEAs) were studied as possible extinct or dormant comets. Hartmann, Tholen, and Cruikshank (1987) described the different stages of a comet: active, dormant, and extinct. They discussed the possibility that some comets may be misidentified as asteroids in appearance due to a very faint tail or coma that is not observable from earth. This ambiguity became a popular area of research because astronomers were interested in determining if any NEAs were at risk of becoming active again. On the other hand, the concept of asteroids having a comet-like appearance was puzzling to astronomers who were unsure of how an asteroid, with a limited amount of volatile material, would begin to generate mass loss.

Jewitt (2012) describes the eleven current explanations for how asteroids can lose mass. These explanations fall under three main processes related to collisional events, near-surface ice sublimation, and rotational fission. While collision events and near-surface ice sublimation are conceptually simple explanations, rotational fission is more complicated and less understood.

The Classical Model for asteroids describes their evolution based on collisions and gravitational effects, but is unable to explain the origin of NEAs (Bottke, 2006). Non-gravitational forces, first discussed by Yarkovsky in the early 1900s, can help to reconcile this issue (Bottke, 2006). These non-gravitational forces are referred to as the Yarkovsky and YORP Effects (Figure 6).

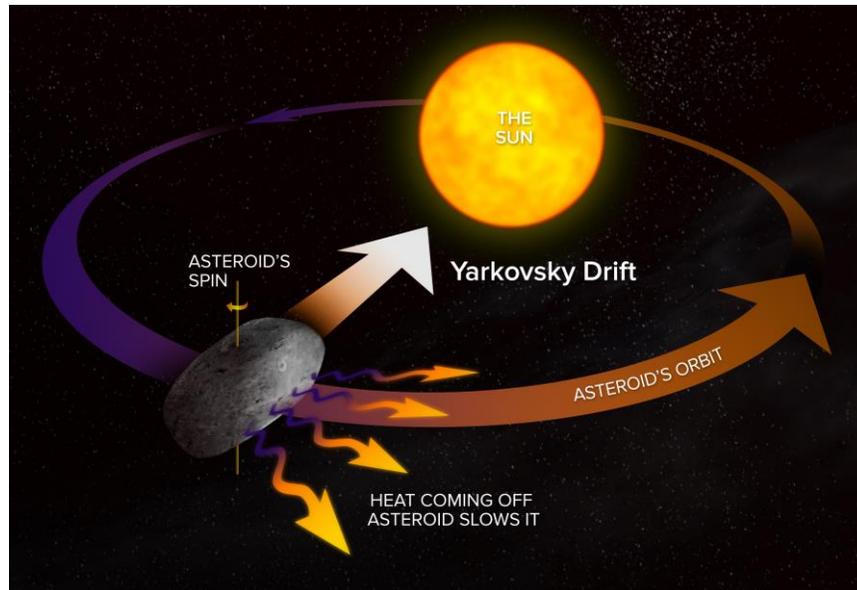


Figure 6: Solar radiation forces, known as the Yarkovsky and YORP Effects, heat up the sunward side of small bodies and alter both the orbit and rotation rate of the objects (Figure from NRAO).

As the object orbits around the sun, the sunward side of the object warms up and the heat is ultimately re-radiated into space. Since photons carry momentum, the asteroid feels a net force opposite in direction to that in which thermal photons are emitted from the hottest point on the surface. Since the object has thermal inertia, resulting in a temperature distribution delay, the object also feels a force along the direction of its orbit. This force results in an increase or decrease in the semi-major axis of the object's orbit depending on the direction of rotation- prograde or retrograde motion. This is referred to as the Yarkovsky Effect. While the Yarkovsky Effect alters the orbit, the YORP effect alters the spin rate. The reflection and re-emission of sunlight creates a net thermal torque on the object as a result of the non-uniformity of its shape, causing the object to either spin up or spin down. The Yarkovsky Effect is the result of rotation, whereas the YORP Effect is due to both rotation and shape. An object that is perfectly spherical will not undergo the YORP torque. Most small bodies, however, are very irregularly shaped. Because of this, they experience the Yarkovsky and YORP Effects simultaneously. Once an asteroid has been spun up by the YORP Effect, it is susceptible to rotational fission, or breakup.

There are two leading theories to explain the process of rotational fission. Scheeres (2007) looks at the different outcomes for a contact binary system that has been spun up by the YORP effect (Figure 7). Scheeres (2007) describes a macroscopic process where rotational fission occurs when the angular momentum of the object has been increased to the point where centripetal acceleration overcomes gravitational binding so that the bodies are no longer in contact.

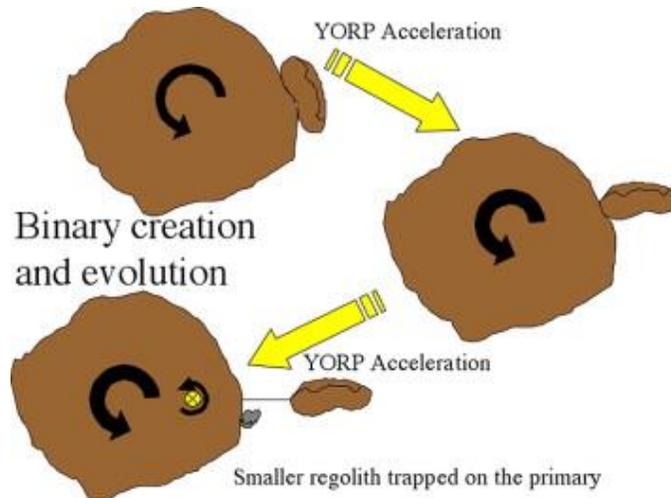


Figure 7: Contact binary asteroids will fission once spun up to the critical spin rate as a result of Yarkovsky and YORP effects (Scheeres 2007).

Walsh (2008) instead looks at how a small binary asteroid system is formed when a rubble pile asteroid is spun up to the critical spin limit by YORP torques. As the rotation of the asteroid increases, self-gravity and centrifugal forces due to the rotation cause stress, allowing mass to leave the poles and accumulate near the equator. The object bulges and mass is shed from the equator, which allows the asteroid to reach a minimum energy state (Figure 8). The shed material can then accrete to form satellites.

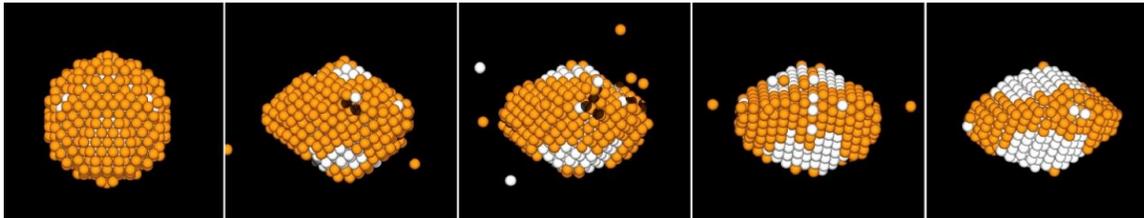


Figure 8: With enough angular momentum, rubble pile asteroids will rotationally fission by shedding mass in the equatorial plane to form satellites (Walsh 2008).

4. HYPOTHESIS

P/2013 P5 is an inner belt asteroid with a semi-major axis of 2.189 Astronomical Units (AU). Jewitt et al. (2013) predicted P/2013 P5 to be a member of the Flora asteroid family based on its location in the inner belt. Due to the history of the Flora family and the small size of the P/2013 P5, which is just under 0.5 km in diameter, P/2013 P5 is thought to have likely undergone many collisions in its lifetime. As a result, the asteroid probably contains little to no volatile material,

making it highly unlikely that the cause of activity is a product of near-surface ice sublimation. As noted previously, Jewitt et al. (2013) took data of P/2013 P5 on both September 10 and September 23. A summary of their results is shown below in Table 1. On each night, a multi-tailed structure was observed extending further than 25". While the nucleus remained in tact, the brightness and position of the tails changed between the nights, leading Jewitt et al. (2013) to conclude that each tail is the result of a separate event. It is extremely unlikely that this asteroid has undergone six separate collision events in a five-month period. As a result, collision is an unlikely cause of activity. Jewitt et al. (2013) claimed that the most likely explanation for the cause of the six unique tails in P/2013 P5 is spin-up and rapid rotation of the asteroid by the solar radiation forces and torques of the YORP Effects. My research plan is to further investigate Jewitt's hypothesis that the cause of activity is due to rapid rotation of the nucleus of P/2013 P5.

Table 1: Summary of Jewitt et al. (2013) results.

Name	Value
Semi-major Axis	2.189 AU
Eccentricity	0.115
Inclination	5°.0
Nucleus	$< 0.24 \pm 0.04$ km
T_J	3.66
H_v	18.6
p_v	0.29 ± 0.09

5. OBSERVATIONS

P/2013 P5 was observed on Universal Time (UT) 2013 November 18 using the Large Monolithic Imager instrument on the 4-meter Discovery Channel Telescope. A summary of the observations is detailed in Table 2 located at the end of this paper. The Large Monolithic Imager is an all-purpose charged coupled device (CCD) camera that images a large 12.5x12.5 arcminute field of view. The data images were binned 2x2 pixels providing a higher spatial resolution of 0.24"/pixel instead of 0.12"/pixel, allowing for the tails of P/2013 P5 to be resolved in the images. At the time of the observations, P/2013 P5 was at a heliocentric distance of 2.028 AU, a geocentric distance of 1.553 AU, and a predicted magnitude of 21.0. The direct scale comparison of my Discovery Channel Telescope data to Jewitt et al.'s Hubble Space Telescope data is shown in Figure 9 below.

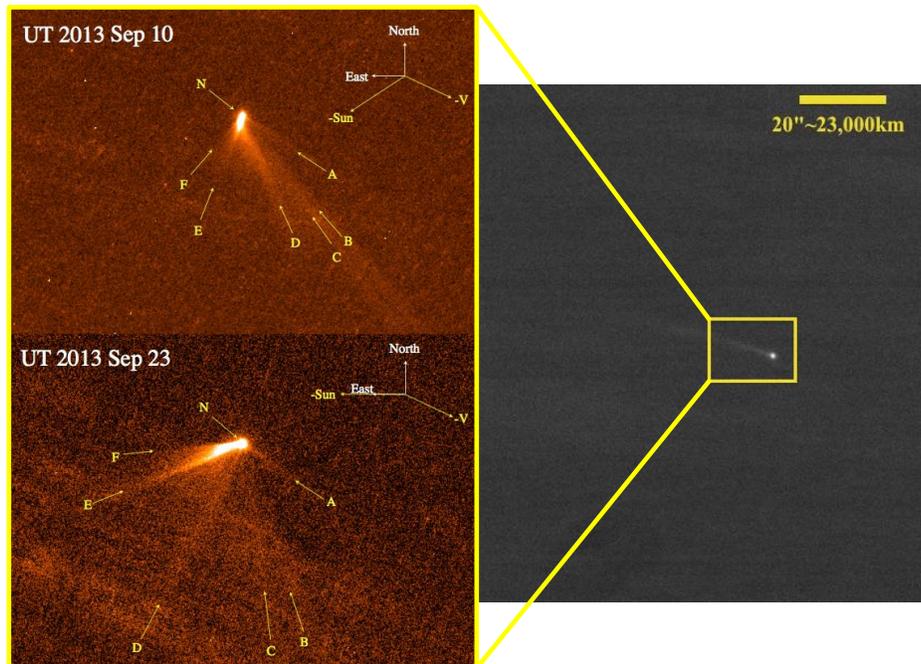


Figure 9: Scale comparison of HST image versus DCT image of P/2013 P5 (Jewitt et al. 2013). DCT image of P/2013 P5 created from composite of asteroid-rate tracked images. The tail extends $>20''$. The width of the image is $2'$ (135,000 km).

6. METHODS

6.1 DATA REDUCTION

The programming languages Interactive Data Language (IDL) and Image Reduction and Analysis Facility (IRAF) were used to reduce and analyze the data to arrive at the proposed conclusions about the rapid rotational period of the nucleus of P/2013 P5. The reduction is a multi-step process that includes three different types of data files: biases, flat fields, and science data.

The bias images and overscan regions are used to calculate the zero noise level of the charged coupled device (CCD) camera. The zero noise level is a pixel intensity offset that is inherent to the CCD, so that once calculated, the offset is subtracted off of all of the asteroid data images. This bias offset is used to avoid negative intensities in the CCD readout when taking data. There are two ways to evaluate the bias offset- through bias images or an overscan region. Bias images are zero second exposures taken with the shutter closed to have data on the readout of unexposed pixels. The overscan region is a set of rows and columns that are added to each data image. These are not physical rows or columns, but instead pseudo rows and pseudo columns created by scanning additional cycles to the readout. The bias frames are usually more useful than the overscan regions because they represent a 2D bias image where the bias offset can be subtracted pixel by pixel from each image, while the overscan is only a 1D vector.

The second type of CCD data file, flat field, is used in a correction process of the CCD detector. CCDs are not perfect imaging devices. Within the CCD, each pixel responds differently to the light coming in. Therefore, it has a different Quantum Efficiency value when compared to its neighboring pixels. The purpose of a flat field image is to correct for this inconsistency. The goal is to have a flat field that consists of uniform illumination of every pixel by a light source that has an identical response to that of the science data. By dividing by a normalized flat field, the pixel-to-pixel variations are removed. There are two types of flat fields: dome flats and twilight flats. Dome flats are taken using a uniformly illuminated screen on the inside wall of the dome whereas twilight flats are taken on a blank piece of sky. While flat fields are primarily used to correct for the pixel-to-pixel variations, they are also used to correct for dust donuts that appear on the image frames as a result of dust on the filters or primary mirror. Flat fields at the Discovery Channel Telescope were created using Twilight Flats.

The third type of CCD data file, science data, is unique to each research goal. For this project, the science data consists of about forty images taken over the course of four hours using the LMI detector at the DCT in Flagstaff, Arizona. All data frames were taken using the Sloan Digital Sky Survey (SDSS) r' filter. The first four images were tracked on the stars using sidereal tracking, while the remaining images were non-sidereal tracked, and instead, tracked on the asteroid.

All of the data files described above were used together to reduce the science data using both IDL and IRAF software. The method for reducing data in IDL is a much more interactive process, while IRAF has many procedures pre-written for convenience. Both software programs require the same reduction steps. The major steps include accounting for instrument effects by subtracting off the bias file and removal of atmospheric effects by applying a flat field correction. These standard reduction steps were performed on all asteroid data files in both IRAF and IDL languages.

After reducing the data, the stacked image shown in Figure 9 above was created as a composite of all asteroid-rate tracked images that were combined to increase the signal-to-noise ratio of P/2013 P5. The increased resolution of the stacked image shows an extended tail from the nucleus greater than 20", slightly less than the size of the tail Jewitt et al. (2013) observed using HST.

6.2 PHOTOMETRY

To prove that the cause of activity on P/2013 P5 is rotational fission resulting from the YORP Effect, we investigated the rotational period of the nucleus using photometry. Astronomical photometry is a technique involving the calculation of total flux of the target object. Once the flux is calculated, the measurement can be converted to an absolute magnitude and plotted with time as a light curve. Here, the rotational period can be calculated. If the object is in fact undergoing a rapid rotation, we would expect to see a light curve with a period of 2.2 hours.

To begin the photometry process, differential photometry and magnitude calibration were performed at the same time for each image. Differential photometry observes both the target object (P/2013 P5) and the comparison objects (solar analog field stars) at the same time in the same image. Solar analog field stars have the same colors as that of our Sun. The sunlight that is

reflected off of objects like comets and asteroids is the light that is collected by the telescope, so comets and asteroids appear solar colored.

Photometric calibration was executed on the magnitude of five solar analog field stars in both the sidereal and non-sidereal rate tracked images. The solar colors are defined as the difference in magnitude between two consecutive filters. The DCT data were taken using the Sloan Digital Sky Survey (SDSS) *r'* filter. In the Sloan field, the filters used are *ugriz*. Solar colors are therefore defined as the difference in magnitude for *u-g*, *g-r*, *r-i*, and *i-z* magnitudes. The Aladin interactive sky atlas from Strasbourg Astronomical Data Center was used with the SDSS-DR9 (Release 8 2012) catalog to search for solar analog field stars that were also in my field of view. Once solar analogs with a range of magnitudes were found, the Aladin software was used to determine the absolute magnitude of the solar analog field stars. Because we are looking at only solar-colored objects, the standard photometric equation can be reduced and simplified (Eq. 2 – Eq. 4).

$$V_{abs} = V_{inst} + Z + \chi \cdot c_1 + (V - R) \cdot c_2 \quad (2)$$

$$V_{abs,asteroid} - V_{abs,star} = V_{inst,asteroid} - V_{inst,star} \quad (3)$$

$$V_{abs,asteroid} = V_{inst,asteroid} - (V_{abs,star} + V_{inst,star}) \quad (4)$$

The standard photometric equation calculates the absolute magnitude of the object (V_{abs}) by applying an offset to the instrumental magnitude (V_{ins}). This offset is composed of a zero point correction (Z), an extinction correction (χ), and a color correction ($V-R$). Because the data were only taken using one filter (r'), the absolute magnitude of the object can be calculated by using information from the solar analog field stars. By subtracting the photometric equation for P/2013 P5 (Eq. 2) from the photometric equation for a solar analog field star (Eq. 2), the offsets are cancelled out, leaving only the instrumental and absolute magnitudes (Eq. 3). This process allows for the direct calculation of the absolute magnitude of the asteroid by subtracting the magnitude difference of the solar analog field star, “delta-mag”, from the instrumental magnitude of the asteroid that is computed by the IRAF *PHOT* package (Eq. 4).

The guidelines explained in *A User's Guide to Stellar CCD Photometry* by Phil Massey were followed to set the photometry parameter values. The basic idea is to place an aperture over the target object and calculate the total flux in the aperture. Initial photometry involving a range of different circular aperture radii and curve-of-growth analysis was used to determine the appropriate aperture radius to use in the photometry of the field stars. From curve-of-growth analysis, a process involving creating plots to maximize the signal-to-noise ratio and maintain 95% of the total flux, an aperture radius of three was selected for the solar analog field stars in the sidereal rate tracked images and an aperture radius of ten was selected for the non-sidereal rate tracked images. Absolute magnitudes specified by the Sloan catalog were used to calculate the calibration offset (“delta-mag”) for the transformation from instrumental to absolute magnitude of the asteroid.

Conversely, an aperture radius of ten was selected for the sidereal tracked images and three for the non-sidereal rate tracked images for photometry on the asteroid- reversed apertures from those used for photometry on the field stars. Figure 10 shows the resulting light curve for the asteroid using the stated aperture radii of 10 and 3. The light curve shows both a positive linear trend and some variability. In order to ensure that this variability was unique to the rotation properties of P/2013 P5, photometry using the same procedure was performed on field asteroid 2006 BZ253 that was traveling at a rate of $17''/\text{min}$, while P/2013 P5 was traveling at $41''/\text{min}$. Figure 11 shows the light curves of both the 2006 BZ253 and P/2013 P5, revealing similarity between the two. As a result, other sources of variability need to be removed from the data. Because 2006 BZ253 is an asteroid and does not display evidence for mass loss, we would expect that it is rotating with a more standard rotation speed and therefore a shorter period than that of P/2013 P5. Thus, the light curves for these two objects should not look the same.

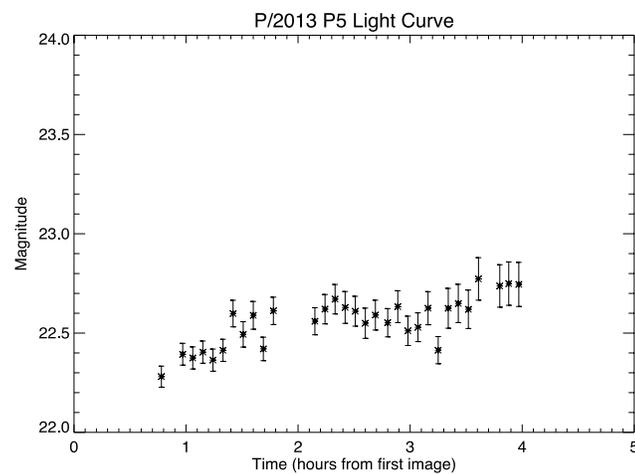


Figure 10: P/2013 P5 Light Curve created using on-chip differential photometry and an aperture radius of 3 pixels.

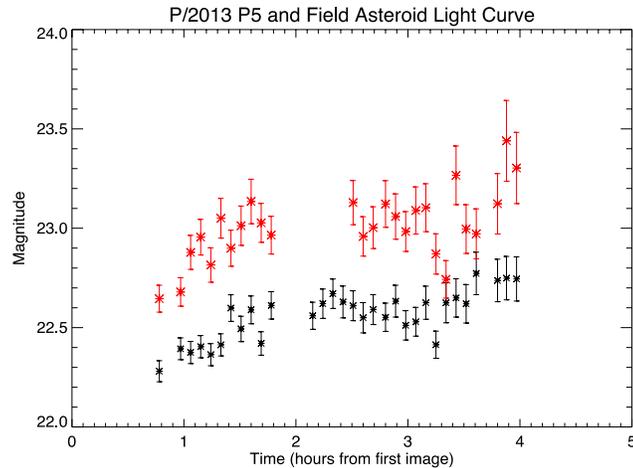


Figure 11: Light curves of P/2013 P5 (black) and 2006 BZ253 (red). Both light curves were created using the same photometric procedures and an aperture radius of 3 pixels.

6.3 CHARACTERIZING VARIABILITY

In order to isolate the rotational properties in the light curve, all sources of variability should be characterized and removed from the data. The first goal was to characterize the effects of seeing. Astronomical seeing describes the blurring and twinkling of astronomical objects caused by the Earth's atmosphere. The easiest way to quantify seeing effects is by calculating the full width at half maximum (FWHM) of the objects. To do this, a cut was taken on the trailed field stars of the asteroid-rate tracked images perpendicular to the direction of the star trails. A Gaussian profile was fit to each cut and the FWHM was plotted with time to quantify the seeing changes throughout the night (Figure 12). This plot illustrates a positive linear trend that is consistent with the linear trend seen in the light curve of P/2013 P5, revealing that the seeing effects had a significant impact on the data.

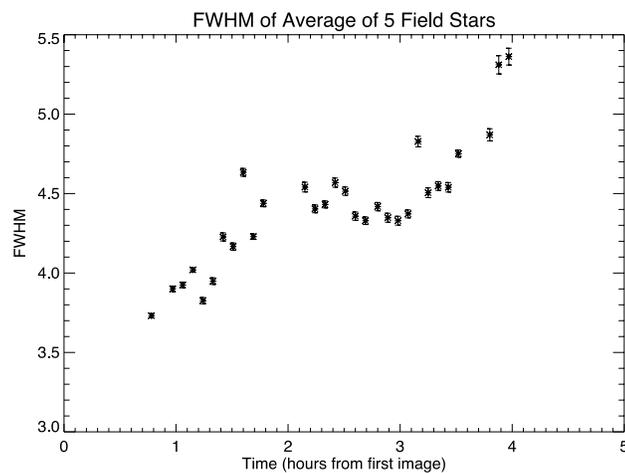


Figure 12: The FWHM was plotted for a Gaussian profile that was fit to field stars in the direction perpendicular to the star trails. The variation in FWHM quantifies the seeing and focus conditions at the time of each image.

The FWHM vector was normalized to an aperture radius of three. This gave a vector of aperture radii that were optimized for the seeing conditions at the time of each image. Scaled aperture photometry was performed on the target asteroid P/2013 P5 using the vector of unique aperture radii specific to each image. Figure 13 shows the resulting light curve for P/2013 P5 using optimized aperture photometry with a variable aperture radius. The plot reveals that the linear trend disappeared with the aperture radius optimization, and there is still some variability in the light curve. The errors are on the level of 0.07 magnitude, while there is no significant variability in the data on the level of 0.15 magnitude.

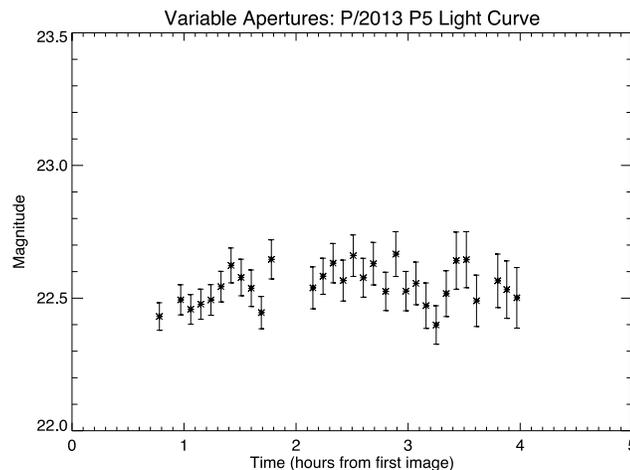


Figure 13: Light Curve of P/2013 P5 created using optimal aperture photometry. Aperture radii were optimized by taking into account the seeing and focus conditions at the time of the image. This was done using the FWHM.

Table 3 located at the end of the paper shows the seeing quantified as a function of both time and airmass. Unfortunately, continuing to characterize the sources of variability would not increase the sensitivity of the variations enough to conclude anything significant about the rotational properties of P/2013 P5. Instead, we chose to proceed forward by analyzing morphological changes in the nucleus-coma of P/2013 P5 instead of through light curves.

6.4 MORPHOLOGY OF P/2013 P5

Looking at changes in the nucleus-coma system in both time and space across the coma relative to the comet's center of brightness could lead to insight in P/2013 P5's rotational properties. We focused on changes in brightness and structure of the coma. The brightness

changes can be observed by looking at how the brightness changes as a function of rotation angle, while the changes in coma are observed by subtracting off the constant nucleus and looking at the changes in the residual. Six stacks of five images were created of asteroid-rate tracked images. These mini stacks were used to track changes in the nucleus-coma system in both time and space.

6.4.1. GENERAL MORPHOLOGY CHANGES

To make an initial inspection of changes occurring in the asteroid, the total flux in the first 90° wedge (the upper left quadrant of the data array) was calculated for each stack and plotted versus time (Figure 14). Figure 14 reveals that there is variation in the flux and the change appears to follow a regular pattern. The variation in the flux is at the level of 10% deviation from the mean. The variation does not fit the trend of seeing throughout the night, which followed a positive linear trend seen in Figure 12, giving us reason to further investigate this variability by looking at both brightness and structure changes in the coma as described above.

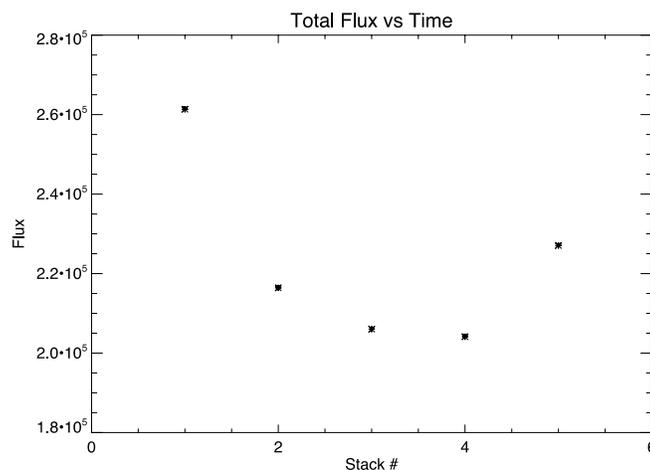


Figure 14: The total flux in a 90° wedge for each of the five mini stacks. The errors are at the level of 0.21% of the mean, while the variance is at the level of 10% of the mean.

6.4.2 BRIGHTNESS CHANGES IN THE NUCLEUS

A $7.68'' \times 7.68''$ box was extracted from each stacked asteroid image, with the nucleus-coma system located at the center. The box was rotated clockwise in increments of 5° . At each 5° rotation, a 5° wedge was extracted from the box (Figure 15). Larger wedges of 15° , 45° , and 90° were created by summing together the 5° wedges to look for morphological changes (Figure 15).

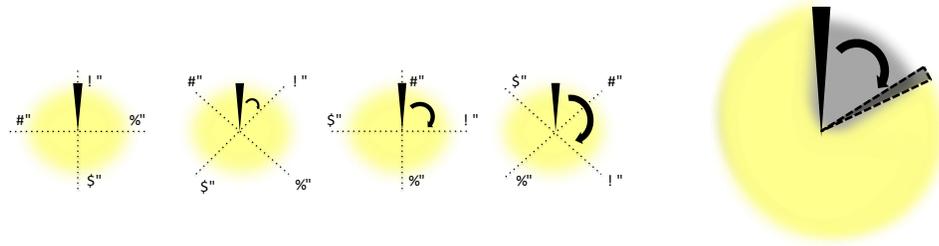


Figure 15: 5° wedges were extracted at every rotation increments of 5° clockwise for each stack. 5° wedges were averaged together to form larger wedges of 15° , 45° , 90° , and 180° .

Radial profiles of the four 90° wedges for each of the five mini stacked images were plotted, as seen in Figure 16. The brightness of each 90° wedge was tracked between the stacks by taking the total flux of each wedge and ranking its brightness from 1:4 with respect to the other three 90° wedges in the stack. These rankings are displayed in Figure 17 and the values of total flux in each wedge can be seen in Table 4. Each grid in Figure 17 represents an image stack where the colored square symbolizes a 90° wedge in its correct location in the image box. The colors of the squares correspond to the colors in the plots, while the numbers in each square represent the brightness ranking of that 90° wedge. The purpose of Figure 17 was to track wedges as P/2013 P5 rotates throughout the night and determine if there was any pattern to the motion of material in the nucleus-coma system. Based on Figure 17, while there was variation, there were no obvious regular patterns of a peak and trough that were expected if the data gave any insight into the rotational period of P/2013 P5.

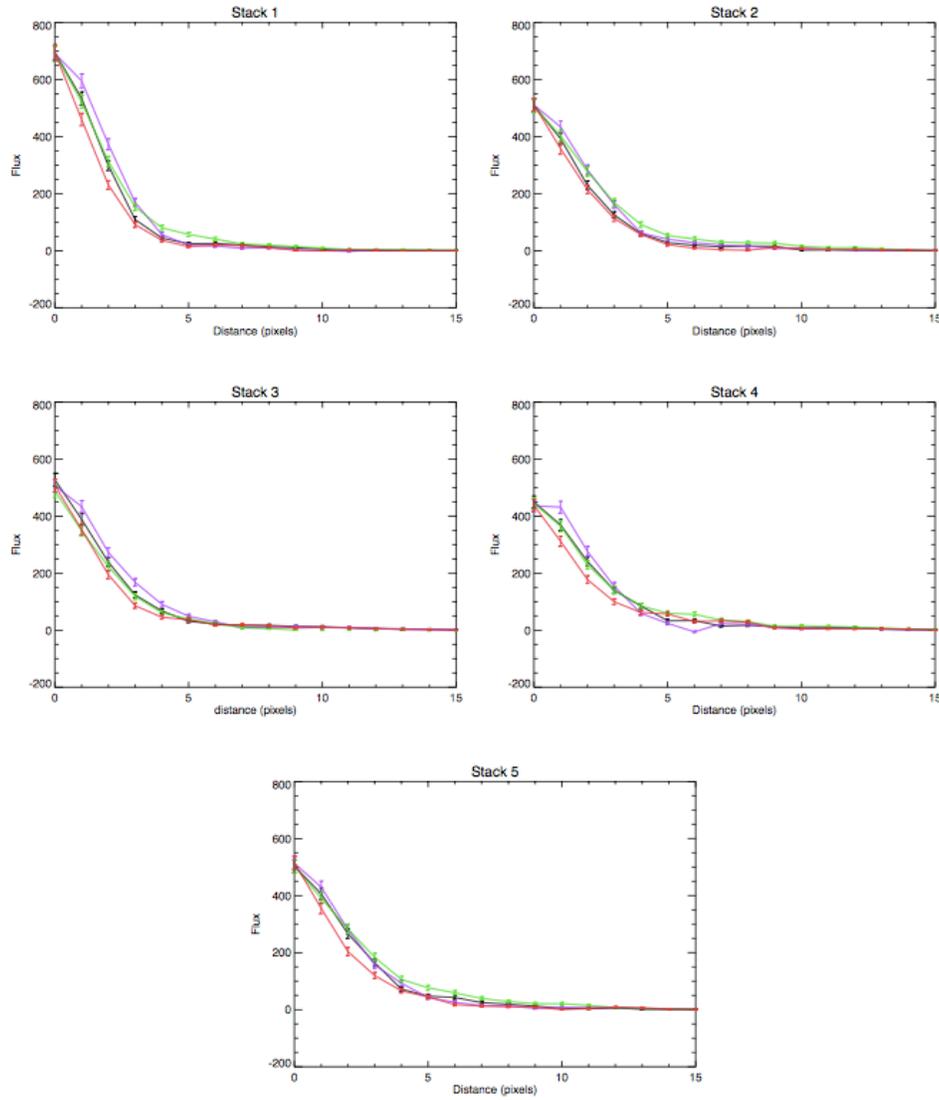


Figure 16: Radial profiles for each 90° wedge for each mini stack. The radial profile goes from the center of P/2013 P5 to the edge of the array, 3.34".



Figure 17: Brightness ranked from 1:4 using total flux in the 90° wedge. (Brightest=1, Least Bright=4.)

Table 4: The total flux of each 90° wedge for each mini-stack.

Wedge #	Flux
1901	1783.09
1902	1948.73
1903	1942.88
1904	1585.64
2901	1422.52
2902	1588.18
2903	1675.82
2904	1324.74
3901	1482.07
3902	1614.69
3903	1313.70
3904	1312.83
4901	1429.00
4902	1454.13
4903	1514.57
4904	1272.03
5901	1575.93
5902	1607.04
5903	1744.70
5904	1379.62

6.4.3 CHANGES IN THE COMA

While the brightness changes in the nucleus revealed variations, again, no clear pattern was observed over time. The next place to search for regular variability is in the structure of the coma. The nucleus-coma system is extremely complex and it is difficult to extract the coma from the nucleus. Ideally, the nucleus acts like a point source that is fuzzed out by seeing conditions, the focus of the telescope, and effects of differential refraction. The coma, which consists of gas and dust surrounding the nucleus, is expected to fall off as ρ^{-2} , where ρ is the apparent distance from the center of the nucleus. The density of the gas and dust in the coma follow the standard r^{-2} . However, because the object is observed in two dimensions, the projected column density goes as r^{-1} . Comets typically reveal behavior that falls off steeper than ρ^{-1} , but because so little is known and understood about the properties of active asteroids, the ρ^{-1} functional fit is assumed.

A Gaussian profile was created using field stars in the sidereal images. The Gaussian profiles for each of the field stars were normalized to the area under the curve and averaged together to form an ideal Gaussian profile to represent the seeing and focus conditions at that time. The FWHM seeing vector that was created in Section 5.3 was normalized to the FWHM of the ideal Gaussian profile created from the sidereal images. The vector was then applied to the Gaussian profile for each mini stacked image to account for seeing and focus conditions.

The idealized Gaussian profiles were subtracted from the 90° wedges in each of the mini stacks, where the radial wedge was mirrored to create a full profile. With the Gaussian profile removed, the remaining information should represent the coma of P/2013 P5 (Figure 18). The

residual, or coma, of each wedge was plotted for all five mini stacks (Figure 19). A similar procedure was conducted here to track the deviation of the coma as with the flux in the radial profiles (Table 5). Figure 20 shows the same five grids, each representing a stacked image. The different colored squares represent the different 90° wedges within a stack. Instead of tracking flux, the standard deviation was calculated for the absolute value of each coma profile and ranked 1:4 from largest to smallest. The resulting rankings are shown in the figure. Again, while there is variation in the structure of the coma with time and position, there is no observable pattern to the variability.

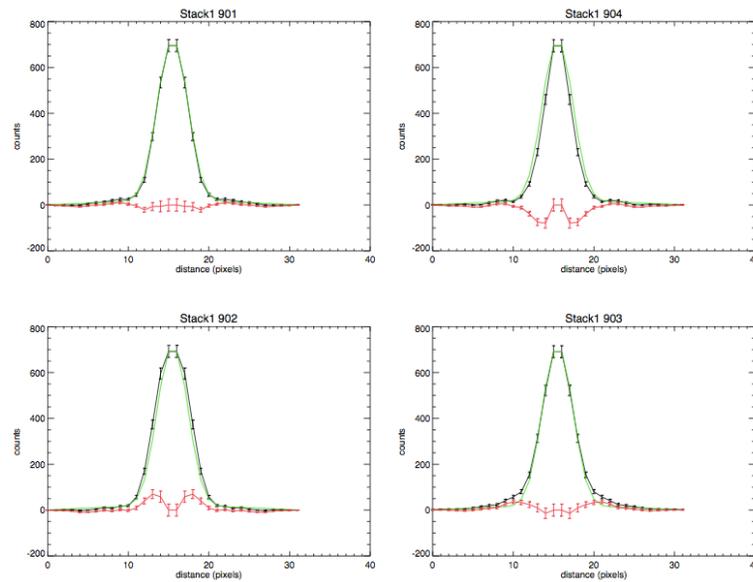


Figure 18: 90° wedges from Stack 1 (black). The ideal Gaussian profile (green) and the residual (red) are also shown.

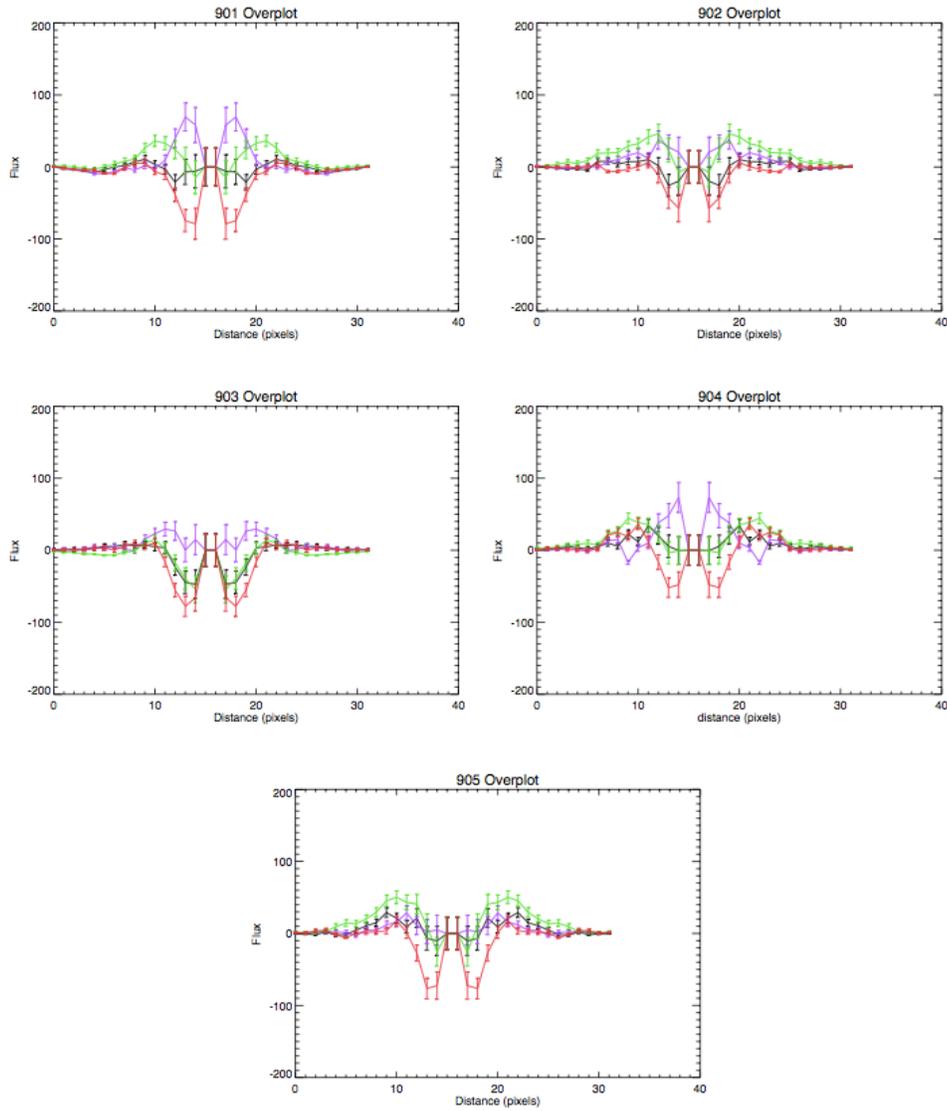


Figure 19: Residual profiles for each 90° wedge for each mini stack. The residual profile goes from the center of P/2013 P5 to the edge of the array, 3.34".

Table 5: The standard deviation of each residual after the Gaussian profile was subtracted from the 90° wedge in each mini-stack.

Wedge #	Standard Deviation
1901	7.16
1902	24.46
1903	14.25
1904	26.27
2901	9.77
2902	11.97
2903	15.90
2904	17.37
3901	17.84
3902	10.45
3903	17.13
3904	28.35
4901	9.72
4902	22.54
4903	15.33
4904	23.34
5901	11.13
5902	7.87
5903	20.71
5904	26.97



Figure 20: Change ranked from 1:4 using standard deviation in the 90° wedge. Largest Deviation=1, Smallest Deviation=4.

7. CONCLUSIONS

Photometry and morphological changes in structure and brightness of the coma-nucleus system of P/2013 P5 were investigated to search for signs of rapid rotation. Conclusions regarding the rotational properties of P/2013 P5 determined from DCT observations are as follows:

1. At an apparent magnitude of $V=22.5$ magnitude, we found no significant variability in the light curve at the level of 0.15 magnitudes.
2. The total flux in the coma-nucleus system is seen to vary at the level of 10% that is qualitatively inconsistent with seeing changes throughout the night.
3. Radial profiles of the 90° wedges for each mini stack further support the observed changes in total flux within the coma-nucleus system of P/2013 P5. The variation of each wedge from the mean flux per wedge is at the level of 11%.

4. Plots of the coma also reveal changes with time. The level in variation of the coma for each wedge from the mean deviation per wedge is at the level of 44%.

8. FUTURE WORK

We reached a null result with the data analysis that we have performed thus far. However, there are still future directions to pursue. The procedure used above only altered the time variable and did not account for the location of features within the nucleus-coma system. The following things can be done to further investigate morphology changes:

1. Break mini stack into individual images and plot total flux versus time for first 90° wedge. (What is the scale of the variance? How does this fit with variance in the flux versus time plot of stacks?)
2. Look at smaller wedges. (45° , 15°)
3. Look at smaller stacks. (10 mini stacks of 3 images)
4. Look at different wedge positions. (90° wedge starting at 15° instead of 0°)
5. Characterize the extinction. (For each image calculate total flux in the field stars and apply correction factor to account for extinction changes in flux of asteroid.)
6. Perform wedge procedure on 2006 BZ253. (These objects should not have a coma, so I could also use the data to form my idealized Gaussian profile.)
7. Use a well-written program to search for faint coma, tail, and any morphological changes (Sonnnett et al., 2013).

If these methods still yield a null result, we can return to photometry and work to fine tune the aperture radii for our optimal aperture photometry procedure by changing aperture size by 10% or 20% and investigating the effects of these changes on the sensitivity of the light curve. We can also use elliptical apertures for trailed field stars in the asteroid-rate tracked images to improve accuracy. If this still does not result in a conclusion, we could re-observe P/2013 P5 the next time it is available to look for any signs of ongoing activity.

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Table 2: Summary of Observations.

UT Time	Exposure Time (s)	Airmass	Tracking	Filter
2:09:08	180.0	1.250	sidereal	SDSS-r
2:15:59	180.0	1.250	sidereal	SDSS-r
2:30:39	180.0	1.250	sidereal	SDSS-r
2:40:26	300.0	1.260	sidereal	SDSS-r
2:58:42	300.0	1.270	asteroid-rate	SDSS-r
3:07:36	300.0	1.280	asteroid-rate	SDSS-r
3:12:59	300.0	1.290	asteroid-rate	SDSS-r
3:18:23	300.0	1.300	asteroid-rate	SDSS-r
3:23:47	300.0	1.310	asteroid-rate	SDSS-r
3:29:11	300.0	1.320	asteroid-rate	SDSS-r
3:34:34	300.0	1.330	asteroid-rate	SDSS-r
3:39:58	300.0	1.350	asteroid-rate	SDSS-r
3:45:22	300.0	1.360	asteroid-rate	SDSS-r
3:50:46	300.0	1.370	asteroid-rate	SDSS-r
3:56:09	300.0	1.390	asteroid-rate	SDSS-r
4:18:20	300.0	1.470	asteroid-rate	SDSS-r
4:23:44	300.0	1.490	asteroid-rate	SDSS-r
4:29:08	300.0	1.520	asteroid-rate	SDSS-r
4:34:32	300.0	1.540	asteroid-rate	SDSS-r
4:39:55	300.0	1.570	asteroid-rate	SDSS-r
4:45:19	300.0	1.600	asteroid-rate	SDSS-r
4:50:43	300.0	1.630	asteroid-rate	SDSS-r
4:57:00	300.0	1.670	asteroid-rate	SDSS-r
5:02:23	300.0	1.710	asteroid-rate	SDSS-r
5:07:47	300.0	1.750	asteroid-rate	SDSS-r
5:13:11	300.0	1.790	asteroid-rate	SDSS-r
5:18:35	300.0	1.840	asteroid-rate	SDSS-r
5:23:58	300.0	1.890	asteroid-rate	SDSS-r
5:29:22	300.0	1.940	asteroid-rate	SDSS-r
5:34:46	300.0	2.000	asteroid-rate	SDSS-r
5:40:10	300.0	2.060	asteroid-rate	SDSS-r
5:45:33	300.0	2.130	asteroid-rate	SDSS-r
5:57:18	300.0	2.280	asteroid-rate	SDSS-r
6:01:41	300.0	2.370	asteroid-rate	SDSS-r
6:07:05	300.0	2.460	asteroid-rate	SDSS-r

Table 3: The seeing quantified in reference to both time and airmass.

UT Time	Airmass	Optimized Aperture Radius
2:09:08	1.25	2.41606
2:15:59	1.25	2.5187
2:30:39	1.25	2.59601
2:40:26	1.26	2.82138
2:58:42	1.27	2.56028
3:07:36	1.28	2.67632
3:12:59	1.29	2.69327
3:18:23	1.30	2.75841
3:23:47	1.30	2.62533
3:29:11	1.32	2.7095
3:34:34	1.33	2.90044
3:39:58	1.35	2.8589
3:45:22	1.36	3.17944
3:50:46	1.37	2.90161
3:56:09	1.39	3.04542
4:18:20	1.47	3.11574
4:23:44	1.49	3.02146
4:29:08	1.52	3.04067
4:34:32	1.54	3.135
4:39:55	1.57	3.09803
4:45:19	1.60	2.99018
4:50:43	1.63	2.97049
4:57:00	1.67	3.03128
5:02:23	1.71	2.9834
5:07:47	1.75	2.97043
5:13:11	1.79	3
5:18:35	1.84	3.31264
5:23:58	1.89	3.09136
5:29:22	1.94	3.12041
5:34:46	2.00	3.11503
5:40:10	2.06	3.26017
5:45:33	2.13	3.57816
5:57:18	2.28	3.34157
6:01:41	2.37	3.64381
6:07:05	2.46	3.67929



Amakosikazi: Undervalued Figures in Zulu History

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ABSTRACT

Extractive European Imperial forces often justified colonization as a crusade, bringing civilization to a timeless and barbaric continent. One way of validating this justification was to create a narrative, or a history of the people being colonized, which allowed a European audience to excuse invasions as an attempt to resituate savage peoples away from their own barbaric past. This paper examines the Zulu Kingdom in southeastern Africa that rose to power after 1816 under the rule of Shaka KaSenzangakona, a controversial and powerful figure whose military and political innovations consolidated loosely affiliated peoples into a more centralized and militarized society. This article examines historical record of Zulu history to identify women who articulated agency in the political and religious spheres of Zulu history. This paper aims to contribute to decolonizing the past by supporting an argument expanding recognition of elite women in Zulu history. This will be accomplished through identifying and examining the roles of specific elite members of the royal family from what is generally considered the rise of the Zulu nation in 1816 until its eventual fall in the early twentieth century. The paper will first detail limitations of sources and explain current academic understanding, and then will progress to an analysis of specific figures in chronological order.

INTRODUCTION

Often there were no written histories in pre-colonial Sub-Saharan Africa. Histories were remembered orally, but not written down, so stories written by adventurers, colonial officials, and missionaries perpetuated many of the stereotypes and assumptions that Europeans in Africa held in early written histories. No alternative written history existed to counter or correct from an African viewpoint. Researchers working on pre-colonial and early colonial African history must therefore rely on written documents produced in a highly biased context. Such narratives, while problematic in themselves, can still permit us to reassess the peoples they depict with a more nuanced sensitivity to the fluidity of gender roles, and a more nuanced awareness of the nature of political power structures.

Under leadership of Shaka, his brothers and their progeny, the Zulu Kingdom posed the most widely recognized threat to settler expansion and colonial conquest in the hundred years following its rise. The fortunes of the Zulu kingdom closely correlated to the Zulu royal family, and while the kings in this family have been studied extensively, the women have been largely ignored in historical texts. European officers, explorers, and historians conveyed an image of the

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Zulu as violently patriarchal, pagan savages to Victorian English Society. This image was informed by their own patriarchy and colonial aims, which sought to validate their exploits to British society. It did not tend to recognition of female agency, and thus often overlooks it, except as an anomalous or unnatural phenomenon. These elite women and collective groups of women have been portrayed as objects of history by English historians who typified Zulu society as a strict patriarchy. However, Zulu elite women did react to external intervention and shaped it alongside their male counterparts.

HISTORIOGRAPHY AND SOURCES

When examining primary sources, it is always necessary to first assess the point of view in which any particular piece was written. The evidence put forth in this paper draws primarily on the James Stuart Archive of Oral Histories (5 volumes), The Diary of Henry Francis Fynn, praise poems collected by James Stuart and translated in A. T. Cope's *Izibongo*, and historical accounts written in the early twentieth century. Each of these sources has its strengths and weaknesses, and historians must assess each in turn.

The James Stuart Archive of Oral Histories is a collection of interview materials gathered by the Colonial magistrate and commissioner James Stuart between 1894 and 1924, during his travels and work in British-annexed Zululand. While a much richer collection than is available for many other time periods and peoples, it cannot be accepted as pure fact. Stuart was severely biased in his views, which exaggerate and minimize the realities of Zulu life to conform to his preconceived ideas about Zulu history or strengthen the credibility of his or his government's political actions.¹ In addition, his informants were often in a compromising position. An imperial official in an expanding British Empire, Stuart effectively usurped the power of the very men he was interviewing. He had no interest in interviewing elite Zulu women, instead he gleaned information about Zulu culture and history from a very select portion of the population under conditions of high stress.

Stuart also relies heavily on stories and views of earlier explorers such as Henry Francis Fynn. Fynn was a trader and government official whose exploits were published for a Victorian English audience. His stories were deliberately crafted to be interesting, but not necessarily to be truthful. Fynn's diary itself did not appear until after his death, indicating a still further removal from the evidence and time period it is intended to represent. However, despite its faults it is a valuable resource considering the lack of other contemporary written accounts.

In addition to these sources, this paper relies on early scholastic interpretations of Zulu History. One historian, Alfred Bryant, wrote on collective identities of people in South Africa's pre-colonial past. In his obituary, his greatest contribution was considered to be his Zulu-English dictionary. However, as a priest in Zulu territory he was exposed to oral histories that informed some of his historical texts.² These texts were well respected by South African

¹ J. Cobbing, "A Tainted Well. The Objectives, Historical Fantasies and Working Methods of James Stuart," *The Journal of Natal and Zulu History* 6 (1988): 115-154.

² D. Mck. Malcolm, "Obituary," *African Studies* 12, no. 3 (1953): 131-132.

historians through the late 1980's. However, work by Carolyn Hamilton and John Wright, two historians concerned with South Africa, reexamines Bryant's works and finds that little was based on pre-existing literature. They conclude that much of his work was his particular interpretation of scrappy and conflicting information from conversations with various unnamed Africans.³

Later biographies of nineteenth century Zulu rulers can also offer valuable information about the lives of elite Zulu women. Like Bryant's histories, these biographies are limited in that their information is often unverified, the writers were white and had variable exposure to Zulu life, and none of the subjects were directly interviewed. These stories were appropriations at best, however they still offer information about the Zulu royal household from a different perspective and include details that are not obvious in official documentation or the contemporary histories.

Stuart also collected contemporary praise poems in his journals. These poems (*isibongo*) acted as a storehouse of social and cultural memory within Zulu society. The poems are useful in that they offer a glimpse of Zulu history from the perspective and in the words of Zulu people themselves. However, they are also difficult to analyze given that metaphors have been since lost to cultural memory. Additionally, *isibongo* could serve as a forum for political slander, and were often rife with innuendo, and sarcasm. Finally, Stuart's collection of poems was not exhaustive, again coming from a select group of men working with imperial officers.

The historians Sifiso Ndlovu, Jennifer Weir, and Carolyn Hamilton have reexamined depictions of elite Zulu women as a class in primary sources. Their works have shown these women have more important roles than was recognized by South African Historians before 1995. ⁴ Hamilton established that *Amakosikazi* (elite women) are now thought to have held a role in political life, controlled *amakhanda* (regimental towns), and even led *amabutho* (military regiments). Weir suggests the relationships between early kings and a few select *amakosikazi*, and Sifiso establishes women's rule as a topic that must be further examined. These sources suggest that female participation in Zulu political life was more nuanced and fluid than earlier histories represented. The following analysis will expand and build on the premises put forth by these historians, by examining specific women as case studies to suggest how the role of the *amakosikazi* changed over time, a subject that has been suggested but not yet studied.

³ Carolyn Hamilton, "Backstory, Biography and the Life of the James Stuart Archive," *History in Africa* 38, no. 1 (2011): 333-335. Carolyn Hamilton, *Terrific Majesty: The Powers of Shaka Zulu and the Limits of Historical Invention* (Cambridge: Harvard University Press, 1998), 59-71; John Wright, "A.T. Bryant and the 'Lala'," *Journal of Southern African Studies* 38, no. 2 (2012): 355-368.

⁴ Sifiso Ndlovu, "A Reassessment of Women's Power in the Zulu Kingdom," in *Zulu Identities: Being Zulu, Past and Present*, ed. Benedict Carton, John Laband, and Jabulani Sithole (New York: Columbia University Press, 2009), 112. Jennifer Weir, "I Shall Need to Use Her to Rule: The Power of 'Royal' Zulu Women in Pre-Colonial Zululand," *South African Historical Journal* 43 (2000): 10.

MNKABAYI: INDIVIDUAL WOMEN WITH POLITICAL INFLUENCE

The first important narrative to examine is that of Mnkabayi. She was the head wife of the father of Shaka kaSenzangakhona (king during the expansion and initial rise of the Zulu Kingdom), and is one of the best-recognized examples of individual elite women wielding actual positions of political power in Zulu society. She played an active part in political life in KwaZulu, negotiating and plotting during changes in rulers on at least two occasions. Bryant labeled her a “tigress” and a “freelancer” in his historical writing.⁵ His word choice suggests that Mnkabayi was a sort of political maverick. However, his narrative is not the only one. South African feminists argue that elite women associated with the ruling Zulu houses “were actually part of the system of leadership before, during, and after Shaka’s reign.”⁶ It was within this very same system of leadership that Mnkabayi was able to gain legitimacy and control within the Zulu political system. In fact she did hold power before, during, and after Shaka’s reign.

Before Shaka rose to power Mnkabayi might have held the position of interim king in the immediate aftermath of Jama and Senzangakona, the two Zulu kings before Shaka. Senzangakona was her husband and Shaka’s father. One of James Stuart’s informants’ states, “that Mnkabayi ruled a little after Senzangakona’s death.”⁷ If Mnkabayi ruled, even in the sense of being in charge of daily activities, before Shaka was named king, then at least one elite woman held the highest position of authority within Zulu society for a brief point in time early in Zulu history. Another of Stuart’s informants states, “Senzangakona had no one who stood armed by his grave as his successor...for when Tshaka got up, people accepted him without a fight...It is probable then that Tshaka was offered the position of king.”⁸ Here we have Shaka passively being ‘offered’ the position. It may well have been Mnkabayi who offered it to him.⁹

If Mnkabayi did indeed place Shaka in power, she did not leave him there for long. John Laband, one of the most meticulous Zulu historians whose research is still considered amongst the most reliable on the topic, discusses Mnkabayi’s role in Shaka’s assassination in 1828 in *The Rise and Fall of the Zulu Nation*. Shaka was murdered by several of his brothers, including Dingane who would take his place as king and rule for the next twelve years. Laband refers to Mnkabayi as the “formidable king-making aunt,” for her role in Shaka’s downfall, during which she “encouraged them [Shaka’s assassins] in their resolve.”¹⁰ Analysis of recorded *isibongo* (praise poem) indicates that Mnkabayi not only incited Dingane and his fellows to murder Shaka, but was also involved in vindicating their actions and supporting Dingane in his rise to the throne. Carolyn Hamilton specifically cites a poem recorded by the contemporary J. T. Arbousset which states, “Death-defilement antidotes were eaten, within; They were eaten by

⁵ Alfred T. Bryant, *Olden Times in Zululand and Natal* (New York: 1929), 41.

⁶ Jennifer Weir, “I Shall Need to Use Her to Rule: The Power of ‘Royal’ Zulu Women in Pre-Colonial Zululand,” *South African Historical Journal* 43 (2000): 10.

⁷ *Ibid.*, 5.

⁸ JSA I: 199.

⁹ Weir, “I Shall Need to Use Her to Rule,” 7.

¹⁰ John Laband, *The Rise & Fall of the Zulu Nation* (London: Arms and Armour Press, 1997), xiii.

Mmama and Mnkabayi.”¹¹ This statement refers to how Mnkabayi and her twin sister Mmamma absolved Dingane of his fault for assassinating Shaka. While such an act would normally have rendered him ineligible for succession, approval of the two older sisters allowed him to take his place as king.

Mnkabayi was not only an *amakosikazi* who was in charge of organizing and coordinating the barracks and regiments responsible for Zulu power. She was also an active participant in Zulu political life, taking direct rule in some instances and in others heavily influencing the actions of the men participating in the actual political battles. She may not have always been featured as a major player in the narratives of South African historians and travel writers, but she clearly exhibited significant influence in a political world that has been labeled as male dominated. The legitimacy of labeling Zulu political and religious authority as an exclusively male arena is further contested by the existence of praise poems which refer to Mnkabayi using the praise name “Soqili.”¹² A.T. Cope, writer of *Izibongo Zulu Praise Poems* published in 1968, called the use of what he considered a male praise name for a female figure, “significant as a reflection of character.”¹³ Norma Masuku argues that the use of this name may have been a reflection of the strong character through which Mnkabayi exhibited “the same cardinal virtues as men”¹⁴. However, this statement assumes that because Mnkabayi’s praise-name referred to her as using a name most commonly used for powerful men, she must have taken on the role of one. This statement could also be interpreted to suggest instead that the praise-name indicates a level of respect as well as a position of authority that could be afforded to particularly praise-worthy or politically involved *amakosikazi* during this time period. While it may also indicate strength of character and the qualities as an influential political payer that Mnkabayi possessed, to discount this as an indicator of personal character is simplistic. Whether or not the praise name is for men alone, during this important period of formation of the Zulu nation at least one powerful elite woman of the royal household actively altered and affected that formation politically.

NANDI: THE ROLE OF ELITE WOMEN IN SUCCESSION AND PATRONAGE

Mnkabayi is not the only significant female who is given the praise-name Soqili. Nandi, Shaka’s own mother, is also described with this title.¹⁵ Nandi, too, is seen as a particularly strong example of a royal woman with extremely strong characteristics that were even labeled as manly by European observers. She certainly was able to influence Shaka’s childhood in ways that Senzangakona, Shaka’s father, could not. As a young boy Shaka lived, for a time, with the Langeni chiefly house, the house of his mother.¹⁶ Some stories indicate that they had to leave in

¹¹ Carolyn Hamilton, *Terrific Majesty: The Powers of Shaka Zulu and the Limits of Historical Invention*, (Cambridge, Mass: Harvard University Press, 1998), 108.

¹² A.T. Cope, Ed. *Izibongo: Zulu praise-poems* (Oxford: Clarendon P, 1968), 172.

¹³ *Ibid.*, 172.

¹⁴ Norma Masuku, “The depiction of Mnkabayi: A Review of her praise poem,” *South African Journal of African Language* 29, no. 2 (2009): 121-130.

¹⁵ Cope, *Izibongo*, 173.

¹⁶ JSA IV: 40.

order to avoid being killed by Senzangakhona's other wives.¹⁷ Other versions describe Nandi as fleeing from Senzangakhona. Regardless of the true situation, all agree that Nandi's family acted as a support system on which Shaka leaned on during his exile, and became important political allies. Without Nandi's family connections Shaka would never have had the support he needed to eventually stage his rise to power.

Sean Hanretta has examined some of the ways in which royal wives might pose a threat to male inheritance. He puts forth that "A woman's power as advocate for her son could, and did, threaten a husband's control over the reproduction of the homestead."¹⁸ A potential heir would need to rely on his mother's family for support in rivalries with other potential heirs from other mothers. If one family wanted to intervene and potentially usurp the power from another family, they might give a wife to the *induna* (headman) in the hope that she would bear a son who could champion their claim to the power. Adam Kuper notes that "a chief who dispatched a wife to a rival was making a political intervention, aspiring to control the succession into the chiefly house into which the princess was introduced."¹⁹ In the Stuart archive, there are stories that relate the fall of great kings to the conniving actions of a wife intentionally causing disruption to further her family's interests.²⁰

An important female population within the royal compound was the *umndlunkulu* (royal handmaidens).²¹ Those women were adopted into the *isigodhlo* (royal compound) as adjuncts. These women could be 'gifted' out to various *induna* (headmen), however there are instances in which the headmen who received these women were required to pay the *lobola* (bride price) back to the royal family. As such, the *umndlunkulu* became a source of wealth for whomever they belonged to. They also maintained their connections with the *isigodhlo* (royal compound) after being sent out in marriage. In this way, they could also act as informants and a symbol of the royal family in a more remote area, further solidifying the control of the region by the royal family.²²

Nandi was important in Shaka's later life because she served as one of the keepers of the *umndlunkulu* (handmaidens). In addition, her status as Shaka's mother put her in a position of authority in the women's portion of the *isigodhlo* (royal compound). This compound was considered by Bryant and others as a private harem for Shaka and the other kings, but Hanretta has shown that "much more than harems of the [chief or] king; they were focal points and sources of regal patronage" because of the possibility of using these women to gain access and favor with distant *induna* (headmen).²³ However, she and her son did not always have the same intentions. Shaka allegedly killed Nandi for hiding an heir from him, which threatened his

¹⁷ Ibid., 39.

¹⁸ Sean Hanretta, "Women, Marginality and the Zulu State," *The Journal of African History* 39, no.3 (1998): 391.

¹⁹ Adam Kuper, "The 'House' and Zulu Political Structure in the Nineteenth Century." *The Journal of African History* 34, no. 3 (1993): 484. Adam Kuper, "Symbolic Dimensions of the Southern Bantu Homestead," *Africa: Journal of the International African Institute* 50, no. 1 (1980): 8-23.

²⁰ JSAl: 216; JSAl: 176-7; JSA III: 232.

²¹ Hanretta, "Women, Marginality, and the Zulu State," 407-409.

²² Control over this process by the *amakosikazi* is referred to earlier in this paper as an example of female agency and participation in political processes (pg. 9)

²³ Ndlovu, "A Reassessment of Women's Power," 113.

political agenda.²⁴ Jennifer Weir argues Shaka engaged in ritual ‘celibacy’ in order to “focus power on himself” and “address potential threats” or heirs who may contend for power and decentralize the state.²⁵ If Shaka had an heir then this child may have grown up to challenge the throne. Thus, any attempts to keep an heir would effectively undermine his authority. However, in one account Shaka discovered Nandi nursing a small child and demanded to know “Where does it come from?” To which Nandi cheekily responds, “Don’t you have a penis then?”²⁶ Shaka, in the story, replies by rashly murdering his own mother. Nandi’s actions can be read as an example of an attempt to enact her own will upon her son, and Shaka’s response would indicate that from his position of political authority in a centralizing state, the threat of a potential harbored heir was great enough to kill the child, and even his own mother to ensure that it would never happen again. It is important to also note the possibility that this story is fabrication. By painting Shaka as a matricidal ruler his rivals could cut away at his credibility, or indeed the legitimacy of his newly consolidated house.

Even if he did kill his mother, Shaka still tried to decrease the disruption this created by having a lavish funeral. Sean Hanretta has shown that “the connection with the natural world and thereby with the spirit world enabled some women to become powerful diviners, and opened roles for wives as chief mourners and potential practitioners of sorcery within the homestead.”²⁷ If Shaka killed Nandi, a connection to the divine and his ancestry, he would have had to find a way to resolve the disruption made by killing an important link to the ancestors. He did this through a funeral ceremony, which emphasized coming together as a nation and consolidating support for the Zulu Royal family. Fynn’s account of Nandi’s funeral involved mass mobilization and grieving.²⁸ Jennifer Weir analyzes that the funeral was “more extravagant than those of male chiefs” and relates it to an “*ihlambo* or purification ceremony” that consisted of a cattle raid instead of the traditional hunt.²⁹ While some might explain this as an excuse on the part of Shaka to raid for cattle, it can more convincingly be read as an attempt to sanctify Nandi’s death and bring peace and balance after the loss of an important religious figure. In addition, Fynn’s account of Mntaniya’s funeral ceremony also showed examples of mourning on a national scale, bringing the surrounding peoples together in reverence of a significant female figure.³⁰ Shaka may have used these ceremonies to consolidate his power and bring support to the Zulu Royal household.

Nandi was certainly a powerful female figure and there are examples of her active attempts to shape Zulu politics through her influence on her son and through her family ties, which supported her and Shaka through his childhood. However, it is clear that this was not unconditional influence, and when pushed to extremes Shaka still had the utmost authority. Despite this, both Nandi and Mntaniya had funerals, which were used as tools to consolidate the

²⁴ JSA V, 35.

²⁵ Weir, “I Shall Need to Use Her to Rule,” 19.

²⁶ JSA V, 35.

²⁷ Hanretta, “Women, Marginality and the Zulu State,” 392.

²⁸ Fynn, *Diary*, 131-133.

²⁹ Jennifer Weir, “Chiefly Women and Women’s Leadership in Pre-Colonial South Africa,” in *Women in South African History* ed. Nomboniso Gasa (Cape Town: HSRC Press, 2007), 14; JSA V: 35. (italics are mine)

³⁰ Fynn, *Diary*, 121; *Ibid.*, 131-133; JSA I: 307, 337; JSA IV: 292-3.

importance of not only Shaka, but his female relatives as well, indicating that the power lay in the family itself as opposed to a singular powerful male.

INCREASING CHALLENGES TO FEMALE POWER

Nandi may have been powerful and important, but she was not the most powerful or important of Senzangakhona's wives before his death. Nandi held only a minor position in a hierarchy of wives, which dictated which wife had which privileges, and controlled what part of the household and whose children would inherit the most. In the Zulu Royal house this was particularly important because these women not only held powerful positions in the home, but were also in charge of particular *amakhandas* (army barracks), or *amabutho* (military regiments).³¹ Therefore, the politics of *amakosikazi* (elite women) in the Zulu household had repercussions on a massive nation-wide scale. The army acted as the source of unity and wealth, so controlling the barracks and regiments would have been an influential position. During the organization of a centralized Zulu nation, Shaka, and later Dingane, maintained a system in which elite women who were not a direct threat to the throne acted as symbols of central authority for the kings.³² They acted as judicial authorities (in one documented instance ordering the death of Shaka's brother), organized military regiments, and as we have seen with Nandi and Mnkabayi, actively entered into Zulu politics.³³ Hanretta argues that the role of women in *amakhandas* (army barracks) was new to Zulu society and was "the most obvious effect" of a new system of organization, which acted as a "subtle disruption of gender duality" within the state.³⁴ However, this new system seems to point towards fluidity of gender roles and collaboration by members of the Zulu Royal household, both male and female, to organize a new more consolidated political and religious system within the region.³⁵

One effect of women participating in this effort to reorganize the state was the way in which politics of the home were magnified onto a national scale in the royal household. Bhibhi was a sister-wife to Nandi, whose interactions with Shaka and other rulers indicate how power struggles within the women's realm had repercussions, or held influence, in the greater political arena. One of Stuart's informants provides a tale of Shaka's rise to power within the Zulu chieftdom that sheds some light on Bhibhi's interactions with the males in her household. In the story, Senzangakhona must identify Shaka, his son who he had not seen in many years, to prove that they are related and indicate Shaka's legitimacy and recognition by his father. Afterwards, Shaka is called by the *amakosikazi* (elite women) in his father's household. These women, referred to as "Tshaka's mothers", "called him" and "kissed him."³⁶ However, Bhibhi alone refused to interact with Shaka. "This woman, who was an *injinjikazi*, and liked by the king, did

³¹ Kuper, "Symbolic Dimensions of the Southern Bantu Homestead," 23.

³² Weir, "I Shall Need to Use Her to Rule," 14; Hanretta, "Women, Marginality and the Zulu State," 398.

³³ JSA IV: 292.

³⁴ Hanretta, "Women, Marginality and the Zulu State," 398.

³⁵ Hanretta writes: "New social positions that opened for or were forced upon women in the early nineteenth century produced overlapping systems for defining worth in relation to men, and created new strategies for increasing personal power and status." Ibid., 414-415.

³⁶ JSA IV: 122.

not kiss him, but simply looked at him.”³⁷ The disapproval by Bhibhi was notable to the observer as an indication that she did not agree with her husband. This kind of disapproval, even from just one *inkosikazi* (elite woman) could hurt Shaka’s chances of taking his father’s place as the *induna* (headman) of the Zulu prior to their expansion. Shaka needed the approval of the entire household, including the *amakosikazi* (elite women) in order to be considered more legitimate. To the extent that *amakosikazi* could publicly legitimize decisions by their male counterparts, women could invalidate decisions as well.

After Shaka’s death, Bhibhi remained an important figure. One of Stuart’s informants states she became a “woman of great importance.”³⁸ She, like many of Senzangakhona’s wives, was in a position of political import as the *inkoskazi* (elite woman) of a particular *ikhanda* (barrack). However, while she was immune during Shaka’s rule, under Dingane elite women became more and more vulnerable to attacks by elite men of the Zulu Royal household. Dingane’s brother (and future rival) Mpande and his allies killed Bhibhi for “impunity” under orders from Dingane.³⁹ “Impunity” suggests that Bhibhi enjoyed too much freedom and may have been considered a threat, especially during a period when many members of the royal household were being killed for opposing Dingane. This indicates that Bhibhi posed a political threat, or at least conceivably might have, to the ruling males just as she posed a threat to Shaka when he met with his father. In an account of her assassination Mpande states, “Let her not be killed. I shall need to use her to rule.”⁴⁰ This phrase indicates the dependency that male rulers had on their female counterparts in order to maintain order and stability. However, Bhibhi is one example that indicates that this significance and the political role was under attack by individual male rulers seeking to consolidate state power in their own person.

EUROPEAN FORCES IN ZULU POLITICS

As European forces became more and more powerful within Zulu politics, the power of women began to wane. With the Boers behind him, Mpande relied considerably less on the diplomatic influence of his mother’s family to gain the throne, and instead used the military might of an external group. This action reduced the importance of the *amakosikazi* (elite women) in Zulu politics at a time when at least some of the women who had disagreed with past male rulers were being killed. This compounded with the fact that through the eyes of the conquering parties, women were political minors, reliant on male spokespeople. To a British colonial official, an elite woman was invisible. European officials would not deal directly with the elite women in the Zulu Royal household, as such an action would have gone against what any British official or Trekker would have considered the proper way that gender roles were divided. This limited elite women in their access to diplomatic exchange and European trade and goods. As the British and other external influences began to hold more and more sway over internal Zulu dynamics, women were faced with what T.J. Tallie has defined as an “assault on

³⁷ Ibid, 122.

³⁸ JSA II: 205.

³⁹ JSA III: 200; JSA II: 206.

⁴⁰ Ibid.

sociality that did not conform to European heteronormative perceptions.”⁴¹ If women were the focus of a particular paper or article it was often only as the object of perverse marriage practices or agricultural laborers. Emphasis was never on the diplomatic agency these women might have had.

Despite the lack of direct dialogue with elite women, women were no less active in seeking forms of agency in both political and religious arenas within their own culture. Mawa, one of Senzangakhona’s sisters, serves as an example of a woman heading a movement and acting in response to a political shift. According to one of Stuart’s informants she led a group of people into Natal in 1843 in order to escape the rule of Mpande after the civil war that led to Dingane’s death.⁴² According to the account, a large number of people intended to join Mawa in her departure Natal. However, many who intended to follow Mawa were stopped by Mpande’s forces, and turned around. Mpande was concerned that “too large a number wanted to accompany her.”⁴³ Mpande then allowed Mawa to depart for Natal, but with a much smaller following.

Stuart’s informant states, “I do not know what troubled Mawa so much as to cause her to leave.”⁴⁴ While this particular informant may not have been able to say, there are some clues that indicate why Mawa may have left for Natal. Mpande had just recently come into power with the help of the Boers. Considering that Dingane had killed members of the royal household, including *amakosikazi* (elite women) who posed a threat to him after he gained power, it is possible that Mawa was departing to avoid a threat to her life. Natal had recently been annexed by the British, and could have been seen as a potential safe harbor for Mawa and others who had been on the losing side of a bloody civil war. Mawa certainly acted actively in escaping, and was able to lead a group of people into a safer area. While this has not played an important feature in the history of the first Zulu Civil War, it is an instance where royal elite women were able to act independently, although without recognition.

Mawa’s exodus was replicated much later during another civil war that erupted in 1856. Another *inkosikazi* (elite woman) also left for Natal. Monase departed during the second Zulu Civil War following the death of her son Mbuyazi. Mbuyazi and his followers clashed with Cetshwayo and his supporters in a civil war in 1856 over who would be the heir to Mpande.⁴⁵ Mbuyazi was killed in the battle of Ndongakusuka. Although Mpande was still alive, his son Cetshwayo effectively secured his position as Mpande’s heir and subsequently began exercising considerably more power in Zulu political life. Controversy about Mbuyazi’s birth and legitimacy centered around the actions of Monase. Support for her son was a unifying force that drew upon her entire family and ties to further kin or those associated with them. However, unlike in the previous struggle, each side relied on some sort of European support. The English Bishop Colenso and his family supported Mbuyazi and harbored Monase’s other son Mkhungu, who

⁴¹ T. J. Tallie, “Queering Natal: Settler Logics and the Disruptive Challenge of Zulu Polygamy,” *Journal of Lesbian and Gay Studies* 19, no. 2 (2013): 169.

⁴² JSA IV: 120 (However Webb and Wright correct Mawa’s crossing as 1843 not 1842); JSA IV: 138.

⁴³ JSA IV: 120.

⁴⁴ Ibid.

⁴⁵ Laband, *Rise and Fall*, 107-135.

Colenso refers to as “the future king (most probably).”⁴⁶ On the other side, Cetshwayo, one of Mpande’s other sons, was strongly supported by the Boers.⁴⁷ Both sides of the conflict had support from external forces. It seems that by 1856, relying on the support of kinship ties was no longer enough to ensure success, and while men were the ones in battle, royal women were also active in protecting their families’ followers under the banners of their sons.

Nomantshali, one of Mpande’s other wives, was a casualty in the struggles of succession. Although not officially in power, Cetshwayo was able to control much of the power after he defeated Mbuyazi, primarily by ensuring that he would not be challenged again. Nomantshali had risen in favor as a new “favorite wife” of Mpande, and had young sons who posed a potential base for a renewed attack on Cetshwayo.⁴⁸ In order to remove this possible threat, Cetshwayo tried to have both sons and mother killed.⁴⁹ Cetshwayo’s increase in influence relative to his father is demonstrated by Mpande’s inability to retaliate to the murder of his favorite wife. Nomantshali’s death can also be compared to Nandi’s. When Nomantshali was killed in 1861, Cetshwayo was held less accountable (at least internally) for killing influential women within the Royal household.⁵⁰ He did not need permission from the king as Mpande had when he killed Bhibhi; nor did he feel the need for a lavish nation-wide mourning ceremony the way Shaka had after his mother’s death.

By the 1860’s there was also a notable absence of strong and powerful individual females who stood out. Although Monase and Nomantshali were each important in their sons’ claims to the throne, and were even perhaps active in their pursuit of power, they did not control the same territory, nor did they directly influence politics the ways that Nandi, Mnkabayi or even Bhibhi did. Cetshwayo’s relationship with his own wives exemplifies this shift in the power differential within the Zulu household. While none of the wives of Cetshwayo acted as powerfully individually (like Mnkabayi had), they still acted collectively. In one story, Cetshwayo’s wife Nhlamule leads her sister wives in shaming Cetshwayo by rejecting a gift from him.⁵¹ Nhlamule is threatened with her life and then fined for her insolence towards Cetshwayo. Cetshwayo’s response to female dissent is considerably more extreme than Mpande’s had been considering Mawa and Monase were able to leave Zulu household for Natal in an act of defiance against Mpande. However, this story also indicates that as a collective, the king’s wives were still able to communally shame their husband. The kind of communal shaming that Nhlamule took part in was described, and recognized as a tactic of the non-elite women in Zulu society. Stuart’s informants describe songs that women would sing to shame their husbands into leaving his favorite wife.⁵² Through rumors, subtle disapproval, and shaming, women were able to exert control over their husbands, even the king.

⁴⁶ Hamilton, *Terrific Majesty*, 96.

⁴⁷ Laband, *Rise and Fall*, 352.

⁴⁸ JSA IV: 63; JSA III: 106; JSA II: 207.

⁴⁹ JSA I: 63.

⁵⁰ JSA IV: 78.

⁵¹ JSA IV: 90-91.

⁵² “*Isigqumiselo*... This song is sung by women of the kraal when one of their number receives too much attention from the husband...The man, on hearing such singing by the other women, will tie up his mats, leave his favorite, and

ELITE WOMEN DURING ZULU DECLINE

Cetshwayo had more to deal with than the embarrassment that his wives could cause him. Between 1860 and 1872 he effectively controlled Zulu politics even though Mpande was still alive. He spent much of this time period chasing after Umtonga as a potential threat to the throne and trying to negotiate with expansionist Boers and Britons. In 1872 Mpande passed away and the throne was passed over to Cetshwayo. During the following six years, relations with the British increasingly soured until forces finally clashed in 1878 after an ultimatum set forth by the British was found to be unacceptable. British forces eventually defeated Cetshwayo's army in July of 1879 and he was captured and removed. Zulu territory was never again under a single ruler. The British split Zulu territory then into 13 different "chiefdoms" and tried to rule indirectly through appointed chiefs. This proved ineffective and in 1883 they tried to reinstate Cetshwayo as ruler but were unsuccessful. Cetshwayo died in 1884. His fifteen-year-old son, Dinuzulu, inherited the throne and Cetshwayo's battle against Zibehebu, a former ally who had used Cetshwayo's exile as an excuse to challenge the Zulu royal family. Dinuzulu defeated him with help from the Boers. This concerned the British colonial powers that were in a political struggle with Boer states for control of land in South Africa. Partially in response, the Boers then annexed Zululand in 1887. The official freedom of the Zulu people had ended and despite several instances of coordinated resistance it would never be as strong again.

It is difficult to find much commentary on elite Zulu women in the James Stuart archives after the early 1860s. James Stuart's informants would have been reluctant to comment on ongoing issues. They would also have been reluctant to comment on more recent conflicts between the British and Zulu in an interview with a British official such as Stuart. At this point the biography of Dinuzulu by Binns, who was not contemporary but interviewed Zulu authorities for oral histories, becomes useful. His book provides insightful information about the role some female members of the Zulu royal household played during and after the decline of their kingdom. Nomvimbu, wife of Cetshwayo and the mother of his heir Dinuzulu, can be examined to analyze the changes that occurred in recorded positions of elite women within the Zulu Royal household in this period of reduced materials. The historian Laband described Nomvimbu as Dinuzulu's "capable mother."⁵³ While Dinuzulu's father was imprisoned after the Anglo-Zulu War, she and her brother were in charge of the young future king. According to Princess Constance Magogo, a descendant of Nomvimbu, "In addition to his uncle Ndabukp another great influence over Dinuzulu during these difficult years was his mother Novimbi Msweli."⁵⁴ Although Nomvimbu did not hold a particular position that was recognized by the contemporary external observers, and perhaps not even by her own husband, she is described by her descendants as an influential figure. It is difficult to compare this kind of vague influence with the kind of direct power that Mnkabayi had held as an individual, but it does indicate that Nomvimbu was at least still worthy of mention, and could influence her son even if not in the same way that Nandi could. It seems that as a whole, the role of the elite women in the Zulu

go to the other women, i.e. those who are stabbing him with words. He will be unable any longer to eat of the food made by his favorite wife." JSA IV: 39.

⁵³ Laband, *Rise and Fall*, 345.

⁵⁴ C. T. Binns, *Dinuzulu: the Death of the House of Shaka* (London: Longmans, 1893), 4.

household became less specific and had less authority from the rise of the nation in 1816 until its decline into the early twentieth century. There are a few specific instances when these elite women participated in ritual ceremonies, but institutional importance in politics and matters of succession decreased during Mpande's rule and especially under Cetshwayo.⁵⁵

Despite this, women still acted collectively in ways that continued the Zulu state and furthered their own houses. In Dinuzulu's early years, "Too many times in the opening of the years of the 1880s he was woken by warning shouts before being bundled away to safety by his father's wives and attendants."⁵⁶ By protecting the heir to the nation, Cetshwayo's wives acted as guardians of the future of the nation, and actively participated in continuing to bolster their family and royal house's position. While individual women are not implicated here, it is still evident that as a group, *amakosikazi* were still active in Zulu society even if European observers did not recognize their role.

Elite women did still actively participate in political and social life, in ways that were not possible for their male counterparts. After Cetshwayo's death a group of women, described as his wives, were able to secure the release of Cetshwayo's body to hold a funeral ceremony.⁵⁷ According to Binns:

"The widows of Cetshwayo, angered beyond endurance at the protracted delay in the funeral arrangements of their royal master, took the law into their own hands. On the afternoon of 8 April they set out and made their way in a body to the man who was responsible for their disappointments. Sweeping every obstacle aside they thronged into the Residency demanding the late king's immediate burial. So excited were they, and so violent did they become that Osborn had to beat an ignominious retreat leaving them in full possession of the building...A few hours later official sanction was granted for the removal of the remains to the kraal of Dabulamanzi"⁵⁸

These women were able to coerce Osborn, a British official, to sanction Cetshwayo's burial. The burial had been forbidden because it required passing through disputed territory, and officials worried it would cause unrest. The elite Zulu men had been unable to convince Osborn to allow this funeral ceremony to take place, but collective action of the elite women succeeded where they had failed. Binns summarizes by saying, "A handful of determined women had succeeded in a task which the combined efforts of the royal brothers had failed to accomplish."⁵⁹ Despite this, the official record does not acknowledge the part elite women played in securing Cetshwayo's funeral. Binns states "The official dispatch, though making no mention of this incident, stated tersely, 'The Resident Commissioner found it necessary to give his consent to the removal of the remains to a kraal.'"⁶⁰ While the incident may have been interpreted by Osborn and other

⁵⁵ Weir specifically notes participation in the *umkhosi*, or first fruits ceremony, by Nomantshali and Songiya, but none of Cetshwayo's wives are implicated in these ceremonies. Weir, "I Shall Need to Use Her to Rule," 17.

⁵⁶ Jeff Guy, *The View Across the River: Hariette Colenso and the Zulu Struggle Against Imperialism*, (Charlottesville: University Press of Virginia, 2002), 95.

⁵⁷ Binns, *Dinuzulu*, 14-15.

⁵⁸ *Ibid.*

⁵⁹ Binns, *Dinuzulu*, 14-15.

⁶⁰ *Ibid.*, 15.

observers as a bizarre and unprecedented act by a rogue group of women, it demonstrates how the *amakosikazi* (elite women) still maintained a sense of political, religious, and social power which they could, as a collective, call on when moved to act. These women were not in fact subordinate and passive in their acceptance of the British rule, but resisted just as much as their male counterparts, if with different outlets. Osborn failed to recognize these women as an important and influential population in the territory he oversaw. That a single woman was not named as leading the group indicates that at this point the effectiveness of a single elite female leader had been reduced significantly. However, in their collective actions elite women still played a role in resisting British and Boer occupation even if it went unmentioned in British official documentation.

At this point in time, evidence of *amakosikazi* (elite women) in Zulu history is most present in praises and music kept alive by royal Zulu women themselves. Princess Constance Magogo, the eldest daughter of Dinuzulu, offers an example of this role after what is considered to be the final “dying breath” of the Zulu Nation when the Maphumulo rebellion was defeated in 1906.⁶¹ Princess Magogo lived in a world that was vastly different from that of Nandi four generations prior. She would have grown up under the watchful eye of British officials who kept Dinuzulu close in the hopes that by controlling the Zulu headman, they could better control his people. However, by this point even Dinuzulu, a man, had ceased to wield the same political power that his father had. He was thrown in jail by the British multiple times and was exiled from his people in an attempt to reduce unrest in Zulu society. Magogo was not able to control any land or army regiments like Mnabayi and Bhibhi or even lead large groups of followers like Mawa or Monase. She was designated to a second-class citizenship under colonial laws, and under the extractive British powers her past was rewritten and appropriated by white males who claimed the land of her ancestors. Despite this, Magogo was able to preserve her lineage in a small way. She served as a resource and authority in Zulu music where she was “widely acknowledged as the greatest living authority on the subject.”⁶² She was considered an important conduit to the past as well as a ritual expert. There is a sense of cultural preservation through Magogo’s songs and knowledge of instruments and religious practices, which has been recognized in recordings that immortalize her as the authority of Zulu traditional music.⁶³ Indeed, with the increasing importance of the Zulu Royal family emphasized by Zulu nationalism, she may in fact have wielded more authority, in terms of cultural preservation, than even some of her grandmothers.⁶⁴

While it may not have been specifically recorded, Magogo’s participation in musical expressions and religious knowledge could speak to a shift in the focus of female agency during

⁶¹Guy, Jeff. *The Maphumulo Rebellion: War, Law and Ritual in the Zulu Rebellion* (Scottsville: University of KwaZulu-Natal Press, 2005), 6.

⁶² David K. Rycroft, “A Royal Account of Music in Zulu Life with Translation, Annotation, and Musical Transcription,” *Bulletin of the School of Oriental and African Studies, University of London* 38, no. 2 (1975): 353.

⁶³Constance Magogo Ka Dinuzulu, ed. Hugh Tracey. “The Zulu Songs of Princess Constance Magogo KaDinuzulu” in *Series: Music of Africa Series 37* (Grahamstown: South Africa, International Library of African Music). Also see Cele, T, “Qualities of King Shaka as portrayed in Zulu oral testimony and in Izibongo,” *South African Journal of African Languages* 21, no. 2 (2001): 118-132.

⁶⁴ Daphna Golan, *Inventing Shaka: Using History in the Construction of Zulu Nationalism* (Boulder: Lynne Rienner, 1994), 20-46.

the last half of the 19th century. As the political sphere became increasingly gendered and male-dominated, women turned to divination, music, and praise singing as forms of expression through which their understandings could be expressed.⁶⁵ While the Zulu nation did not exist as a separate entity, it was still present in the cultural identity of peoples on the east coast of South Africa.

CONCLUSION: ELITE WOMEN REASSESSED

It is clear that the roles of Zulu women were fluid over the course of the hundred years in question. They held positions of power and actively participated in the creation of various new constructs during the rise of the Zulu nation. As time went by, the powerful positions that these women held were contested and usurped by male rulers trying to dominate and centralize their people. Furthermore, as politics became increasingly linked to relationships with Europeans, or settlers of European decent, who recognized only male elites as important power holders and searched for a singular powerful figure to have control, elite women were pushed even farther to the side. *Amakosikazi* (elite women) were increasingly targeted during disputes of succession. Through this period the strong female figures present in the Zulu royal household either departed or were killed. Those who remained were still able to affect change and react to oppression through collective action, but this role was much diminished from the kind of power they had once been able to hold, especially in the face of increasing challenges to indigenous ways of life across the region and even across Africa itself. Eventually, as the Zulu nation ceased to be a single entity, the roles of elite women became even more vague. The Zulu household remained a figurehead of indirect rule under the British, but effective autonomy had ceased to be. Still, some elite women remained active in their attempts to preserve their history through music, oral history and customs.

Although Zulu society has historically been presented as a static society with fixed gender roles, closer examination reveals a dynamic culture wherein both men and women's roles fluctuated over time and circumstance. Continuous formation over the course of 100 years shows contributions by both genders and significantly more fluidity and creative agency than has been previously recognized in Zulu society as a whole and by elite women in particular. Much remains to be explored and explained. There are certainly more important *amakosikazi* (elite women) whose stories are not shared here. However, through careful reconstruction of the influence of the women whose influence has been examined, we can begin to piece together the other half of the history ignored by the traditional narrative.

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⁶⁵ For a full discussion of praise singing and female views on morality, judgement, and history see Eileen Jensen Krige, "Girls' Puberty Songs and Their Relation to Fertility, Health, Morality, and Religion Among the Zulu," *Africa: Journal of the International African Institute* 38, no. 2 (1968): 173-198.

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This Year the Birds Fly North: An Historical Short Story of Medicine Man Oytes and the Forced Removal of the Northern Paiute to Yakima

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ABSTRACT

Through a multi-character narrative approach, this paper tells of several specific struggles for cultural retention, leadership, and survival along the Northern Paiute's "trail of tears" from the Malheur reservation to the Yakima reservation in 1879, following the end of the Bannock War. This narrative style and the use of multiple, individual histories all speaking to the same swath of time in 1879, challenges the current way history is often read and acknowledged. Voice is given to oral stories, life is given to family histories, and the reader feels the tangible humanity of day-to-day existence during a shared trauma in society. I mainly utilize primary source materials including oral histories, memoirs, letters, newspaper articles, and interviews about Paiute language and culture with tribal elder and Oytes descendant Myra Johnson Orange. I also incorporate multiple secondary sources, including the work of visiting scholar James Gardener, and multiple articles written about the Bannock War, Sarah Winnemucca, the medicine man Oytes, Northern Paiute spirituality, and the march to Yakima. This paper contributes to the recorded history of the Northern Paiute, especially regarding Oytes, who is rarely portrayed as the powerful spiritual leader his descendants know him to be. This paper also contributes an alternative historical experience, giving equal weight to oral histories, personal recorded histories, and scholarly works.

PROLOGUE

When Indian Agent Rinehart of the Malheur reservation forced the Paiute to walk to Yakima in winter with little food or clothing, it was one of the final attempts made by the government to eliminate the Paiute from existence. Thankfully, this attempt was unsuccessful. Though some elders and children were lost to the cold, many tribal members survived the harsh walk and prison camp experience that awaited them in Yakima, returning to Oregon within a few years of this event.

My research paper, written as historical fiction, presents Oytes as he is remembered through memory by his family and many Paiute tribal members: passionate, powerful yet humble in his healing powers, and with a personal, spiritual connection to the earth and the elements. I have been incredibly fortunate to work with the wonderful great granddaughter of Oytes, Myra Johnson Orange, and I hope this paper can serve as a written story that adds another voice to what is currently written about Oytes in scholarship. This work is not meant to be a definitive

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description or explanation of the events and lives of people in the Paiute tribe during this period, but is meant to elicit an alternative, emotional reaction alongside other historical documentation.

To allow Oytes's actions to stand out, I needed to present a contrasting character to oppose him. I found that contrast in Sarah Winnemucca, a Paiute woman who often worked as a translator between the Paiutes and whites, and is considered by many Northern Paiutes as a traitor to her people, but is considered a hero in the eyes of many other people in Nevada. Her family was deeply afraid of Oytes and his powers, yet it is Sarah Winnemucca's viewpoint on Oytes that was recorded, published, and carried in print to today. In the narration I tell, Sarah Winnemucca speaks only in English, and speaks briefly of the Indian Agents of Malheur and of her distrust of Oytes. In addition to Sarah Winnemucca, I have included the story of a fictional Paiute family, in order to show the emotional, personal loss the trip to Yakima brought. Each section of this paper is written in a different voice, moving between Sarah Winnemucca, Oytes as both a young man and adult, and members of the fictional Paiute family. The trip from Malheur to Yakima was not the only atrocity committed against the Northern Paiute – far from it. Indeed, where this story leaves off, a separate tragedy could be written about the horrible time suffered at the hands of the Yakima natives and their own Indian Agent, but that is a tale for another time, a whisper for another night.

The few sounds lingering in the wind are the rumbles of wooden wagon wheels, the occasional clink and rattle of metal chains, and the occasional cry of an infant. This is the time of year without harvest, without growth. This is the time for story sharing, for education from elders, for explanations of creation and lessons learned, for tales of conquest and days of abundance, for whispers told around fire and under blanket, for time shared with family.

PAIUTE FAMILY: Late January 1879

Too many days away from home, and too few days to come

This is not a normal sort of cold tomo morning.¹ It's not the sort of morning, like previous tomo seasons, where the first breath I take after stepping outside causes my lungs to want to wrap in my soft, warm kwasibi blanket and stay inside.² No. This is a persistent sort of chill, one that never fully leaves. I have felt the warmth of my body slowly turn inward over the last few weeks – first the heat from my skin faded and I grew numb, then the bones in my once powerful arms and formerly tree trunk-like kowpa grew numb, then my waist and shoulders, then my wo – still held high with a thick braid trailing down my back, and now the final place of warmth, my nungaba, my chest, flickers with warmth like the last ember of a fire.

That inner warmth dwindles with each step I take. My moccasin-wrapped kuku strike the ground as ice strikes ice, and a feeling of reversed lightning splinters from my heel up my calf, and illuminates each step with bright, hot flashes of a pain that I have never felt before. Each movement of each kuku takes all of my strength, but if I stop for too long I lose sight of my wife and son, ahead of me on the wagon.³ Seeing them alive keeps me marching. I fear that soon the lightning in my kuku will strike higher, reach farther, freezing over that ember inside me, that last part of my beating piwe. I will kneel in the cold nehabi, the snow, as I saw my dear brother, my

Wanga'a do three nights ago. I will kneel and ask the Creator to return me to the ground and take what is left of my ember to warm my family⁴ – please, please warm them! This cold is unbearable, and this is not a normal sort of cold.

Before this particular day breaks across the basin, before the sun can kiss the sage, a young boy healer named Oytes hears the lightning strike, sees the pains of the dying man in the future,⁵ and hears the death march of his people years from now as the braying of birds of today. Time and space have a way of distorting the events of the future to the prophets of the past.

YOUNG OYTES: November 1850

A morning wherein the ground feels harder, the wind feels colder

As the sun rose this morning, I opened my pooe from a dream and was struck for a moment by the sound of the honking nageta. There were hundreds of them, crying loudly, making the normally blue, poohe sky a dark, ominous black, toohoo color. I could not stop staring at them, crowding the sky and deafening my ears during that short moment between asleep and awake. The nageta were flying the wrong way for the upcoming season, the tomo – they were all flying north, as though the world had been turned around on me as I slept.

That vision was troubling enough, but now I find this wounded, writhing nageta in front of me on my walk. She's dying in my arms, crying in pain. I could wring her neck and take her back to my father, my Na, but something tells me not to kill it. I should heal it, the way I heal Moo'a's swollen feet, and the way I've seen Moo'a heal others. I can feel the pain rushing through this bird, like fast river rapids. It's pulsing from her broken bones into my fingertips as I touch each bone, each joint. Let the death leave you, let it fall from your body like shed feathers, let my young, grassblade-like mi, my soft and tender hands heal you, like the gnarled root-mi of my grandmother, my Moo'a, heals others. Let my left mi press into your wounded nungaba to weave your veins back together, move your ribs into place, and allow your breath to be steady.⁶

As the young Oytes moves his hands over the goose, she becomes well and whole again, sitting up in his arms, stretching her mended wings, then flying north in the same direction as the birds in the terrifying vision he had earlier that day. He shudders slightly at the memory of the vision, and knells upon the earth, placing his hands upon it and thinking about what the vision meant. It is not the first vision he has had in his short life, and it was becoming known around his band that he had his grandmother's gift of healing, and now perhaps the gift of prophetic sight. Before returning to his family from his morning walk, young Oytes asks what is meant of this vision, what is meant of this wounded goose? He looks up to the sky as he asks and the first flake of snow lands upon his forehead.

ADULT OYTES: 1874-1875

Isn't this Big Father just so generous, giving us a reservation to live on?

You think you know how much land, *exactly*, and how much sugar and coffee, *exactly*, and how much education and civilization *exactly*, an Indian needs, Agent Linville? Have you figured out, with your little, metal stick and lined book the exact number of grains of rice to provide an Indian each week? We know what we need, we know where to live, and we know what we need to know. Let the tatta sun melt you – leave me and my men to our lives and our land.⁷ And you, Agent Parrish? You say I need your permission to trade? *Permission?* Some of my people may think of you as “father,” Parrish, or think of your leaders as “big father,” but does that make our people your little children? Are we to do as you say, trusting our lives to your false parenting? No. We are not hairless babes in need of a teat to suckle. I do not need your permission to trade as I have traded my entire life, as we have traded for as many lives as we can collectively remember. I will not farm this patch of land you tell me to farm, and I will not seek your permission to trade. I will take the food the mother of us all gives, and I will trade with anyone whenever we have reason and supplies enough to support it. My people who want to join together laboring for you can go ahead and become you, become white. I remain black. I am proud of who we are, who we were before you came here, and I do not need to dig ditches for a blanket and a dollar.⁸

Oytes holds back the white cloud surrounding his ancestral lands, but the white cloud moves ever closer with gold pans, mines, cattle ranches, houses, newspapers, and roads. Fog can be shifted, moved, eased away with the right words, the right motions, the right intentions. What is this that surrounds us but another approaching fog?

SARAH: Late 1876

Unrest before upheaval

On a pinewood nightstand, Sarah, daughter of Chief Winnemucca, places a small trunk, opening the lid with flick of the metal latch. She is wearing a tasteful, modest flannel dress, but has her summer dress as well as a woolen coat resting upon the mattress atop her metal-framed bed.

“Ridiculous,” she mutters, a little louder than if she were just speaking to herself, “as if the only man in the entire country able to be our Indian Agent is Rinehart. Oh, if only our father Parrish could have stayed! Big Father in Washington, what are you doing with us?”

She pauses for dramatic effect, hoping slightly and fearing greatly that someone on the other side of the thin wall is listening, then thinks better of her outburst and straightens her dress front and hair in the mirror above her low dresser. She then begins opening drawers to remove various goodies collected from her time in this cozy room. A pair of nearly-new stockings, a gift from the sweet lily mother, wife of Agent Parrish,⁹ is now being balled up and catapulted across the ten foot by ten foot room, landing perfectly into the trunk, which is so small it could really be considered to be more of a hatbox. Sarah half-smiles at her successful toss and next grabs a small sachet of

dried flower petals, saved from her time in spent in California at St. Mary's as a young woman. The petals must have lost their scent by now, but she can still smell them: orange and lemon blossoms, and the crumpled remains of eucalyptus leaves. When she was homesick at St. Mary's, she used to snap the eucalyptus leaves in half, then snap them in half again, then into smaller and smaller pieces to release the intoxicating scent of their acrid oil, which almost reminded Sarah of the scent of pine sap when it oozes from chopped firewood. With a quick flick of her wrist, the sachet sails across the room and lands in the truck.¹⁰

She inadvertently whistles a bar from a choir song she used to hear in California, then catches herself, grimaces, and blurts out, "Fire *me* as interpreter? Ridiculous." She slams the middle dresser drawer closed with her thigh and opens the top, right drawer gingerly, "Even Egan hates you, Rinehart! *Egan!* I've never seen Egan hate someone so much before! He even likes that scary black magic-slinger, Oytes!"¹¹

The next few items are placed gently into the trunk instead of lobbed: a bible with faded, yellowing pages, a hymnal book with the words written both in English and in Spanish, a small stack of handkerchiefs, various bits of underclothing, a small comb, and a single broken beadwork necklace - the only one her ex-husband had neglected to steal from her.¹² These precious items fill the small box entirely, so Sarah rolls her summer dress inside a blanket, and then ties the blanket to the top of the trunk with a length of thin rope. She dresses herself in the woolen coat, makes one final sweep of the room with her eyes, then picks up the box and turns to face the door of her former room.

"Well then," she says aloud as she turns the handle, "to Camp Harney, to put an end to this madness!"¹³

The consequences of our actions are not often felt immediately, not often opened in front of us, bleeding. They do not often have a beating heart and a speaking voice. We often just continue marching forward in life. Keep marching forward, keep marching forward, keep marching forward...

PAIUTE FAMILY: Late December 1878

Preparations are made, but what are we preparing for?

"Pea! Pea, mommy, Pea!" I try to get my Pea to turn to me, to see that I am in need of her, but she is sad and withdrawn as she gathers food from our winter storage, placing dried tuhudya meat, berries, and ground kuyi into one of her large baskets, "Pea! I saw him! I saw the Puhana, the Medicine Man, Oytes!"

"Oh did you?" Pea breaks from her trance a bit and turns to face me, "Ask him, ask the Medicine Man to save us from this journey. Not all of us sided with the Bannock, and not all of us should suffer."¹⁴

"But Peeeeea....Peeeeea, he was like a bird inna tree, way at the top, and I saw him looking ahead and speaking into the hekwa," I point to the tall pine that stands to the north of our winter

home, “I saw him but he did not see me. And I saw him looking, and speaking, and moving his arms, but then I saw him *jumping!*”

“Mm,” says my Pea, as she removes my little Pune’e, my baby sister, wrapped in her first cradleboard, from her back, placing her against the wall. I’ve been out of my cradle board for a long time, but sometimes I play with mine – count the stripes on the top, hide my treasures inside, and hide myself behind it, then pop out to scare my Pune’e. My Pea hoists the basket of food and our thick family blanket, made of kammu kwasibi, rabbit furs, on her back and carries them out of our winter home. “Stay here with your Pune’e, I am going to place our items on the wagon,” she says, and tosses me two of the dried berries.

“Pune’e, I saw the Medicine Man on the treetop!” She smiles at me, drooling down the laces of her cradleboard, “He was speaking, and the trees were swaying, and then he suddenly STOPPED. Just like that. He stopped speaking and the tree stopped waving, and you know what he did?” A long ribbon of drool hangs from her chin, and I pause to eat the dried berries, “he LEAPT from the top of the tree, and landed on the ground, and he wasn’t hurt at all!¹⁵ He landed softly, on his feet, and the pagena swirled around him, like it was trying to crawl on top of him! What do you think of *that?*” She smiles at me, her big, strong Pabe’e, and chuckles in the baby language that I used to speak but have since forgotten.

He used to know her infant language, but now he knows the word for his ball, his father, his wikiup, the hill, and the river. He has a word for the color of the hills when they are dry in summer, and a word for the soft, secure feeling within a rabbit skin blanket, but he does not yet have the word for the loss of a father or a little sister.

OYTES: 1877

It is not a food “shortage” when the food exists but is denied us

The first time I saw my Moo’a heal, I was still a young child. I watched her place the wrinkled root-like mi extending from the ends of her branch-like arms on my father, my Na, who looked wet and lifeless on the ground. My distraught mother, my Pea, was preparing herbs for a strong tea for her husband, and Moo’a moved closer with her mi stretched out toward him. But as Moo’a placed her hands on Na’s long kowpa, his strong arms, his stomach, and throbbing wo, he began to move a little, showing signs of life. He then sat up and asked Pea for a drink of water. Most children as young as I was would not have known what was going on, much less remember these details as an adult, but this was a rare event that remains as clear in my mind as the sparse meal I just ate.

Moo’a was always wonderful to me, encouraging me as I placed both mi on her own swollen ankles and kuku at night, my short child-fingers drawing out her pain. When she would smile at me after I did this, there was always an extra sparkle in her deep poee, as dark as the toohoo obsidian when it shines in the sun. When she smiled this way, there was always an extra curve in her grin causing all of her wrinkles to bend and smile as well. She knew that I had her healing touch, but she allowed me to discover what I could do on my own. I had to learn what disease and

pain felt like, to know how my own skin could call to the pain and sooth it out of others. Healing my Moo'a's pain was like a second nature to me by the time I was old enough to join the kammu hunt, and that was the year I found the dying nageta and healed it. And that night after I healed that nageta, Moo'a took me aside and shared with me some stories which were only for me.

I am now the most trusted Medicine Man, Puhanaana, in our tribe, but how can I heal the hurt being caused by these agents? First were told that all of the land we lived on before was not ours to own, but this section of land was now ours to farm. Agent Parrish expected us to earn dollars, and accept clothing, blankets, and food from Washington. Now Agent Rinehart tells us that this section of land we have been farming is *not* ours, but is his, is Washington's land. The seeds we force into our mother to produce crops and the crops we pull from her later are Washington's crops. Our people have been forced to work for money and receive standard goods for free, under Parrish, but now under Rinehart we work without money and are paid instead with the items that were freely given before? I stand by Chief Egan in this, for how are we supposed to live, with our ways of living replaced, then the replacement replaced with nothing? You starve us then threaten to starve us more when someone takes from you, out of desperation, the food they have rightfully worked for. Do you wish us to work until we collapse into the ground we till? I can heal my people with my touch, but I cannot heal them through hunger and exhaustion.¹⁶

When Oytes places his hand over a starving woman, he feels his own hunger meet her hunger at the thin place where skin meets skin. The hungers clash together, like stone on stone, and ripple back to the stomachs that sent them. The medicine for this hunger is action.

SARAH: 1878

Where observations become words and words become bullets

Silently walking back to General Howard's camp from the Bannock camp, Sarah Winnemucca pauses to look up, noting the brightness of the Great Bear in the sky.¹⁷ She must make a choice during this walk, a choice to relay the information she had found to the army, or to deny that she found anything.

"It isn't like Egan and Oytes are in the right here, you know," she states, speaking perhaps to the twinkling bear. "Father is right. We need to side with General Howard for our own safety."¹⁸

The only sounds she can hear are the soft snaps of spring shoots as her padded feet land upon their heads. It is still too early in the year for buzzing insects, and still too early in the morning to hear any birds.

"Father is right. This is right." She punctuates, shortly, "This is *right*."

As dawn breaks over the plateau and Sarah enters the General's tent to share the position and future plans of the combined Paiute-Bannock forces against the army, her thoughts stray to her aging father, her sweet sisters and brothers, and the love she has for her family.

Bullets spray the Paiute with cracks and pings, like tree branches breaking in a hailstorm. Gripping her sister Mattie's hand, Sarah holds her breath behind a large boulder, unable to think, unable to speak, unable to know who has been hit. One voice is distinct amongst the cries and cracking: the voice of Oytes. Clinging to the edge of the rock, she peers through the strange mist he has called down – some of the bullets have melted in mid-flight as they zip towards him, and the Gatling gun is jamming, clogged by the melted tip from the fog.¹⁹

PAUITE FAMILY: Early January 1879

The narrow space between two flags

With thick nehabi to our waists, and breath hovering in the cold air, we are being forced to line up, single-file, before start our journey to Yakima. The wagons were placed on the trail the day before yesterday, and all of the Pea, the mothers, were called forth to gather their supplies for their families. Our horses are strapped into the wagons, for they will not be holding all of our men. No. Metal shackles line the road behind the wagons, one pair for every walking man. We are waiting now, as a group. Waiting to begin.

A man in an army uniform is stepping out into the trail, and that traitor Sarah Winnemucca is by his side, translating again.

“We...we are to take these wagons...and...we are to...to cross the Blue Mountains now...we are exiled to Yakima...for our participation with the Bannock...in the Bannock conflict of last summer. I am coming with you, my people; I will be riding my own horse, Meride,²⁰ so fear not! But...but first...we...oh, oh God...oh...!”

This white army man, shackle keys clinking at his belt, has taken a thin, sharpened flagpole and used it to skewer the closest baby into the ground,²¹ the way I have seen the Wasco prepare salmon to dry. He plants another flag a few feet from the baby-flag, and is pointing to them as he is yelling at traitor Sarah Winnemucca. She has tears flowing from her poee, and I am frankly surprised that she has human feelings.

“He...oh God...he says we must walk between these two...oh...these two flags. He...he says that this is a warning, a sign that we are to be...to be Good Indians as we march...that bad things will happen to Bad Indians, like this has happened to this...this little one.”

No, Sarah. This is not “a sign.” I know what a sign is, what a prophecy this, and this is just cruelty, not a sign. We will walk between these flags, and we will march, and I will be the first one to do so.

Oytes steps forward, steps toward the wailing mother of the slain baby and touches her shoulder. A warmth rushes to her heart, her piwe, and she clutches her young son and husband, one in each hand, and nods to the Medicine Man. He slowly nods back, and walks toward the two flags. Knelling before the baby, he see her crimson pii still pulsing, her rapid, shallow breath, and he feels her pain. “Little Pune’e, be still. Return to the ground and wait for us to return to you, sweet one, dear one.” He places his left hand upon her small body and releases her from

life. Then he stands, brushes the snow, the nehabi, from his knees, and walks between the flags towards his shackles.

PAUITE FAMILY: Mid-January 1879

The elements in one hand, the health of the people in the other

“Pea! Pea!” I call to my mother, my Pea, “Wake up! Wake up! I cannot see Na on the trail! I cannot see Na! Pea, Pea! Where is Na?”

Her head, her wo, has lately looked three times as heavy as it normally looks, and her thick, beautiful tsopuhu, always kept neat and shiny, has been matted and lopped where it meets her forehead. She turns to me, large circles under red-rimmed pooe, and stretches out her arms for a hug. I, of course, scoot toward her on the wooden wagon, and we embrace as tightly as we can, as though we are going to squeeze together into one person. I can feel her ribs poking me, and her chest, her nungaba heaving as she sobs.

“Why isn’t Na on the road?” I venture, meekly.

“He...” She holds my face in her hands, tears running down in pulses, “He is in the ground, planted like a seed. He is with your little Pune’e, remember her sweet laughter? They are together, making the ground ready for our roots, and ready for our nuts.” She smiles at me, and uses one shaking hand to wipe the water from her face, “They are making the grasses grow for the tuhudya to eat! They are making the ground soft for the kammu to burrow in. Do you understand, strong Pabe’e?”

I do understand, and I do not understand at the same time, but I nod my head and do not cry, because I know this will make Pea happier, to see me strong, like my Na.

“Pea,” I say, in my strongest man-voice, “Pea we must stop the caravan. We must give Na the ritual under rocks that we gave grandmother,²² Hootse’e. Pea, we must stop!”

She strokes my messy tsopuhu, “Strong man, we cannot give Na the ritual of burial. We cannot give it to Pune’e, either. We cannot stop. We must keep going forward right now. Do you understand?”

Again, I nod.

“Pea,” I ask her, sweetly this time, like I would have asked her a year ago, when I was a young child, “Pea, would you like some dried berries?”

She looks at me, concerned, “Pabe’e, we have been out of berries for a week. We have very little food.”

“I know, Pea, but we can pretend. We can pretend Na and Pune’e are here on the wagon, and we are all in our winter home, having berries and telling the story of Na’s first tuhudya kill, or of the time when Pune’e was born, during the lightning and thunder that shook the world, or of

Coyote, we could tell of his...” Pea cut me off with another tight embrace, this time without sobbing, but with silence. Looking up as we hug, I notice that all around us is a powerful storm, with hekwa and nehabi swirling around, wailing loudly as we cross this mountain, but none of it touches our skin. Somehow the storm cannot reach us, as though our entire trail of people and wagons, horses and shackled men, are protected by a clear bubble.

“Pea! Look! How...” She unlocks our arms and looks up, gasping.

“It’s Oytes, it’s the Puhanana!”²³

We both gawk at the swirling white flakes, suspended above our heads, wanting to touch us but unable to get any closer. Behind us on the trail, the walking men see it too, and they cheer feebly and are given motivation to stand upright, to walk faster. I get up to rummage around the basket for a celebratory morsel of food for Pea and me, and my leather ball, my tisung’uyapi matapo’u, the best one any of the other children had ever seen, my perfect matapo’u, crafted by my Na, it rolls out from behind the basket and bounces off the wagon, rolling down the trail, past the shackled men, and past the barrier of protection created by the Medicine Man. It is gone forever, and the tears I had felt for Na and for my little Pune’e come now, they come in rivers, because I had been trying to be strong for so long now...

Oytes, at the front of the trail on a horse, with hands in cold iron chains, holds the storm at bay with a secret story, secret words, words said to him long ago by the nageta he had healed, words the nageta had sent to him from the future, from the past, perhaps from his grandmother, or her grandmother, from all times and all ancestors, who seem to swirl together like flakes of snow in the air of a mountain.

OYTES: Near February 1879

As one journey closes, another opens wide

As the sun rose this morning I saw another vision, one that reminded me of one I saw long ago as a boy, before I knew what they were and how to read them. The vision was of hundreds of strong tuhudya, thundering head-on toward me on the trail. As they ran the splintered off, one would take a sharp left and split into two equally sized tuhudya, then another would sprint to the right and split into two more, then each of the split tuhudya would split again, then again, then again, until thousands were all running, kicking up dust and causing the whole of the earth to notice them. Unlike the nageta I saw as a boy, these tuhudya did not scare me, they made me cheer! Run! Be free! Thunder over the ground! I thought the vision was over, until I saw the brown fog rolling in.

As the brown fog approached I saw that it was not fog but hundreds of kammu, their fur rolling together like rapids, and every place their paws touched on the ground, a root flower sprang forth in a brilliant illumination of white blooms. Like the tuhudya, the kammu would run right, left, leaping and rolling over each other, spitting into two, then four, then eight, then sixteen each, until thousands of kammu washed around me as I cheered for them! The rustle of their fur was

joyous! I thought this was quite a long vision, so it must be finished, but then my old fear, the nageta, came flocking overhead.

Unlike the last nageta vision, this flock of nageta had the sunrise instead of the darkness attached to their feet and wings. They soared over me and my breath left me momentary – I swooned backwards on my horse and was stunned by the beauty before me. These nageta did not multiply like the kammu or tuhudya, but flapped a breeze into my face to bring me back to the world, to bring me to the present. All of the animals had been moving south, toward our home lands, and they had all been filled with purpose and vigor, life and motion.

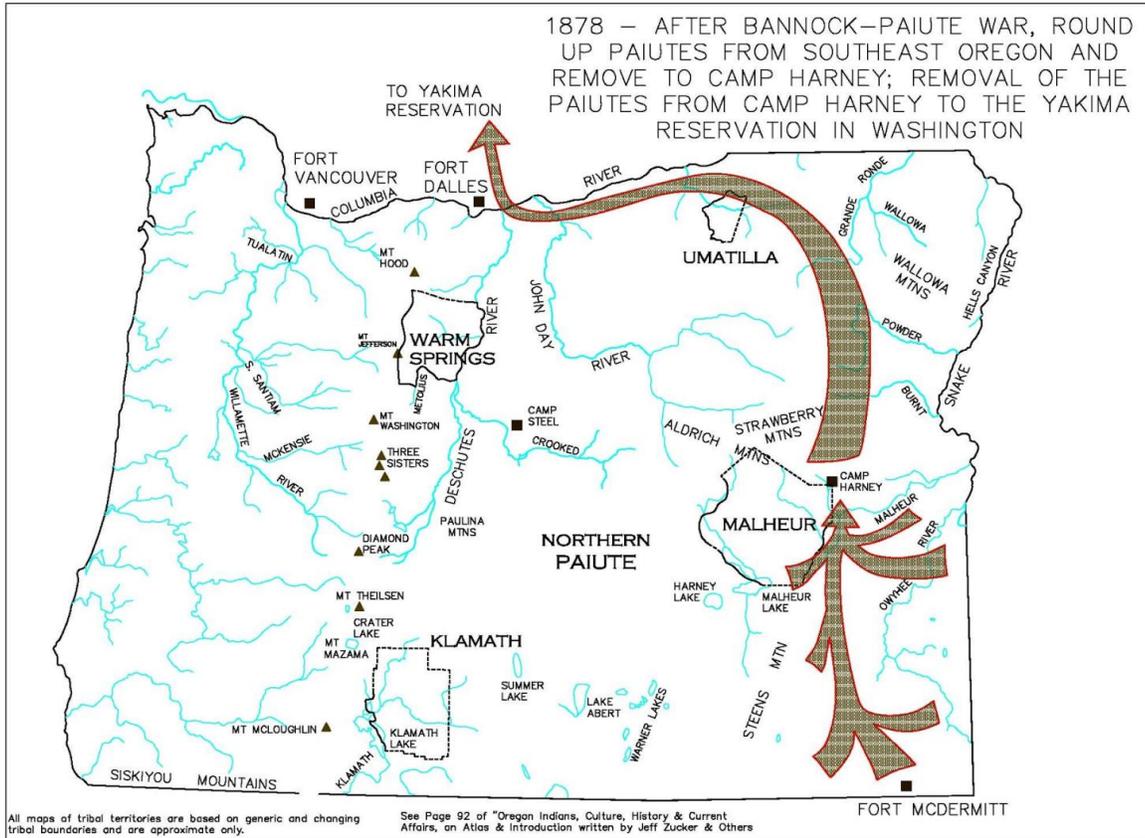
That vision was inspiring, and now I can see the first tender little shoots that are reaching up, poking out of the nehabi, as my own shoot-like finger reach up to the elements. I can laugh a bit even though my arms feel as though they will break or fall off of me from exhaustion, and these metal chains feel so heavy. I feel the pain of my people, and I have been calling to it to come to me, to sprint ahead of the wagons and find me, but my healing does not work without touch. The pain remains in my people, but at least I kept the storm at bay, at least we are going to make it.

And what is this on the side of the road? An injured nageta, like the one before, when I was a boy? Come, nageta, let me heal your pain. Let my left mi press into your wounded nungaba to weave your veins back together, move your ribs into place, and allow your breath to be steady...

As Oytes heals the nageta, she pauses a moment, looking at him expectedly. Oytes leans forward to her little goose-ear and whispers to her a secret word, a secret story about holding back a snowstorm above the Paiute people as they marched across the mountain. The nageta nods, stretches her wings, and launches into the air to fly south, to fly back home.

APPENDIX

Figure 1: Map of the Route the Northern Paiute Took to Yakima



Map from Zucker, Jeff, Kay Hummel, and Bob Hogfoss. *Oregon Indians: Culture, History, and Current Affairs: an Atlas and Introduction*. Madison: Western Imprints, the Press of the Oregon Historical Society, 1983.

GLOSSARY: Provided by Paiute Tribal Elder Myra Johnson Orange

Numu word	English equivalent
Ham'a	Older sister
Hekwa	Wind
Hootse'e	Paternal grandmother
Kammu	Rabbits

Numu word	English equivalent
Kowpa	Leg
Kuku	Foot
Kuyi	Edible roots
Kwasibi	Skins/furs
Matapo'u	Ball
Mi	Hand
Moo'a	Maternal Grandmother
Na	Father
Nageta	Geese
Nanagapitaa'a	Chief
Nehabi	Snow
Nungaba	Chest
Pabe'e	Older brother
Pagena	Fog/mist
Pea	Mother
Pii	Blood
Piwe	Heart
Pooe	Eyes
Poohe	Blue
Puhanana	Medicine Man
Puhu	Ducks
Pune'e	Younger Sister

Numu word	English equivalent
Tatsa	Summer
Tawano	Spring
Tisung'uyapi	Leather
Toha	White
Tomo	Drier (winter)
Toohoo	Black
Tsopuhu	Hair
Tuhudya	Deer
Tu'nu	Top (toy)
Wanga'a	Younger brother
Wo	Head
Yabano	Fall

ENDNOTES

1. All Paiute words are from Myra Johnson Orange, email conversation regarding word translation, December 12, 2014. Instead of listing each word with an individual footnote, please see the list Paiute terms in the Glossary.
2. C. Melvin Aikens and Marilyn Couture. "The Great Basin," in *The First Oregonians*, ed. Laura Berg (Portland: Oregon Council for the Humanities, 2007), 280.
3. *Ibid.*, 48.
4. "Our people have that connection. They knew that our people, when they get put back into the ground, they become part of that ground. And out of the ground comes all of our medicine, all of our roots, all of our berries – all of the things we need for our livelihood." Wilson Wewa quoted in "We Are Created from this Land: Washat Leaders Reflect on Place-Based Spiritual Beliefs," *Oregon Historical Quarterly* 115, no. 3 (2014): 309. <http://www.jstor.org/stable/10.5403/oregonhistq.115.3.0298>.
5. Oytes would have had his powers from youth, passed through the family line. Myra Johnson Orange, conference call with the author, November 25, 2014.

6. Myra Johnson Orange, conference call with the author, November 25, 2014.
7. Letter from March 7, 1874, written by U.S. Indian Agent H. Linville: "I desire to state in explanation to the Cou. Commisioner that the Indian Oytz, referred to in the accompanying letter, has been constantly trying to drive all Indians away from this part of the reservation: telling them that this is his particular range, and that they have no right whatever here. Oytz was very profuse with promises when I first came here....since then he has tried to induce other to join him to [?] me to issue to them in such quantities as they see fit. Sugar. Coffee. Rice. Tea....he is the curse of Winnemucca."

U.S. Office of Indian Affairs. Malheur Agency Records, Correspondences 1876-1880. Box 53, Folder 1.
8. Sally Zanjani. Sarah Winnemucca. (Lincoln: University of Nebraska Press, 2001): 129-133.
9. Sarah Winnemucca Hopkins. *Life Among the Piutes: Their Wrongs and Claims*. 1883. http://www.yosemite.ca.us/library/life_among_the_piutes/
10. George F. Brimlow. "The Life of Sarah Winnemucca: The Formative Years," *Oregon Historical Quarterly* 53, no. 2 (1952): 112. <http://www.jstor.org/stable/20612063>.
11. Sally Zanjani. Sarah Winnemucca. (Lincoln: University of Nebraska Press, 2001): 138.
12. Canfield, Gae Whitney. *Sarah Winnemucca of the Northern Paiutes*. (Norman: University of Oklahoma Press, 1983): 110.
13. Sally Zanjani. Sarah Winnemucca. (Lincoln: University of Nebraska Press, 2001): 140.
14. James A. Gardner. *Oregon Apocalypse: The Hidden History of the Northern Paiutes*. Publication Forthcoming 2015, Oregon State University Press: 559.
15. Myra Johnson Orange, field research trip recorded discussion, October 17, 2014.
16. Sally Zanjani. Sarah Winnemucca. (Lincoln: University of Nebraska Press, 2001): 142.
17. George F. Brimlow. "The Life of Sarah Winnemucca: The Formative Years," *Oregon Historical Quarterly* 53, no. 2 (1952): 111. <http://www.jstor.org/stable/20612063>.
18. James A. Gardner. *Oregon Apocalypse: The Hidden History of the Northern Paiutes*. Publication Forthcoming 2015, Oregon State University Press: 559-562.
19. Myra Johnson Orange, field research trip recorded discussion, October 17, 2014.
20. James A. Gardner. *Oregon Apocalypse: The Hidden History of the Northern Paiutes*. Publication Forthcoming 2015, Oregon State University Press: 568.
21. *Shoshone Paiute History*. Produced by Lewis-Clark State College Information Technology Media Services. Shoshone-Paiute Tribes, 2003. <http://www.shopaitribes.org/culture/>
22. Cynthia D. Stowell. *Faces of a Reservation: A Portrait of the Warm Springs Indian Reservation*. (Oregon Historical Society Press, 1989): 119.
23. Myra Johnson Orange, field research trip recorded discussion, October 17, 2014.

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The Economic Impact of Sporting Events in Lane County

David Cole, John Hurley, and Jeffrey Naber, Economics*

ABSTRACT

When considering the full economic impact of sports in Lane County, the first events that come to mind involve the University of Oregon athletics program. But the Ducks are not the only events that the University hosts. For example, Hayward Field is the home of the yearly Prefontaine Classic. State high school football championships take place in Autzen Stadium, along with the Susan G. Komen Race for the Cure. The Matthew Knight Arena hosts championships for high school basketball, along with the Duck's basketball program. Moreover, the University is not the only place in Lane County that holds these events. The Willamalane Center for Sports and Recreation hosts state volleyball championships, gymnastic meets, and even roller derby. There are drag boat races at Dexter State Recreation Park, sailing regattas at Fern Ridge Reservoir, marathons, golf, model airplane, and horsing events held in town. Amazon Pool hosts several swim meets every summer, each with hundreds of athletes and spectators. Understanding the full impact of sporting events on Lane County's economy requires understanding how varied the sporting culture is in the county.

INTRODUCTION

The purpose of the report is to estimate the impact of sporting events on the Lane County economy during 2013. Over 200,000 people attended sporting events hosted in Lane County in 2013, and their spending produced a sizable impact on the local economy:

- Between \$31.6 and \$43.1 million in additional economic output;

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- Between \$9.6 and \$13.1 million additional earnings for employees in Lane County;
- Between 386 and 512 additional jobs created to support these spectators' spending.

In addition, events hosted by Junction City Athletics and Lane Community College accounted for an estimated:

- \$10.4 million in economic output;
- \$3.1 million in earnings for local workers;
- 127 additional jobs in 2013.

This substantial impact to the economy would not be possible without the diverse sporting community, both collegiate and community that exists within Lane County.

LITERATURE REVIEW

The economic impact of sporting events is a well-studied area. For this project, we focused our research on studies that closely matched the demographics of Eugene and Lane County, notably avoiding the economic impact of professional sports, as there are substantial differences between local level, collegiate, and professional sporting events. The purpose of avoiding professional sporting events is to keep the analysis an apples-to-apples comparison: professional sports teams have significantly different cost and revenue structures, as well as differing supply chains.

A common thread across every study reviewed was the importance of differentiating between spending by local spectators and out-of-town spectators. Local spectators, had they not visited a sporting event, would have likely spent the money on some other form of local recreation. In other words, if an event does not provide for a new source of spending in the community that is directly related to that event, then that event has no economic impact (Duy). The spending in the local economy would likely have occurred with or without the sporting event. This demonstrates why it is important to pay attention to the origin of the spectators and athletes when measuring the true economic impact. Every study considered took this effect into account and made specific note of the impact to the local economy from out-of-town visitors, a methodology followed in this paper.

All of the studies researched defined the total impact of sporting events as the combination of both the direct, indirect, and induced impacts of the events. The direct impact captures the initial payments made by the venue to its employees and local businesses to provide the services (personnel, maintenance, signage, and so on) necessary to run the venue. Direct spending also captures additional expenditures by visitors, such as meals, hotel rooms, and any other such spending that takes place in association with attending the sporting event. The indirect and induced effects are explained through the use of economic multipliers.

Multipliers are built around the fact that expenditure from one economic agent is income for a second agent. The second agent then spends a portion of that new income, which becomes income for another agent and so on. This allows each dollar spent to have a greater economic impact than \$1. Direct effects take into account the spending of revenues by local vendors. For example, a family in town for a volleyball tournament might stop at a local restaurant for dinner before leaving for home. That local restaurant then spends that new revenue on local vendors for supplies, which then has a second impact on the local economy. Induced effects take into account further spending by local employees. The server at the restaurant now has additional income they would not have gained, had the family not come into town. The server now uses that income to purchase goods and services in the local economy providing a secondary impact.

The framework of this study's methodology encompasses the use of economic multipliers derived from the RIMS II regional economic model provided by the Bureau of Economic Analysis (BEA). The RIMS II model was created as a tool for investors, planners, and elected officials to estimate potential economic impacts of public or private projects. The model uses economic multipliers appropriate to the project and the region the project is being conducted in. The RIMS II framework is based on a set of national input-output accounts that show the goods and services produced by each industry and final users. These input-output accounts provide the foundation for the model's economic multipliers. The benefit and the limitation of using RIMS II multipliers is that these multipliers are only meaningful for analyzing the impact of a final demand change in a region. These final demand transactions take the form of 1) purchases by consumers outside the region, 2) investment in new building, equipment, and software, 3) purchases by government, and 4) purchases by households. These transactions are considered final because they are not used as intermediate inputs by industries in the region. However, as is the case with all economic models, there are certain assumptions that must be made and recognized while conducting the economic impact study. The RIMS II model assumptions implemented in this study are detailed in appendix A

Multipliers are widely used throughout economic impact studies. For this paper we are making use of the RIMS II (Regional Input/Output Modeling System) provided by the BEA. The RIMS II multipliers do not have separate multipliers for induced effects. However, this is not a concern with this paper, as we are considering only the impact from out-of-town visitors. These multipliers break out the multiplier effect by industry to better explain how sporting events affect the community. The RIMS II multipliers are region-specific, providing estimators unique to Lane County. The studies examined had multipliers ranging from 1.5 (Thompson) to 1.81 (University of Arkansas) for expenditures. The multipliers used in this paper are all within this range, suggesting this methodology is within an acceptable range.

These multipliers were applied to estimated values of spending both from day and overnight attendees. The studies we reviewed also provided a range of possible estimates. Travel Lane County estimates that overnight visitors spend an average of \$166 per day, while day visitors spend \$57 per day. A study done for Traverse City, Michigan, examined the spending effects of out-of-town visitors attending multi-day youth soccer tournaments and found average total spending per family to be \$518.42/day for visitors to the annual Cherry Cup youth soccer

tournament, and \$410.42/day to the annual Cherry Bomb youth lacrosse tournament (Smith). Discrepancies between these estimates are due in large part because of a mandatory fee charged to the Traverse City study participants.

The Traverse City, Michigan study provides examples of other important issues to consider with an economic impact study. The authors began by mentioning an estimation made by the Sporting Goods Manufacturers Association (SGMA), stating that nearly 70% of children between the ages 6-17 in the U.S. are participating in at least one team sport. The authors state that there has been a large increase in the number of traveling teams to away games and tournaments. These youth tournaments are often 2-3 days long and are played by multiple teams traveling from all over the country. According to Don Schumacher of the National Association of Sports Commissions, parents spent about \$7 billion in 2012, on just traveling involved with youth sports. The researchers examined the economic impact of the Cherry Capital Cup youth soccer tournament and the Cherry Bomb youth lacrosse tournament on the local economy of Traverse City. The researchers conducted several interviews with the tournament hosts and sent out hundreds of surveys to the tournament participants to get a thorough understanding of the participant demographics and spending habits. The researchers recognized that since these are youth tournaments, most players are accompanied by at least one parent. The researchers found that 66% of the athletes had two parents with them, 50% had one or more siblings, 16% have one or more grandparents, and 14% have additional relatives joining them. The researchers' surveys revealed that each athlete competing in the tournaments had brought 2.14 additional people with them. Combined, the weekend tournaments attracted 17,400 people, 80% of which had traveled from outside the Traverse City area to take part in the tournament. Drawing on the results of the survey, the study estimates an average total spending of \$985 per non-local family attending either tournament, resulting in \$3.4 million in direct spending in the region. It is noteworthy that the researchers specifically chose to not use an economic multiplier to estimate indirect spending, as there was debate as to which multiplier to use.

The authors did note that their estimates were conservative, and that the use of an economic multiplier could in fact help get an estimate of the tournament's indirect impact in the regional economy-- noting that most studies use a multiplier of 1.3. The use of multipliers in determining economic impacts is widely accepted and used in economic research. A study conducted in Charlotte, NC MSA economy in 2011 employed economic multipliers when analyzing the economic impacts of sporting events in the region. The primary focus of the study was on the more important measure of economic activity concerning output and employment. To determine the total economic impact on output and employment due to sporting events, the study used the multiplier methodology IMPLAN provided by the Minnesota IMPLAN Group. Originally developed by the U.S. government, IMPLAN provides industry-specific multipliers, as does the BEA's RIMS II multipliers. The indirect multipliers obtained from IMPLAN were used to determine the overall economic impact in sectors including spectator sports, radio and television broadcasting, cable networks and program distribution, food and beverage stores, gasoline stations, general merchandise stores, hotels and motels, and food services and drinking places. The study first determined the direct impact in these industries in association with expenditures that took place with the event. After the direct impact was determined, the IMPLAN multipliers

were used on the direct estimates to obtain an overall impact estimate to the specified industries. The IMPLAN multiplier methodology also gives multipliers for indirect and induced impacts that are able to be calculated separately from the total impact at the regional level. The use of the IMPLAN multiplier methodology created multiplier ranges for the total impact on output between 1.63 to 2.29 and a total employment multiplier range of 12.51 to 24.94 per \$1 million in direct spending with industry specific multipliers.

SPORTING EVENTS IN LANE COUNTY

Travel Lane County assists sporting events with finding appropriate venues to meet their needs, promoting the event, and even helping to find rooms for the competitors and their families to stay in. Travel Lane County has collected statistics on the events that they have helped with, including the number of out-of-town visitors broken down by event. For this paper, the authors used the most recent data for a full year's impact from 2013. Table 1 summarizes the visitor data:

Table 1: Visitor Breakdown by Type of Visit

Sum of Show Attendees	205,597
Sum of Hotel Attendees	60,568
Sum of Day Attendees	145,029
Adjusted Hotel Attendees	139,630
Adjusted Day Attendees	293,067

Sum of Show Attendees is the total number of individual spectators who visited sporting events in Lane County each year. Sum of Hotel Attendees is the number of individuals who stayed in a hotel during their visit, and Sum of Day Attendees is the number of individuals who did not stay in a hotel during their visit. As several events last more than one day, it is necessary to account for the fact that visitors will be spending money each day they are here. Adjusted Hotel Attendees takes into account multiple-day hotel stays. Similarly, Adjusted Day Attendees takes into account day visitors who do not stay in a hotel during multiple day sporting events.

Day Attendees include everyone who attended a sporting event without staying in a hotel. Unfortunately, there was no available data whether or not these individuals chose not to stay in a hotel because they live in Lane County already, or because they chose to return to their home outside of Lane County. As mentioned above, money from outside the county is the primary driver of additional growth. Money spent by the residents of the county is most likely displaced from other recreational spending within the city. Further complicating the analysis, the number of out-of-town visitors depends on the specific event. With individual high school sporting events, around half the players in the game are from out-of-town. With larger events, such as regional championships, or the Olympic Trials, that number is likely to be considerably higher. To account for the lack of this data, we have prepared a range of estimates from which to consider. In Table 2 we assumed that 25%, 33%, and 50% of day visitors are from out-of-town.

Table 2: Estimated Number of Out-of-Town Day Attendees

Percentage	Estimated Sum of Attendees	Estimated Adjusted Attendees
25%	36,257	73,267
33%	47,860	96,712
55%	72,515	146,534

The variety of venues and events is crucial to the overall sporting culture in Eugene. In order to understand why this is the case, we turn to a study from Dean Runyan Associates, a Portland based economic consulting firm who has compiled county-specific traveler spending and impact information, detailed in Table 3.

Table 3: Dean Runyan Associates Estimates of Aggregate Visitor Spending

Industry Spending	Direct Impact (in millions of dollars)
Accommodation & Food Services	1422.1
Professional Services	0
Transportation	344.5
Arts, Entertainment, & Recreation	290.9
Government	0
Retail Trade	233
Finance, Ins., & Real Estate	0
Other Services	0
Mining & Manufacturing	0
Agriculture and Food	0
Processing (Construction)	0
Total Spending	2290.5

As Table 3 shows, most traveler spending occurs in the services sectors, particularly food services, and hotels. Service industries tend to have flexible staffing, so increased customer needs during single events can be satisfied by providing current employees with extra hours. While this does provide the currently employed with more income, there may be no need for businesses to add additional jobs. It is the overall sporting culture in Eugene that contributes to persistent job creation. Therefore, in this study we do not consider the impact of any single sporting event; instead, we focus on the aggregate impact of sporting culture in Eugene.

ESTIMATED IMPACT—TRAVEL LANE COUNTY/DEAN RUNYAN ASSOCIATES

The data provided by Travel Lane County provides the primary estimates of the overall direct economic impact of sporting events. To determine the indirect impact, we use the RIMS II multipliers, in Table 4.

Table 4: RIMS II Multipliers for Relevant Industries

	Multipliers		
	Output	Earnings	Employment
Lodging	1.6459	0.4979	19.4989
Retail Shopping	1.6384	0.5278	20.1867
Food & Beverage	1.7249	0.5255	24.5683
Private Auto Expenses	1.6700	0.5186	15.3333
Rental Car Expenses	1.6346	0.4033	8.6956
Airfare	1.6695	0.5452	13.2854
Other	1.6627	0.4192	18.4762

For example, every dollar spent by an out-of-town guest for lodging, once it has circulated fully through the economy, actually generates \$1.6459 in total economic activity and \$0.4979 in earnings for local workers. The employment multiplier estimates that 19.4989 jobs are created per \$1,000,000 aggregate spending on lodging. As stated above, it is important to remember that the jobs multiplier relies on *aggregate visitor spending*, because service industry employers are able to offer extra hours to current employees easily to accommodate one-time events, without actually creating new jobs. For example, the Olympic Trials at Hayward Field last for nine days, every four years. Businesses are very unlikely to take on the substantial cost of hiring and training new staff just for nine days of events, only to lay off those new staffers as demand returns to normal levels. Dean Runyan Associates estimates that, in Lane County specifically, it requires \$69,680 of aggregate visitor spending to create one job, or a multiplier of 14.351 jobs per million dollars in aggregate visitor spending.

As noted above, the available data did not differentiate between day attendees who lived in Lane County, and those attendees who live outside the county. To fully account for this, the report will first estimate the impact from only hotel attendees, and then estimate the impact of day attendees using the proportions from above.

The primary difficulty lies in determining how much the average out-of-town visitor spends. This report uses two different spending habits for tourists to estimate the economic impact. The first spending estimates, listed in Table 5, use the spending estimate of \$166/day for hotel attendees, proportioned into industry-specific spending habits using the data from Dean Runyan Associates.

Table 5: Estimates of Aggregate Spending by Spectators Staying Overnight

Industry	Percentage of Total Spending	Direct Spending Per Industry
Accommodation and Food Services	62.11%	\$14,396,216
Transportation	15.05%	\$3,488,376
Arts, Entertainment, and Recreation	12.67%	\$2,936,726
Retail Trade	10.18%	\$2,359,579

There is one final complication to address. For retail sales (including gasoline sales), only a portion of the spending remains in the local economy to produce an impact. The remainder must pass from the seller to the producer. This can be in the form of profit, retained earnings, or dividends issued to owners. The amount that remains with the local retailer is known as the margin. The use of the margin is a standard accounting convention allows the true impact of retail sales alone to be determined, instead of conflating the sales and production of retail goods together. In other words, without a margin, the impact of the creation of retail goods would be included in the sales of retail goods, greatly overstating the true impact of retail sales¹. The margins, also provided by Dean Runyan Associates, and the final direct impact of overnight visitors, are listed in table 6.

Table 6: Estimates of Direct Spending Totals by Spectators Staying Overnight

Industry	Estimated Spending Per Industry	Margin	Direct Spending
Accommodation and Food Services	\$14,396,216	1	\$14,396,216
Transportation	\$3,488,376	0.17	\$593,024
Arts, Entertainment, and Recreation	\$2,936,726	1	\$2,936,726
Retail Trade	\$2,359,579	0.5	\$1,179,790

With the industry specific spending, the appropriate industry specific multiplier is applied to determine the overall impact², and the total direct impact is recorded in Table 7.

Table 7: Total Direct Impact of Out-of-Town Visitors For Sporting Events – Dean Runyan Associates Spending Estimates

Industry	Direct Spending	Output	Earnings	Employment
Accommodation and Food Services	\$14,396,216	\$23,733,602	\$7,075,740	279
Transportation	\$593,024	\$1,048,051	\$325,689	11
Arts, Entertainment, and Recreation	\$2,936,726	\$5,001,538	\$1,588,475	63
Retail Trade	\$1,179,790	\$1,932,732	\$620,569	23
Total	\$19,105,756	\$31,715,923	\$9,610,473	376

¹ More information on margins, and why they are necessary for economic impact studies, can be found in the BEA RIMS II User's Guide.

² In the case where the industry groupings used by Dean Runyan Associates covered two industries as defined by the BEA, the smaller of the two RIMS II multipliers was used.

These numbers apply to the “average traveler” into Lane County, which means they do not take into account the unique spending habits of sporting spectators. People in town for recreation are here in order to experience something in the town, which typically involves spending money at local businesses. People in town on business, or those simply staying the night passing through, are less likely to spend money, which means these numbers likely underestimate the true overall impact.

As mentioned above, the data provided by Travel Lane County did not differentiate between day visitors who live in Lane County and those who do not. In Table 8 we use the 25%, 33%, and 50% estimates of out-of-town day visitors to estimate the total aggregate direct spending.

Table 8: Direct Spending Estimates Based on Percentage of Day Visitors From Out-of-Town

Industry	25%	33%	50%
Accommodation and Food Services	\$2,593,841	\$3,423,870	\$5,187,682
Transportation	\$106,848	\$141,040	\$213,696
Arts, Entertainment, and Recreation	\$529,125	\$698,445	\$1,058,250
Retail Trade	\$212,569	\$280,591	\$425,138

Finally, using the multipliers from Table 4, we arrive at estimated final demand impact for each percentage estimate.

Table 9: Economic Impact Estimates for Varying Percentages of Out-of-Town Day Attendees

Industry: 25%	Output	Earnings	Employment
Accommodation and Food Services	\$4,276,206	\$1,274,873	50
Transportation	\$188,833	\$58,681	2
Arts, Entertainment, and Recreation	\$901,153	\$286,204	11
Retail Trade	\$348,230	\$111,811	4
Total	\$5,714,422	\$1,731,569	68

Industry: 33%	Output	Earnings	Employment
Accommodation and Food Services	\$5,644,592	\$1,682,832	66
Transportation	\$249,259	\$77,459	3
Arts, Entertainment, and Recreation	\$1,189,522	\$377,789	15
Retail Trade	\$459,664	\$147,591	6
Total	\$7,543,037	\$2,285,671	89

Industry: 50%	Output	Earnings	Employment
Accommodation and Food Services	\$8,552,412	\$2,549,745	101
Transportation	\$377,666	\$117,362	4
Arts, Entertainment, and Recreation	\$1,802,306	\$572,408	23
Retail Trade	\$696,460	\$223,622	8
Total	\$11,428,844	\$3,463,138	136

In total, it is estimated:

- Between \$37,430,345 and \$43,144,767 generated in additional output;
- Between \$11,342,042 and \$13,073,611 in additional earning for local employees;
- Between 444 and 512 additional jobs created in 2013 to accommodate these visitors.

The second set of spending estimates is provided by Timothy Duy, PhD., a faculty member in the economics department at the University of Oregon. The numbers are taken from a survey of visitors to the Duck's athletic events, and so may more closely represent actual spending habits of sporting spectators in Lane County.

Table 10: Estimates of Individual Spending

Industry	Oregon Visitor Day	Oregon Visitor Overnight	Out of State Visitor
Lodging	\$3.09	\$41.08	\$31.46
Retail Shopping	\$17.93	\$23.55	\$23.81
Food and Beverage	\$25.48	\$33.49	\$32.59
Private Auto Expenses	\$27.58	\$27.16	\$19.31
Rental Car Expenses	\$0.77	\$0.34	\$5.66
Airfare	\$0.07	\$1.75	\$37.20
Other	\$6.49	\$7.43	\$8.60
Total	\$81.41	\$134.80	\$158.63

As these are individual spending numbers they must be adjusted for aggregate spending in order to determine the full aggregate spending per industry, per year. As before, these numbers are estimates of the total direct impact. As such, a margin is needed to determine an accurate economic impact. Duy provides these margins in "The Economic Impact of the University of Oregon Athletics Department." Table 11 provides the initial estimated spending numbers.

Table 11: Aggregate Spending by Overnight Visitors

Industry	Estimated Output	Margin	Direct Spending
Lodging	\$5,736,000	1	\$5,736,000
Retail Shopping	\$3,288,287	0.5	\$1,644,143
Food and Beverage	\$4,676,209	1	\$4,676,209
Private Auto Expenses	\$3,792,351	0.5	\$1,896,175
Rental Car Expenses	\$47,474	1	\$47,474
Airfare	\$244,353	1	\$244,353
Other	\$1,037,451	0.5	\$518,725
Total	\$18,822,124		\$14,763,080

As above, the industry-appropriate multipliers are used to determine the overall economic output of overnight visitors.

Table 12: Estimated Final Demand Impact by Overnight Visitors

Industry	Output	Earnings	Employment
Lodging	\$9,440,883	\$2,855,955	112
Retail Shopping	\$2,693,764	\$867,779	33
Food and Beverage	\$8,065,992	\$2,457,348	115
Private Auto Expenses	\$3,166,613	\$983,357	29
Rental Car Expenses	\$77,601	\$19,146	0
Airfare	\$407,946	\$133,221	3
Other	\$862,485	\$217,450	10
Total	\$24,715,285	\$7,534,255	302

To determine the impact of day visitors, we again construct estimates of 25%, 33%, and 50% of all day visitors being from out of the area. The direct spending estimates are given in table 13.

Table 13: Estimated Direct Spending by Day Visitors – Varying Percentages

Industry	25%	33%	50%
Lodging	\$226,394	\$298,840	\$452,789
Retail Shopping	\$656,836	\$867,024	\$1,313,673
Food and Beverage	\$1,866,837	\$2,464,225	\$3,733,674
Private Auto Expenses	\$1,010,348	\$1,333,660	\$2,020,697
Rental Car Expenses	\$56,415	\$74,468	\$112,831
Airfare	\$5,129	\$6,770	\$10,257
Other	\$237,751	\$313,831	\$475,501
Total	\$4,059,711	\$5,358,818	\$8,119,421

Multipliers are applied to determine the final, full economic impact of day visitors.

Table 14: Economic Impact Estimates for Varying Percentages of Day Visitors from Out of Lane County

Industry: 25%	Output	Earnings	Employment
Lodging	\$372,622	\$112,722	4
Retail Shopping	\$1,076,161	\$346,678	13
Food and Beverage	\$3,220,107	\$981,023	46
Private Auto Expenses	\$1,687,282	\$523,967	15
Rental Car Expenses	\$92,217	\$22,752	0
Airfare	\$8,562	\$2,796	0
Other	\$395,308	\$99,665	4
Total	\$6,852,259	\$2,089,603	84

Industry: 33%	Output	Earnings	Employment
Lodging	\$491,861	\$148,793	6
Retail Shopping	\$1,420,532	\$457,615	18
Food and Beverage	\$4,250,541	\$1,294,950	61
Private Auto Expenses	\$2,227,212	\$691,636	20
Rental Car Expenses	\$121,726	\$30,033	1
Airfare	\$11,302	\$3,691	0
Other	\$521,806	\$131,558	6
Total	\$9,044,981	\$2,758,276	111

Industry: 50%	Output	Earnings	Employment
Lodging	\$745,245	\$225,443	9
Retail Shopping	\$2,152,322	\$693,357	27
Food and Beverage	\$6,440,214	\$1,962,045	92
Private Auto Expenses	\$3,374,564	\$1,047,933	31
Rental Car Expenses	\$184,433	\$45,505	1
Airfare	\$17,125	\$5,592	0
Other	\$790,616	\$199,330	9
Total	\$13,704,517	\$4,179,206	168

In total, it is estimated:

- Between \$31,567,544 and \$38,419,803 in additional output in Lane County;
- Between \$9,623,858 and \$11,713,461 in additional earning for employees in Lane County;

- Between 386 and 470 additional jobs created.

ESTIMATED IMPACT—OTHER LOCAL EVENTS

In addition to the groups that Travel Lane County works with, Eugene hosts hundreds of other sporting events every year. To take these events into account, a survey was sent out to several sports facilities and organizations inquiring about their events. Unfortunately, many of these events involve youth athletics, which complicates the data collection process. Junction City Athletics (JCA), for example, hosts leagues for youth baseball, softball, soccer, and flag football. In addition, they host a series of girls' fast pitch tournaments every year, as well as renting out their 13-acre complex for another organization's fast pitch tournament. JCA is also a volunteer-driven organization and the leagues that participate in these tournaments are not necessarily affiliated with any one school. This means there simply is no money available for robust data collection. Similarly, the Eugene area high schools hold many youth sporting events, including tournaments and one-off games against visiting teams. The ticket takers and concession workers at these events are usually parents – again, meaning there is no formal, robust way to collect useful data.

In some cases, such as recreational sporting leagues for adults, there is no contact information available, as the teams and leagues are arranged in an ad hoc fashion, with simple email lists shared between members. There is no available data, yet these players enjoy meals together after games, and in some cases pool money to rent fields and pay fees associated with their sports. Keeping the difficulties in managing this data in mind, we applied a very conservative methodology to estimate the impact.

JCA, as mentioned above, has rougher estimates of overall participation. Mark Steinmetz, one of the sports directors for JCA, provided us with some of those estimates. According to Mr. Steinmetz, JCA hosts six major fast pitch tournaments every summer. On average, thirty teams attend with twelve players per team. As these are high school events, many family members visit the area along with the athletes, so Mr. Steinmetz estimates four visitors per family. Once coaches and staff are included, JCA estimates 60 individuals per team, per tournament attend each of these three-day events. Finally, Mr. Steinmetz informed us that most of the teams who attend these events are from out of the area. We estimated that 80% of the attendees were from outside Lane County.

Lane Community College (LCC) hosts several events during the year, including youth soccer, high school baseball, and several events for the Oregon Schools Athletics Association, among others. Brent Ellison, Director of Student Recreation and Special Events for LCC, provided us with data for total participants in the events LCC hosted during 2013, and, for certain events, estimates of total spectators. These numbers were used to estimate total attendance. We did not include an economic impact from the practices, as they obviously would only include local families. We also did not include an economic impact from normal season play, focusing instead on tournaments, meets, and other special events. This is because normal season play includes games played at home and away. While money does enter the local economy as out-of-town

attendees spend money during their visit, money also leaves the local economy as local families take their money out-of-town. For the special events, LCC unfortunately does not track where the athletes and spectators are coming from. Many of these events are tournaments/meets, so we again assume 80% of the attendees were from out-of-town. The attendees are presented in Table 15.

Table 15: Estimated Visitors from Secondary Data

	LCC	JCA
Sum of Participants	6,230	2,160
Sum of Spectators	22,678	8,640
Sum of Adjusted Hotel Attendees	77,800	22,896
Sum of Adjusted Day Attendees	19,450	5,184

As above, the fact that several events (including all of the JCA events) were held over the course of several days was accounted for, by using Sum of Total Hotel-Day Attendees to account for individuals who stayed several days in a local hotel, and Sum of Day Attendees used to account for individuals who spent the night at home, returning each day for the event.

With these estimates, we first use the spending estimates from Travel Lane County, with the Dean Runyan Associates industry proportions. Then, we break down the spending and apply the appropriate multipliers, as above.

Table 16: Estimated Economic Impact of LCC and JCA events – Dean Runyan Associates Spending Estimates

Industry	Estimated Spending per Industry	Margin	Direct Spending	Output	Earnings	Employment
Accommodation and Food Services	\$5,791,705	1.00	\$5,791,705	\$9,548,205	\$2,846,623	112
Transportation	\$1,403,400	0.17	\$238,578	\$421,639	\$131,027	4
Arts, Entertainment, and Recreation	\$1,181,467	1.00	\$1,181,467	\$2,012,156	\$639,055	25
Retail Trade	\$949,276	0.50	\$474,638	\$777,552	\$249,660	9
Total				\$12,759,553	\$3,866,365	151

Using the spending estimates provided by Professor Duy, we construct the estimates in Table 17.

Table 17: Estimated Economic Impact of LCC and JCA Events –Duy Spending Estimates

	Estimated Spending	Margin	Direct Spending	Output	Earnings	Employment
Lodging	\$2,170,644	1.00	\$2,170,644	\$3,572,662	\$1,080,763	42
Retail Shopping	\$1,445,317	0.50	\$722,658	\$1,184,003	\$381,419	15
Food and Beverage	\$2,055,134	1.00	\$2,055,134	\$3,544,901	\$1,079,973	50
Private Auto Expenses	\$1,752,698	0.50	\$876,349	\$1,463,502	\$454,474	13
Rental Car Expenses	\$27,223	1.00	\$27,223	\$44,499	\$10,979	0
Airfare	\$91,703	1.00	\$91,703	\$153,097	\$49,996	1
Other	\$466,356	0.50	\$233,178	\$387,705	\$97,748	4
Total			\$6,176,889	\$10,350,371	\$3,155,354	127

Combined, these two organizations provided sports facilities for an additional 8,390 athletes and 31,318 spectators to Lane County in 2013. These spectators generated between \$6.2 and \$12.7 million in local spending, \$3.2 to \$3.8 million in additional earnings for local workers and between 127 and 151 additional jobs in Lane County. This all further highlights the importance of having a diverse portfolio of sporting events in Lane County.

It is important to note that these are just two organizations that host these events. There are many more organizations that had no data at all available, yet clearly provide a large economic impact to the area.

ESTIMATED IMPACT—THE UNIVERSITY OF OREGON

No study of the impact of sporting events in Lane County would be complete without taking into account the impact of the University of Oregon's athletic program: the Oregon Ducks. As mentioned above, the impact of the Ducks is not just limited to the university's formal athletic program. To detail the economic impact, we again draw on a study from Duy, for the 2011-2012 fiscal year. As in this report, the economic impact is estimated using spending estimates from both Dean Runyan Associates, given here in Table 12, and Duy's work with the Duck athletic department (Duy, *Economic Impact of the University of Oregon: A Comprehensive Revision*), given here in Table 13³.

³ Note that both of these studies are measuring economic impact across the fiscal years. The rest of this study measures impact across calendar years.

Table 18: Tourist Spending – FY 2012: Dean Runyan Associates

	Direct Expenditures	Output	Earnings	Jobs
Food Service	6,784,344	14,011,026	4,055,002	177
Accommodations	4,085,738	7,703,660	2,263,499	85
Retail Sales	1,843,590	3,470,005	1,067,439	39
Local Tran. & Gas	575,602	1,083,397	333,273	12
Arts, Ent. & Rec.	3,127,355	6,082,706	1,881,730	9
Food Stores	645,816	1,215,554	373,927	14
Visitor Air Tran.	1,689,781	3,088,750	769,188	19
Total	\$18,752,226	\$36,655,098	\$10,744,058	355

Table 19: Tourist Spending – FY 2012: Duy

	Direct Expenditures	Output	Earnings	Jobs
Accommodations	6,398,712	12,064,772	3,544,887	133
Retail Sales	2,408,157	4,532,632	1,394,323	51
Food Service	6,628,545	13,689,272	3,961,882	173
Local Tran. & Gas	1,953,024	3,675,982	1,130,801	42
Rental Car	1,151,199	2,166,441	515,852	11
Visitor Air Tran.	7,566,182	13,830,225	3,444,126	85
Other	869,809	1,637,154	503,619	18
Total	\$26,975,628	\$51,596,478	\$14,495,490	513

It must be noted that the Olympic Trials were held in 2012, and as such, these numbers are likely higher than they would be in years without those trials.

UNQUANTIFIABLE BENEFITS

The impact and influence of sporting events goes beyond the measure of dollars spent in an economy. These sporting events produce many unquantifiable benefits for their communities.

Local teams help create an atmosphere of team spirit and local excitement. This creates a sense of community that is hard to find anywhere outside of sports. Observe the Timbers Army, the supporters group of the Portland Timbers, or the parking lot of Autzen Stadium on any given game day. This attention and community atmosphere creates additional awareness for local schools and programs that could lead to educational contributions, facility improvements, and increased enrollment. The sense of community even helps to inspire public volunteerism, leading to additional opportunities for members of a community to interact and work together for common goals.

Media coverage, particularly for events at the regional, state, and national level, provides free exposure for Lane County, alerting a wider audience to the opportunities in the area. Media

exposure can lead to increases in tourism, and even more interest from the state and national community in holding more sporting events in Lane County, a virtuous cycle.

Finally, as this paper demonstrates, people enjoy watching sporting events in person. Sports are a strong enough cultural institution that people will set aside time and money specifically to spend watching sports. With several major franchises nearby – the Portland Blazers, the Portland Timbers, and the Oregon State University Beavers – there are ample opportunities for residents of Lane County to leave the area to enjoy sports. Part of the methodology of economic impact studies includes the assumption that spending by local attendees involves circulation of existing money, not adding money to contribute to overall growth. If the presence of local sports does provide a means for local residents to spend their money in the community, then that money should be counted as money that the local community would otherwise not have access to. This is particularly true in the case of high school regional and state level tournaments. These tournaments will happen somewhere. If they do not take place in Lane County, then parents of Lane County high school athletes will leave town and go spend their money elsewhere. This unmeasurable “anchoring effect” means that the study necessarily *understates* the overall economic impact of local sporting events.

SPORTING INFRASTRUCTURE

When arguing for additional spending on sporting infrastructure, the public is concerned with any estimated economic impact studies that seek to justify the public expense – and rightly so. These studies are commissioned by organizations who are seeking out public money to expand their facilities, and have every incentive to make broad assumptions about spending habits, occupancy, and cost, in order to justify the spending. This unfortunately means that the public is skeptical about any economic work seeking to justify the public spending, regardless of the level of care that went into the study.

To combat this negative public sentiment, keep in mind the value of a diverse sporting culture. If a facility adds value to the community not only for the one-off events that are hosted there, but for a broad array of events open to the public, then the focus shifts from a simple return-on-investment calculation to a much broader focus on overall benefits to the community, including the unquantifiable benefits discussed above.

Consider the recently completed WJ Skate Park and Urban Plaza. As the largest covered outdoor skate park in the nation, it is often the site of skating tournaments. However, when there are no scheduled tournaments, the all-ages park is open to the public for free skating, or for rentals for celebrations or smaller competitions. The measureable economic impact is bolstered by the community impact the park generates, adding considerable value to Eugene.

Compare this impact with venues such as Autzen Stadium, or Matthew Knight Arena. These venues, while still very important to the area, are only useful to the community for the duration of a scheduled appointment. Outside of football games in Autzen, or basketball games and the occasional concert in Matthew Knight, the venues sit empty, adding no real value to the area. Hayward Field, on the other hand, while primarily a single-event space, is widely used by such a

diverse number of organizations that even without being routinely available to the community it produces consistent economic benefits.

FUTURE WORK

The primary issue with this report is the lack of data from events not covered by Travel Lane County. These organizations simply lack the funding and manpower to accurately measure the number of visitors. It becomes very difficult to draw robust conclusions regarding the overall economic impact of these events, though there clearly is an impact. Future work on this project should therefore entail working with the other local sporting groups, including the JCA, the Eugene School District, Oregon Horse Center, and other groups, in order to allow for future researchers to more accurately determine how many people these diverse groups are bringing into Eugene.

By allying with other groups, there are two benefits beyond better understanding of the economic impact of sporting events. First, communication with other groups in the sporting industry allows for a greater ability to work with these groups to further encourage growth in the existing sporting culture, and all the benefits that come with it. Second, by allying with groups, and helping those groups develop the means to track attendance, the incredibly time consuming process of sending individual people to individual events to try and track attendance can be avoided entirely. With over 200,000 visitors to Lane County each year, it is important to maximize the return on effort when measuring attendance. Having attendance accurately measured at Willamalane Center would provide a far greater measure of impact than trying to send individual people to each individual event Willamalane hosts.

There are also assumptions about spending habits that should be examined. Lacrosse players, horse riders, and individuals who participate in yachting events possibly have different spending habits than families in town for a high school football game, or a youth basketball event. The most robust studies found used formal survey methods sent out to visitors to the events to determine the specific spending habits of those visitors. The typical visitor to the two tournaments in the Traverse City study had a median income of \$124,000, compared to the median income of the typical Michigan visitor to Traverse City of only \$67,000. Likewise, it is likely that athletes, media, and other individuals who come to Eugene for the Olympic Trials have very different spending habits than the parents who come to town to watch their daughter compete in her high school tournament. Duy's survey estimates that overnight visitors to the Duck football games spend, on average, \$138 per day. Travel Lane County estimates the typical overnight visitor to Lane County spends \$166 per day. With over 200,000 visitors to town for sporting events, even \$30 difference between the spending estimates produces a considerably different impact. Surveys of the attendees of individual events would provide a better understanding of these differences, and thus a more accurate estimate of the actual impact.

Finally, there are assumptions about how many people are coming to town for these events, athletes and spectators that merits closer examination. Much of Oregon's population is concentrated along the I-5 corridor, making for relatively easy access to Eugene. Better

determination of how many of those attendees are staying overnight, versus visiting just for the day, would allow better estimates of their economic impact. As with spending habits, a survey handed out at individual events to collect this data would likely be the best way to collect this data.

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APPENDIX A: RIMS II MODEL ASSUMPTIONS

- 1) Backward linkages – In a backward-linkage model, an increase in demand for output results in an increase in the demand for inputs. RIMS II is a backward-linkage model.

- 2) Fixed purchase patterns – Input-Output models use an assumption that specific industries do not change the relative mixture of the inputs used to produce output. In Input-Output models, it is also assumed that there are constant returns to scale, where if the industry doubles its inputs, it will produce double output. Without this assumption, using the model's multipliers may inflate the impact estimates due to industries that hire many part-time or seasonal workers. These industries can simply extend the staff's hours rather than hiring as many workers as the model assumes.
- 3) Industry Homogeneity – Input-Output models assume that all businesses within an industry use the same production process. If the production process of the business initially affected by a change in economic activity is not consistent with the production process of the industry in the national Input-Output accounts, using the RIMS II multipliers will yield inaccurate impact estimates.
- 4) No Supply Constraints – Input-Output models are commonly referred to as “fixed price” models because they assume that there are no price adjustments in response to supply constraints. With this we can assume that if a new business opens up within an industry, that business can hire new workers at the existing wage rate.
- 5) Local Supply Conditions – RIMS II is based on national Input-Output relationships that are adjusted to account for local supply conditions. These adjustments account for the fact that local industries often do not supply all of the intermediate inputs needed to produce the region's output. Industries must purchase some intermediate inputs from suppliers outside the region. These purchases are often called leakages because they represent money that no longer circulates in the local economy. RIMS II accounts for these leakages by considering each industry's concentration in the region relative to its concentration in the nation.
- 6) No Regional Feedback – RIMS II is a single region Input-Output model and it ignores any feedback that may exist among regions. Economic services for projects between two regions will not be accounted for using multipliers to estimate impacts.
- 7) No Time Dimension – The length of time that it takes for the total impact of an initial change in economic activity to be completely realized is unclear because time is not explicitly included in Input-Output models. The initial change in economic activity should be permanent, or at least persistent enough to fully work through the economy.