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Dear Reader,

We are pleased to present the fourteenth volume of the Stanford Undergraduate Research Journal (SURJ). Since its founding in 2001, SURJ has produced intellectually vibrant collections of outstanding undergraduate research to celebrate students' accomplishments, share their discoveries, and promote an investigative spirit among undergraduates. In this volume, we invite you to explore theatrical storytelling through online musicals with Mirae Lee ('17), delve into real-time musical chord recognition with Pranav Rajpurkar ('15), Brad Girardeau ('16) and Toki Migimatsu ('16), examine musculoskeletal stress generated through performing arts with Bright Zhou ('16), and pursue research-grounded pathways to happiness with Cayla Hatton ('17).

This year, we proudly introduce Lynx, a new online companion to our traditional print journal that shares the stories of the people behind the research. By recognizing their experiences, we hope to make their work more accessible to a wider audience and further foster undergraduate interest in research. In honor of the Lynx debut, the first four online articles are included in this print edition of the journal. For future Lynx articles, please visit the SURJ website.

This journal would not have been possible without the tireless efforts of our staff. In particular, we would like to acknowledge our Social Science Section Editors Anthony Cordova ('15) and Taide Ding ('17), Natural Science Section Editor Devan Diwanji ('15), Engineering Section Editor Evelyn Chang ('15), and Humanities Section Editor Allison Dods ('16). This volume of SURJ is a testament to their dedication and leadership. We are also deeply grateful to Emily Alsentzer ('16), our Production Officer, whose enthusiasm and diligence brought this volume to life. We also thank Kate Nelson ('17) and the Lynx team for their pioneering efforts in developing the online magazine. Finally, we extend our thanks to Helen Xiong ('17), our Outreach Officer, and Anthony Cordova ('15), our Financial Officer.

We would also like to express our gratitude for the support of our authors, the ASSU Publications Board, the Office of the Vice Provost for Undergraduate Education, and the Office of Undergraduate Advising and Research. We also thank our Faculty Advisor, Dr. Vivienne Fong, and our Editing Mentor, Dr. Shay Brawn for their invaluable guidance and encouragement.

On behalf of the entire 2014-2015 SURJ staff team, thank you for reading this journal. We hope you enjoy the wonderful work in the pages ahead.

Sincerely,

James Nie ('15) and Laurie Rumker ('15)
Editors-in-Chief

TABLE OF CONTENTS

"TAKE MY RESEARCH AND USE IT by Pooja Varman

PRIYA FIELDING-SINGH & THE SOCIOLOGY OF FOOD

When Sociology Ph.D. Candidate Priya Fielding-Singh traveled to New York last fall to present her research to the nonprofit Humanity in Action, she walked up to the front of the room to the sound of appreciative applause. Over a dozen board members of the organization read her report and were genuinely interested in her findings. This kind of grateful reaction is hard to come by in academia, which tends to be individualistic. "People will give you fantastic feedback, but they're usually not invested in your work the way you're invested in your work," Priya explained. It became clear to her in that moment that she wanted to do work that people could actually use.

While working for Humanity in Action she identified people who were fervent activists in college and followed up with them a decade later to gauge their current involvement with similar issues. Surprisingly, she found that very few of the participants were still actively involved in the traditional activism of their earlier days. "People can care so deeply about something," Priya realized, "and intentionally decide not to make it a priority."

Priya's current research focuses on this discrepancy between ideals and priorities in the context of food choices. She cares deeply about food. One of the most substantial diet changes she made was during college one summer when she stopped eating meat because of a lack of attractive meat options in the dining hall. When she realized that she didn't miss eating meat and felt healthier, she chose to practice vegetarianism. Her journey to educate herself on food eventually took her to Germany, where she noticed a pride around cooking that seemed to be overshadowed by fast and convenient food in the United States. There are cultures around food that inform individuals' food choices, and these eventually tie into the larger food system.

Priya then started to ask, "how can we get people care about food and to choose healthier food options?" Informed by the results of her work on social movements, she recognized that choosing healthy food is not always a simple question of caring about health. People can care deeply about issues without treating those issues as a priority. In the context of food, a bigger concern may be the accessibility of healthy options.

The next leg of Priya's journey to influence food system reform involved an examination of the food options that are the easiest to access. Last summer, she was hired by the Center for Science in the Public Interest (CSPI) to investigate the consequences of food availability on obesity and malnutrition. She combed through 30 different checkout aisles in the Washington D.C. metropolitan area to figure out how widespread junk food is. Her observations were predictable, yet powerful. About 90% of all of the food and drink items offered were unhealthy. Such easy access to unhealthy food options is overwhelmingly prevalent, a form of marketing, and a barrier to making healthy choices. For Priya, this kind of research is meaningful because of her personal enthusiasm for food system reform. "CSPI commissioned me to conduct this study with the intention of doing something with it," Priya said, appreciating the immediate impact her results could have on educating consumers and encouraging policy changes.

"Food," Priya told me, "is a means by which both advantage and disadvantage are simultaneously reproduced." We can make healthy food the default, but this solution won't immediately ameliorate the underlying health inequalities. While some people have access to foods that promote health and longevity, others do not. In her dissertation, she maps the food landscapes of adolescents from different socioeconomic backgrounds. She collects data about what adolescents in the Bay Area eat at school and at home and decipher how food choices are socially and socioeconomically produced. So far, she is disappointed in the limited number of healthy food options many high school students have. But it is this kind of research that she believes can raise awareness and effect meaningful change in food policy.

Priya wants more than to grow our collection of knowledge of social inequality and food systems: "I want people to take my research and use it to actually inform how they run an organization or how they craft policy." In an ideal world, she wants everyone to care about how their food choices affect their health. But until that vision can become reality, she hopes to conduct research that can inspire action to reform the current inequitable food system.

> **"THERE'S GREAT VALUE IN PRODUCING KNOWLEDGE FOR KNOWLEDGE'S SAKE, BUT THAT'S NOT MY PASSION."**

social sciences

The Behavioral Economist's Soup for the Soul:

Refining Decision-Making Processes to Promote Happiness

Cayla Hatton
Stanford University

As the fields of positive psychology and behavioral economics expand, the science of happiness and the study of choice have become increasingly entwined. The majority of contemporary studies on the connection between choice and happiness focus on exogenous factors, such as the number of purchasing options presented to consumers. Those that do address endogenous factors such as decision-making strategies tend to point out faults without proposing actionable solutions. However, a growing body of research suggests that solely addressing external decision factors is both impractical and incomplete, and that a plan that focuses on internal mechanisms would provide a powerful tool for the individual to bolster his or her own happiness. If specific decision-making strategies are used to one's advantage, the individual would be able to make more optimal choices that augment short-term satisfaction and long-term wellbeing. In particular, one can promote happiness by refining his or her process of comparison through cognizance of common comparison fallacies and the values of choice.

Over the past decade, Americans have become obsessed with the notion of happiness – how to attain it, how to maintain it, and of course, how to maximize it. Titles like *Happier and Stumbling on Happiness* have topped bestseller lists, and over $10 billion were spent on self-improvement products in 2012 alone. Intellectual venues as prestigious as the Stanford Roundtable have been devoted to the topic of happiness [1] -[4]. This obsession is not misguided: in the words of Aristotle, "happiness is the meaning and the purpose of life, the whole aim and end of human existence" [5]. Nevertheless, the American pursuit of happiness remains woefully unresolved.

Though Aristotle pinpointed its significance, modern-day psychologists and philosophers continue to struggle to explain exactly what happiness is. Some argue that happiness is fundamentally an emotion — a neurological state associated with positive feeling and pleasure [6]. Others argue that happiness is much more than a momentary sensation, but rather the long-term manifestation of personal fulfillment and a sense of meaning [4] - [8]. While some believe one's happiness level is genetically predetermined, others believe happiness can be modulated by behavior or experience [6], [9]. Despite numerous models, heuristics, and indices that attempt to concretize this surprisingly elusive state-of-being, the scientific nature of happiness is still far from fully understood [6], [10].

Without a clear direction from modern-day experts, let us return to Aristotle and consider another bold statement of his: "Happiness depends upon ourselves" [5]. To some, this declaration may seem liberating, in that we have the freedom and power to control our own wellbeing. To others, the assertion may instead seem demanding; it implies that we must actively pursue happiness, as it will not be passively bestowed upon us. Although these interpretations—autonomy on one hand and responsibility on the other—have inherently different connotations, both reactions stem from the underlying element of choice.

Happiness and choice are intimately connected, but not simply so. For one, happiness is not a binary choice; one does not decide each day whether to be happy or not. Nor is it a definite choice; happiness may represent a spectrum of emotions and experiences that can fluctuate with life changes [3], [6]-[8]. Perhaps, then, happiness is the cumulative result of one's choices. Yet, empirical evidence suggests that different individuals who make the same decision, or choose to consume the same good, often report distinctly different affective experiences [11], [12]. Thus, rather than viewing happiness as a choice in and of itself or as the direct result of one's decisions, happiness may be better understood as a manifestation of the way in which one chooses [9], [10]. Indeed, if specific decision-making strategies are used to one's advantage, we may be able to better foster both short-term satisfaction and long-term wellbeing.

This viewpoint — that happiness can be modulated internally by optimizing decision-making strategies — has perhaps been traditionally overlooked because of the historical emphasis on how choice is influenced by exogenous rather than endogenous factors. Before 1980, decision theory was widely considered the domain of economics; in particular, economists typically modeled human behavior according to Rational Choice Theory (RCT) [10]. According to this framework, an agent (such as a consumer) makes a decision by objectively assessing the value of each option then choosing the option of highest value. RCT assumes that the decision-maker has all of the information necessary to accurately evaluate those options and is influenced only by the content, not the context, of the decision at hand [10]. Though its simplicity is attractive, RCT can seem quite contrived; after all, humans in reality have a hard time collapsing the inherently multivariate nature of options to some unified axis of utility, and humans quite frankly can be outright irrational. Recognizing RCT's limitations, psychologists and economists have worked in recent years to develop new

theories that acknowledge the flexibility, variability, and complexity of human behavior [13].

Most recently, psychologists have challenged Rational Choice Theory with Choice Overload Theory [10], [14], [15]. On one hand, RCT implies that more choices will result in a better decision. In particular, RCT implies that as a rational agent, one's analysis of the best option does not become inordinately more complex as the number of options increases -- as more options are presented, the likelihood of being presented with some higher value option rises; or, at worst, the value of the best option remains constant [10]. Choice Overload Theory, on the other hand, argues that there can be "adverse consequences due to an increase in the number of options to choose from" [15]. Essentially, Choice Overload Theory asserts that more is not always better. Indeed, studies have shown that more options do not necessarily lead to more satisfying decisions, and that rather, too many options can be overwhelming – paralyzing the decision-maker into inaction or leaving the individual less satisfied than the value of the option chosen would suggest [10], [14], [15].

Experiments by Columbia Business School professor Sheena Iyengar elucidate these negative effects more specifically [10], [14]. In a landmark study of Choice Overload, Iyengar set up two sampling tables in a grocery store, one with six flavors of jam and another with 24. The incentive to visit each table was the same: each customer would receive a one-dollar coupon if they decided to purchase a jar of jam. As Rational Choice Theory would predict, the table with 24 jams was approached at a significantly higher rate. Presumably, consumers believed that they would walk away with a more satisfying choice given more jam flavors to choose from. However, those who approached the table with six flavors were 10 times more likely to purchase a jar than those who approached the table with 24. Though people were drawn to the situation in which they had more options, they ended up becoming paralyzed by the multitude of choices [16]. Furthermore, even if the consumers choosing between 24 flavors did make a final decision, they were on average less satisfied with their choice than the consumers choosing from six. Related studies demonstrate the same phenomenon: for instance, when presented with a selection of either six or 30 chocolate varieties, those who chose from 30 systematically rated their chocolate as less enjoyable [16]. These associations between increased options, resistance to action, and dissatisfaction have been corroborated in cases ranging from students choosing between essay prompts to 401k-plan enrollment [15].

This tendency for individuals to seek more options despite the negative consequences of Choice Overload has been termed the "Paradox of Choice", with over 60 studies were conducted on the phenomenon between 2000 and 2010 [15], [17]. Psychologist Barry Schwartz, who coined the term in his book *The Paradox of Choice*, has since argued that "people might be in general better off with constrained and limited choice than with unconstrained choice" [10]. This statement suggests that to increase happiness, the number of options available should be limited. However, while the viewpoint of Choice Overload stands in diametrical opposition to the implications of Rational Choice Theory, it continues to construe the relationship between happiness and decision-making as a function of external circumstances, when merely focusing on exogenous factors is insufficient. In *The Paradox of Choice*, Schwartz explains that the desire for choice is based on the recognition of three values: instrumental, expressive, and psychological. Choices exhibit instrumental value by fulfilling consumers' specific needs.

A consumer with peanut-allergy can only eat at a restaurant if peanut-free options are available. Options exhibit expressive value by facilitating the consumer's creation of identity or display of individuality. For example, access to multiple apparel stores allows an individual to dress in a distinctive or characteristic way. Finally, choices have psychological value if an individual benefits from the feeling of agency over his or her own decision [17].

Instrumental value does hinge on the availability and quality of external options, but for each individual, the perception of what is instrumental—what is needed—is in many cases determined by internal personal expectations. Suppose that one enters a restaurant expecting a menu allowing a full range of options, but instead is presented only with a prix fixe menu. Imagine again that the consumer is allergic to peanuts. Even if the prix fixe menu is peanut-free, therefore objectively meeting his dietary needs, the customer is nonetheless likely to feel that it does not meet his subjective nutrition or taste preferences—in reality, his desires—because he expected to have more freedom of choice. On the other hand, if our consumer had entered the same restaurant with the expectation of a prix fixe, peanut-free menu, he would more likely have been satisfied that it met both his objective and subjective needs. The consumer may also have recognized that the prix fixe menu often displays the chef's best dishes, saving him the strife of comparing excessive options and sparing him the jealousy of thinking that his friend's meal looks better than the one he ordered.

Similarly, expressive choices are as much a function of underlying expectations and personality as they are a function of available external options. A woman may buy a new purse thinking that it will showcase her sophistication and glamour. She may strut around believing that she is exuding opulence, but others may not notice the new purse at all, or instead interpret it as a sign of frivolity and vanity. The expressive value she believed to gain from the purse is internally constructed, and may externally be either absent or contrary to her expectations.

Lastly, psychological value is also inherently intrinsic. The extent to which autonomy is desirable is a highly philosophical point of debate that would warrant another paper entirely [18], [19], but for now, it is sufficient to recognize that one would feel good after making a prudent independent decision, even without external validation. If the value one derives from choice depends at least partially on internal factors, the satisfaction one gleans from decisions cannot be solely determined by the options with which one is presented.

Empirical evidence supports the idea that the decision-maker's mindset plays as much a role in his or her own satisfaction as do the objective qualities of a choice [15]. Meta-analysis of over fifty studies on choice and decision-making suggests that choice overload is not an entirely consistent phenomenon [15]. Rather, the threshold and intensity of overload appear to depend on certain preconditions such as how options are categorized, how similar the choices are, and how complicated they are to compare [15]. Consumers may be overwhelmed more easily if options are displayed in a disorderly fashion, differ only in minutiae, and have multiple relevant criteria for comparison. Importantly, these judgments of order and complexity differ between individuals. When comparing options, some people may consider significantly more or different attributes of each choice than others. Some may only be satisfied with the option that is "the best" while others simply seek an option that seems "good enough." Certain individuals will be more inclined to heed pre-existing preferences and rules-of-

thumb, while others will prefer to make more calculated and situation-specific decisions [15]. If Choice Overload is situation- and individual-specific, one cannot simply assume that choice abundance and happiness are inversely related.

Both theoretical and empirical analyses imply that objective criteria are insufficient in predicting happiness levels derived from decisions. Moreover, it may be unproductive to focus on these external influences because it is often impractical or impossible to limit external options. For example, a breakfast cereal company would not constrain its product line to three cereal flavors if production capacity allows for more consumer segmentation; likewise, a university would not deliberately trim its course catalog if budget and faculty permit otherwise. Even if it may be in the individual's best interest to have a limited number of choices, it is usually in the market's best interest to provide variety to satisfy different segments of demand. Other types of decisions are not exacerbated by market incentives, but are essentially impossible to make if "all" relevant options are considered; there will always be another bachelor that just could be better than one's fiancé, but the world population will not shrink to six people just to make mate selection satisfyingly simple. Since the number of options cannot always be decreased externally, the detrimental effects of overabundance must be minimized internally.

> **Both theoretical and empirical analyses imply that objective criteria are insufficient in predicting happiness levels derived from decisions.**

Instead of externally regulating the abundance itself, internal decision-making strategies should be used to promote both short-term satisfaction and long-term wellbeing in the face of excess choices. University of Chicago behavioral economist Christopher Hsee provides a primer on numerous intrinsic decision-making strategies in his paper "Hedonomics." In particular, Hsee argues that decisions are heavily influenced by impulse, prediction, memory, and reliance on heuristics [9]. All of these cognitive tools are fallible, and thus often lead people astray. However, these strategies are also malleable, and if shaped optimally, they can be used to increase the happiness derived from decisions.

One sub-strategy that underlies many of Hsee's decision-making mechanisms is particularly fallible and malleable: making comparisons profoundly affects the interpretation of predictions and memories, and can also independently undermine decision satisfaction [9], [12], [13]. Comparisons between current and predicted experiences can lead to inaccurate evaluations and subsequently poor decisions [9], [12]. In order to judge value, people often compare their current state with the feeling they predict they will have the moment they obtain a new item or begin a new experience. That is, people often compare their current emotion to their acquisition emotion. The larger the predicted affective difference, the larger the value one places on the change. The problem is that the strength of an individual's acquisition emotion often fades as he adapts to change over time. Consequently, the individual's everyday experience — his consumption experience — ends up differing very little from his baseline experience, but is very different from his acquisition experience. Therefore, if the individual uses the gap between his current experience and his predicted acquisition experience to judge a decision's value, he would tend to overvalue the choice [9].

Hsee presents the example of someone upgrading from a 2,000 sq. ft. apartment to a 2,500 sq. ft. house. When deciding whether to buy a house and how much to offer, the prospective buyer will likely compare his experience in his current house with the feeling he predicts he will have the day he moves into the larger house. He will likely predict that he will revel in his newfound space when he first moves in. This prediction of his initial reaction may be correct, yet over time the homebuyer will become accustomed to his new space, and his long-term daily experience with 2,500 sq. ft. will likely be quite similar to his life with 2,000 sq. ft. Even if his predicted acquisition experience is accurate, his evaluation of the value added by the extra 500 sq. ft. will be inflated if he fails to consider his long-term consumption experience [9]. Consequently, the homebuyer may end up offering far more for the house than serves him financially well in the long run, or may end up deciding to move when the disruption of moving outweighs the true value of more space. Without changing any external decision criteria, the homebuyer would make a more accurate evaluation, and accordingly a more optimal decision, if he recognizes and implements a more appropriate comparison.

Just as misplaced comparisons of the present and the predicted future can be misleading, so can comparisons of the present and the past [12]. Daniel Gilbert, professor of psychology at Harvard University, presents the following example:

> A $2,000 Hawaiian vacation package [is] now on sale for $1,600. Assuming you wanted to go to Hawaii, would you buy [the] package? Most people say they would. Here's a slightly different story: A $2,000 Hawaiian vacation package is now on sale for $700, so you decide to mull it over for a week. By the time you get to the ticket agency, the best fares are gone – the package now costs $1,500. Would you buy it? Most people say, no. Why? Because it used to cost $700, and there's no way I'm paying $1,500 for something that was $700 last week. [12]

In this case, people overemphasize the comparison between the past discount and the current discount and fail to consider the original value of the ticket. In the first scenario, the consumer feels like he is making a net gain of $400 since the price has decreased from $2,000 to $1,600. In the second scenario, he feels like he is experiencing a net loss of $800 because the price has subsequently increased from $700 to $1,500. This perceived loss is unattractive. Even though the traveler would have thought the trip was worth $1,600 in the first scenario, the trip does not even seem worth $1,500 in the second scenario. Let's say that in attempting to avoid his perception of a net loss, our traveler makes the decision not to travel to Hawaii. The decision seems prudent based on the focus of his comparison, yet it deprives him of the potential happiness resulting from a Hawaiian vacation. If he had simply changed the frame of his comparison and compared the current price with the original, undiscounted price, he would see a net gain of $500, and likely decide to enjoy a trip to Hawaii. The external decision criterion does differ in this example: The final price is either $1,600 or $1,500. Yet it is often the consumer's internal criteria—namely, the specific comparisons he makes—that overpower the external criteria and determine the course of his decisions.

What about comparisons that are not intertwined with prediction or memory? After all, decisions that fall prey to choice overload most often involve evaluation of multiple options in the present. Unfortunately, studies suggest that the cognitive act of comparison is often inherently biased. When evaluating options, people systematically highlight negative rather than positive aspects in order to differentiate between the choices [13]. As the number of options increase, people identify proportionately more disadvantages for every option in the effort to distinguish between them. In one study, subjects were asked how much they would pay for a subscription to *People* magazine. One group was presented with *People* alone; another group was presented with *People* along with four other magazines to evaluate. On average, those who examined *People* alone valued it 25% higher than those who compared *People* with other magazines. Presumably, those making comparisons highlighted the negatives of each magazine in order to distinguish between them, and so the perceived value of each magazine consequently decreased [13]. Since comparison heightens awareness of the negative aspects of each option, even the option one decides is best would not offer as much satisfaction as it may have if it were evaluated alone or against fewer alternatives. In other words, though the options' characteristics may remain objectively the same, comparison can render them subjectively worse.

The above examples demonstrate how internal decision-making processes, specifically the use of comparisons, can affect short-term satisfaction. Presumably, the accumulation of satisfying, prudent decisions would also promote long-term happiness. Barry Schwartz's study, "Maximizing Versus Satisficing: Happiness is a Matter of Choice," lends credence to this assumption. Schwartz proposes a distinction between two decision-making mindsets that can either predispose or immunize the agent to choice overload. In theory, those who try to maximize — that is, those who seek the best possible option — are more vulnerable to the negative effects of choice overload. As the number of options increase, maximizers must compare proportionately more options [10]. More comparisons progressively highlight each option's negatives and proportionately degrade each option's subjective value. The increasing number of necessary comparisons can become exhausting and frustrating. On the other hand, satisficers—those who seek an option that is "good enough" — are unaffected by an increasing number of options. A satisficer can end his search as soon as he identifies a suitable option. Thus, he makes fewer comparisons in general and the total number of options does not affect the number of comparisons he must make [10]. Real-life maximizers and satisficers confirm this theory. In a study that examined consumer purchase behavior, maximizers made more between-product comparisons and systematically reported feeling less satisfied with their decisions than satisficers; additionally, maximizers reported feeling more regret with their decisions [10]. These findings support the claim that comparison—in this case, particularly when inspired by a maximizing mindset—can undermine the subjective outcome of decisions.

Most importantly, though, when maximizers' and satisficers' self-reported dispositions were systematically compared, "maximizers reported significantly less life satisfaction, happiness, optimism, and self-esteem, and significantly more regret and depression, than did satisficers" [10]. Therefore, it appears that maximization not only affects immediate post-decision satisfaction, but also is associated with multiple indicators of decreased long-term wellbeing.

It may seem then that the answer is simple: to be happy, be a satisficer. Yet, there remain a number of caveats to consider. Schwartz focuses on consumer purchase decisions in his studies, and it is quite possible that adopting a satisficing mindset may not be optimal in all decision-making situations. Schwartz provides the example of an ill patient deciding on a treatment. In this scenario, a maximizing mindset may motivate the patient to seek out the very best care, which may result in a better recovery and a higher probability of wellbeing. A satisficer may end up with a treatment that is successful, yet entails a longer or more difficult recovery than optimal. Moreover, a satisficing mindset can lead to general complacency; maximizers may be motivated by their constant pursuit of improvement, while satisficers' contentment may lead them to pass up potential opportunities to increase their happiness [10]. Though a satisficing mindset may promote short-term satisfaction and long-term wellbeing when applied to certain decisions, it should not be applied blindly. Schwartz's study does provide promise that internal decision-factors such as a maximization vs satisfaction mindset can modulate long-term wellbeing, but does not delineate a clear or comprehensive route to happiness.

It is evident that misplaced comparisons with the moment of acquisition, misplaced comparisons with the past, the negative cognitive effect of comparison, and maximization (a tendency routed in excessive comparison) can all potentially undermine happiness. It is therefore tempting to suggest that people simply make fewer comparisons; however, as Schwartz's example of an ill patient demonstrates, more comparison may indeed sometimes lead to enhanced wellbeing. Rather than indiscriminately restricting comparison, people should be more particular in the comparisons they make. This judiciousness should be guided by a cognizance of common comparison fallacies and the values derived from choice.

This method can be demonstrated with the examples previously discussed. When considering how much to offer for a new home or whether or not an expansion is desirable, one will benefit simply from an awareness of the difference between acquisition and consumption experiences. If one knows to compare his current experience with his consumption experience, he will valuate his prospective purchase more accurately, and thus will likely save money in the long run. If an individual would like to go to Hawaii and is offered a discount from the original price, he must recognize that a bargain is a bargain, and comparing today's bargain to last week's is irrelevant. When faced with consumer decisions—such as choosing magazines or breakfast cereals—we should remind ourselves of the negative effects of choice overload, as well as the positive effects of searching for something that is good enough, while not necessarily the best. Of course, the thresholds of choice overload and 'good enough' are not always obvious. When it is unclear how much comparison is prudent, we can consider Schwartz's values of choice. If further comparison will increase at least one of these three values, it may be beneficial. When deciding on medical treatment, further comparison can yield a result that better serves our needs, thus increasing the instrumental value of choice. On the other hand, if more comparison does not increase one of the three values, it is likely detrimental. Examining 24 as opposed to six jam flavors will most likely not satisfy some unmet need, will not significantly impact the expression of our personality, and will not increase our sense of autonomy. In this situation, it would serve us better to simply approach the table with only six options.

Refining the use of comparisons, particularly through becoming familiar with cognitive and logical fallacies as well as the inher-

ent values of choice, can bolster both satisfaction with decisions and long-term wellbeing. This process is not meant to be definite or perfect; there is not a precise optimal number of comparisons to make, and it is unrealistic to expect that one can always recognize when to compare and when not to. Yet this impreciseness should not be viewed as a shortcoming; rather, it is an acknowledgement of the variability and flexibility of human cognitive processes. The route to happiness will never be set in stone; what is most important is that we each recognize our internal potential to improve our search for it.

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Towards a New Urbanization for China

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In striving to become a developed nation, China's urbanization problems are of global concern. The recent surge in China's economy has ushered in one of the largest migrations in world history. The annual increase in migrant workers in Chinese cities is 10 million, on top of the current total migrant worker population of 270 million.

This paper reveals the complicated state of China's urbanization. It explains the origins and problems with the nation's current strategies. In doing so, it reviews documents and records published by the PRC government as well as concerns raised by critics in China, many only published in Chinese. In addition to an overview of policies being applied to cities, this paper presents a case study of Guangdong (Canton), which demonstrates current experimental strategies.

If migrant workers and their immediate family members are officially assimilated into cities, the urbanization rate in China would surge to 78%, achieving official target levels. However, this implied 34% rise in total urban population could overwhelm the already scarce resources and services in cities. As such, a highly viable option would be to draw investments away from metropolises and towards smaller developing cities where industry and commerce can flourish without conflicting as severely with the interests of the existing population.

While this paper does not seek to propose a definitive solution to a problem that has been tackled by multitudes of specialists, it does aim to highlight the complex web of interdependency between urbanization, migrant workers, and the spatial registration system. The conclusions drawn shed light on the futility of a metrics-driven strive for urbanization that has been adopted by so many Chinese cities in the last decade. In order for China to become an urbanized, modern country, the population needs improvements in quality of life, not increasingly taxed resources.

INTRODUCTION

Concrete debris, rusted rebar, and broken bricks flood the cityscapes of China, spilling over into the surrounding countryside. From the coastal east to the mountainous west, China's cities are cast in a web of steel cranes, perpetually transforming the skylines to achieve the international vision of the modern city. In 2013, Prime Minister Li Keqiang surprised the world when he announced his goal to turn "hundreds of millions of [China's] rural population… into urban residents"[1]. Meanwhile, the National Development and Reform Commission has begun drafting the *Urbanization Development Plan, 2011-2020*, detailing plans for China to move 400 million people to cities in just 10 years.

According to the 10-year plan, the urban population would jump from 52.6% to 80% and 40 trillion RMB (6.7 trillion USD) would be disbursed. In terms of urbanization rates, China would become on par with other developed countries. However, if we squint beyond the smog and the inexorable cycle of construction and demolition, one begins to wonder if reaching an 80% urbanization rate will bring the necessary quality and services of city life to its intended demographic.

TWO METHODS FOR URBANIZATION

Mirroring its move towards a market economy, China has commoditized its urban land, selling property in order to reach target levels of urbanization. Historically, China's rural land has been controlled and owned by local groups[2,3]. Thus, by turning rural areas into cities, the government receives considerable income from the "sale" of property[4]. With the land now appropriated, the government then applies two methods to increase the rate of urbanization.

In the first approach, suburban districts[5] are appropriated to build new developments on the outskirts of existing cities (Figures 1, 3). The displaced farmers receive money and employment as compensation. In addition, they can access civil
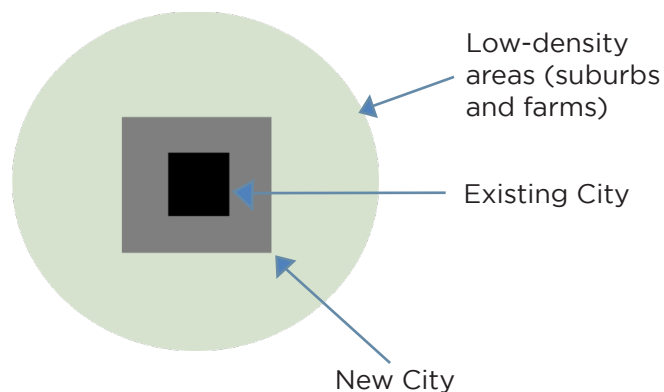

Figure 1. In the first approach, suburbs near existing cities (light green circle) are developed into dense urban areas (gray box).

Low-density areas (suburbs and farms)
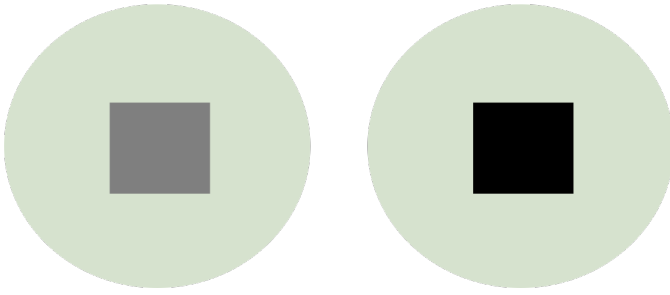
Existing City

New City

Figure 2. In the second approach, rural areas (left circle) are conglomerated into constructed cities, separate from existing cities (right circle).

services such as healthcare and primary education as city people. The farmlands, formerly communal but now in the hands of the government, are then "sold" to corporations, usually to build factories and warehouses that entice farmers from other regions, some very distant, to work in these areas. These immigrant workers are referred to, with a negative connotation, as farmer-workers, or *nonmingong* (农民工). As a result of incorporating new suburban districts and the growth in migrant workers, the population and size of existing cities increase as well. Today, China has 661 cities with a status as county or larger; some, including Beijing and Shanghai, have become vast metropolises.

The second strategy is to tear down rural settlements, appropriate land, and move farmers to apartment complexes as compensation (Figures 2 and 4). Unlike the first approach, this does not expand the size of existing cities, but instead results in seeding a city often in the middle of a rural stretch of land. After the land is appropriated, the farms are centrally managed, and some land is leased to companies to create large factories. This approach is rather poetically referred to as the "New Socialism Rural Construction" and entices both city officials and farmers because the displaced rural populations become urban and receive public services. Ideally, the former farmers will have access to a modern city life while the officials benefit from seeing a statistical increase in urbanization rates.

These newly formed cities, however, do not provide the services or the quality of living on par with other cities, as they often lack facilities and services such as hospitals, schools, banks, entertainment, etc. Furthermore, the farmers, now settlers of a "constructed city," are left without land or employment. They rely instead on unemployment welfare well below the minimum wage that, depending on the area, is usually set around 400 RMB (65 USD) per month. As a result, many rural inhabitants, especially young adults, are forced to find jobs in larger cities. They move to bustling cities and become *nonmingong*.

As can be seen, one system of urbanization creates *nonmingong* while the other attracts them. These migrant workers are a direct result of China's spatial administrative system, and their migrations sharply increase cities' densities and populations, pressuring available resources, services, and policy-makers. (Figure 5).

CHINA'S *HUKOU* SYSTEM

The problem of *nonmingong* is a direct result of China's current land ownership policies and the residential registration system. In Chinese cities, people are not able to own land itself; the maximum lease is for 70 years, even for properties with apartment buildings. In the city, however, people have an opportunity at a much better life. Urban residents can apply to state-owned enterprises and government jobs, the latter of which are highly coveted. In the countryside on the other hand, people in local groups own and farm rural land while the government controls the management and transactions of the land for them. The farmers cannot independently buy, sell, or develop the land—they can only utilize the land for agriculture, so their incomes are very low. In addition, public sanitation, primary education, medical services, retirement income, private enterprise, popular entertainment, and other city services are usually lacking or nonexistent in rural areas.

In order to efficiently distinguish between the rural and urban population and to prevent city services and resources from spreading thin, the government created a special household registration system known as the *hukou* (户口)[6], in which everyone must register at local police office for identification papers. While

Figure 3. High-rise complexes loom over a former village in Shanghai. This picture shows one of many suburbs that are appended.

Figure 4. Apartments from the New Rural Reconstruction Movement in Changqingsha, a rural island in Jiangsu. These large apartment blocks, called cooperatives, are "constructed cities," a result of building cities in rural areas.
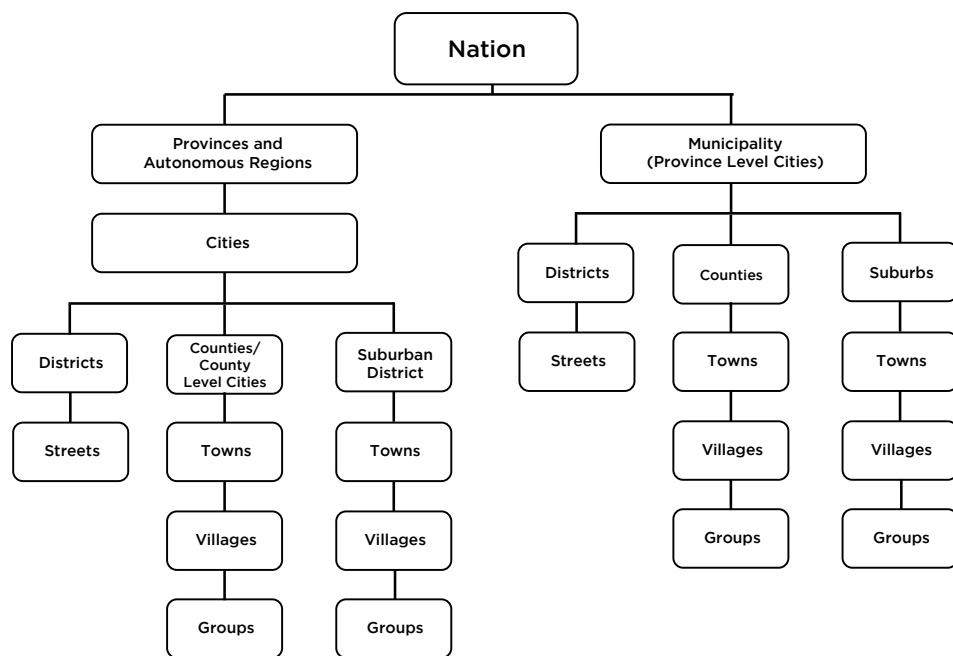
Figure 5. To understand urban planning in China, one must first look at the nation's Spatial Administrative Hierarchy. This diagram, up to date as of 2013, reflects changes made by the government to simplify the hierarchy. This model is further simplified by excluding special and autonomous regions.

traveling or living in another city is not restricted, access to public services such as medical insurance and primary education are only possible in the specific city from which one's *hukou* originates. Transferring *hukou* between cities or rural areas is very difficult, and even more so to change from a rural residency to that of a city. Few exceptions apply; recent college graduates with rural *hukou* can transfer to the city if they find employment, and military officers regardless of background can receive city residency upon completing active service. Under this system, even employed residents of the city, without a *hukou*, cannot access city functions such as medical insurance, affordable housing, retirement pensions, or primary education. Living in a city without local *hukou*, these farmer-workers become *nonmingong*. While they may work and permanently reside in the city, their official status is that of a farmer.

CHINA'S MIGRANT WORKERS

As the rate of urbanization increases, the *nonmingong* population will also increase sharply. These people, although permanently residing in the cities and counting towards the urban population, do not have *hukou* and therefore cannot gain access to public services. Many of these rural workers live in crowded factory dormitories or construction site tents (Figure 6). The *nonmingong* lack basic healthcare, have no retirement funds, and are far away from family members. Living in worker barracks prevents many *nonmingong* from raising their own children. The rising generation in China is comprised of many children who are raised by their grandparents and see their parents only once a year.

According to 2012 statistics, China's urban population accounts for 52.6% of the nation[7]. Of the 711.82 million long-term residents of cities (i.e. non-locals who have resided there for more than 6 months), 262.61 million, or 36.9%, are migrant workers[8]. According to a census on February 7, 2013, the city of Beijing, with a non-local population of 20.693 million people, has 7.738 million residents without a Beijing *hukou* (37.4%)[9]. These statistics will continue to accelerate if not controlled -- as the urbanization rates approach the targeted goal of 80%, the *nonmingong* population will remain at or rise above 30% of the

urban population.

The current situation in China is very similar to what Brazil, Mexico, and other Latin American countries experienced during their urbanization processes. Statistically speaking, Brazil and Mexico have a higher urbanization rate than many developed countries, but their migrant worker population has gone out of control, creating many poor districts and slums.

STEPS ALREADY TAKEN TOWARDS URBANIZATION

Prime Minister Li Keqiang, who holds a Ph.D. in Economics, realized the severity of the problem during its early stages. He reneged on his aforementioned statement made during his ceremony in 2013 and has invited many urban planners and other experts to participate in an advisory board. Already, he is taking action in Guangdong (Canton) province, where the *nonmingong* population is most established.

Guangdong is a popular destination for migrant workers because of its ample job opportunities. In the 1980s during

Figure 6. An example of *nonmingong* dormitories.

Deng Xiaoping's role as advisory chairman, the economic reforms opened up China to foreign enterprises, many of which located their factories in Guangdong. Since then, Guangdong has attracted millions of workers from both nearby and faraway provinces to work in its factories and boasts the largest provincial GDP in China. These *nonmingong* permanently work and pay taxes in Guangdong but are excluded from public services in rural and urban Guangdong, causing many social issues, including increased crime rates, social stratification, and disruption of family structures.

One of the experimental measures being taken in Guangdong is a point system that allows *nonmingong*, upon reaching a number of points, to become local citizens. Once they have a local *hukou*, they can buy affordable government-subsidized housing, send their children to be educated in the city, and gain access to medical insurance as well as other city services. For example, as of 2013, to attain *hukou* in the provincial capital of Guangzhou[10] requires migrant workers to complete a primary education and have a clean criminal record in addition to obtaining 85 points. Even fulfilling these requirements does not guarantee their *hukou*; they are merely requisites for beginning the application. Part of the point system is shown in Table 1[11].

These figures show that even our ideal applicant, an educated young adult with a critical job in a preferred area, has a starting score of just 45 points, proving how difficult attaining 85 points can be. Through various community services, such an individual must earn 40 more points in order to file an application for a *hukou* registration in the city of Guangzhou. For this aspiring population, this is a small window of opportunity to access modern medical care, obtain loans from a bank, send their children to top-tier schools, and find better jobs.

The government is not oblivious to the plight of the migrant workers, but the problem is a difficult one to solve, requiring time and strategy. Some cities have adopted other methods to accept migrant workers; for instance, many smaller cities accept migrant workers when they purchase housing in the city. As of December 16, 2013, the People's Republic of China (PRC) government has announced its goal to grant local *hukou* to all migrant workers by 2020[12].

FEASIBILITY STUDY

That the *nonmingong* population accounts for up to a third of a city's population presents a much deeper problem with far-reaching future implications. The ubiquity of migrant workers has become deeply entwined in the dynamics of every Chinese city's sociopolitical fabric.

Migrant workers are contributing to a new type of family structure as a result of their distance from family members.

Whereas in America, the family usually moves as a unit to where work can be found, the *nonmingong* live far away from relatives in worker barracks for all but a few weeks each year while their families are located in their hometown, not assimilated into the urban population. As a result, this problem cannot be solved by simply giving migrant workers hukou for the cities; the family is an important unit in Chinese society, so naturalized immigrants will almost certainly bring their child, spouse, and parents to cities even if these family members cannot receive *hukou*. This places extra demands on schools, hospitals, and other city services, compounding the resources demand in cities several times over.

While no direct figures exist for the resultant increase in population if all migrant workers were given local *hukou*, an estimate can be made based on 2011 figures from the National Bureau of Statistics of China[13]. According to their data, 42% of current *nonmingong* are older than 30 years of age while 58% are younger. Of the younger generation, 70% are unmarried. In total, this means that roughly 59.4% of *nonmingong* are married[14]. Of the married population, 59% live with their spouses in the city. If we assume that each family will bring three people with them (four if the spouse is not already present)[15], this means that for a population of 230 million migrant workers (262.61 million as of 2012), roughly 344.9 million family members will likely move into the cities with them[16]. The migrant workers and their immediate family members would account for over half a billion people that, if naturalized into cities, will increase China's urbanization rate to 78%. If these migrant workers have access to improved living conditions, then China's urbanization would be comparable to those of developed countries. However, China cannot become a developed nation when such a large contingency of the population does not have access to services such as healthcare and education. In addition to the issue of future populations, the people living in Chinese metropolises today are already facing problems including congestion, pollution, and limited resources.

TOWARDS A DEVELOPED CHINA

Several underlying problems are evident in China's urban landscape. Its urbanization rate of 52.6% does not accurately reflect the portion of the population that can utilize services provided by cities. One third of the urban population are farmer-workers that serve as a steady labor force while receiving low wages and denied services such as healthcare, education, and retirement funds. Our data shows that this significant populace, if given local *hukou* so that their families can be with them in cities, would help China reach its urbanization rate. However, the current resources in cities are insufficient for the existing population, and not on par with those in

Age	Points	Background	Points	Occupation	Points	Service	Points
Under 35	5	Primary education	5	Critical Skill	10	Community service	+2 per 50 hours
35-45	2	Secondary education	10	Critical Trade	10	Blood bank donation	+2 per unit (max 10)
46-55	1	Preferred area	10			(and others)	

Table 1. The point system that allows migrant workers to apply for *hukou.*

developed nations. Abruptly abandoning the *hukou* system is also not an option, as many cities will not be able to support the influx of migrant populations. Current urbanization strategies are not working, and China needs to find and pursue alternatives.

Indeed, the Chinese government is beginning to make its next moves. On March 18, 2014, after several years of research, discussion, and modification, the PRC National Development and Reform committee released the aforementioned Urbanization Development Plan, 2011-2020. The plan outlines two target goals. The first is to focus on improving the quality of life for all existing *nonmingong*. The second is to rebuild the slum areas in existing cities. While not a complete or detailed solution, the shift in focus from reaching a specific metric of 80% urbanization rate to an impactful goal, even if it is less quantifiable, marks a change in approach.

This paper's findings seek to add to the larger understanding of the problem. Because of its unique political and cultural context, China's urbanization strategy must be flexible and adaptable to its ever-changing cities. The goal should not be to pursue high urbanization rates, but to encourage private enterprises to invest in and develop rural areas and smaller cities. The improvement of opportunities in smaller Chinese cities would hopefully entice many of the migrant workers to settle in cities where they would be able to contribute to development without reducing the accessibility of city resources. As many Chinese cities are already full-grown metropolises, the further urbanization of those cities would not necessarily improve the quality of living for their inhabitants. Instead, if employment opportunities are created from investments in industry, the burgeoning mid-sized cities would entice many of the potential migrant workers, and the profit can then in turn be used to improve the availability and quality of city services, allowing existing migrant workers to become permanent residents and live healthier lives.

The next step for China would be to build a better city, not just in developing its hardware of infrastructure and housing, but also its software, e.g. public services and quality of life. Urbanization for China should not be simply about expanding cities or building new ones, but rather strengthening existing cities and increasing their capacities. These cities must be able to provide a proper way of living for the families of naturalized workers as well as for existing families. Only then will it be possible for migrant workers to truly settle in the city.

END NOTES

1. Why Switzerland, Neue Zürcher Zeitung. 李克强5/23/2013

2. Groups are a subset of villages. See China's spatial-administrative hierarchy (Figure 5).

3. By constitution, rural land belongs to the people while city land belongs to the government.

4. Urban property in China cannot be permanently sold, only leased for a maximum of 70 years. When property, regardless of what is built on the land, is "sold," the government has rights to deny the re-leasing of property.

5. Suburban districts are a subset of cities. See China's spatial-administrative hierarchy (Figure 5).

6. Can also translated as residential registration system.

7. 《2012年国民经济和社会发展统计公报》中国国家统计局2013年2月22日

8. 《2012年全国农民工监测调查报告》中国国家统计局2013年5月27日

9. 《北京市2012年国民经济和社会发展统计公报》北京市统计局2013年2月7日

10. Guangzhou is the capital city of Guangdong province.

11. 《广州市积分制入户政策与申办指南2013版》广州市人力资源和社会保障局2013年7月13日

12. Hukou reforms target 2020: official, Xinhua Net (xinhuanet.com) 12/18/2013

13. 《新生代农民工的数量、结构和特点》中国国家统计局 2011年3月11日

14. To simplify our calculation, we assume that migrant workers above the age of 30 are either married or settled. As a result, keep in mind that the number of additional family members for each *nonmingong* can be greater than our estimate.

15. Given China's one-child policy and cultural value for taking care of the elderly. We also assume that each couple in the family will bring, on average, 2 grandparents. In future generations, due to the one-child policy, each spouse will need to bring his or her own parents, further increasing our estimate.

16. Calculations as follows: *Nonmingong* separated from spouse: 41% (59.4% × 2.3E6) assume family of 4 = 224 million; *Nonmingong* together with spouse: 59% (59.4% × 2.3E6) ÷ 2 assume family of 3 = 120.9 M; Total: 344.9 million increase.

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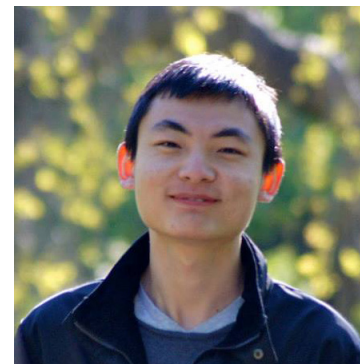
Spatiality and Solidarity: Exploring the Revolutionary Tactics of the Madres de Plaza de Mayo

Elise Racine
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Throughout the years of 1976 to 1983 in a period known as the "Guerra Sucia," or Dirty War, Argentina experienced a state of government-sponsored violence. As a large part of the terror instigated by the dictatorship, forced disappearances were in line with the oppressive nature of both the government and the Argentina it had created. Hence, few predicted the outlet for political and social discussion that these disappearances ultimately provided as mothers of the disappeared began to share their stories with one another, breaking through this sphere of silence. But if few predicted the emergence of the "Madres de Plazo de Mayo," even less would have expected its continued existence and success. Since 1977, the Mothers have marched on the Plazo de Mayo, shaping not only Argentina's political and social atmospheres, but also the quest for human and women's rights worldwide. Using the boomerang, spatial network, collective behavior, and resource mobilization theories, this paper examines why this specific instance of collective action has flourished when most movements eventually lose momentum and decline.

"It is the perfect crime, as the crime itself is invisible, except to those who are victims or relatives. Both are meant to suffer silently, individually and alone. The victim is denied martyrdom; those left behind are prohibited the final ritual of bereavement."
~ Schirmer on "los desaparecidos," or "the disappeared" (1989)

HISTORICAL CONTEXT

Throughout 1976 to 1983 in a period known as the "Guerra Sucia," or Dirty War, Argentina experienced government-sponsored violence accompanied by a number of disappearances targeting unarmed guerilla fighters and anyone else associated with activists groups or considered threats to the military. Other victims of the terrorism included trade unionists, students, journalists, Marxists, and Peronists. The estimated number of these "desaparecidos" ranges from 9,000 to 30,000, including 500 children who were adopted by military families (Anderson), which occurred under Lieutenant General Jorge Rafael Videla's military dictatorship (Anderson). This dictatorship – ironically called a "natural reorganization process" by its proponents – enacted systematic and unusual repression and torture of its own people.

Prior to Videla's dictatorship, the country had been run by President Isabel Peron, the third-wife, previous vice-president, and widow of deceased president Juan Peron. While the transition of power had been smooth following Peron's death on July 1, 1974, Isabel Peron's presidency became characterized by increasing brutality. And while the rightist policies of Lopez Rega (Argentina's Minister of Social Welfare at the time) were partly to blame for the unrest, the hostility ultimately led to a military coup on March 24, 1976 that deposed Peron as president. Five days later, a three-man military junta, or committee, filled the presidency with Videla, initiating a reorganization process and the horror that become infamously known as the Dirty War (Anderson).

As a large part of the terror instigated by the dictatorship, forced disappearances were in line with the oppressive and silent nature of both the government and the Argentina it had created. This not only allowed the government to control through fear, but also isolate unrecognized victims, who then turned to their communities for support. As mothers of the disappeared began to share their stories with one another, they began to break the silence that had dominated Argentina's sociopolitical scene.

INTRODUCTION TO THE "MADRES"

As these mothers searched for their disappeared children, a unique human rights organization began to take shape. Known as the Madres de Plaza de Mayo, or Mothers of the Plaza de Mayo, this group has protested for the right to re-unite with their abducted children. It began with the action of fourteen women: Bound by their shared grief, these women gathered in the Plaza de Mayo on April 30, 1977, wearing white headscarves embroidered with the names of their children. These white headscarves have evolved into an international symbol for the Madres de Plaza de Mayo (Agosin).

With support from other activists groups in the past three decades, the Mothers have expanded their mission into a broader fight for human rights. The Mothers of the Plaza de Mayo have used their experiences with traditional views of women in Argentina to move their grief into the public arena (Bouvard).

As a result of this transition of mothers to public protesters, the organization redefined the interrelationships between the concepts of motherhood, feminism, activism, resistance, and social action. Since they have not specifically protested the gender system of Argentina, Madres de Plaza de Mayo contrasts traditional understandings of a feminist movement.

As the Mothers' approaches began to diverge, the group started to fracture until 1986 when the organization split into two factions – Mother of the Plaza de Mayo Founding Line and the Mothers of the Plaza de Mayo Association (Agosin). On one hand, the Founding Line has concentrated on using current political channels to help recover remains and bring ex-officials to justice. The Association, on the other hand, strives to finish their children's work. Despite this divergence, both subgroups of the Mothers of the Plaza de Mayo have maintained nonviolent modes of activism. Through the Mothers' place-based collective rituals and symbolism, their organization has built and maintained a high level of network cohesion despite physical distance, while also garnering the resources and support necessary for sustained mobilization. By traversing boundaries previously negotiated by men within Argentine society, the Mothers redefined male dominance and reclaimed the rights that accompanied their roles as mothers. The Mothers' association has bridged the gaps between the public and private, domestic and public, and rural and urban.

RESEARCH QUESTION

Taking into account the diverse and transformative nature of the Mothers of the Plaza de Mayo movement, the present study analyzed the growth of this social movement Through my exploration of the boomerang theory, spatial network theory, collective behavior theory (specifically the Chicago School approach to collective behavior), and resource mobilization theory, this analysis attempts to answer the following questions:
• What factors can be traced to the Mothers' rise and support?
• What coalitions did the movement build?
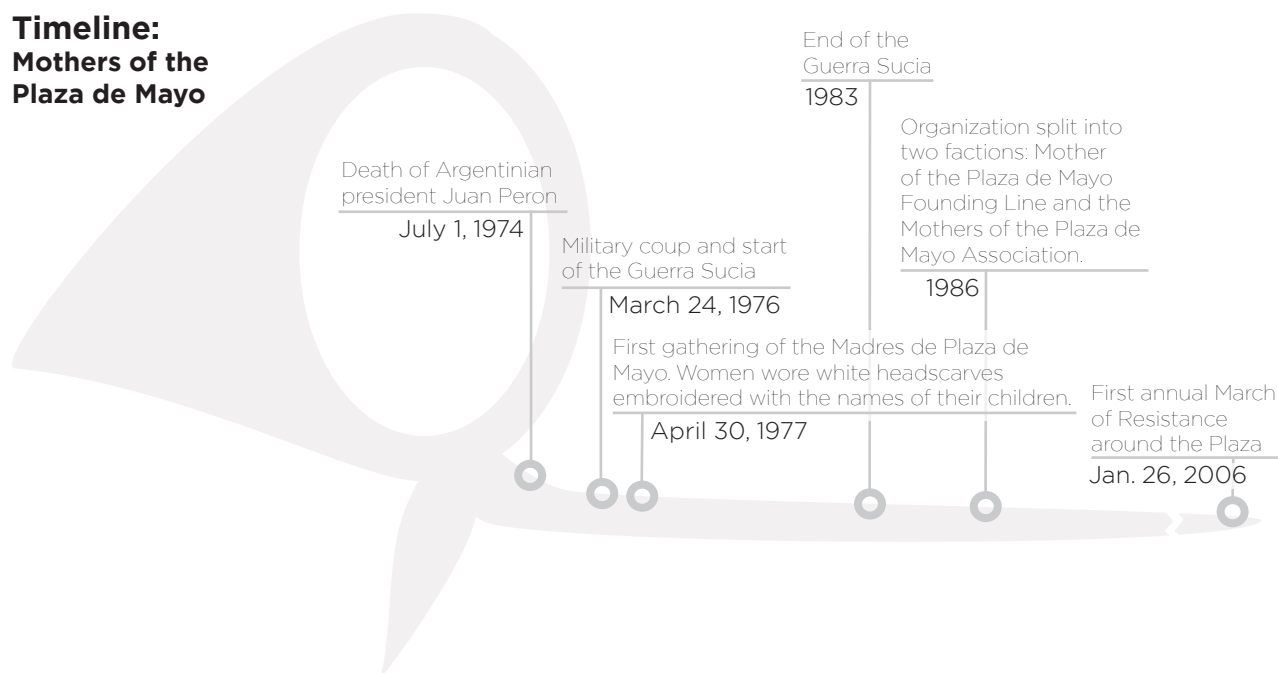• What factors explain the continuity of the movement?

BOOMERANG THEORY

In his essay "Figures of Solidarity: Reconciling Cultural Relativism and Universalism," Ryan Wilson uses Margaret E. Keck and Kathryn Sikkink's boomerang model to discuss why more domestic human rights non-governmental organizations (NGOs) have developed within Latin America compared to any other part of the third world. According to the model, "figures of solidarity emerge when a repressive government violates the basic tenets of human rights" and as a "discursive space within both the international and domestic realm creates an opportunity for previously silenced voices to be heard" (Wilson, 1). Wilson's analysis of Madres de Plaza de Mayo as an example of the "boomerang theory" continually refers to the concept of transnational advocacy. Fundamentally, a transnational advocacy network is a "network of activists, distinguishable largely by the centrality of principled ideas or values in motivating [its] formation," which can emerge when governments deny domestic groups the space necessary for self-expression (Wilson, 1). According to the boomerang theory, domestic NGOs "residing within a structurally repressive government" must "boomerang" and form links with international organizations, which then use their influence to pressure these governments from the outside (Wilson, 6). The boomerang theory, however, assumes that the domestic group can contact those international organizations even under its repressive government.

The Argentinian people's repression and violence during its Dirty War Years provided ideal conditions for the emergence of Mothers of the Plaza de Mayo, which began as a domestic group but then transformed into a transnational advocacy network. Early on, the Mothers of the Plaza de Mayo had trouble overcoming government repression to contact international NGOs. Emerging at a time riddled with violence and human rights violations, the Mothers often fell prey to the precise actions they were protesting against. Twelve of the fourteen founding mothers disappeared themselves (Agosin), and others were tortured by the dictatorship's military (Anderson). However, by refusing to be silent, the Mothers exposed their country's human rights abuses and partnered with international organizations to form a transnational advocacy network.

SPATIAL NETWORK THEORY

Timeline:
Mothers of the
Plaza de Mayo

Death of Argentinian president Juan Peron
July 1, 1974

Military coup and start of the Guerra Sucia
March 24, 1976

First gathering of the Madres de Plaza de Mayo. Women wore white headscarves embroidered with the names of their children.
April 30, 1977

End of the Guerra Sucia
1983

Organization split into two factions: Mother of the Plaza de Mayo Founding Line and the Mothers of the Plaza de Mayo Association.
1986

First annual March of Resistance around the Plaza
Jan. 26, 2006

Fernando J. Bosco explores the importance of spaces and places in network cohesion and the sustainability of mobilization within his article "Place, Space, Networks, and the Sustainability of Collective Action: The Madres de Plaza de Mayo." Focusing on the how the practice of place-based collective rituals and symbolic associations tie into geographical flexibility and influence access to resources, Bosco examines the spatial dimensions of collective action, as well as the development and duration of the Mothers movements. He begins his analysis with a testament to the importance of networks in the mobilization of social movement organizations like the Mothers. By "linking local activism across different contexts" and "creating trans-national webs that facilitate the efficacy of collection action," social networks contribute to the success of social movements (Bosco, 309). Social locations, such as ethnicity and sexuality, also aid in providing meaning and establishing connections.

Bosco also examines the three types of networks crucial for collective action to exist. These networks consist of interpersonal networks of activists "that facilitate recruitment and individual participation," "links between individuals and organizations that are based on individuals' multiple personal and group allegiances," and "inter-organization networks used to coordinate actions and share resources that are crucial to achieve large scale mobilization" (Bosco, 310). While these different networks sometimes overlap, they are not necessarily comprised of the same members.

This complex web of networks can be discerned in both factions of the Mothers movements, the Mothers of the Plaza de Mayo Founding Line and the Mothers of the Plaza de Mayo Association. In the Founding Line faction, interpersonal links are built around the knowledge that each member is a mother struggling to discover the truth surrounding their child's disappearance. These women are further united by their desire for those responsible to experience legal punishment (Bosco, 310). In the Association, the interpersonal bonds are sustained by the concept of "socialized motherhood," or the idea that each member is not an individual mother searching for a specific child, but rather a representation of all mothers whose children have disappeared, even those who never became activists (Bosco, 310). Both groups also share bonds with other social movements based on strategic interests and occasionally emotional links or shared identities (Bosco, 311).

Overall, Bosco's spatial network theory reveals how spaces, through their establishment of networks, act as contexts for both symbolic and cultural productions. By traversing a variety of spatial scales, the Mothers have expanded nationally and trans-nationally and forged alliances with other social movements and groups. This growth would not have been possible, however, without the symbolism the movement attached to the Plaza and the collective action it organized around it.

COLLECTIVE BEHAVIOR

According to the collective behavior theory, collective behavior occurs during a period of social disruption, such as when grievances are deeply felt. Therefore, participants' mobilization following this strain relies heavily on shared beliefs (Staggenborg, 13). Propelled by the strain of losing their children to Videla's dictatorship, the Mothers de Plaza de Mayo united to protest against systematic human rights violations.

In the case of the Mothers, Videla's violently oppressive dictatorship destroyed prior sources of meaning as its instigation of terror disestablished societal norms and relations. Although the regime emphasized traditional gender roles, including the woman's place as a housewife and mother (Bouvard), by taking away their children, the government had also taken away the Mothers' sense of meaning. To fully satisfy their responsibilities as mothers and regain structure, the women mobilized. They used their rights as matriarchs to justify their evolution into public protesters and activists. As a result, the Mothers – mainly homemakers, few of whom had received an education beyond secondary school – emerged in a previously male-dominated public forum.

The Mothers mobilized in an attempt to regain their children and, by extension, the ability to satisfy their responsibility as mothers. One could argue that their actions stem from a desire to reclaim an identity constructed by society in concurrence with Argentina's traditional gender system. Their tactics publicly criticized society by how it challenged the sphere of silence permeating Argentina's sociopolitical atmosphere rather than in how it redefined the concept of male dominance. The Mothers concentrated their efforts on a different form of radicalism – vocalized dissent.

But the method through which a movement establishes meaning is only one aspect of collective behavior theory. One must also examine how this sense of meaning in turn shapes an actor's agency, identity, and actions. While ideology plays an important role in guiding collective behavior, the "beliefs that govern this behavior are not fixed, rather systems of belief emerge and develop as social movement actors interact with one another, the public, opponents, and authorities," or so the Chicago Approach argues (Staggenborg, 13). As these actors try out new tactics and are influenced by the events and opportunities around them, they revise their ideas.

This malleability accounts for the shift in beliefs of the Mothers, including the radicalization of the Association. While initially an organization consumed with the search for their lost children, the Mothers begin to evolve into a general human rights organization following their interactions with other social movements. As the Mothers gained support and became more concerned with changing the political scene of Argentina, they not only broke into two groups but also begin to adopt their children's radical ideals. In an attempt to promote these revolutionary ideas and keep the spirit of their children alive, the Mothers have created an independent university, bookstore, library, and cultural center (Bouvard). Offering subsidized and free education and health, these facilities, show how support, opportunity, interactions with other movements, and even opposition lead to the development of collective action.

RESOURCE MOBILIZATION THEORY

As the Mothers of the Plaza de Mayo and their plights garnered more international acknowledgement, the resources available to the group increased from other human rights organizations supporting the Mothers' cause, contributing to its success and development. The resource mobilization theory explores how varying structures of social movements influence their longevity and strategic choices. According to theorists, organizations "with more formalized or bureaucratic structures are better able to sustain a movement over time, whereas informal organization are better at innovating tactics and taking quick action in response to events" (Staggenborg, 18). At its beginnings when it still largely

consisted of loosely structured groups, the Mothers of the Plaza de Mayo was more creative, or revolutionary, in its tactics. Constant revolutionary tactics are not, however, generally sustainable in the long-term. The success of a group while tied to the innovative nature of its actions, also relies upon the stamina of its methods. If a movement cannot reasonably sustain its tactics, it will become more disorganized leading to a breakdown of its support, identity, collective behavior, and available resources until the point where it collapses (Staggenborg, 18).

During the reign of terror that characterized the Dirty War Years, the Plaza de Mayo was hampered by the omnipresence of the security police, who threatened public assembly. As the organization gained more support and became more institutionalized, they became concerned with continuous political action and their weekly Thursday marches on the Plaza became a long-standing symbol of the movement. While still powerful, these marches lost their novelty. This development, combined with the shift in goals to broader human rights issues caused the Association faction to engage in their final annual March of Resistance around the Plaza on January 26, 2006. They decided to continue their weekly Thursday marches in support of other social causes (Abreu). As the Mothers movement became more formalized, it became content in its tactics, re-using strategies that had succeed in the past. These strategies, while initially innovative, became signs of the continuous sustainability of the movement.

CONCLUSION

At first glance, the Mothers of the Plaza de Mayo may seem like a simple protest organization – the collective collaboration of mothers who had lost their children to a repressive military regime. Deeper analysis reveals, however, the many intricacies and implications of the movement: the group is a living manifestation of the boomerang, spatial network, collective behavior, and resource mobilization social theories, and has adapted to changing political and social atmospheres.

Although the mothers are still missing their children, their organization has expanded to include support for other human rights violations, empowering others both nationally and internationally. This shift highlights the resilience of the movement - a rather unique aspect considering how few social movements have lasted as many decades as the Mothers. For example, looking at some of the major players in the African-American Civil Rights Movement, such as the Student Nonviolent Coordinating Committee (SNCC) and the Black Panther Party, neither parties lasted longer than two decades. The Mothers are about to celebrate their 38th anniversary. While such resilience stems partly from continuous action, a balance of innovation and stability, and cross-cultural support, the Mothers' main victory is their strategic use of space. By harnessing spatial symbolism through their Thursday marches and other seemingly simple activities, Madres de Plaza de Mayo challenged Argentina's violent atmosphere and managed to create community and international partnerships.

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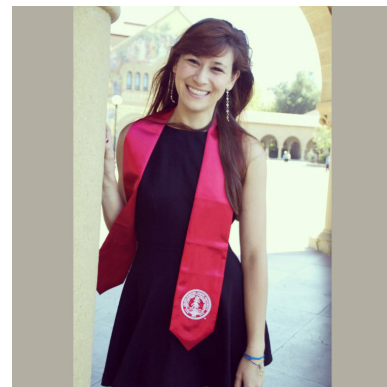
The Monetary Dynamics of Poverty

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Strata analysis is proposed as a method for analyzing the dynamics of poverty using a monetary approach. The nature of money circulation through wealth strata within an economy is an important dimension through which poverty can be explored. This article shows that wealth groups form strata through which money flows at a rate termed the "inter-strata money mobility rate" where the aim of the poor is to maintain a positive rate of money mobility into their wealth strata, and to exchange the gains for standard-improving commodities that raise their living standards. However, for the money mobility rate to increase, members of the low wealth strata need to produce more (and higher quality) goods and services that members of higher wealth strata find valuable so that wealth can flow from the higher wealth strata to the lower wealth strata. Productivity and quality of production can be improved if members of lower wealth strata gain greater access to factors of production (land, labor, physical capital and human capital); such an improvement would lead to a higher rate of money mobility into the lower wealth strata, as well as a reduction in wealth inequality through a natural redistribution of wealth from higher to lower strata.

INTRODUCTION

Poverty is a social phenomenon which permeates all countries. Its elimination is the goal of every reasonable policy maker. However, although the concept of poverty is not difficult to understand, the dynamics of the phenomenon may be far more complex. For instance, merely the definition of poverty encompasses several complex questions, with each having a multitude of possible answers: What is the nature of poverty? What are the causes of poverty? Is it a multidimensional or a single dimension phenomenon? Is it objective or subjective? Poverty line or poverty lines? What level of analysis should be emphasized: individual, family, society, or class? [1].

These questions need to be answered conclusively before moving on to the question of what policies and social actions should be undertaken to overcome poverty. This is the aim of this article: to explore the nature of poverty using a monetary approach. Using strata analysis, this article explores the dynamics of money circulation and its relation to poverty. The analysis, for simplification, assumes a closed economy with a fixed stock of money. It is interesting to see how a fixed stock of money circulates within an economy, and yet large proportions of the population are unable to get a hold of sufficient proportions of that fixed stock. The article also presents reasons why lower wealth strata have difficulties in increasing the proportion of money stock circulating within their strata. Finally, a few suggestions are proffered for improving inter-strata money circulation.

Wealth Inequality

Economies are usually characterized by levels of income inequality [2], which in turn fuel a rise in wealth inequality—inequality in the proportions of the total stock of money shared by members of society. This is a logical conclusion to come to when one considers that those who earn more are able to acquire a greater quantity of assets, and wealth accumulates over time. The highest earners are also able to save much of their incomes, and typically do [3]. That means high earners can accumulate more and more wealth as time goes on. In this manner, income inequality leads to wealth inequality. In the United States, for example, some estimates suggest that the top 1 percent of Americans hold nearly 50 percent of the wealth [4].

Wealth inequality naturally exists in an economy for four primary reasons:

1. Ability Inequality: Different individuals have different intellectual, physical, biological and creative abilities, which leads to differences in the wealth that they possess. [5].

2. Product Value Inequality: Different individuals and institutions offer goods and services that differ in value to the buyers. Products that are valued more can earn a higher return for their producers than products that are valued less.

3. Factor Ownership Inequality: There is unequal ownership of factors of production, further compounded by an inequality in the market values and qualities of those factors [5].

4. Psychological Inequality: Different individuals may have different tastes, preferences, personalities, monetary orientations, moralities, religions and/or knowledge. This creates variation in individuals' attitudes toward money and monetary value. [5]. These factors that cause wealth inequality are inherent in the socioeconomic system. Thus, complete equality cannot be reached; however, inequality can be minimized.

INTER-STRATA MONETARY CIRCULATION (STRATIFIED ANALYSIS)

Assume a closed economy (one in which the government does not have the ability to increase the money supply), so that the total stock of money (M) within the economy is fixed. The

stock of money may degrade by a rate *d* (rate at which currency is physically degraded to the point of uselessness), but government re-grades at rate *a* (by printing currency notes to replace the useless one), so that the total stock of money remains constant, i.e.

$$(1) \qquad d = a$$

The economy is in autarky, which implies that money neither leaves nor enters the economy from abroad.

The first step in the analysis is to divide the population into four groups, or strata, according to the proportion of money possessed by each stratum. For this analysis, money is taken as a broad term that also includes relatively illiquid assets such as bonds and stocks. Wealth is defined as "a measure of the value of all of the assets of worth owned by a person, community, company or country. Wealth is found by taking the total market value of all the physical and intangible assets of the entity and then subtracting all debts" [6]. In other words, for this analysis, money less debt is regarded as wealth.

Although, in reality, there are multiple subgroups within each wealth group, the analysis is limited to four macro-groups. Still maintaining a fixed stock of money, I begin by assuming that there are different groups of agents within the economy who own specific proportions of the total money stock; that is, each stratum has a definite proportion of money stock circulating within it. The four wealth strata and their respective endowments are assumed as follows:

A = 0.05 M; B = 0.15 M; C = 0.3 M; D = 0.5 M
A = 0.1 N; B = 0.3 N; C = 0.5 N; D = 0.1 N

Where A, B, C and D are wealth strata, M denotes the total stock of money and N denotes the total population size.

The definition of poverty as used in this analysis is the condition whereby an individual's wealth (*Y*) is insufficient to cover essential expenses (*E_e*) so that,

$$(2) \qquad Y - E_e < 0$$

An essential expense is taken as one which, if not incurred, would lead to significant short-term or long-term adverse effects on an individual's wellbeing (i.e. expenses that are required for basic survival). For instance, healthy food, water, and basic medical services
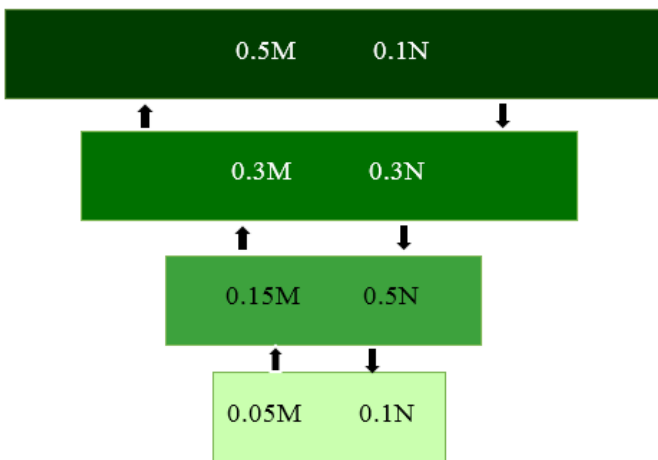

Figure 1. Pyramid of money stock division. Wealth groups with larger endowments are represented by larger rectangles. The arrows represent the flow of money between wealth groups (inter-strata money mobility).
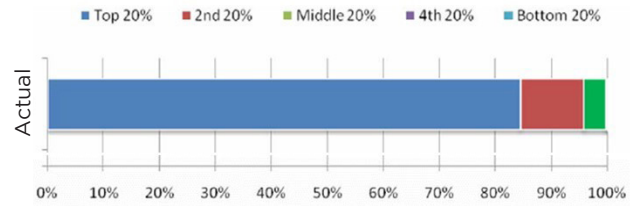

Figure 2. As reference, the top 20% of the population own 84% of the wealth in the United States.

are essential expenses. This article, however, does not focus on what constitutes essential expenses. Rather, it is assumed that all wealth groups share the same essential expenses.

The higher the wealth stratum, the larger ($Y-E_e$) is. An individual can be in one of two long-run states of economic wellbeing: wealth-deficient ($Y-E_e < 0$), or wealth-sufficient ($Y-E_e \geq 0$).

Furthermore, we can define the *aggregate wealth-sufficiency* condition of a stratum as:

$$(3) \qquad \left[\left(\sum_{i=1}^{N_X} Y_i \right) - (N_X \times E_{ei}) \right] \geq 0$$

Where Y_i is wealth for individual *i*; N_X is the population of stratum *X*; E_{ei} is the monetary value of individual *i*'s essential expense. Likewise, the *aggregate wealth-deficiency* condition of a stratum is:

$$(4) \qquad \left[\left(\sum_{i=1}^{N_X} Y_i \right) - (N_X \times E_{ei}) \right] < 0$$

In this analysis, it is assumed that the lowest wealth group (Group D = 0.05M) is largely wealth-deficient, meaning that a very large proportion of the individuals within this wealth group are poor. Therefore, it is assumed that stratum D is characterized by the aggregate wealth-deficiency condition.

Inter-strata Money Mobility (IsMM)

The inter-strata money mobility (IsMM) rate is the rate at which money flows between wealth strata. It may be viewed as the average flow of money from one stratum to another. IsMM occurs when members of a stratum purchase goods, services, and factors of production produced by members of another stratum (e.g. stratum A members hiring workers from stratum C; stratum B members purchasing land from members of stratum D, etc.). IsMM rates vary between wealth strata as well as across time. At certain periods of time, the upward IsMM (UIsMM) rate (the rate at which money moves from members of a lower wealth stratum to members of a higher wealth stratum) is high, and downward IsMM (DIsMM) rate (the rate at which money moves from members of a higher wealth stratum to members of a lower wealth stratum) is low; the reverse may happen at other periods of time. The IsMM rate may be calculated as the percentage change in money stock circulating within a stratum in unit time:

$$(5) \qquad m_i = \frac{M_{it+1} - M_{it}}{M_{it}}$$

Where m_i is the IsMM rate of wealth stratum *i*, M_{it+1} is the stock of money held by wealth stratum i at time *t*+1, and M_{it} is the stock of money held by wealth stratum i at time *t*. If m_i is positive, the downward IsMM rate is greater than upward IsMM rate; the op-

posite is true if m_i is negative.

The IsMM can be observed empirically. Take the United States, for instance. Looking at two wealth strata – the top 1% and the bottom 99% - one can see changes in their shares of wealth (Table 1). The only way for individuals with lower wealth sufficiency to gain wealth (and improve sufficiency) is to receive from those with higher wealth-sufficiency. Thievery is not the connotation of this statement. Members of the wealth-deficient class can exchange their goods and services for money from members of wealth-sufficient classes so that wealth rises, wealth-deficiency improves, and natural (i.e. non-intervention) wealth redistribution occurs. Thus, the aim of the wealth-deficient stratum D is to increase DIsMM and decrease UIsMM so that m_D (IsMM rate of stratum D) is, on average, a positive number. It is impossible that m_D continues to be positive for an infinite period of time. Fluctuations occur in the short run, and structural problems might cause long-

	Bottom 99 percent	IsMM Sign	Top 1 percent	IsMM Sign
1922	63.3%		36.7%	
1929	55.8%	-	44.2%	+
1933	66.7%	+	33.3%	-
1939	63.6%	-	36.4%	+
1945	70.2%	+	29.8%	-
1949	72.9%	+	27.1%	-
1953	68.8%	-	31.2%	+
1962	68.2%	-	31.8%	+
1965	65.6%	-	34.4%	+
1969	68.9%	+	31.1%	-
1972	70.9%	+	29.1%	-
1976	80.1%	+	19.9%	-
1979	79.5%	-	20.5%	+
1981	75.2%	-	24.8%	+
1983	69.1%	-	30.9%	+
1986	68.1%	-	31.9%	+
1989	64.3%	-	35.7%	+
1992	62.8%	-	37.2%	+
1995	61.5%	-	38.5%	+
1998	61.9%	+	38.1%	-
2001	66.6%	+	33.4%	-
2004	65.7%	-	34.3%	+
2007	65.4%	-	34.6%	+
2010	64.6%	-	35.4%	+

Table 1. Share of wealth held by the bottom 99% and top 1% in the United States, 1922-2010 [7][8]. The sign of the IsMM shows the positivity or negativity of the flow of money into a wealth group. Note that from 1922 to 2010, the IsMM rate has been positive for the top 1%

run m_D to fall as well. Therefore, the ultimate goal of policymakers should not only be to maintain the positivity of m_D, but also to employ money acquired from the wealth-sufficient towards the purchase of standards-improving goods and services. Standards-improving goods and services are defined as goods and services which raise the long-run standard of living of an individual, and may be regarded as the ultimate goal of the wealth-deficient. Examples of such commodities are clean water facilities, electricity facilities, healthcare facilities, healthier sewage facilities, better living environments, and so on.

Member Mobility Paradox

If the m_D of the wealth-deficient stratum D is positive for a sufficiently long time, and population remains fairly stable, the proportion of money stock held by members of the stratum D increases until members reach wealth-sufficiency and move into a higher wealth-stratum C. This movement from the lower stratum to the higher then causes the proportion of money stock held by stratum D to decrease, but it also causes the population size of stratum D to decrease significantly. This effect may be termed the member mobility effect. However, if m_D maintains positive for a sufficiently long time, the bulk of money that flows into stratum D is retained by a small group of people in stratum D (i.e. Gini coefficient within stratum D rises). The transit of stratum D members still leads to a decrease in the proportion of money stock held by the stratum, but it leads to a less than proportional decline in the population size of stratum D (since only a few people transited).

Thus, the member mobility effect follows the following process: when stratum D's IsMM rate is positive ($m_D > 0$), M_D (money stock owned by stratum D) rises over time. With growth in population being assumed to be approximately zero ($\Delta N_D \sim 0$), proportions of N_D reach the state of wealth sufficiency,

$$(6) \qquad \left[\left(\sum_{i=1}^{N} Y_i \right) - \left(N \sum_{i=1}^{n} E_{ei} \right) \right] \geq 0$$

Thus, the population in stratum D begins to decline, and the population in stratum C increases, leading to a decline in M_D and an increase in M_C.

Productivity and Factors of Production

Going back to maintaining the positivity of m_D, to exchange goods and services for money from higher wealth strata, the wealth-deficient must first have goods and services to exchange. This is where the factors of production come into play. To produce, land, physical/human capital, and technology need to be available for the wealth-deficient.

The difficulty in enabling the wealth-deficient class to increase their productivity (so that wealth flows from the wealth-sufficient classes at a higher rate) is that the wealth-deficient are generally characterized as having the least access to factors of production. The wealth-deficient lack high quality human capital (as they have insufficient wealth to afford quality education), and so they are more likely to depend on physically-demanding labor such as lawn mowing, bricklaying, etc. This can be corrected with government-sponsored educational services provided to members of the wealth-deficient strata, but that is not enough. It is well known that poverty may have particular psychological consequences that can lead to economic behaviors that make poverty difficult to escape
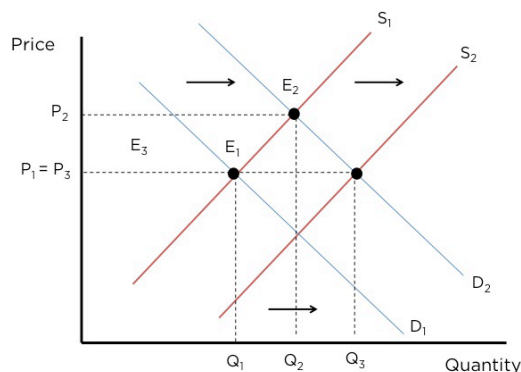
Figure 3. Effects of stratum expansion on average prices of stratum-level goods and services. As stratum C expands (from a contraction in stratum D), the demand for stratum-level goods and services in stratum C increases, causing the demand curve in stratum C to shift to the right (D1 to D2). If the emancipation paradox holds, then equilibrium price rises from P1 to P2, with equilibrium quantity demanded at Q2. If the emancipation paradox does not hold, and supply rises significantly to match demand (supply attraction), then the supply curve shifts to the right, causing equilibrium price to match the pre-expansion equilibrium price (P1 = P3), and the equilibrium quantity demanded to increase to Q3.

[9]. Therefore, educational services must be customized to suit the psychological and behavioral patterns of the wealth-deficient in order for these services to have greater effect.

Capital (money) is sourced from savings, grants or loans. There are few wealth-deficient individuals who are able to save enough money over time to eventually employ as capital for productive purposes. Many wealth-deficient individuals are unable to save because, by definition, their wealth is insufficient. The poor man's Marginal Propensity to Save (MPS) is lower than the rich man's; the poor tend to spend a higher percentage of their wealth because they have more unsatisfied needs [4]. Therefore, grants and loans are sources of capital for productive purposes. Monetary grants are usually given to wealth-deficient people in the form of charities and welfare grants. However, because the wealth-deficient still have needs to satisfy before engaging in productive activities, monetary grants may usually be expended on unproductive goods and services. Thus, unless a monetary grant is sufficient to cover both deficient essential expenses and act as capital for production, monetary grants are ineffective as a source of productive capital.

Loans as a means of capital are typically not abundantly available to the wealth-deficient, as their assets to be used as collateral are typically of low market value. This inadequacy of collateral causes lenders to regard the wealth-deficient as too risky to give large loans to. One way to correct this is to provide low-interest and wealth-targeted loans to the wealth-deficient. In practice, these are provided for (although not sufficiently) through microfinance services, agricultural loans for poor farmers, and other small-loan services aimed at lower-wealth classes.

The Emancipation Paradox

In this world of fixed stock of money and inequality of wealth, there exists enough surplus money to sustain the entire popula-
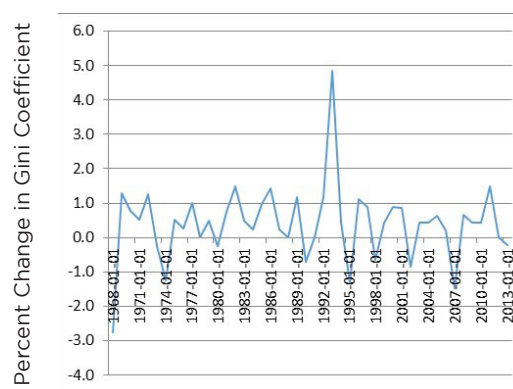

Figure 4. Percentage change in Gini coefficient from 1968 to 2013. [10]

tion if the money is distributed equally among all members of the country:

$$(7) \qquad [M - (E_e \times N)] > 0$$

Thus, theoretically, everyone in the nation can be wealth-sufficient (holding prices constant). However, if the lowest wealth stratum shrinks significantly (for instance, as a result of the member mobility effect) and the second-lowest wealth stratum expands (holding the population growth rate at zero), the cost of living of the expanded wealth stratum also increases significantly due to an increase in the demand for stratum-level goods and services (e.g. caviar as a good is demanded for by members of higher wealth strata). On the other hand, many people whose wealth is insufficient to maintain such living costs fall to a lower wealth stratum. However, this may be untrue, as it is known that demand attracts supply; so that when the demand for stratum-level goods and services (e.g. private hospitals, recreational facilities, foodstuff etc.) rises in the expanded stratum, supply of those goods rises as well, and prices do not change significantly.

It is, however, reasonable to expect that the emancipation paradox may occur only in the short run, where prices rise due to increased demand, but then supply increases to equilibrate the increased demand over time.

The Case of the United States

The theory has been presented, but does it reflect the real world? In the United States, the proportion of wealth owned by the top wealth stratum has been rising. This implies that the IsMM rate for the top wealth stratum is high, and the gap between the highest and lowest strata has been widening. As seen in Figure 4, the percentage change in the Gini coefficient (a measure of wealth inequality) in the United States has been mostly positive over the years.

This continued positivity in the rate of change of wealth inequality means that the highest wealth stratum is owning a greater proportion of total wealth, while the lower wealth strata are owning a lesser proportion. This clearly implies that the long-run UIsMM rate (rate at which money flows from the lower to higher wealth strata) is positive, while the long-run DIsMM rate (rate at which money flows from higher to lower wealth strata) is negative: more money is flowing into the higher wealth strata. Hence, there is a need for the U.S. government to quell this trend by improving

the productive factor ownership of the wealth-deficient stratum to improve the positivity of that stratum's IsMM rate and by instituting measures to reduce the IsMM rate of the highest wealth strata.

CONCLUSION

The monetary dynamics of poverty, using strata analysis, have been explored. Maintaining assumptions of a fixed money stock and economic autarky, it has been shown that poverty (wealth-deficiency) can be naturally improved through monetary redirection - by increasing the productivity (and quality of productivity) of the wealth-deficient strata so that their produced commodities may be offered to the wealth-sufficient strata in exchange for money. This money can subsequently be exchanged for standard-improving goods and services, so that the wealth-deficient live on higher standards as time progresses, regardless of fluctuations in the stock of money held by the stratum.

A possible pitfall that policymakers should be cognizant of is the emancipation paradox, which occurs when a portion of the wealth-deficient stratum transits to a higher wealth stratum, causing the prices of the frequently consumed higher wealth stratum goods to rise. This leads to those individuals with lower wealth (which happens to be insufficient to cover the new, higher cost of living) within that wealth stratum to fall into a lower wealth stratum, thus increasing the population proportion of the wealth-deficient stratum.

Also investigated are reasons why the downward inter-strata money mobility rate might be low. Reasons proposed include inadequate quantity and/or quality of factors of production available to the lower strata. If these factors of production (especially physical capital and human capital) can be increased in quality and quantity, then the productivity of the wealth-deficient strata would also increase. This means that inequality must be countered by establishing institutions that provide productive factors to the income-deficient for them to be able to produce and increase the flow of money into their income class. Practical examples of such institutions include microfinance banks that provide financial capital to low-income earners, subsidized or free education in high prospect fields and/or vocational training capital, and entrepreneurship programs and schools for low-income earners. The provision (and subsequent use) of productive factors would be beneficial in maintaining a satisfactory rate of inter-strata monetary mobility and facilitating.

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A Candy for Suckers: The Peace Process and Election Campaigns in Israel (2003-2013)

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This paper examines Israeli public opinion on the peace process from 2003 to 2013 through the lens of electoral campaigns, addressing the central question of whether there is a correlation between the focus of political campaigns and Israeli public opinion. Parsing through polling data, campaign ads, and interviews with campaign experts and politicians, the paper traces out a picture of Israeli society during these years. The findings show that a correlation exists between the emphasis placed on the Israeli-Palestinian conflict by political campaigns and the intention of Israeli voters to vote based on this issue. Research revealed a growing disinterest in the conflict among Israelis as it became a less immediate concern and a more tiresome issue to address. The results suggest that policymakers must find a way to restore the Israeli public's faith in peace so that it may again bring them to the polls in 2015.

INTRODUCTION[1]

P*eace is sort of candy for suckers, a trap…. Campaign management is selling, not different from selling anything else. The fact that they didn't use peace is evidence that its currency is weak. If they could sell it they would use it…. Political electorate is a currency.*[2]

Thus explains Lior Chorev, a political strategist who worked with Ariel Sharon. The peace process, along with how it is addressed or is not addressed, how it is utilized in political campaigns or how it is brushed aside, has been a central part of Israeli politics for as long as they have existed. Since its creation in 1948, Israel has fought ten wars and has been almost continuously entangled in waves of terror attacks. Israel officially made peace with Jordan in 1994 and Egypt in 1979, but has yet to reach a lasting peace with Palestinians, or its other neighboring countries.

This paper explores Israeli public opinion on the peace process as viewed through the lens of political campaigns from 2003 to 2013. The findings demonstrate that political campaigns in Israel are inextricably bound up with the opinion of the electorate, and indeed there is a direct correlation between attention paid to the peace process by political campaigns and the public's prioritization of the issue. The directionality of the issue remains unclear, with the data and interviews pointing to a complex relationship in which the two components influence each other. What is clear, however, is that the Israeli public appeared increasingly apathetic as the conflict became a less salient feature of their daily lives.

THE ELECTION CAMPAIGNS

As Israel has numerous political parties, many of which come and go within just one election cycle, the present paper focuses on the parties that have presented a viable candidate for Prime Minister in every election over the last decade: these three parties were Kadima, Likud, and Labor. In order to determine the focus of each campaign, the paper concentrates on their respective me-dia campaigns and ads rather than the party platforms. Because the importance of platforms has decreased in Israel to the point that for example, Likud -- the biggest party in the 2013 election -- did not even have a platform in the 2013 campaign, the analysis looks at ads, slogans, and media attention devoted to issues in each election cycle.

2003

The 2003 elections pitted incumbent Likud's Ariel Sharon against Labor's Amram Mitzna. The backdrop for the 2003 campaign was the Intifada and the "death of Oslo," referring to the Oslo Accords, a peace agreement between Israel and the Palestinian Authority signed in 1993 and 1995. The agreement failed to bring peace and dissolved into another cycle of violence and terror known as the Intifada. Likud's 2003 campaign focused mainly on Sharon as a personality and less on the security issue. Sharon was a decorated war hero who served as a commander in the Israeli army since its creation in 1948. After retiring from the military, he entered politics and became the head of Likud in 2000 and Israeli Prime Minister in 2001. According to George Birnbaum, the strategist who built Sharon's campaign, "with Ariel Sharon's ads, we had him with his grandchildren clipping roses on his farm. We made him the grandfather and his personality became larger than life. Personality campaigns are sometimes so big that nothing else matters."[3] Indeed many of the campaign ads focused on Sharon personally, and Likud's poster slogan became "The nation wants Sharon,"[4] a spin-off of the popular Israeli slogan "The nation wants peace." Labor's campaign attempted to combat this with slogans such as "We will not be in Sharon's government"[5] or "Only Mitzna can, not the Likud."[6] These slogans further illustrate the focus on the candidates' personalities rather than on the issue of security. A study by Sheafar, Weimann, and Tsfati on media coverage, which looked at news items on television channels 1, 2, and 10 in the three weeks preceding the 2003 elections, found that only 7.2% of coverage dealt with Palestin-

Figure 1. Likud Poster: The Nation Wants Sharon.

ians and negotiations and only 9.6% of coverage dealt with terror and security, while 5.8% of coverage was dedicated to education, health, welfare, and social justice.[7] The issue that received the most attention was crime and corruption with 33.2% of the election coverage.[8] This study establishes that terror and the peace process were not at the center of the 2003 campaign. According to Shamir and Arian, "the 2003 election…was held under the cloud of the ongoing Al-Aqsa Intifada….nevertheless the issues pertaining to this round of confrontation did not dominate media coverage." The Intifada and the security question formed the backdrop for the 2003 election, but nevertheless, personalities emerged as the main story.

2006

The 2006 election followed in the wake of the Israeli military withdrawal from Gaza in August 2005 and the creation of the centrist political party Kadima by Ariel Sharon in 2005. The Kadima party was started in late 2005 by moderate members of the right wing Likud Party along with members of the Labor Party. The party arose largely as a result of disagreement over Sharon's contentious unilateral Gaza disengagement plan. The 2006 race centered on Kadima's Ehud Olmert against Labor's Amir Peretz and Likud's Benjamin Netanyahu.

Peretz shifted Labor's focus to social and economic issues, evidenced by the home page on the Labor newspaper website, posted in December 2005. The headline reads "Labor is the only party that presents a real social alternative."[9] Labor's main ad poster displayed the slogan "a social economic plan for many years ahead."[10] The study by Tsfati et al. found that 11.5% of media items in the 2006 campaign dealt with terror, attacks, intifada, and security, and 13% dealt with Palestinians and negotiations, whereas 20.3% dealt with education, health, welfare, and social justice and 19.1% with crime and corruption.[11] Compared with the 2003 campaign, Tsfati et al. found a more significant rise in the coverage of social issues than in the coverage of terror and the peace process, marking the shift in campaign focus towards social issues.

Likud and Kadima paid more attention to the conflict than did Labor in the 2006 campaign. Likud used slogans such as "Strong Likud, safe Israel"[12] and the jingle "my future, my security, Likud is right."[13] Kadima's campaign rested to a certain extent on Sharon's personality, combined with the issue of the conflict. Prime Minister candidate Ehud Olmert, head of Kadima and guiding force in setting the tone for the 2006 Kadima campaign, explained the following in an interview with the author:

In 2006 I knew what I wanted to do. I knew I wanted to pull out of all of Judea and Samaria and this why I wanted this to be on the agenda so that if it happens, because Judea and Samaria are a hundred times more sensitive an issue than Gaza and the opposition is much tougher. I wanted to receive a mandate from the public so they would not say to me after "You asked for a mandate for one policy and use a different one."[14]

In one telling 2006 Kadima TV ad, different Israeli politicians speak of Sharon's leadership and valor. The ad ends with Olmert saying to the viewer, "Say yes to permanent borders, a Jewish state with a Jewish majority, and a stable economy."[15] Olmert's words are in a deliberate order, an order that pegs resolving the border issue and ensuring a Jewish majority -- two issues that relate directly to the conflict -- above the economic issue. Another campaign ad prominently displays a picture of Sharon and Arafat shaking hands and beneath it the words "Kadima, in Sharon's path. Strong leadership for peace."[16]

The combination of attention paid to foreign affairs and to internal issues in 2006 is indicative of a general movement towards the center of Israeli public opinion. Labor's campaign shows that the appeal of social issues was rising, but Likud's and Kadima's campaigns demonstrate that the conflict remained relevant. Israelis cared about both social issues and the conflict and overall felt neither hawkish nor dovish. It was in part this movement to the center that resulted in Kadima's success. For the first time in Israeli history, a centrist party was a ruling party candidate. Political scientist Levy explains that "the party tapped into fertile soil in offering the Israeli electorate a party alternative that epitomized the median voter's stance - a specific combination of the left and right…a pragmatic middle ground."[17]

2009

Looming over the 2009 elections were both the recent war in Gaza and the worldwide economic crisis. The two viable candidates for Prime Minister were Tzipi Livni of the Kadima party and Benjamin Netanyahu of the Likud Party. Media coverage showed a focus on the security issue. Tsfati et al. analyzed all of the political party broadcasts aired on TV by major parties in 2009, as well as the video segments each party posted on its website, and found that 28.3% of party broadcasts dealt with terror, attacks, intifada, or security and 6% with negotiations.[18] Only 23% of party broadcasts

Figure 2. Labor Poster: "A Social Economic Plan for Many Years Ahead."

dealt with education, health, welfare, and social justice and a mere 2.3% dealt with economy and finance. This study also found that 19.9% of the news items on major channels dealt with terror, attacks, intifada, and security, while 10.6% dealt with Palestinians and negotiations with Palestinians, and 18% dealt with Israeli Arabs. By contrast, only 14.9% dealt with education, health, welfare, and social justice and 11.8% with crime and corruption.[19] The number of news pieces devoted to terror and negotiations is markedly higher than in previous elections, whereas the number of pieces dealing with crime and social issues decreased from 2006 to 2009.

Likud's campaign focused on the peace process from the standpoint of security threats. One Likud ad portrayed Tzipi Livini as a security threat. The ad depicted outcomes of voting for smaller parties, each ending with Tzipi Livni dividing Jerusalem, returning to 1967 lines, and Qassam rockets falling on Israel. The ad then exclaims, "There is only one way to promise a government lead by Netanyahu, one way to change the government, a big Likud. Only Likud will stop the disengagement, beat terrorism, and protect Jerusalem and the Golan Heights. Likud is a strong Israel."[20] Another Likud ad reads "Choosing Bibi means security, economy, and education."[21] Security is purposely listed first.

Kadima's campaign, led by Tzipi Livni, also centered on the conflict. In one ad, which tells the story of Tzipi Livni's rise to power, Tzipi appeals to the viewer to vote for her in order to ensure that the conflict is dealt with in a pragmatic manner.[22] The 2009 election campaign therefore evinced a general shift in focus to the conflict, as the war in Gaza loomed large.

2013

The 2013 election campaign avoided the Israeli-Palestinian conflict more than any previous campaign in Israel. The election came after nationwide social protests in 2011, the biggest protests unrelated to the Palestinian conflict Israel had ever experienced. Netanyahu was the clear frontrunner, perhaps the only viable candidate for Prime Minister. Likud had retained its slogan of "a strong Israel"[23] but there was no mention of security. Instead its signs read "Free education for the age of 3" or "Lowering the price of gas,"[24] indicative of the focus on people's wallets rather than a political stance regarding the peace process. Also influential in the 2013 campaign was the Labor Party, led by Shelly Yechmovitch. Labor's campaign evoked the social protests of 2011, which called for social justice and economic equality. Labor added two leaders of the social protests to its electoral list and even placed pictures used by the social protest in its posters. One sign read, "Fighting for our home,"[25] the slogan used by the social protesters in their campaign to lower the price of apartments. Social issues were at the core of Labor's campaign, with its signs and campaign messaging making almost no mention of the conflict. One *New York Times* article on the eve of the election declared, "In this campaign…voters here… said the issues that have been staples of Israeli politics for generations have been largely invisible, and social values or pocketbook concerns have been front and center."[26]

PUBLIC OPINION

Analysis of public opinion prior to each election relied on polls conducted by The Peace Index, a project run by the Israel Democracy Institute and the Open University that systematically follows Israeli public opinion on the Israeli-Palestinian conflict, as well as

other polling data. This data was supplemented with qualitative information, i.e. interviews with Israelis, to achieve a more complete depiction of public opinion. The data show a gradual shift in public opinion towards disinterest in the peace process.

The 2003 Israel National Election Study pre-election survey found that 67% of voters cited peace and the territories as a major voting consideration, 66% cited terrorism, 63% cited economy and 51% social policy.[27] The Peace Index showed that 45% of voters believed that rehabilitating the economy should take first place on the new government's order of priorities and 42% believed the top priority should be solving the conflict.[28]

In the run-up to the 2006 elections, several Peace Index polls are of interest. A November 2005 poll showed that 52% of voters named socioeconomic considerations as the major factor in guiding their voting decisions, while 27% named security-political issues.[29] A Peace Index poll in February 2006 showed that 47% of the electorate saw security as the paramount factor in deciding the elections while 37% thought socioeconomic issues would decide the election.[30]

An October 2008 Peace Index poll, in the run-up to the 2009 elections, found that 47% of interviewees regarded the parties' positions on security and peace as most important, 23% named social and educational issues, and only 13% cited the stance on the economy.[31] Another survey taken a few months after the new government was formed showed that the majority of Israelis (62%) believed that the economic crisis was the most important problem facing the government and only 27% named negotiations with Palestinians.[32]

A 2013 Peace Index poll found that 51% of Jewish voters cited domestic issues (religion, society, and the economy) as the motivation for their vote, while only 22.8% of voters cited foreign and defense issues. The Peace Index report declared that in the 2013 elections "domestic issues are paramount."[33]

It is also important to note that the number of Israelis supporting a two-state peace agreement has remained relatively constant. A poll commissioned by the Daniel Abraham Center for Middle East Peace, which measured Jewish Israelis' support for a two-state peace agreement between 2003 and 2013, showed a consistent strong majority, 50-70%, in favor.[34] These numbers remained high even during times of war and crisis. In an interview with newspaper Yedioth Aharonot in July 2013, Israeli polling veteran Mina Tzemach explained that over the years, Israeli support for a peace agreement has remained relatively stable around 67%, regardless of the government or the situation on the ground. "The percentage barely changes," she said.[35] These findings demonstrate that it is not Israeli support for peace that has changed but rather their prioritization of the peace process relative to other issues.

THE STORY OF THE INTERACTION

The comparison of campaign focus with public opinion shows a clear correlation. The graph below shows the comparison on an election-by-election basis. The graph relies upon Shaefer et al.'s data on media coverage as a quantitative indicator of the focus of election campaigns, and data from the Peace Index and National Election Studies as a measure of public opinion. Since Tsfati et al. did not analyze the 2013 campaign, the number is an estimate based on the ads and media data available. The graph suggests a positive association between the focus of election campaigns and public opinion on the peace process. The only discrepancy is the

drop in public opinion from 2003 to 2006, which may be a result of a different source of public opinion data for 2003. Peace Index data was unavailable for that year so the data was taken from the National Election Studies, which may conduct surveys in different ways and therefore report different public opinion estimates. Otherwise, the past decade as a whole shows public opinion and election campaigns moving together in their emphasis on the conflict.

This correlation is also apparent in an analysis of each of the four campaigns. In 2003, the election campaigns of Labor and Likud campaigns both focused on security, although not exclusively. As mentioned before, the Likud campaign relied primarily on Ariel Sharon as a personality. Similarly, public opinion appeared to be split between security and social and economic issues. While the Israel National Election survey found that the majority of the electorate named terrorism and peace in the territories as a key voting consideration, many said the economy swayed their vote as well. Although security still came first in the public mind, as it did in the campaigns, socioeconomic issues came a close second. In the January 2003 Peace Index poll, Hermann and Yaar wrote that, "in the latter stages of the election campaign most of the main parties' propaganda efforts focused on the security issues, with social and economic issues pushed to the side. Yet it seems that for the public, the social economic issue does not lag behind the security issue." The Peace Index findings confirm the split in public opinion between resolving the conflict and rehabilitating the economy.

The 2006 election campaign continued to address both security and social issues as public opinion evolved. In the campaign, Labor focused mainly on socioeconomic issues while Likud and Kadima continued to speak mainly about the conflict. Sheafar's study of media coverage of the campaigns shows that coverage of both peace- and security- related issues as well as socioeconomic issues rose but coverage of socioeconomic issues rose more dramatically and more news pieces were dedicated to socioeconomic issues. This campaign, with one party focusing on exclusively on socioeconomic issues, demonstrated that although the conflict was never far from people's minds, other issues began to gain precedence. Likewise, the public opinion polls of the 2006 election, with security and socioeconomic issues trading places at the top of people's voting considerations as the reality on the ground changed, establish the rising prominence of social and economic issues even as security concerns remained strong.

The 2009 election saw the return of security concerns as a result of Operation Cast Lead in Gaza and this is reflected in both public opinion and the election campaigns. Again the positive cor-
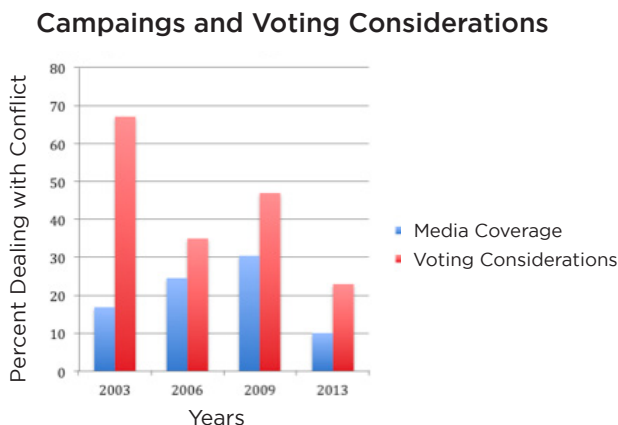
Campaings and Voting Considerations

Figure 3. Correlation between campaigns and voting considerations.

relation between public opinion and the focus of election campaigns proves strong. The media coverage of terror and peace issues rose, and analysis of specific Likud and Kadima ads and commercials reveals a similar focus. Polls show that the majority of the public voted on the basis of security concerns as well.

The elections of 2013 present another public and political shift, this time away from the security issue. As in the previous elections, both public opinion and political campaigns moved together. For the first time, a clear majority of the public named socioeconomic reasons for their voting decisions rather than peace or security issues. In this election campaign, the Labor Party made a point of avoiding the issue, Likud touched on it only minimally, and Yesh Atid, a party whose principle was to address internal problems first, saw tremendous success. Neither public opinion nor political campaigns attached great importance to resolving the conflict in the 2013 elections.

The directionality of the interaction between public opinion and political parties remains unclear, with evidence pointing to the two components influencing one another. Many of the politicians interviewed contended that leaders have great power to shape the issues that are important to the electorate before an election. Former Prime Minister Ehud Olmert asserted that, "If I were PM I would do what the nation needed and make them understand that and accept it. This is the test of leadership, to do what the nation needs and rally them to support it." Former politician Dan Meridor said, "I cannot go to elections without talking about the things that are important to me." These statements represent the view that politicians shape public opinion through their own actions and personal values. Other interviewees also suggested that political figures may reshape public opinion by tackling certain issues. Politician Meirav Cohen echoed this sentiment, explaining, "Sometimes you need to do what Ben Gurion once said 'not only what the people want but what is good for the people.' The people are sometimes confused and we lack someone who will say, 'I know what is good' and set the tone instead of optimizing the vote."[39]

Nevertheless, public opinion molds political campaigns because politicians appeal to the public interest in trying to win votes. Strategist Lior Chorev's analysis suggested that political parties position their campaigns relative to public opinion. He explained, "The considerations are purely electoral. Whoever tells you that they have ethical considerations or foreign affairs considerations, that's true maybe for running a government but is not relevant to managing a political campaign. The considerations are electoral. Your job as the manager of a campaign is to get your politician elected or get your party to realize its electoral potential."[40] Strategist George Birnbaum reinforced the idea that campaigns manipulate what is already on people's minds to their own advantage, explaining that the right wing parties always promote the security issue. He concluded that the campaigns do not make people more aware but play on their existing awareness of the security issue, saying that "They are aware because of what they read in the newspaper every day. It makes it easier to talk about. There is always something going on that keeps security in people's minds."[41] Dan Meridor, who spoke of an Americanization and increased focus on public opinion in creating campaigns explained that "The question became what the public wants to hear rather than what I want to say. I don't think that people talked in opposition to what they thought but they chose subjects based on what the public was interested in."[42]

One example of differing opinions on the interplay between public opinion and political moves was the formation of the Kadima party and the leadership of Ariel Sharon. Professor Reuven Hazan explained that "direct elections forced candidates to appeal to the undecided voter and move towards the center and as a result the Israeli public moved towards the center. In 2006 Sharon read public opinion polls when he decided to create a centrist party."[43] This analysis places the beginning of movement towards the center long before Kadima's formation and centrist campaign. In their book addressing public opinion on the peace process, Shamir and Shikaki go even further, writing that "the Israeli public moved ahead of its leadership on a crucial policy issue, that of relinquishing Palestinian territories…the willingness evident in public opinion to relinquish Palestinian territories provided an opportunity and impetus for Sharon's dramatic policy reversal."[44] This analysis suggests that public opinion moved first and swayed political action. On the other hand, Meirav Cohen presented the opposite assessment, explaining that "Ariel Sharon really shaped public opinion and not the opposite way around."[45] Cohen's assertion implies that the flow of opinion and political consequence moved in the opposite direction.

Though intricacies of the relationship between public opinion and political campaigns remain unclear, the data does show that the public began to focus less and less on the peace process over the 2003-2013 time period. Why do the data show this pattern of disinterest? It appears to result from intangibility of the negative aspects of the conflict, the disappearance of terrorism, and a sense of powerlessness in effecting change. Journalist Nahum Barnea spoke of a lack of urgency among the Israeli public, a perception that because there is no terror and "the issue is beyond the fence,"[46] it does not present a pressing threat and there is no need to deal with it right away. Strategist Roey Yalin also made this point when he explained that, "Israelis do not see Palestinians. They see them only when they are blowing up and not when they are not blowing up or violent. And if there is quiet who cares. No one sees Palestinians at roadblocks every day. Most of the population lives in Tel Aviv."[47]

Public disinterest is also fueled by a feeling of despair and exhaustion attached to peace efforts. Barnea, an expert on the Israeli political arena and Israeli society, emphasized the despair of the Israeli public, saying that the disillusionment "stems from the fact that for a hundred years this conflict has not been solved but furthermore, that since the Oslo Accords, the efforts to solve the conflict have brought mostly bad news."[48] A 22-year-old Israeli soldier active in political causes voiced the same ennui. She told the author, "We are tired of hearing about this issue. It's all we have been hearing about our whole lives. We want to solve other issues that affect us every day."[49]

Barnea characterized this attitude as "benign neglect," the perception that nothing can be done that will move the issue forward in any case, so there is no added benefit to thinking about it. Reuven Hazan explained that, "Today, two thirds of the electorate was born into the situation of Israeli occupation of the West Bank, and together with the sense of continued failure of negotiations, this creates the cynicism that we see in Israel today… People understand that there is nothing to be done right now about the peace process because there is no one to talk to."[50] The perceived difficulty of reaching an agreement pushes the public towards a mindset of benign neglect. They believe that nothing can be done because they have not seen anything work. They do not see the point in trying to move the process forward.

CONCLUSION

Analysis of public opinion and election campaigns reveals an association between the two and a growing disinterest with the peace process among Israelis during the 2003-2013 time period. In their video "One Wish Jerusalem," artists Joseph Shamash and Jeff Handel went to the marketplace in Jerusalem and asked the marketgoers, religious and secular, Jewish and Arab, young and old, what they would ask for if they had one wish.[51] Overwhelmingly, the Jewish Israelis asked for love, health, money, happiness, even weight loss, whereas the Arabs' wishes were predominantly related to the conflict, whether they wished for peace or for Palestinian victory. This short feel-good video clip captures the essence of the problem. Israeli Jews, though they still believed in a peaceful two-state solution, did not long for it. If they had one wish, it would not be for peace, and this is reflected in Israeli election campaigns. Remedying this distraction or demoralization, whether through leaders who sway public opinion or through a public that chooses the politicians who care about the issue, is a necessary first step towards peace.

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"A LEARNING HEALTHCARE SYSTEM by Vishnu Shankar

PROFESSOR RUSS ALTMAN & PHARMACOGENOMICS
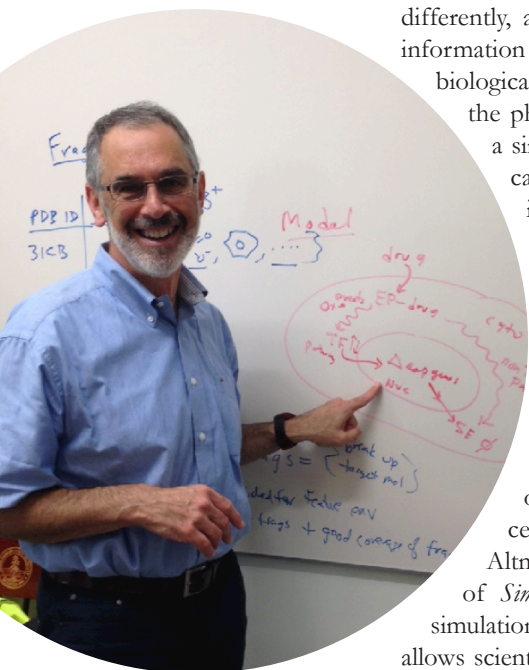
Professor Russ Altman, department chair and professor of Bioengineering, has always worked to harness the power of computing to understand our biological systems. Humans respond to drugs differently, and Altman's team uses our genetic information to understand why. By combining a biological understanding of the proteins with the physical behavior of the molecules in a simulated environment, Altman's team can make critical predictions about individual responses to drugs. Then, they can use this information to design new drugs to target diseases.

Altman has always felt strongly about conducting interdisciplinary research, undertaking numerous initiatives from studying protein structure and function (proteomics), to understanding how differences in our genes change our responses to certain drugs (pharmacogenomics). Altman is also a principal investigator of *Simbios,* an initiative that runs physical simulations of biological systems. *Simbios* allows scientists to understand the dynamics and underlying biological mechanisms for even large atom systems.

Altman's team is trying to answer some of the most fundamental questions in current pharmaceutical industries by studying pharmacogenomics. How do we characterize how good a medicine is? How do we determine which drugs to prescribe an individual? As Altman explained, the genes we inherit from our parents play a crucial role in determining how we respond to various drugs and medications.

Personally tailoring each patient's course of treatment maximizes the efficacy of drugs, leading to higher quality healthcare. Through various computational techniques coupled with biological understanding of genetics and drugs, Altman's team has facilitated personalized treatment by creating the first pharmacogenomics database,

pharmgkb.org. The database provides valuable clinical information allowing physicians to assign a personalized prognosis to an individual's genome.

In one case, Altman's team was studying two widely prescribed drugs: paroxetine, an antidepressant, and pravastatin, a lipid-lowering agent. With collaborators, Altman's team determined that when taken together, paroxetine and pravastatin lead to an increase in blood glucose that is even larger in diabetic patients. By using retrospective computational studies like these to guide clinical understanding, physicians can carefully assign medications that optimize treatment.

Altman is still focused on the last translational component of his pharmacogenomics research. Given the rapid progress of computing since the 1980s, he believes that doctors need to be trained in applying the information gained from computational platforms such as *pharmgkb*.

According to Altman, doctors find incorporating such genetic information in their prognosis to be stressful, given time constraints. The general practitioner has an average of 12 minutes per patient. He hopes to provide a computational platform that doctors can easily use to access clinical information. Ideally, under this "learning healthcare system" a doctor could quickly make a prognosis with an iPad or mobile device, using every patient's medical and gene data to determine the appropriate treatment. Every patient's data could help improve another patient's treatment.

Altman believes that "failures in research should be looked at as a research experience." He hopes one day to use this experience and his bioinformatics models to bring a large scale positive impact to health care industries. His work towards the steady curation of pharmacogenomics data can lead to a system where each patient has a tailored, effective treatment.

> **"I CARE ABOUT COOL COMPUTER PROGRAMS AS MUCH AS I DO ABOUT BIOLOGY."**

engineering

A Supervised Approach to Musical Chord Recognition

Pranav Rajparkur, Brad Girardeau, Takatoki Migimatsu

Stanford University

In this paper, we present a prototype of an online tool for real-time chord recognition, leveraging the capabilities of new web technologies such as the Web Audio API and WebSockets. We use a Hidden Markov Model in conjunction with Gaussian Discriminant Analysis for the classification task. Unlike approaches to collecting data through web-scraping or training on hand-labeled song data, we generate symbolic chord data programmatically. We improve the performance of the system by substituting standard Chroma features with Chroma DCT-Reduced log Pitch (CRP) features, which have greater invariance to non-pitch qualities, to push test accuracy on clean data to 99.2%. We finally propose a set of modifications to have the system predict with speed and accuracy in real-time.

I. INTRODUCTION

There is significant value in an automated tool to determine chords from audio. Knowing the progressions of chords underlying the melodies is an essential part of understanding, playing, and building on the music. To a curious learner of music, such a tool creates the opportunity to play a new pop song without meticulously hand-labelled chord tags. Equally useful to a learner is being able to receive feedback concerning the accuracy with which a chord was played, making such a system a good automated feedback tool, capable of being plugged into an online music course. To a song writer, the system is useful for exploring chords supporting the melodic content of a song.

Furthermore, the use of such a system extends into other machine learning tasks. The tasks of identifying a song from its waveform data, and of classifying its genre can be linked to finding the chord progressions underlying its harmonic content. Hand-labelling chord names and marking chord changes in a song takes significant manual time and effort. An automated tool for this process saves time and allows for the development of new musical tools and research.

There has been progress in chord recognition research, including some real-time systems with promising results [1, 2]. However, these have not leveraged the web to make a chord-recognition system accessible online. We build a real-time online chord recognition system that makes use of modern HTML5 capabilities such as the WebAudio API and WebSockets and detail the offline training strategies and online challenges posed by the novel adaptation.

II. DATA GENERATION

Chord prediction is a multiclass classification task. In music, a chord is a set of notes played simultaneously. We choose to classify the minor and major chords, which are the two most common sets of chords in popular music. Using the traditional twelve pitch scale (C, C#, D, D#, E, F, F#, G, G#, A, A#, B), we have 24 distinct chords.

There are different ways of playing the same chord. The C Major triad, for instance, is the set of three notes C, E, and G played simultaneously. On a piano, these chords can be played on different octaves. For example, C Major in the fourth octave would have the notes C4, E4, and G4. Each chord also has inversions defined by the lowest note of the chord - E4, G4, and C5 make up the first inversion of the same C Major chord, and G4, C5, E5 make up the second inversion.

To train the system, we generate training data programmatically. This has been found to have advantages over hand-labelling song data in its ability to generate sufficient training data [3]. We generate MIDI files for each of the 24 chords, taking into account eight octaves, and three inversion forms, to generate a total of 576 MIDI files. We then use an audio synthesizer "Timidity++" to convert the 576 generated MIDI files, in conjunction with three soundfonts for piano, guitar, and violin, to generate a total of 1728 audio files in WAV format.

In musical chord recognition, feature extraction operates over frames. The generated WAV files, which are an average of four seconds in length, are first split into frames of window size 100ms each, and an n-dimensional feature vector is extracted for each frame. We label each frame with the label of the chord on its corresponding sound file, to generate 69,120 examples. We use 80% of the data as our training set, and 20% as our testing set.

III. PARALELLING SPEECH RECOGNITION

The pipeline of a chord recognition system is similar to that of speech recognition and relies on techniques that were originally applied to speech recognition tasks. The use of Hidden Markov Models (HMMs) [4], and the division of a sound file into frames on which the prediction task is performed, are two such techniques that have been reproduced in identifying chords. An HMM predicts a series of hidden states (not directly observable) from a series of observed data that depend on the states in some

way. In both speech and chord recognition, observed feature vectors from the frames are used to predict the hidden series of states that relate to the chord or word being said. However, the task of finding chords is also different from speech tasks in a few ways, and these differences can be exploited to specialize a system in the task of chord recognition.

3.1 Feature Extraction

One important difference between the two is made apparent in the choice of features for the tasks. Mel-frequency cepstrum coefficients (MFCC) have been the dominant features in speech recognition systems. These represent the short-term power spectrum of a sound. It has been found that MFCCs are closely related to timbre, a characteristic that captures the quality or tone of sound, e.g., the tonal difference between an oboe and a cello. Since they discard the pitch content of the sound, MFCCs have traditionally been seen as poor features for chord recognition, but are useful in setting a baseline benchmark for such a system.

Instead, chroma features are commonly used for chord recognition tasks [2]. Chroma features are a representation in which the entire spectrum of sound frequencies (or pitches) is distributed into 12 bins representing the traditional twelve pitch scale. An advantage of chroma features is that they are invariant to octaves and inversions. We use the Matlab Chroma Toolbox to extract chroma features for the frames [5]. Figure 1 shows the extracted chroma features for the C Major chord. The energy spikes at C, E, and G, the notes constituting the C Major chord, supporting the idea that chroma features encode the harmonic content of a chord.

To test the performance of chroma features against MFCC features, we start with a binary classification problem of distinguishing major chords from minor chords. A Support Vector Machine (SVM) with RBF kernel given by (1) is trained with regularization and kernel parameters $\gamma = 1$ and $C = 100$. An SVM is a classifier that separates data points using the hyperplane that gives the most separation between the two classes, with the kernel controlling the space in which the SVM operates. Table 1 summarizes the results, and confirms that chroma features are much better suited to the task of chord recognition than MFCCs.
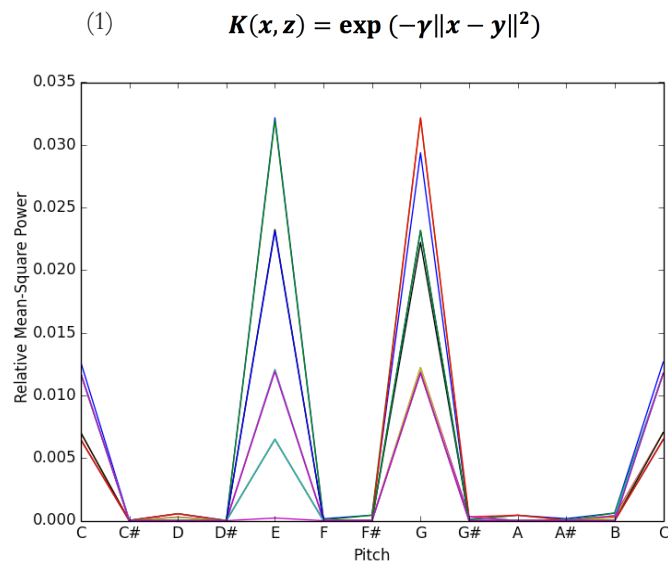
$$(1) \quad K(x, z) = \exp\left(-\gamma \|x - y\|^2\right)$$

Figure 1. Chroma features for C Major in various octaves and inversions.

Features	Test Accuracy
MFCC	51.0%
Chroma	97.7%

Table 1. Accuracies for MFCC and Chroma on the binary classification task of distinguishing between major and minor chords.

Data Set	Accuracy
Training	51.2%
Testing	32.1%

Table 2. Softmax regression frame model train and test set accuracies.

IV. INITIAL MODELS

4.1 Frame Model

With chroma established as good features for the chord recognition task, we can now extend to the multiclass classification problem of determining the exact chord played. We first use multinomial logistic regression (a generalization of logistic regression), also called softmax regression, as our initial frame model. The frame model is responsible for making chord predictions on individual frames. Table 2 shows the accuracies achieved by the softmax classifier on the training and test set.

4.2 Mixer Model

Our frame model outputs a prediction for each frame. Our final classification task, however, is on an audio file, which consists of a sequence of f frames. Let us first make the simplifying assumption that a test sound file consists of a single chord being played.

We now define a mixer model, which is a model for collecting and using the results on individuals frames outputted by the frame model. A simple mixer model, the Middle Frame model, outputs the result for the entire file based on the frame model's output for middle frame in the file. Another simple model, the Max Count model, counts the most frequent prediction made across all of the frames.

Consider another such model that we call the Independence Mixer model, which assumes that the prediction on each frame is independent of the prediction on other frames. The probability that chord y is the single chord played in the file is calculated by considering the probability that y is the chord played at each frame. For a test file X made up of frames $x_1, \dots, x_f$, our predicted output y_p is given by (2).

$$(2) \quad y_p = \text{argmax}_y \, p(y|X) = p(y|x_1, \dots, x_f) = \prod_{i=1}^{f} p(y|x_i)$$

Note that each $p(y|x_i)$ (the probability of a chord y being played given that frame x_i has been observed) is given by our softmax frame model. The accuracies achieved with different mixer models are summarized in Table 3.
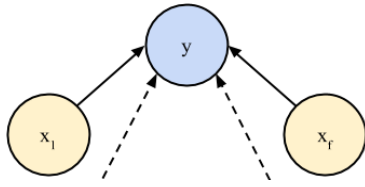
Figure 2. Bayesian network of Independence Mixer model.

Model	Test Accuracy
Middle Frame	6.7%
Max Count	33.3%
Independence Mixer	48.3%

Table 3. Comparisons of accuracies of mixer models with softmax frame model.

V. IMPROVED MODELS

5.1 Improved Frame Model

Softmax regression is a learning algorithm that models $p(y|x)$, the conditional distribution of the chord given the extracted frame features. We now look at a frame model that models $p(x|y)$ and $p(y)$, Gaussian Discriminant Analysis (GDA) [6]. GDA models the chords as normal distributions in the feature space, giving a likelihood that a frame represents each possible chord. We assume all of the normal distributions share the same covariance matrix $x|y = i \sim N(u_i, \Sigma)$. Furthermore, since we aim to make the system independent of any specific genre, we model $p(y) = 1/24$, a model in which all chords are equally likely. Table 4 summarizes the classification accuracies.

5.2 Improved Mixer Model

Earlier, we had imposed the constraint that chords could not change in a WAV file. Our next model allows us to drop that constraint. We now use an HMM to predict the chord sequence in sound files, allowing us to determine chord changes in a file [7].

First we use our GDA frame model to model the emission probabilities $p(x|y)$ for the HMM. While state transitions for the HMMs are usually learned in chord recognition tasks [3], since each genre of music has a different distribution of transitions, assuming uniform state transitions allows us to remain flexible to any genre of music.

Data Set	Accuracy
Training	67.8%
Testing	53.9%

Table 4. GDA frame model train and test set accuracies.
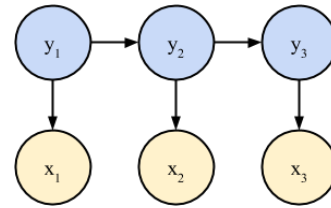

Figure 3. Hidden Markov Model to determine most likely chord state sequences.

We determine the most likely state sequence by Viterbi decoding. Table 5 summarizes the accuracies achieved by the improved mixer model trained and tested on different sets of instruments.

Figure 4 shows the confusion matrix for the Mixer Model trained and tested on generated Piano audio, which shows what the system has misclassified. The most common misclassifications are ones between major chords and the corresponding minor chords. This is explained by the fact that a major and a minor chord of the same key have two out of three notes in common.

VI. IMPROVING FEATURES

Chroma features, in their invariance to octave and inversions, make good features for the chord recognition task. To boost the accuracy further would require features invariant of instruments. CRP (Chroma DCT- Reduced log Pitch) has been recently introduced as a chroma-based audio feature that boosts the degree of timbre invariance [6]. The general idea is to extract chroma features, and then discard timbre-related information similar to that expressed by MFCCs, in effect leaving the information related to pitch. Table 6 summarizes the accuracies achieved by the new CRP features in relation to the chroma features.

VII. LIVE SYSTEM CONSIDERATIONS

Our real-time system makes use of the Web Audio API to capture live audio. Every 800ms, we encode the audio in WAV format, and transfer it to a server using WebSockets. We then extract features for every 100ms frame in the WAV file, and predict the most likely chord sequence in the 800ms using the HMM.

7.1 Handling Noise

A live online system, while pushing the extents of possible uses of the system, presents new challenges for chord recognition.

Training Data	Testing Data	Accuracy
Piano	Piano	97.0%
Piano	Guitar	99.5%
Piano	Violin	72.2%
All	All	90.7%

Table 5. HMM accuracies training and testing on different data sets.
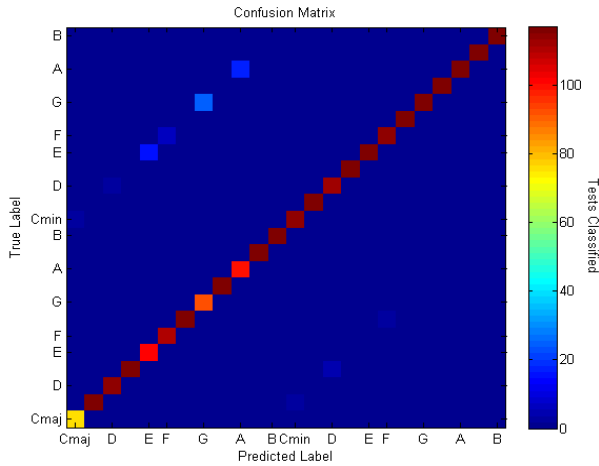
Figure 4. Confusion matrix for HMM training and testing on piano.

Figure 5. CRP vs. Chroma Features for different instruments. Note the invariance of CRP to instruments.

One of the most important considerations for a live system to take into account is noise. It is ideal for a system to not predict any chord in when there are no chords being played.

Once the HMM returns that most likely chord sequence, we are able to determine whether the 800ms segment is a noise or a chord. Using the knowledge that it usually takes a few seconds before chords change, we can then post-process the output by looking at the number of times chord changes were predicted by the HMM in the 800ms segment. If any chord lasts for more than 400ms in the prediction, then we output the chord as our prediction for the 800ms segment. Otherwise, we understand that segment of sound as consisting of noise.

800ms was found to be the optimal time interval over which to process the audio. Increasing the interval for collecting the recording from 800ms was found to create a noticeable delay in the live system. On the other hand, reducing the window time not only decreased accuracy, but also made it harder to distinguish between noise and chords.

VIII. CONCLUSION

In this paper, we present an implementation of an online, real-time chord recognition system using modern web technologies. We show the effectiveness of Hidden Markov Models with Gaussian emissions in classifying chords. Furthermore, we show how timbre-invariant CRP features can improve robustness compared to chroma. Finally, we detail a strategy for noise detec-

tion to create an effective live recognition system.

With this system, we improve the feasibility of live automatic chord recognition, and pave the way for making this technology more accessible to the public.

Real-time chord recognition can play a key role in online music education. It could help beginners learn to play guitar by giving live feedback or be used for live song analysis by musicians and composers. Chords form the basic structure of music, so allowing computers to understand this basic structure enables a wealth of opportunities. An accessible real-time chord recognition system promotes musical engagement, powering computer music applications of the future.

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Training Data	Testing Data	Accuracy
Piano	Piano	98.7%
Piano	Guitar	99.96%
Piano	Violin	98.5%
All	All	99.2%

Table 6. New scores after replacing Chroma with CRP.

Pranav Rajpurkar is a senior majoring in Computer Science. He enjoys working on problems that he personally faces, creating technological tools that address them, and deploying them for those in need of a similar solution. His undergraduate honors research, at the intersection of Human-Computer Interaction and Artificial Intelligence, explores how crowdsourcing can be leveraged to build neural networks for reliable autonomous driving.
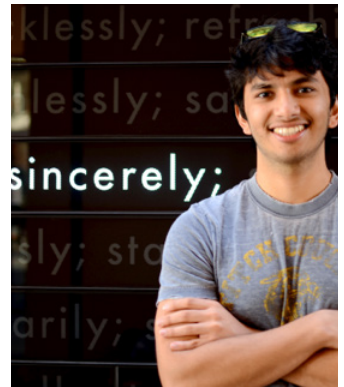
Brad Girardeau is a junior and coterm student in Computer Science. He is interested in computer security and theory and enjoys working at the intersection of math and computer science. He has participated in research to enable practical cryptographic private information retrieval, and he plays violin in the Stanford Symphony Orchestra.

Toki Migimatsu is a junior majoring in Computer Science with a focus in AI. Ever since travelling to Japan in high school to conduct research in robotics and AI, his dream has been to pursue AI research in graduate school. Since the fall, Toki has been involved with Andrew Ng's research group in autonomous driving, and this summer, he will do a CURIS internship with Oussama Khatib on the neural processes underlying human motor control.

"IT STARTS WITH THE SOUND by Shu Chen

SARAH MCCARTHY & MUSIC IN CONTEXT

Sarah McCarthy began her journey to ethnomusicology on an unexpected note: aeronautical engineering. For the first few years of college, Sarah focused her time on science and engineering classes. While she found them interesting, she was often frustrated. No matter how much time she put into the classes, she couldn't form a personal connection to the subject matter. After drifting through her engineering major, she stumbled on a subject that she was deeply drawn to: "Electrical engineering was okay, but I wasn't excited about it. Music, on the other hand, was this whole other world with people in it."

It's the human side of music that drew her to the research she does today. Sarah is in her third year of her ethnomusicology PhD studies, and the question of how music affects people dominates her methodology. Ethnomusicology as a subject focused on putting music in its cultural context. Rather than being an isolated act of creativity, music serves as a snapshot of complex social factors and identity. Sarah has had opportunities to work with people and learn about their cultures through the music they create: "I love interacting with people and understanding why they make the music that they do, to write about human history." She sees the creation and experience of music as integral to understanding a given group of people.

Although she currently studies questions of authenticity and identity in the music of the Pacific Islands, her passion for this research began with the tango. By listening to this music, she gained a better understanding of the immense cultural factors that contributed to its making. Rather than tackling the questions of identity from the human perspective, she starts with the music itself: "It starts with the sound — how it's made and why it's made this way. In tango alone you can hear many different parts from different areas of the world." Then, she moves to the context: "I like to get a grasp of the literature surrounding the music, and then I get to know people from the culture and build connections with

them." Sarah's love for human culture drives her identity. While her research focuses on the music of specific communities, she is passionate about all of its genres and how they affect people.

> **"I FIND ALL MUSIC AND HISTORIES INTERESTING, AND I LOVE EXPLORING WHY PEOPLE WRITE MUSIC AND DO THINGS A CERTAIN WAY."**

Sarah's ultimate goal is to use her research for teaching. "As long as I'm teaching, I'm happy... I love the feeling of seeing someone understand something." She wants to use her research to form connections with people and help them gain further insight into how they, as part of a wider community, form their identities through music. Though her research starts with a sound, it is firmly rooted in the people.

humanities

On the Line: The Potential of the Online Musical

Mirae Lee

Stanford University

The "online musical": a genre at the crossroads between two mediums, the Internet and traditional theater, weds the two unlike any genre has before. With a reach and global capacity that goes beyond the limits of homogenous Broadway-attendee demographics, the online musical harnesses the democratizing possibilities of the Internet, while sharing the making and the consuming of the theater arts. Epitomizing this genre is director Joss Whedon's niche 2008 success, Doctor Horrible's Sing A-Long-Blog, a 43-minute musical about a lovelorn scientist antihero published on the Net, for the Net. With a case study of this work, accompanied by studies of other generative and recent examples, this paper will explore the capacities of the online musical genre, and its implications it has for the art of theatrical storytelling itself.

On October 29, 2008, Time magazine published a list of the "Best Inventions of 2008," a list of 50 of the most innovative, game-changing products and ideas with promising implications for the future. Among such contenders as "moving skyscrapers" and "invisibility cloaks," an unlikely candidate stood, ranking 15 on the list: an online musical. Specifically, this notable production was Doctor Horrible's Sing-A-Long-Blog, a "43-min., three-part online supervillain musical" developed by director Joss Whedon.[1] Many might question whether such an apparently niche product can stand its ground among the year's best inventions. Nevertheless, the reach and effect of the online musical on the storytelling tradition itself clarifies the right of Dr. Horrible, and the online musical itself, to such a laurel. At the heart of the argument for the value of the online musical as an outstanding invention lies its innovation. The most striking innovation of the online musical lies in its bridging of two mediums: the unconventional Internet, and the more traditional medium of musical theater. The online musical, through this synergistic approach to the traditional American musical, brings to it a newfound sense of democracy. This medium democratizes theatrical storytelling by making musicals more accessible on two levels, production and consumption of stories, which leads to democracy in aesthetic as well in affordability. The power behind this democratic innovation is that the "online musical" is truly both "online" and a "musical"—both accessible and beautiful—which is what gives it the potential to be a game-changer in both of its mother communities.

While Doctor Horrible is the online musical that often occupies the limelight of such publications as that of the above-mentioned Time article, it is important to analyze the other iterations of online musicals of the past and present in order to gain a greater understanding of what the online musical can be and what it achieves. Other online musicals that I will be touching upon include Doctor Horrible's major predecessor, the online "hip-hopera," Trapped in the Closet, distributed by the popular rapper, R. Kelly.[2] This production, while not quite an online musical, certainly established awareness in both niche and popular interest circles—as shown in the series' surprising economic success—of online musicals. This "hip-hopera" will provide some context on the development of the medium, and will inform the following discussion, a case study of the quintessential online musical, Doctor Horrible. Finally, I will examine a present case of an online musical, embodied in the YouTube channel, AVbyte, which is in the business of producing a quality "series of two-minute musicals" every week. This case study is particularly exciting because it embodies both a continuation of the musical theater tradition, with its "Old Hollywood-style melodies" and the classical music training of the channel's producers and an embracing of the modern-day online phenomenon, by basing their endeavors on YouTube, and reaching people, who like themselves, do not necessarily identify themselves as "musical theater people."[3]

OUT OF THE CLOSET AND ONTO THE STAGE

The development and history of the online musical as a genre began in 2007, with the publication of R.Kelly's unclassifiable Trapped in the Closet, a series of 33 videos "starring a Beretta-toting hero, a gay pastor and two unfaithful women." With a broad target audience ranging from avid rap/R&B listeners to soap-opera-watching types, this series of approximately 3-minute videos confused, yet enraptured, critics and audience alike. The series was a huge economic success, hitting the high half of Billboard sales charts at the time of its production. But while it was successfully aimed towards a popular audience, what the producers of Trapped in the Closet did not expect was the huge faction of fans and viewers that arose from the Internet community. The videos, when posted online via YouTube, quickly became viral, leading to a current view count of over 9 million views for the first "chapter."

What is most stunning about Trapped in the Closet was this ability to reach a new base of fans previously untouched by the musical genre—a generation of people raised on R&B and rap, and get them excited about what was really a quasi-musical. Trapped in the Closet's connection to the traditional musical was further verified when in 2012, R. Kelly announced that he was working on a Broadway adaptation.[4] While this production never did come to fruition, the excitement that spread as a result of this announcement supports the idea that this "hip-hopera" posted online had a democratizing effect on the culture of the musical—people were surprised, but supportive of the idea of the "hip-hopera" coming to Broadway, as represented by commenter "james312" on a Guardian article announcing plans for Broadway, "That would be amazing and of course it would be INSANE! Just what Broadway needs something a little of the wall [sic]."[4] This support speaks to a newfound brand of aesthetic democracy which provides a platform on which the story of Trapped in the Closet can be told—a story on which an audience that was raised on My Fair Lady and Singin' In the Rain might not have been so keen, but perhaps one raised on online musicals can embrace.

> **What is most stunning about _Trapped in the Closet_ was this ability to reach a new base of fans previously untouched by the musical genre—a generation of people raised on R&B and rap.**

Perhaps it might take something as foreign and innovative as a "hip-hopera" to add a splash of color to a greying stage. While Trapped in the Closet was not necessarily an online musical, having been initially published through traditional means, such as CD and DVD sales, and only made popular through Internet posting, it was one of the building blocks towards a culture that would support true online musicals, like Doctor Horrible.

HORRIBLY INNOVATIVE

One year after Trapped in the Closet debuted and introduced the concept of online, music-based storytelling, a Hollywood director stepped up to the challenge of championing the online musical. The director? Joss Whedon, of Buffy the Vampire Slayer, Firefly, and now Marvel's Avengers fame. Whedon entered the world of the Internet armed with what is arguably the quintessential online musical: Doctor Horrible's Sing-A-Long-Blog, a musical about a lovelorn super-villain anti-hero who just wants to defeat his macho-man arch-nemesis, get the girl, and take over the world—all to the beats of some catchy tunes. This is not to say, however, that other Hollywood studios had not attempted to break into the Internet, catching the scent of a lucrative new frontier just as Whedon had. Prior to Doctor Horrible, "high profile names" in the studio industry such as Sony, Disney, Warner Bros., and even MySpace, had been trying to break into the internet culture for years through such efforts as web-series and online short films, but had failed in catching anyone's attention, a fact which is echoed in the fact that very few of these efforts are remembered today.[5]

So what made Doctor Horrible different? What did Whedon have in his personal formula that beat out all the other studios attempting to find success telling stories on the Internet? The answer lies in the medium itself. What makes Doctor Horrible not only one of the most iconic online musicals, but also one of the first major breakthroughs in online storytelling is that it chooses to embrace the nature of the Internet, which can be summed up as weird and innovative. The Internet is the birthplace of both email and a picture-editing trend that likes to put Nicolas Cage's face on everything.

Doctor Horrible matches this "Internet flavor" very well, filling the minutes (the whole piece is only about 45 minutes long) with tongue-in-cheek jokes featuring spontaneous music numbers, phallic imagery, painfully awkward moments, and puns. The online musical even not-so-subtly alludes to its place in the scheme of the Internet through its title, Doctor Horrible's Sing-A-Long-Blog…a blog. Whedon himself has the Internet streaming through his veins, expressed by the fact that the announcement of his project took shape as a comment on his fanbase's website, and was full of such Internet tomfoolery from using "Forest King" metaphors to describe Hollywood politics to prefacing the blog post with whimsical instructions and cautions for "safe reading."[6] Dr. Horrible is obviously not everyone's cup of tea, but very much something that appeals to the generally younger, more sarcastic Internet audience. Meanwhile, Doctor Horrible is also, as Time Magazine suggested, an "invention." It is a musical born and belonging online, and the grass-roots approach to its production was unlike traditional means that require extensive funds and personnel. As Joss Whedon said himself, "The idea was…to turn out a really thrilling, professionalish piece of entertainment specifically for the Internet. To show how much could be done with very little."[6] This idea of doing a lot with a little is what big studios such as Disney and Warner Bros. could not comprehend, and it is what has made Dr. Horrible the innovative piece it is famed to be.

But adding to the importance of the show's embracing its "online" identity, Doctor Horrible would not have been nearly as successful if it had not embraced just as equally its identity as a musical, and Whedon made sure to pay equal amounts of attention to his musical-loving audience in both his publicity and his content. In the same post in which Whedon announced his plans to produce Doctor Horrible, he very crucially mentioned what audiences he had in mind for the production: all audiences. The show would be "good for the community—communitIES: Hollywood, Internet, artists around the world, comic-book fans, musical fans"[6] which speaks to how important it was that this production did not target merely a small, niche, cult following, but rather a larger community of storytellers and people who enjoy stories. Whedon takes specific interest in appealing to musical fans, making small references here and there in his announcement post. Such references include a sly allusion to The Phantom, the anti-hero of a beloved Broadway musical. Within the production itself, Whedon displays a dedication to making good theater despite the decreased opportunity for spectacle that comes with transitioning from the grand stage to a small computer screen. His target audience was an unlikely

45

one, an innovative amalgam of different fandoms that would normally never be seen together. Whedon made sure to set a standard of quality for the music and performance involved; for the main roles, he cast Broadway actor Neil Patrick Harris as his lead and Nathan Fillion and Felicia Day (both actors he had worked with previously and who had proven their talent starring in shows such as Firefly and Buffy the Vampire Slayer) as the co-stars, thus securing a good amount of performance quality. Doctor Horrible may even see itself on the stage, since, after the successful online production created fans worldwide, earned millions of views, and sold thousands of copies of both the DVD and soundtrack, Whedon claimed that Doctor Horrible may one day have a Broadway musical of its own. In fact, the show has already acquired its own paratexts that are original musicals in their own right, such as the equally-innovative, commentary-reel-turned-independent-musical, Commentary![7] With sensitivity to both its online identity and its identity as a musical, Doctor Horrible's Sing-A-Long Blog is the perfect case study for what an online musical is, and what it can be.

HORRIBLY DEMOCRATIC

Of all of the auspicious qualities of the online musical in both its present and future iterations the most promising is its democracy. With all of its glamour and glitz, the traditional Broadway musical has a weakness that is rarely discussed: its lack of diversity. This single shortcoming can be said to affect several aspects of Broadway, manifesting itself in homogenous audiences, donor pools, and stories/subject matter of the productions themselves. Largely, this lack of diversity in traditional musical theater stems from the fact that theater is expensive—expensive to make, expensive to see, expensive to get interested in.

Ticket prices reach record highs nearly every year, with the average Broadway musical show in the 2012/13 season reaching an unreasonable $102.45.[8] The average theatergoer in the same year was a 42.5 year-old Caucasian woman who saw four shows in the last year, a hobby supported by an annual average household income of $186,500. This is the kind of person who makes up a Broadway audience, but there are very few people like her in the population, nor are there many people with the same experiences or stories as this average theatergoer. The typical Broadway audience appears to be a specific and economically exclusive one, especially what with the startling fact that at the very top of the frequently-attending audience members is the 5% of the audience that attends 15+ performances annually, and account for a huge 31% of the tickets.[9] It is obvious that if the American musical is to survive, it must be more sustainable than it is today. One significant way that it can accomplish its own salvation is diversification of theater viewers and makers. Diversification of audience and production leads to audience in stories being asked for and stories being told, which will create a greater interest in musicals among people who may feel alienated by the startlingly wealthy All-American-ness that is often displayed onstage. Essentially, this is a call to democratize theater, which is exactly what the online musical specializes in doing.

When Whedon related his ideal for the reach of Doctor Horrible, it very much reflected the Internet's democratizing ideals, as well as resulted in a statement that could prove to be a mantra for all online musicals to come. "It's time for the dissemination of the artistic process.

$102.45

the average ticket price for a musical show in the 2012-2013 season

The average **42.5** year-old Caucasian woman

She saw **4** shows

Her average annual household income was **$186,500**

Most frequent attendees see **15+** performances each year

They account for **5%** of the total audience & **31%** of the tickets sold.

Create more for less…You [the viewer] are the ones that can make that happen."[6] The inspiration behind this "a lot with a little" mentality was the lovechild of 2007's Writer's-Guild-Strike-induced-studio-hiatus and Whedon's own boredom-inspired ingenuity, and it screams of democratization of the production process. The online musical is dynamically democratic at two levels—production and consumption—and brings that democracy to the traditional musical itself. The first level lies at the level of production. While it is true that he has connections to talent and has the ability to self-fund, when he put on Doctor Horrible, Whedon pioneered the idea that anyone could make musical theater. One no longer needed a studio, nor a huge production crew to make a hit show. During the filming of Doctor Horrible, there were scenes where lighting consisted of "a guy with a flashlight" and sound consisted of "someone with a boom box,"[7] and with private-use recording and editing technology becoming more and more sophisticated, it becomes infinitely easier to emulate this "big show" effect with a low budget. Whedon, with Dr. Horrible certainly found a way to get around traditional production means, and managed to attract an unconventional, diverse audience hailing from, as Whedon

HUMANITIES

hoped, multiple "communities." This truly was democratizing theater.

Unfortunately, the Internet is oft misrepresented in society as an engine for unnecessary, inferior products. The Internet and its sites gathered a reputation so bad that it became a regular convention of people to express how extremely amateur they deemed a video by correlating it with the "'home video on YouTube' sense of amateur."[10] Nevertheless, in the past ten years, the Internet has developed startlingly quickly, and gained surprising amounts of prestige, what with the parallel development of other innovative ideas, such as the MOOC (Massive Open Online Courses). On the web, people have the opportunity to communicate and to consume each other's work across the globe, and to hear stories that they never would have come across in their own socio-geographical surroundings, all for free as long as one has an Internet connection. The Internet has come to the point where it has earned potential of being a platform for social impact—a potential that the online musicalcapitalizes on.

A BYTE OF THE FUTURE

We are now beyond 2007, and Doctor Horrible's Sing-A-Long Blog has come and gone. What is next? There is no better group to carry on the legacy of the online musical than burgeoning YouTube channel AVbyte. AVbyte, composed of two musically-inclined brothers, Antonius Nazareth and Viljay Nazareth, aged 20 and 23, respectively. The purpose behind these brothers' inspired channel is singular—to produce an original 2-3-minute musical every week. Joining YouTube in 2011, this dynamic duo's channel has since accumulated 738,888 subscribers and over 187 million views, and is among the top 600 most popular Youtube channels today. While they are not nearly as well-funded as Joss Whedon was, AVbyte still manages to produce "high-quality visuals," speaking to the democratizing effect that the online musical as a medium has on people who want to pursue an artistic vision, but who do not meet the massive production resource requirements to do so. AVbyte pursued their own visions with reasonable resources, and casts made up of their university friends from NYU, which Antonius Nazareth in fact dropped out of in order "to live the YouTube dream."[3] This decision of course, is a curious one, because it suggests that there is a YouTube dream to be lived. What AVbyte and their work has proven is that we and the Internet may have moved past the days when claiming a video as "YouTube-quality" is no longer an insult but at the very least a neutral statement, because these brothers are now living entirely off of their earnings from YouTube views and subscriptions, winning contests such as the "YouTube NextUp, a prestigious development program for thirty channels that the company believes will have big futures,"[3] and gaining popular acclaim. With all of this going for them, they definitely appear to be living some sort of dream or to be experiencing some sort of stardom.

What is most touching about this scenario is that AVbyte has found its success through its involvement in both the musical theater tradition and the incredibly supportive online community. The result is a combination of two (or more) fan groups, or as Joss Whedon called them, "communities." A lot of the power of combining musicals and the Internet lies in the fact that both cultures rely heavily on a tradition of fan-hood. Musicals are sustained by long runs of returning fans, and by that 5% of people who attend more than 15 shows a year, while the Internet is sustained by the surfers who generate, comment on, share, and like content, and share what they find and love with each other. In this shared dependence on fan culture, the two communities are not very different, but rather share a fascinating, obsessive quality. If more content like AVbyte's work is generated that combines these two mediums of the musical and the Internet, there is a huge chance that both communities will benefit.

AVbyte's subject material itself subscribes to this online-musical mantra of hybridization, as it relies on satire, parody, and popular culture for content, but delivers "musicals featuring Old Hollywood-style melodies."[3] The brothers reflect today's youth generation, having "[grown] up watching Gene Kelly movies…but never [thinking] about musical theater as being contemporary"[3] and, true to the inventive style of the online musical, the duo addresses this lack of relevance by putting it into a dynamic medium with which this generation is familiar—the short, witty YouTube video.

Meanwhile, as the younger generations crowd around computer screens, Broadway's audience is slowly dwindling.[12] As the regulars get older and more exclusive, the traditional musical needs a new way to find fresh clientele, and one that is more economically diverse in order to be sustainable. Perhaps as the online musical gets new populations interested in musical theater, populations that normally would have been unable to access theater economically or culturally, will find their way to theater, and add to a new, more diverse and sustainable audience. Maybe this way, American musical theater could rise as a major source of relevant culture, unlike the dinosaur that the AVbyte brothers first thought was embodied in the Gene Kelly movies. Meanwhile, the tradition of American musical theater informs the production and development of the online musical, much as Gene Kelly's did for the AVbyte brothers, who took those "Old Hollywood" styles, updated them, and ran with them.

CONCLUSION

If it does nothing else, what the online musical does for the world of traditional theater is remind theater of its own nature. Theater has always embraced the new, the shocking, the spectacular, and the talented. At the core of it all, musical theater is about telling a good story through the bodies and the voices of people. The Internet is a place where people do just that, tell a story, and it does it in new, shocking, spectacular, and talented ways, only now it is more widely available through the democratizing effects of

> "As the regulars get older and more exclusive, the traditional musical needs a new way to find fresh clientele, and one that is more economically diverse in order to be sustainable."

the Web. It is only a matter of time until people begin to realize the potential of this new medium, and create stories of their own. At this point, it is no longer a matter of whether or not we should use this medium, but how we should do it, and how we can do the most with the resources we have, to tell the best story we can because in the end, that's what musical theater is all about: people telling stories. Only now, there are more stories that can be heard.

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The Tiresian Position

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As embodied subjects, as proprioceiving products of a discourse informed by heteronormative hegemony, transsexuals have much cause for anxiety. Where the discourse that constitutes them fails and refuses to comply with the bodies it creates and insists upon a dualistic indictment of their well-being, transsexuals, the medico-legal realm, and society at large remain at risk of succumbing to a centuries-old understanding of who and what persons are. This work attempts to demonstrate and defend both the livability and validity of the Tiresian position. It supports the notion that a subject can exist a subjectivity between male and female by arguing that subjects are neither essentially gendered nor sexed, that body image better explains bodily alienation than does the dualistic wrong-body phenomenon, and that heteronormative discourse is the culprit responsible for transsexuals' discomfort and current situation in the clinical realm.

Though it is sometimes referred to as a new frontier of Queer Theory, the concept of transsexuality is not entirely new. From Greek mythology, Tiresias was the blind prophet of Thebes famous for having been turned into a woman for seven years by the goddess Hera. The Tiresian position—the name that gender theorist Elizabeth Grosz gives to lived experience situated somewhere between male and female—is viewed by some current medico-legal models and some gender theorists as an invalid and phenomenologically unlivable position. Due to current standards, governed by models and manuals of wellness[1], a shared narrative has developed around transsexuals to meet the expectations of sex-reassignment preoperative processes. This narrative commonly involves what clinicians have named the "wrong-body phenomenon" whereby transsexuals report discomfort with their bodies based on a mismatch between the sex of their body and who they are 'inside.' Such a notion is strikingly similar to Cartesian Dualism—the conception of a separate body and soul that underlies essentialized notions of body, sex, and gender and that perpetuates interpretations of transsexuals as dysfunctional or aberrant. Current standards seem to interpret the wrong-body phenomenon as experienced by a person of a gendered identity 'in' a body of the opposite sex; it is taken by those standards to be a genuine dysfunction, seemingly due to their failure to consider the livability of the Tiresian position. This failure warrants philosophical investigation in a culture where the medical field promises to relegate transsexuals to pathology, the legal realm threatens to erase their narratives, and society tends to persecute them. I wish to suggest that subjects can live between male and female without dysfunction and that the nature of body image better explains transsexuals' reports of discomfort. By normalizing the bodily alienation that founds the wrong-body phenomenon, I further wish to suggest that transsexuals are not dysfunctional and that their lived experience of the Tiresian position is valid. In what follows, I will attempt to demonstrate and defend the livability and validity of the Tiresian position by considering an etiology of embodied subjects and body image, locating the source of tension at the site of the body image, and suggesting two ways that discourse might validate and accommodate the lived experience of transsexuals: by changing who participates in the discourse and in what capacity, and by proliferating gender beyond its morphological fetters.

THE 'I' FACTORY

In what does an embodied subject subsist and how does it come about? What is this phenomenon of gender observed at work in and upon subjects, their bodies, and their identities? Most importantly, what insights can be gleaned from the nature and origin of subjects and which assumptions can then be refuted? In this section, I will argue that the dualistic conception of

Figure 1. Tiresias, blind prophet of Thebes and priest of Zeus, came upon two snakes in the act of coupling and struck them with his staff, killing the female of the pair. He was transformed into a woman thence by the goddess Hera. Tiresias became a man once more upon striking another pair of snakes seven years later, killing the male. Tiresias went on to settle disputes between gods about love and sex, for he had lived as both man and woman.

subjects, which seems to underlie clinical accounts of the wrong-body phenomenon, fails to take their phenomenological nature and discursive origin into account. I will consider the following accounts of gender, body, and identity to refute the essentialized notions of each that dualism depends upon to perpetuate theories that transsexuals are dysfunctional and their lived experiences invalid.

Queer theorist Judith Butler exposes gender in its ontological fragility as an enculturated program of acts. Her most succinct definition of gender names it "an identity tenuously constituted in time—an identity instituted through a stylized repetition of acts… the mundane way in which bodily gestures constitute the illusion of an abiding gendered self."[2] Butler likens gender to a dramatic script in that it "survives the particular actor who makes use of it."[3] In its dramatic nature, gender is performative, where 'performative' "carries the double-meaning of 'dramatic' and 'non-referential';"[4] that is to say that "there is nothing about femaleness [or maleness] that is waiting to be expressed."[5] This distinction between expression and performativity is crucial, Butler notes; for, "if gender attributes and acts are performative, then… the postulation of a true gender identity would be revealed as a regulatory fiction," rather than an essential characteristic of subjects as it is often conceived upon common, dualistic conceptions.[6] Butler's profile of gender continues unto a re-conception of the gendered body itself as "the legacy of sedimented acts rather than a predetermined or foreclosed structure."[7] Butler's phenomenological rendering of gender as a performative social phenomenon serves to dismantle certain aspects of common conceptions that theorize subjects as necessarily or essentially gendered at some interior and unreachable level.

Gender theorist Gayle Salamon takes up Butler's discussion of gendered subjects to demonstrate another aspect of subjects— their bodies or, rather, that they are necessarily embodied—citing Butler's note that the emergence of a body and one's assumption of it are, "phenomenologically speaking, simultaneous."[8] Salamon explains of bodily assumption that "the body as it exists for me, the corpse propre only comes to be once the 'literal body' assumes meaning through image, posture, and touch."[9] That the body only exists for a subject upon its assumption of meaning challenges understandings of the body as a vessel that awaits our mastery over it, as essential materiality that will foster a similar proprioceived experience for each subject. Salamon also asserts that "the body itself… is only given, only accessible through a mediating psychic structure."[10] This is not to say that the body would indeed be a body independent of a subject's mediation, but rather that a body only becomes so through such mediation; it is only in its assumption by a simultaneously emerging subject that a body becomes a body as we understand and live it.

Salamon does not attempt to deny the materiality of the body. Instead, she affirms Butler's claim that "the undeniability of these 'materialities' in no way implies what it means to affirm them," where to affirm the body is to assume it, to proprioceive[11] it, to assign it meaning. Butler argues that "we must affirm this materiality [as] a fundamental condition of subjectivity."[12] Salamon summarizes the body's relationship to (and genesis in) the world, naming the body "the vehicle through which [one is] compelled into relation with the world, where it is finally only that relation that gives [one] a body."[13] Bodies are not strictly inherited, according to these accounts, and their assumption is an accumulative task, an accomplishment of sorts, in much the same way that a subject must develop and exercise its capacities to crawl, toddle, and walk before it can run. Salamon appreciates Foucault's description of the body as "a social construct masquerading as a natural entity."[14] It is this 'natural entity' that is thought, on dualistic conceptions, to have essential and determining ontological sway over subjects and that is hereby undone. If bodily assumption is a task accomplished by each individual subject, the ontological dicta of its materiality— especially genital morphologies, where sex is theorized—are weakened unto incoherence and cannot be understood to compel any character, behavior, or desire upon a subject's core identity, if it exists at all.

In an overview text, Mimi Marinucci says of subjectivation that it is "the very real impact of social phenomena on physical bodies," and says that "bodies themselves are moulded by the social environment from which they emerge."[15] Through his studies of discourse and its powers of constitution, Foucault describes a process known as 'subjectivation' or, more plainly, the production of an 'I.'[16] If one accepts Foucault's terms and respective conclusions, then it is clear that one is "always-already trapped" by the influence of discourse, being constituted thereby.[17] Salamon attests to the encompassing nature of language and cites Butler in her work within this Foucauldian framework: "to posit a materiality outside of language… is to undermine the possibility that language might be able to indicate or correspond to that domain of radical alterity."[18] Butler's claim here can be made simpler; she asserts that there is no thing or tenable position outside or beyond discourse for the purposes of subjects. Just as the body of Salamon's subject does not pre-exist her affirmation and assumption of it, Butler claims that "neither do embodied selves pre-exist… cultural conventions."[19]

Butler argues elsewhere that, "if we accept the body as a cultural situation, then the notion of a natural body and, indeed, a natural 'sex' seems increasingly suspect."[20] Keeping with Merleau-Ponty's naming the body "an 'historical idea' rather than 'a natural species'," Butler demonstrates that the body is something one does and does stylistically.[21] She also demonstrates that this stylistic doing that is gender "not only [constitutes] the identity of the actor, but [constitutes] that identity as a compelling illusion, an object of belief."[22] Further into her investigation, Butler argues that, because gender is performative, there is no pre-existing, core identity.[23] In Butler's work with the phenomenological theory of acts, gender is shown to be merely a performative mode of embodiment that "is not

> ❝ **The dualistic conception of subjects, which seems to underlie clinical accounts of the wrong-body phenomenon, fails to take their phenomenological nature and discursive origin into account.** ❞

contrasted with the real, but constitutes a reality," the subject itself, the 'I.'[24] Butler negatively defines the 'I', noting that it is not a locus of "disembodied agency preceding and directing the embodied exterior."[25] Neither is it the Cartesian (and popularly Judeo/Christian) soul, nor the Freudian ego, nor an unrealized realizer; it is not an essentialized entity by any means, let alone a gendered entity. It is, rather, an act of embodying, a doing of one's body where gender is just one mode of so doing. Butler tells us "the authors of gender become entranced by their own fictions whereby the construction compels one's belief in its necessity and naturalness."[26] Here enters the concept of a 'necessary fiction'—our reliance upon the belief that we exist as persons with core identities. This 'necessary fiction' is naught but the conglomerate "reifications that tacitly serve as substantial gender cores of identities."[27]

These theorists' conclusions about embodied subjectivity encourage the abandonment of dualistic understandings of subjects, as they make explicit that the subject is neither separately her body nor her mind, but distinctly and simultaneously both. Their findings also discourage the view that observable gender emanates from one of only two interior, non-negotiable monoliths. Gender is shown to be a performance assumed by a subject rather than a force spilling outward through a subject. It knows no origin in either body or mind distinctly and therefore merits no place as the ontological directive is has traditionally held. Though a subject is neither her body nor her mind, but rather an affirming and proprioceiving amalgamation of both, the question remains of the wrong-body phenomenon. How is it that two entities, neither of which house gender distinctly—traditionally and popularly conceived as separate, yet shown here to be the same product of discourse—can be at such odds as to cause dysphoria, depression, and the host of other dysfunctions associated with transsexuals? If neither of these 'entities' dictates their own becoming in accordance with some interior essence, whence comes the internal conflict purported by so many transsexuals and sought by clinicians as evidence of their dysfunction? Furthermore, why must the current standards pathologize those who purport to exist in a position in between the masculine and feminine genders?

AN UNNECESSARY FICTION

As edifying as are Butler's and Salamon's theories of gender, bodies, and selves, the question of the wrong-body phenomenon remains at large. I conclude from their genealogies of subjects that there is no account of a 'right' body; significantly more perplexing, then, is the notion of a 'wrong' body. As psychoanalysis has postulated and neuroscience still investigates, there is for the embodied subject a concept of the material body that lacks matter whatsoever. This conception is referred to as body image; it is what gender theorist Henry Rubin calls a 'psychical representation' of the body as it is for a subject.[28] By considering the following theories on body image, what it does, and how it is formed, bodily alienation—a trademark of the clinicalized transsexual—is shown to be indeed the norm and a necessary condition of embodied subjectivity. I suggest that it is also the means by which one comes to exist in the Tiresian position. I attempt in this section to normalize bodily alienation by arguing that, because the body image does not track the external contours of the body exactly, all subjects reside at

one point or another upon a continuum of bodily alienation as a condition of embodiment. Moreover, I attempt to locate the source of transsexuals' discomfort in the situation of body image as it is informed both subjectively and by the world.

Rubin's theory of body image picks up where Salamon's work on the body leaves off. Before any attempt to positively define body image, let us consider Sartre's three-level model of bodily ontology from which it comes. Rubin cites Sartre as follows:

> *"The first level of bodily ontology as the body-for-itself: the body as point of view, as it is lived for the I that exists it… [this] body is an absolute point of view… This body is lived, not known… The second level of bodily ontology is the body-for-others. This is the body as object, the body that is touched… an instrument for others. This is the body as flesh, as corporeal reality… The third body is the alienated body. This is when the I is coerced into taking the viewpoint of the Other on its own body, when the body as a point of view is grasped as a second-level body, as the body-for-others." [29]*

Sartre's phenomenological conception of the body makes way for the following accounts of what body image is and how it comes about for subjects. Salamon defines body image as "a 'mental image' that is both representative and constitutive of the self."[30] She clarifies that "the function of the body image shows us that the proximity between our bodies and the world can be closer than the distance between the materiality of our bodies and our grasping of that body."[31] As part of an overarching project, Salamon hereby complicates the assumption that "the materiality of the body is something to which we have unmediated access, something of which we can have epistemological certainty."[32] Moreover, Rubin says of the body image that it "need not correspond directly with the physical body," and that it is "often configured differently from the corporeal body."[33] While Salamon's worldly genealogy of the body image is sound, it is incomplete according to the theories on which it stands. Salamon cites Schilder's claim that "body image cannot be construed as an entirely voluntaristic project," leaving open the possibility that it is, however, somewhat voluntaristic.[34] Rubin likewise suggests that body image is 'subjectively informed.'[35] One's body image is informed by both relation with the world and the subject herself; tension exists here between the competing sources of information and influence upon the body image. Equipped with this understanding of body image—that it is available only through psychic mediation, that it need not match the material body exactly, and that it is informed by both the subject and her environment—I now consider what it does, what role it plays in the lived experiences of subjects.

The usefulness of the materially and temporally labile body image for theorizing gender embodiment, Salamon tells us, is precisely that it "allows for a resignification of materiality itself," serving as a reminder of Butler's three-fold conclusion of what it is to embody a gender—to compel and induce the body, and to materialize oneself—and that none of those are achieved by the inheritance of 'vague material.'[36] Rubin says of body image that it "enables a continued engagement between the subject and the world."[37] Rubin's claim here returns us to Butler's earlier notion of affirming the materiality of the body, where the body takes on meaning for the subject and for others through

cultural investments of the body. To affirm the materiality of the body as Butler prescribes above is "to undertake a constant and always incomplete labor… to create and transform the lived meaning of those materialities."[38] Without this meaning and these investments, Salamon claims that the body is "reduced to 'vague material'," and that "our relationship to that 'vague material' is often one of distance rather than proximity."[39] Where she defends the lived body from critiques that advance its naturality and givenness, Salamon says of the natural, 'real' body that it is "mute and impenetrable, a fleshy monad… foreclosed from language, symbolization, and meaning. It is a body that belongs to no one."[40] Language, symbolization, and meaning are what allow a subject to be embodied, to affirm the materiality of her body, to assume her body; a body foreclosed from these conventions is not a lived body and is incapable of grounding any lived experience.

On these accounts, it becomes clear that the nature and function of the body image are necessary for and inherent to embodied subjectivity. Schilder is careful to note that such extreme cases as the anosognosic and the phantom-limb patient "are 'exaggerations' of the disjunction between the body and its representation that is present even in the 'normal person'… insisting that we 'normal' people have phantoms, too."[41] Likewise, Butler states that "fantasy is not something that the subject does, but rather something that enables the subject;" this fantasy is precisely the

> **"We all inhabit, to some degree, an alienated position between our body image and the external contours it attempts to track."**

necessary fiction described above.[42] It is this mode of belief that enables embodiment. Embodied subjects maintain belief in the necessary fiction that their body image matches their flesh; on these accounts, embodiment requires this belief. The challenge is, hence, to separate necessary fiction from unnecessary fiction. If we are necessarily embodied, and if the three Sartrean bodies are ontologically inextricable to us, it follows that each subject maintains her own personal phantasm of her body—her body image. If the first Sartrean body, the body for itself, is an 'absolute point of view' as Henry Rubin suggests, and each subject holds a body image, then are we not all somewhere on this continuum of dysphoria? We each hold the necessary but faulty belief that we proprioceive ourselves precisely as others perceive us. Given gender's ontological frailty and this necessary fiction, how then are transsexuals any different from any other subject? Gayle Rubin's account of a 'continuum within a continuum'—that of dysphoria within that of gender—leads her to conclude that "one's status as a transsexual in [such an account] is less determined by where one finds oneself on the gender continuum than [by] one's relative position on the dysphoria continuum."[43] This situation of a continuum within a continuum illuminates the correlation between transsexuals and the wrong-body phenomenon. Henry Rubin agrees that "some transsexual[s]… have a body consciousness, a body image, that is at odds with their second level body… They are, in Sartrean terms, alienated bodies."[44] He also suggests that this tension "between the body image (subjectivity) and the physical body (materiality) is at the heart of transsexual desire."[45]

I conclude that, because of the necessary function of the body image, this tension is present in each and every subject. We all inhabit, to some degree, an alienated position between our body image and the external contours it attempts to track; for example, consider that we are unable to view our dorsal sides without some mediating intervention or that we are unable to touch most of the arm with the hand at its end. So, shall the clinical model then change to hold that every subject is dysphoric or is a viable candidate for sex-reassignment surgery? Such a holding would establish dysphoria as the norm. Perhaps, instead, the 'dysphoria' in which each and every subject shares by virtue of her embodiment might be better fashioned into the norm that it is and, so, better understood as bodily alienation. Each and every subject can hence reside at some point or another on a continuum of bodily alienation without warranting the negative associations of dysphoria.

Now that the normative subject is recast as a dweller upon the continuum of alienation and the transsexual is normalized in that respect, a conversation might form, at last, around weeding out unnecessary fiction. Body image, as it is theorized here, better explains a subject's feeling of alienation from their body than does the wrong-body phenomenon in its dualistic foundation and clinicalized reputation. While a subject may feel herself to be a certain gender and have a certain body (as her body image guides her projects in and engagement with the world), her body image fails to present to her the exact body as others observe. This situation is not problematic; as I conclude above, all subjects share in bodily alienation. The tension seems to enter in situations where the body one feels herself to have through the subjectively informed aspect of body image is one that, through the relationally informed aspect, discourse tells her means something 'impossible' for her. Such impossibilities might well be a subject who is beautifully complected, but believes herself displeasing; another might be a subject who works tirelessly to enhance his physique, but perceives himself as scrawny and amorphous. Such cases are discussed in clinics around the world. Why, then, is the case of a subject who was born male but who views themselves as female so radically different? In each case, a subject proprioceives the materiality of their body differently than others perceive it. Each dwells in a necessary fiction somewhere along a continuum of bodily alienation. Proprioception and body image are not completely subject to the interpretation of others. Though each subject is alienated from her body to some degree, I suggest that this alienation only becomes dysphoric and thus pathologized because of heteronormative discourse, where the conflictual meanings and libidinal investments that are assigned to bodies and the ontological inflexibility assigned to genders reside. It is through the world that the body becomes invested with meaning, that it becomes human, that it is embodied as a subject. It is also in the world—where discourse reigns—that libidinal investments, historical assumptions, and social sanction and taboo reside. On this account, the wrong-body phenomenon could be said to be a fiction—and quite an unnecessary one—whose origin is better explained by two sources of information that merge and conflict at the site of the body image. Now that I have offered a case for the possibility and livability of the Tiresian position, I

move next to argue for its validity. What notions and assumptions are present in the dominant discourse on sex and gender that worsen, intensify, and yet deem impossible any merging of masculine and feminine subjectivities? I turn my attention now to heteronormative discourse in its constitutive force and its failure to accommodate or deem as valid transsexuals' differently sexed and gendered lived experiences.

WE OTHER TIRESIANS

Considering Foucault's characterization of power and the issues that arise out of the discourse it maintains, Butler argues that "the transformation of social relations becomes a matter, then, of transforming hegemonic social conditions,"[46] and that "[w]hat is needed is… a displacement of the hegemonic symbolic of (heterosexist) sexual difference."[47] Both Butler and Salamon indict the discourse, calling for its alteration. There seem to be two ways to alter the discourse apropos transsexuals. The first takes advantage of Foucault's description of discursive power and suggests a change to who is participating in the discourse and in what capacity in an attempt to facilitate a more significant place for transsexuals in the discourse about transsexuality—a place unlike their traditional place as subjects of scrutiny from whom the truth must be extorted and interpreted by the cleric or the clinician and, rather, like one that affords transsexuals' accounts of transsexuality the authority that an absolute perspective deserves. The second follows fresher counsel and suggests the proliferation of genders through an unmooring of gender (and desire) from physiological sex. Upon these considerations, I argue that it is the discourse informing sexed and gendered body image and perpetuating the experience of transsexuals' discomfort that deserves correction—not transsexuals themselves.

In his portrayal of the nineteenth-century homosexual, Foucault seems to have forecast the current climate around transsexuals; he seems almost to tell their story as it takes place in the clinic.[48] "In order to gain mastery over it [, transsexuality for the present purposes,] in reality, it had first been necessary to subjugate it at the level of language," where after a "widespread dispersion of devices… were invented for speaking about it."[49] Foucault continues, "sexual irregularity was annexed to mental illness,"[50] and, in the cat-and-mouse between clinician and the deviate, the persecution of peripheral sexualities led to a "new specification of individuals… [the] homosexual became a personage… the homosexual was now a species."[51] Confession, as Foucault uses the concept, is represented today by the function of the clinical experience in its gatekeeping tendencies.[52] "It is in the confession," Foucault demonstrates, "that truth and sex are joined;" he describes confession as the "ritual in which the truth is corroborated by the obstacles and resistances it has had to surmount in order to be formulated," where its veracity is guaranteed "by the bond, the basic intimacy between the one who speaks and what he is speaking about."[53] Phenomenology takes this bond to heart in its vesting of subjects with epistemic authority and its regard of their perspective as an absolute perspective, without associations with abnormality. Phenomenology accepts Foucault's counsel, as should the standard clinical experience and those attempting to theorize transsexuals, that "the validity of introspection, lived experience as evidence, or the presence of consciousness to itself [are] responses to this problem that is inherent in the

functioning of truth in our society."[54] This counsel combats the modern clinical experience as it currently exists and replaces the old models of confession, extortion, and treating persons as incapable of interpreting themselves for themselves.

A discursive fashioning of the transsexual into a species, into an 'essentially different,' proliferates the discourse around them and, as Foucault suggests of the nineteenth-century homosexual, thus is possible "the formation of a 'reverse discourse'," whereby the transsexual can speak in its own behalf.[55] Transsexuals should hence be allowed to participate in the discourse regarding their lived experiences of differently-sexed subjectivity in an authoritative capacity, exercising the interpretive authority that a distinct personage or species demands. This participation might be catalyzed in two foreseeable ways: the clinician's turn to phenomenology's placement of authority in the subjects they study and the transsexual's harnessing of discursive power and formation of their very own narrative and voice. We might not be surprised that, should these two suggestions be taken seriously, the shared narrative of the wrong-body phenomenon may diminish or even disappear.

Marinucci heralds the remedy to heteronormative hegemony, stating that "a more inviting way to challenge the existing binary is to construct additional alternatives, so that instead of just two categories there are many."[56] Butler offers a little more substance by arguing that, "if binary restrictions are to be overcome in experience, they must meet their dissolution in the creation of new cultural forms," where "the subversion of binary opposites does not result in their transcendence… but in their proliferation to a point where binary oppositions become meaningless in a context where multiple differences, not restricted to binary differences, abound."[57] Considering the findings of Butler's investigations thus far, it might seem oppressive or even impossible to insist, through documents and scalpels, that a particular living-experiencing subject takes up one of only two sanctioned gender scripts. Thus, a call is made for more scripts, for a proliferation of genders. Salamon warns us that "where there is a cultural imperative to corral and bend… resignifications to the service of a singular designation, the depth of the misrecognition puts the stakes at nothing less than life itself."[58] Along similar lines, Elizabeth Grosz expresses her hope that transsexuals might live "in excess of the cultural significations of the sexually specific body."[59] It is this excess, this living beyond binary gender, that will tear down the borders of sexual and gender difference if Butler's arguments are to be taken seriously. However, this could only be the case with some respect to morphology; it is morphology that holds the focus of the heteronormative discourse and makes possible our surprise when performance and morphology do not match. Surprise is, after all, but a shade in the hue of betrayal, be it for better or worse; it is the result of violated assumptions. The facts are never the cause of surprise; the culprit is, rather, our assumptions thereabout.

It is the 'surprise' that one manifests a gender different than that historically assigned to a sexed subject that casts transsexuals as 'transgressive.' It is their ability to surprise in this way that stigmatizes and endangers them. This surprise is much less an ability of transsexuals and much more a product of heteronormative hegemony's failure to assume (or, indeed, accept) an unmooring of morphology and performance. This need not be the case, if only heteronormative discourse could account

for the nature and function of body image and the ontologically fragile origins of sex and gender. Recall that Butler cripples the concept of essentialized genders; that is, she demonstrates that there is no perfect, essential gender performance. There are, rather, acts that are culturally legible as appropriate to one gender category or the other and acts that are illegible as such and are thus not considered a part of the script. This failure of the two hegemonic genders to account for all actions that can belong to necessarily-gendered subjects is described by what Butler calls an 'unnatural conjunction.' It is the "association of a natural sex with a discrete gender and with an ostensible natural 'attraction' to the opposing sex/gender."[60] Considering the process of subjectivation, Butler tells us that "there is nothing about a binary system that is given. As a corporeal field of cultural play, gender is a basically innovative affair."[61]

In considering the legitimacy of non-heteronormative couples, Salamon considers a few of the possible 'new' gender categories where she reminds her readers that in "a couple consisting of a transman and a gay man… each member of this couple is indeed a man."[62] A transman's or a gay man's performance of masculinity is (sometimes) different than that of a cisgender, heterosexual male; all the while, each performs and thus reifies his subjective interpretation of the masculine gender. Likewise, a lesbian, a transgendered woman, and an intersex person might all perform their respective interpretations of femininity. Each performs a different gender script by virtue of performing 'woman' differently. Each one's interpretation and performance of gender becomes that one's lived experience thereof and thus weakens any serious notions of heteronormative hegemony's essential binary—that is, if culture will allow. A new gender is created by the unmooring of social performance from morphology and lacks only society's recognition as a viable lived experience. 'New' genders are already present; in light of the performative nature of gender, the call to proliferate them is thus exposed as a call for their recognition and validation.

Salamon says of transsexuals' interactions with the legal realm that "understanding transgender as a 'border crossing' figures gender itself as a kind of bounded territory—gender not just as a property of bodies but as property itself."[63] Gender is understood on such an account as bound, essentially delineated, and concrete. Luckily, Butler undoes the conception of gender that would perpetuate such an account. Should dominant hegemony allow an unmooring of gender from its historical association with morphology, then, to use Salamon's language, the borders disappear.[64] Without borders, there is no border crossing; without border crossing, there is nothing to police, no surprise to be had, and no subject to deem 'transgressive.' More simply, should gender be understood as the borderless cultural phenomenon that it is—as susceptible to alteration, evolution, and innovation as are fashion, language, or law—then a change in one's gender is no longer the astonishing feat it is made out today. Such a reconceptualization would likely take 'trans' out of 'transgender,' considering that this articulation assumes the relocation from one to another of only two gender territories. To refute the binary is to refute the impossibility and invalidity of the Tiresian position.

As embodied subjects, as proprioceiving products of a discourse informed by heteronormative hegemony, transsexuals and their allies still have much cause for anxiety. Where the discourse that constitutes them fails and refuses to comply with the bodies it creates and insists upon a dualistic indictment of their well-being, transsexuals, the medico-legal realm, and society at large remain at risk of succumbing to a centuries-old, dualistic, understanding of who and what persons are. This stasis in philosophical understanding of narrative subjects and phenomenological embodiment falls short of doing justice to subjects themselves. Furthermore, what justice is to be had when the institutions and models that govern subjects fail to consider all defensible findings and tenable perspectives in their attempts to understand their subjects? When models of wellness are allowed to deem those as normal as any other to be 'dysfunctional' or sufferers of a false consciousness? When a culture cannot accommodate without hostility the problems it perpetuates? Our respect for transsexuals' interpretations of who and what they are is beyond justified—it is imperative.

By considering arguments that expose gender, the sexed body, and identity itself in their non-essential nature, we can ask more informed questions about the lived experiences of transsexuals. By considering the nature and necessary function of body image, we can better understand the close bond between the subject, her world, and the discursive forces therein. Finally, by considering the characterizations of heteronormative discourse, we can at last treat the real patient—heteronormative discourse. I have here attempted to demonstrate and defend both the livability and validity of the Tiresian position. I have supported the notion that a subject can exist a subjectivity between male and female by arguing that subjects are neither essentially gendered nor sexed, that body image better explains bodily alienation than does the dualistic wrong-body phenomenon, and that the discourse's extensive influence of over body image is the culprit responsible for transsexuals' discomfort and current situation. One might even suggest that, as subjects without essentialized gender or sex and for whom phantasm is requisite of embodiment, we *all* live the Tiresian position.

ENDNOTES

[1] Referring to Diagnostic and Statistics Manual of the American Psychological Association and International Classification of Diseases of the World Health Organization

[2] Judith Butler, "Performative Acts and Gender Constitution: An Essay in Phenomenology and Feminist Theory" Theater Journal 40:4 (1988): p. 519.

[3] Ibid., p.526.

[4] Ibid., p.522.

[5] Ibid., p.530.

[6] Ibid., p.528.

[7] Ibid., p.523.

[8] Gayle Salamon, Assuming a Body: Transgender and Rhetorics of Materiality, (New York: Columbia UP, 2010), p.35.

[9] Ibid., pp.22-25.

[10] Ibid., p.35.

[11] Salamon defines proprioception as "the primary but unlocatable 'felt sense' that allows a body to be experienced as a coherent whole rather than a collection of disparate parts." p.4.

[12] Ibid., pp.36-37.

[13] Ibid., p.56.

[14] Ibid., p.79.

[15] Marinucci 2010, pp.70-71.

[16] Michel Foucault, The History of Sexuality, Volume I: An Introduction, (New York: Vintage Books, 1990).

[17] Ibid., p.83.

[18] Salamon 2010, p.40. Butler's use of the word "language" can be taken, for the purposes here, to mean discourse as Foucault treats it.

[19] Butler 1988, p.526. Where, again here, "cultural conventions" can be taken to mean discourse.

[20] Judith Butler, "Variations on Sex and Gender: Beauvoir, Wittig, and

Foucault," Praxis International 4 (1986): np.
[21] Butler 1988, p.520.
[22] Ibid., p.520.
[23] Ibid., p.528.
[24] Ibid., p.527.
[25] Ibid., p.521
[26] Ibid., p.522.
[27] Ibid., p.530. Salamon also speaks on the necessary belief in the 'I.' She writes, "the force of conviction about the certainty of my own body…obscures the social realm and the formative   role it plays in making embodiment legible." Salamon 2010, pp.78-79.
[28] Henry Rubin, "Phenomenology as Method in Trans Studies," GLQ 4:2 (1998): p.270.
[29] Ibid., pp.268-269.
[30] Salamon 2010, p.26.
[31] Ibid., p.33.
[32] Ibid., p.1.
[33] Rubin 1998, p.270.
[34] Salamon 2010, p. 31 (emphasis, mine).
[35] Rubin 1998, p.274.
[36] Salamon 2010, p.38.
[37] Rubin 1998, p.270.
[38] Salamon 2010, p.42
[39] Ibid., p.33.
[40] Salamon 2010, p.88.
[41] Salamon 2010, pp.33-34.
[42] Ibid., p.36., (emphasis, mine)
[43] Ibid., p.164.
[44] Rubin 1998, p. 274.
[45] Ibid., p.274.
[46] Butler 1988, p.525.
[47] Salamon 2010, p.42.
[48] Foucault 1990.
[49] Ibid., pp.17-34. This section, among others, deals with Foucault's larger, parallel projects of describing the nature of discursive power and constitution and refuting 'the repressive hypothesis.'
[50] Ibid., p.36.
[51] Ibid., pp.42-43.
[52] Ibid., pp.58-73. Confession was the means in prior centuries of extorting the truth of sex from sexual irregulars which is likened here to the gatekeeping clinician.
[53] Ibid., pp.61-62.
[54] Ibid., p.64.
[55] Ibid., p.101.
[56] Marinucci 2010, p.61.
[57] Butler 1986.
[58] Salamon 2010, p.193.
[59] Ibid., p.153.
[60] Butler 1988, p.524.
[61] Ibid., p.531.
[62] Salamon 2010, p.143.
[63] Ibid., p.172.
[64] Ibid., pp.171-193. "Withholding the Letter."

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"Racing Neoliberalism": The Paradox of Perpetuating Racial Stereotypes in the Movement to Erase Race in Times Square Advertising

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Neoliberalism, a global, market-based discourse that the United States adopted around 1975, promotes the free market as the center of economy and governance while simultaneously attempting to offer itself as the solution to class, gender, race, and other social problems. This paper specifically analyzes the relationship between race and neoliberalism. Neoliberalism's social discourse emphasizes individual choice, especially the individual's choice to consume. According to this emphasis on individual choice, race almost becomes a commodity one chooses to put on. Yet this denies the existence of racism on a more collective, social scale, concealing how the market is economically dependent on race. To investigate this paradox, I will explore the concept of "racing neoliberalism" – a term first coined by David Roberts, a lecturer at Ulster University – that suggests neoliberal discourse is not only intrinsically racist through its reinforcement of previous racial stereotypes through market-based logic, but also through its re-formulation of how we define racial diversity, dismissing diversity's social significance. In attempting to erase deep-rooted social problems by twisting the meaning of diversity for economic gain, the neoliberal market ultimately creates a 'neoliberalized' re-configuration of 'multiculturalism'. In order to illustrate the dangers of neoliberal adaptations of race, I first explore the definitions of 'commodity' and 'multiculturalism' in neoliberal contexts. Then, I analyze two Times Square billboards with African-American models as case studies. By providing detailed analyses, the paper ultimately asserts that neoliberal racism is a perpetuation of conventional African-American stereotyping. I suggest that this is indicative of how market-based strategies paradoxically use stereotypes in order to deny the existence of racial diversity as a complex social construct.

MARX, HARVEY, AND MELAMED: THE NUANCES OF COMMODITY AND MULTICULTURALISM

Before investigating the case studies, it is important to understand the complex connotations of two terms that are fundamentally associated with "racing neoliberalism": multiculturalism and commodity. Both of these are important terms in our discussion: multiculturalism, a concept closely associated with race, is commodified through neoliberal discourse. Evidently, one must have a sense of how these terms are utilized as well as manipulated in post-World War II United States, the period in which the concept of neoliberalism established itself. Karl Marx and David Harvey's definitions of how a commodity functions are imperative to understanding "racing neoliberalism". Karl Marx asserts that a key factor of capitalism's resilience lies in the "commodity", a product that has a use-value, labor-time, and exchange-value. Capitalism survives because it abstracts the idea of labor power into a mere "social relation between objects, a relation which exists apart from and outside the producers," so that namely, a commodity's use-value or labor-time becomes an inherent, "objective form" (Marx 165). Marx portrays capitalist commodification as a fetishization and mystification of labor. In other words, the object is commodified by its separation from the human labor involved in producing it, because capitalism portrays the objects as interacting independent from its producers. These objects, having produced themselves and functioning separately from human labor, seem to have lives of their own. Thus, objects become fetishized. Whereas Marx focuses on how the commodity conceals certain aspects of labor in order to mystify it, David Harvey argues further that its connotations simplify "infinite", diverse relationships between labor and product to a singular (and thereby marketable) dimension (253). When he tackles the term "urbanization of consciousness", he shows how capitalism makes people employ abstract ways of perceiving the production and consumption associated with urban life. Thus, because it is both a physical object and an enigmatic concept, Harvey argues that commodities, especially money, are all "concrete abstraction[s]" in human day-to-day life (253). These explications of how capitalism commodifies and mystifies objects will be crucial to understanding the racist implications of the case studies.

Jodi Melamed is a professor from Marquette University who con-

ducts research on racism and contemporary global capitalism. In her article "The Spirit of Neoliberalism From Racial Liberalism to Neoliberal Multiculturalism", she applies Harvey's "concrete abstraction" to examine neoliberal commodification of multiculturalism: she argues that the neoliberal definition of multiculturalism not only naturalizes, objectifies, and therefore contains the implications of race, but also mystifies the notion of racial diversity. Race becomes simultaneously an objectified and mystified concept. Melamed provides a brief history of racial liberalism. First developed in the 1940s, racial liberalism is an ideology that is morally revered as being actively against colonialism, racial discrimination, and euro-centrism that has contributed to the global ascendancy of the US in the post-World War II world. However, under the political pressure of anticolonial and anti-racist movements during World War II, racial liberalism became used by the US as a tool to quickly legitimize its own powerful international position, rather than to seriously address racism at home or colonialism abroad. In a sense, racial liberalism has created a hypocritical foundation for neoliberal discourse in terms of multiculturalism after World War II. Melamed states that since the 1990s, multiculturalism has become a modified "racial reconstruction" for realms like business, government, society, and education, where it is appropriate to be politically correct, instead of in movements for justice on the part of historically marginalized groups (15). In other words, "neoliberal policy [becomes] the key to a post-racist world of freedom and opportunity," where there is no need to tackle the real social issues concerning racial minority groups. In fact, the word "post-racist" in itself is racism in disguise, as it dismisses racism as a present issue by defining it as an issue confined to the past. Melamed points out that economic incentive was the driving factor that sparked the contemporary connotations of multiculturalism. Harvey would also agree with this assertion. In his book A Brief History of Neoliberalism, he argues that neoliberalism is against any submerging of the individual voice for the sake of collective social justice (167). While Harvey claims that society has little need for collective social justice, the neoliberal market continues to exploit racism, one of the biggest social injustices, because racism remains useful as a way to subconsciously manipulate of our thoughts and opinions in order to (echoing Melamed) ultimately boost monetary profits for companies (Harvey 1). After politicizing the injustices of white supremacy since World War II, neoliberalism attempts to reassure the world that the United States is fighting an antiracist war using the economy. Of course, this becomes quite ironic because, in the United States, the pervasive phenomenon of racism against and commodification of people of color is prevalent in daily life, creating a "racial contradiction on a globalized scale" (Melamed 4) that has, in the modern day, become prevalent in American commercial advertising.

The different theoretical approaches of Melamed, Marx, and Harvey can be further illuminated through an analysis of how Times Square billboards portray people from different backgrounds. Time Square, named the "The Crossroads of the World", has approximately 335,000 pedestrians passing by every day and therefore is one of the world's greatest hotspots for advertisers. The billboards in Time Square certainly receive a great deal of public attention. While the majority of these billboard campaigns claim to promote 'multiculturalism' in order to attract more consumers, they are in fact only exercising racial commodification. The 'multiculturalism' in these advertisements is a con-

tinuation of post-WWII racial liberalism, but what has worsened the situation is that, no matter what race the models on the billboards are from, they are all the same in that they promote the consumption of a certain brand. Although neoliberalism claims to support individual choice, these advertisements instill conformity to a consumerist culture, gradually erasing race's relevance in modern, capitalist societies. By emphasizing and solidifying the models' consumerist core, thereby mystifying the origins of their racial differences, capitalist economies successfully commodify not only 'multiculturalism' but also the term 'diversity'. Diversity is reduced to a single, feasible dimension of consumption, yet with a simultaneously elusive connotation, which once again echoes Harvey's idea of "concrete abstraction". Diversity then becomes fundamentally intangible as a collective universal idea, but also overly concrete because neoliberal advertising redefines it – neoliberalism turns a term that is focused on differences into a concept that centers around sameness, and in particular, a sameness revolving around consumption of a fixed brand. This type of advertisement commodifies the brand as well as the social concepts of 'multiculturalism' and 'diversity', because both the brand and the concepts become concrete abstractions. Neoliberal discourse thus creates a mystified relationship between these the brand and the concepts. Harvey summarizes this relationship in a broader context as a struggle between a genuine understanding of concepts relating to one's place in society – an "opportunity for self-realization", and "a community [being defined]…as consumption goods" (257).

CASE STUDY: AFRICAN-AMERICAN FASHION AND LIQUOR BILLBOARDS

Neoliberal manipulations and perceptions of racial commodification can be directly illustrated through detailed description and evaluations of specific billboard advertisements portraying African-American models that were put up in Times Square. One billboard is a Calvin Klein advertisement, and the other is a liquor advertisement for Remy Martin cognac. The case study will apply the theoretical analyses conducted by Marx, Harvey, and Melamed to a specific modern neoliberal market of advertising. Perpetuations of conventional African-American stereotypes in these two advertisements contribute to the intrinsic racism of neoliberal discourse. Through detailed descriptions and focused analyses of these two advertisements, this case study hopes to demonstrate two facets that culminate themselves in the idea of "racing neoliberalism", which are the perpetuation of racial stereotypes and the more complex instillation of as well as justification for race erasure or flexibility.

The Calvin Klein and Remy Martin billboards both put disproportionate emphasis on the muscular body of the male models. The Calvin Klein poster (Figure 1), which is part of Calvin Klein's 2010 Spring/Summer Collection, was hung up on a billboard on top of a brick building in Times Square. In the 2010 Collection, this poster is the only one with a black model. On the poster, there are two different portrayals of the same male model. The man on the left is completely nude – something never portrayed in other Calvin Klein 2010 campaign posters. He faces the right, leaning slightly forward and placing his body weight on his right leg – the leg closer to the spectator – as he strides forward, forming a seventy-degree angle with his left leg. His biceps and abdominals have distinct muscles that seem to be stretched

Figure 1. Calvin Klein billboard poster.

taut. His body is oily, glistening with a slick white from almost all angles. The waist of the model is extremely thin. This thin waist, along with the oiled skin, draws great attention to his bicep and thigh muscles. On the right side of the image, the same model, now clothed, faces the spectator, his eyes directed towards the spectator. His right eyebrow curves up. He has high cheekbones and is wearing a fitted, black suit and pants, yet his face remains slicked with oil. The poster on the whole incorporates only two colors: black and white – the deep black color of the model's skin and clothes is juxtaposed with the white background.

The Remy Martin billboard (Figure 2) was also in Times Square in 2010, right before the Remy Martin Heart of Cognac Experience campaign in Times Square. The male model is between two women, with his back facing the spectator, and he wears a black T-shirt that accentuates the bulges of his bicep, upper back muscles, and thick neck. His shaved head tilts completely towards the right - his face is only slightly revealed to the spectator, which allows spectators to place more emphasis on his very well crafted back and bicep muscles. The cayenne brown color of his skin corresponds to the hints of red in the background. The two women, their bodies mostly concealed behind the man, each with a slender hand moving across the man's upper body, are noticeably lighter skinned. The woman on the left has black hair that only covers her temples and is swept back until it is obscured by the surrounding black background. The other woman also has light-brown skin with a pinkish hue. Her facial structure is wider than the face of the woman on the left. Her sleek hair is also swept back to merge completely with the opaque black background. Centered at the bottom of the image is large white print: REMY MARTIN, and on the upper right corner of the image, in half the size of the Remy Martin logo, is the sentence: "Things Are Getting Interesting". The billboard has the

predominant color of burgundy-brown that fades to blackness – this is inherent in the background as well as the models.

Julia Bristor, a professor at Texas A&M University interested in commerce-related research, specifically tackles the remaining traces of African-American stereotypes in advertising. The Calvin Klein billboard and the Remy Martin billboard both emphasize a key part of what Bristor calls "ideological themes" that lean towards white supremacy, which is the portrayal of African-Americans as "athletes…[with a focus on] physical prowess" (50). According to Bristor, advertisements portraying black men that only focus on raw, physical strength suggest to African-American audiences that the only way to be successful is through bodily – and never intellectual – labor (51). The Calvin Klein model is heavily oiled, which accentuates the muscles and skin, and all the other models in the Spring/Summer 2010 Collection are not oiled. In Remy Martin, the women caress the muscular man, thus glorifying his raw strength. This is a fetishization of what achieving 'success' entails for African-Americans through "concrete abstraction": one only achieves success with his physical capabilities. Furthermore, it is a perpetuation of traditional African-American stereotypes that reduce African-American men into strong beasts with no brains.

Due to the presence and actions of the female models in the Remy Martin commercial, this commercial also retains a sense of exclusive physical prowess that implies sexual potency. The two women literally cannot keep themselves off the man in the center. This mysterious physical attraction renders African-Americans as exotic beings with wild hyper-sexuality that triggers primitive, unexplainable, almost beastly desires. This signifies the perpetuation of another kind of racial stereotype, where black men are deemed to be more sexually potent because they are defined to be less civilized than their white counterparts (Davis 269). Also, the parallel between the African-American man and the centaur logo of the product itself further highlights this beastly, raw sexuality. Bristor notes this focus on beast-like sexual prowess simultaneously tries to mystify and appropriate what white Americans perceive to be the African-American "traditional culture", although she does focus much more on the prejudiced notion of physical prowess built from manual labor rather than sensual exoticism as an intrinsic part of African-American "culture" (53). Furthermore, the general trend of targeting ethnic minorities in liquor advertisements during the 21st century denotes a negative solution to the relationship between race and class: for marginalized people, these alcohol media appeal to them as a condescending "invitation to participate in the 'good life' … of social affirmation…a way to assimilate into the mainstream" – that is, the exclusively white, upper-middle class mainstream culture (Alaniz et al. 448).

Figure 2. Remy Martin billboard poster.

ANALYSIS: RACIAL ERASURE AND EXPLOITATIONS OF COLOR

Although continuations of racial stereotypes remain a prevalent problem in the two advertisements, one might argue that objectification of the male body as well as emphasis on physical sexuality may exist outside of racial premises. However, the post-World War II definitions of multiculturalism and notions of race erasure that Melamed discusses can reinforce our understanding of the racism that is prevalent in the representations of male bodies in these two billboards. The first billboard is the only Calvin Klein poster in the 2010 where the same model is placed in two opposite, contrasted states of being. It seems like the model has an upper-class stature on the right with his suit and tie, but its relationship with the left image gives a different impression. This does not only imply the gradual civilization of Africans from being naked to wearing Western formal attire – it is as if he transferred the color of his skin onto the black suit and is literally wearing his race as a commodity. Race becomes, as Marx asserts, an object in relation to the market, nothing more an external skin to don on and take off. This erases the significance of race as a complicated social issue. The dangerous repercussions of that logic are: race becomes forever detached and thus deleted from the concept of internal identity. Here, Bristor's arguments perhaps fall short, as she exclusively restricts racism in advertising to perpetuation of racial stereotypes instead of racial erasure, although she does seem to be superficially aware of the contemporary phenomenon of "race neutralization": she states briefly that the advertisements send a message that in order to succeed, African-Americans must manipulate and eventually transcend racial barriers (51). In other words, African-Americans are assigned with the impossible task of detaching their own identity from their racial identity and reaching at some abstract goal that forces them to 'take off' their skin color, along with the racial identity that is attached to it. This, combined with the objectification of the model's physical body, evidently makes the Calvin Klein poster a neoliberal contribution to racial stereotyping.

All three models in the Remy Martin billboard have nearly identical red-toned, darker skin that conveniently matches the red-brown paneling in the background. One may easily assume the advertisement, which is specifically geared towards African-American consumers, embraces dark skin as well as multiculturalism. Here, it becomes important to return to Melamed's point that multiculturalism as a modified rubric for "racial reconstruction" for business, government, society, and education instead of movements for justice on the part of historically marginalized groups (Melamed 15). The billboard utilizes a tactic of commercial manipulation named by Scottish anthropologist James Frazer as the Imitative Magic Spell, apparently used in colonial times to coerce African, Asian, and Native American "savages" to trusting white settlers: it uses various objects and actions associated with those objects to make "savages" imitate and gradually believe that the color of their skin is detached and therefore transferable (Frazer 16). In modern contexts, this implies that, since African-Americans have brown skin and the cognac is (reddish) brown, drinking Remy Martin will transfer the dark color, along with the sexuality associated with this color, to the imbiber. Race is not a complicated social construction, but rather an individualized, simplified commodity that one can literally drink in and become. Both advertisements make race personal, flexible, and individually customizable. This commodification dismisses entirely the need for social justice against racism. After all, if we can easily wear on or imbibe the color of our skin, we can avoid racism simply by taking our race off, like a piece of clothing. Amy Hasinoff explores this exact marketing strategy that Bristor neglects through analyzing the TV show America's Next Top Model, stating that "marketable personal narratives of racial self-transformation… contend that…racial rhetoric makes race hyper-visible as a malleable commodity and confirms the neoliberal fantasy of the structural irrelevance of race and class in the US" (1). This "structural irrelevance" underscores the effort to make race into a non-issue in 21st century capitalist society. More specifically, her use of the word "structural" becomes crucial in that race is inevitably a complex construct that cannot be reduced from a social identity to a commodity one can 'wear' or 'drink in'. This poses the question of whether, in a neoliberal society, race can only become visible when it becomes "hypervisible", simplified into a manipulable, externalized commodity.

> " Race is not a complicated social construction, but rather an individualized, simplified commodity that one can literally drink in and become. Both advertisements make race personal, flexible, and individually customizable. This commodification dismisses entirely the need for social justice against racism. "

CONCLUSION

In general, neoliberal discourse on race is evidently a powerful force in today's commercialized society. The case studies on advertisements portraying African-American models are only two specific examples utilized in this essay, to illustrate the heavily compromised position of race within neoliberal discourse, due to the erasure and commodification of race, combined with the insistence that we live in a post-racial world. At Times Square, models of various skin colors are represented in innumerable advertisement campaigns, convincing passerby that neoliberalism indeed goes hand in hand with social diversity and multiculturalism. However, this demographically "hypervisible" portrayal of race has in fact been oversimplified and dismissed as a non-issue in 21st century America. Neoliberal discourse simultaneously stereotypes and erases the notion of multiculturalism as a social function, redefining race as no more than an external commodity, detached from society. These are the core aspects of "racing neoliberalism". The commodification of complex

social structures into an externalized, flexible marketing asset marks not only neoliberalism's attempt at erasing deep-rooted social problems, but also the market's manipulation of race and diversity for its economic gain. As David Roberts states as the explanation of the term "racing neoliberalism", "race is both evoked and suppressed under this neoliberal discourse." Perhaps race is evoked in order to be suppressed under this discourse, and the insidiousness of race suppression only makes racism more threatening in modern society. In many ways, the two strategies behind "racing neoliberalism" form a dangerous, double-edged sword: neoliberal discourse provokes conventional racist stereotypes of African-Americans while simultaneously denying its own racism by mystifying the definition of racism itself, along with the terms 'multiculturalism' and 'diversity'.

ACKNOWLEDGEMENTS

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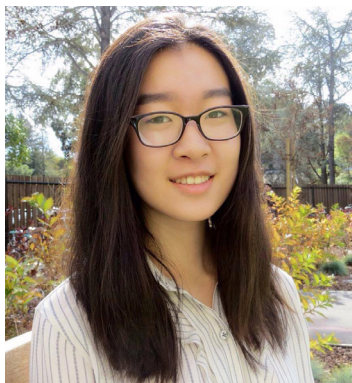
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Replicating William Blake's Illuminated Printing: The Innocence of Art Nouveau and Experience of Art Deco

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This paper details my experiences conceiving of, writing, and illustrating my own set of *Songs of Innocence and of Experience,* as well as etching and printing this collection of poems using the difficult and revolutionary method of "illuminated printing," designed by the English Romantic poet-engraver, William Blake. My 2012 collection of *Songs of Innocence* was set in the Art Nouveau style, where *Songs of Experience* projects the aesthetic of Art Deco artwork. These eras of art history were chosen for their stylized portrayals of the female body, as well as the comparisons I believed could be drawn between the rapidly changing views of feminism in the 1890s-1920s and the radical era of the 1780s-90s when Blake was producing his *Songs of Innocence and of Experience*. Besides providing an account of my creative process and a proposal for an "updated" method of illuminated printing (taking into account technologies available to printers in the modern age), this paper also seeks to encourage young scholars of Literature and of Art History to supplement their "armchair analysis" with a more immersive study: through actual replication of the technical processes behind the texts and pieces of art they examine.

INTRODUCTION

With the generous support of Stanford University's Chappell Lougee Scholarship, I spent two weeks in Edinburgh the summer after my sophomore year, studying and reproducing William Blake's "infernal method." When I conceived of this project, Blake's world seemed shrouded in mysteries. I knew nothing of etching or printmaking, and felt almost like a fraud trying to formulate postulations about his works. Comprehending the intricacies of his revolutionary and complex printing process seemed vital to a complete understanding of Blake's works. I hoped that by actually putting his techniques to practice, I would gain insight into Blake's artistic process in a way that I could not learn from reading descriptive articles or from merely surmising assumptions from images reproduced in books.

I hoped that the experience of replicating the process of illuminated printing would open my eyes to the intricacies of his illuminated books, and make me a more attuned scholar of Blake's work. If, for example, I should find that the thin curlicue lines distinctive to his aesthetic were extremely difficult to realize in his etching and inking process, I would know that Blake made the conscious decision to incorporate these signature curlicues, despite the sheer difficulty such an artistic move presented. By grappling with the same logistical problems with which Blake did, I would have a better understanding of the purpose and manifold meanings behind Blake's enigmatic works.

However, I wanted to go further than just practicing Blake's printing process by reproducing the exact copper plates of his Songs. I wanted to try to understand the totality of work that went into Blake's production of *Songs*: the conceptual stage, the intricate relationship which he forged between word and image, the arsenal of symbolism he created (where each different texture and shape has a significant meaning encoded into it), and, of course, his style of illuminated printing. For that reason, I applied for the Stanford Chappell-Lougee Scholarship (a grant for sophomore undergraduates who wish to pursue studies in the Humanities) to practice Blake's "infernal method" by writing, designing, illustrating, etching, and printing my own set of *Songs of Innocence and Experience.*

ART NOUVEAU FAIRY AND ART DECO GODDESS

Instead of mimicking poetry and art of the 18th and 19th centuries, I decided to set my *Songs* in the Fin de Siècle and Prohibition eras. The poetry was written in varying styles (similar to those of the 1890s-1930s) and dealt with the concepts of innocence and experience. The illustrations were inspired by Parisian and American art of the 1890-1914 (Art Nouveau) and 1925-1939 (Art Deco) eras. Through the medium of this aesthetic, I examined the changing views and roles of women during the eventful late 19th and early 20th centuries.

The social climate of the 1890s-1930s can be compared, in some ways, to the 1790s-1830s. [1] In Blake's era, William Wilberforce's slavery abolition movement was making huge strides towards freedom for slaves in Britain and its colonies. Blake, along with his fellow artists and writers (Thomas Paine,

Mary Wollstonecraft, Edmund Burke, Josiah Wedgwood), took up the brush and quill to pen texts and create art advocating emancipation from slavery. Indeed, Blake's works are steeped in the duality of enslavement and liberation – his art features trampled and chained figures from which he speaks to us about the shackling institutions of his society.

Just as Blake exhibited in his works an obsession with the concepts of enslavement and emancipation, I similarly engaged with motifs of the enslavement and supposed emancipation of women from the Art Nouveau to Art Deco eras. Jan Thompson astutely observes how artists of the Art Nouveau era depicted women "almost to the exclusion of the male," and how this single-minded obsession crafted the female into an "attractive decoration…an extension of the furnishings" whom they "perched on a pedestal" – kept as "charming playthings" or "virtual pets…made to feel helpless and therefore desirable." (158-9) [2] Most Art Nouveau artists locked women into an image of maternal femininity: delicate and breakable, shown in domestic spheres or closely tied with nature and mothering. (See Fig. 1.) Women in the art of the Belle Époque were sexualized pantomimes of maternity: they were depicted serving beer in revealing dresses or dancing provocatively in cabarets, yet full-breasted, Gaia-like figures with long flowing hair and welcoming, motherly arms.

The Suffrage movement (1890s-1910s) gave rise to the sexual freedom and experimental masculinity women enjoyed during the Flapper movement of the Jazz Age (1920s-1930s). Women wore revealing clothing, danced provocatively in speakeasies and revolted against Prohibition. In bobbing their hair, these women opted for a masculine hair-do which squelched the mothering, "stay-at-home" image of woman and promoted a look of independence and empowerment. In commercial art, women made a similar progression from the meek and innocent Art Nouveau fairy to the thin-waisted and chic Art Deco goddess, with her expression of cool, casual boredom. Drawn with hard, geometric lines, the Art Deco woman had a clipped masculinity about her that was both asexual and highly appealing. (See Fig. 2.)

Her slim cut body was cleaved of all maternal imagery. Fischer describes Art Deco first and foremost as a Feminist movement – a rare moment between the Art Nouveau and pin-up art of the 1950s – where women became more than merely a "pantomime of unbridled sexuality." (3) [3] Indeed, many scholars agree that Art Deco elevated the female form to a transcendent ideal – inviting its audience to worship and revere the new, independent woman emerging in the 1920s. Weber discusses the chic, machine-like, "high-tech" robotic nature of the female, and her elevated place and speed in a fast-paced city. (11) [4]

However, some critics debate the proposition that Art Deco was a force for positive change, contending that the sleek, streamlined nature of the Art Deco woman only served to perpetuate an enslavement of the female body. Winokur discusses the mannequin-like features of the Art Deco goddess, speculating that the body's simplified, compressed nature was a marketing ploy. (199) [5] Duncan agrees with this assessment, arguing that the Art Deco woman became the thing that she was selling – the car in front of which she was standing, the dresses she was wearing. [6]

Freedman's compelling article investigates the question of "what happened to feminism during the decade after…suffrage" and "who precisely was the new woman; what was her fate after 1920?" (372-3) She examines the trope of the flapper through many contemporary lenses, including the notes of Judge Ben Lindsey, whose counseling sessions with 1920s youth "revealed a strong conflict between the appeal of flamboyant freedom and the sense of sin it still engendered." (Freedman 377) [7] Despite the seeming strides of the Suffrage movement, we can see from several feminist and art historical critics that women still remained enslaved by their society.

And so, like Blake, I steeped my *Songs of Innocence and Experience* in the struggle for liberty. My *Songs of Innocence* examine women of the Art Nouveau style – in their "proper places," marked by naïve and meek innocence, while my *Songs of Experience* examine women in Art Deco – challenging their expected roles, confident and commanding respect, yet constrained in strict geometrical shapes. Unlike Blake, I crafted my *Songs of Innocence and Experience* into two aesthetically different entities. I did this to give a broader perspective of art and cultural thought during this time frame, and because I think that the Art Nouveau style perfectly encapsulates the feel of innocence (the whimsical, curvilinear, and womanly qualities), whereas the Art Deco style perfectly evokes the sturdiness of experience (masculinity, confidence, movement, dynamism).

PROJECT DESIGN AND AESTHETIC: ARTISTIC SOURCES

I drew artistic inspiration for my *Songs of Innocence* from several Art Nouveau artists. The border for the title page for *Songs of Innocence* and the font for *Innocence* were both inspired by the decorative style of architect Hector Guimard: the square-cut, yet curvilinear curlicues and elongated, blot-like type-set. I also admire the poster art of Alphonse Mucha: the warm, earthy colors, the decadence and over-detail, the light sfumato, yet the distinct sense of realism. I tried to evoke some of this feeling in my panels through my use of color. The feel of my *Songs of Innocence* is also indebted to Leonetto Cappiello's interesting portrayal of body movement, his use of striking colors, and the whimsical surrealism of his imagery. I looked often to Charles Gésmar for the manner in which I drew the body positions of my characters. Gésmar's women are arresting. He embraces the curvilinear and natural style of Art Nouveau in innovative, provocative ways. I also used Mucha's model for the way in which my women interact with their background – their flowing hair intertwined with the nature surrounding them – sinewy foliage enfolding and embracing the characters. Lautrec's influence on my project is most noticeable in the font, as well as in his vivid images and colors, and occasional poignant minimalism. I also tried to emulate the simultaneous realism and freedom which Lautrec takes with the shapes of his figures.

The artistic inspiration for my *Songs of Experience* came from an array of Art Deco artists. The jaunty, elegant Art Deco style was derived from both exotic Egyptian, Aztec, and Oriental repetitious patterns and from the sleek lines and angular geometric shapes of Italian Futurism and French Cubism. I borrowed Cassandre's marked use of Futurist symbolism. Communist propaganda hearkened back to Cassandre's minimalist, Futurist style: the blocks of color, speed, motion, and dynamism. Lempicka's style is, too, distinguished by its visual representation of motion and its Cubism. I incorporated Cassandre's and Lempicka's styles to

Figure 1. Alphonse Mucha, "Dance" (1898). Courtesty of WikiArt.

provide the background and underlying aesthetic behind my *Songs of Experience*. The artistic style of my border for the title page for *Experience* came from Lepape's pleasing use of repetition and geometry in his backgrounds. Lepape and Benito also had very inventive ways of incorporating text into their images and backgrounds in a way that feels natural but also draws attention to its cleverness (e.g. a scarf hanging from a figure's neck will spell out a word in the air). From Benito, I appropriated most of my aesthetic. I think that his near-Cubism, strict geometry, colors, and shapes all work together beautifully to encapsulate the Art Deco movement. I also find the way he draws his women (their stances and expressions) exotic and haunting. My women were a combination of Benito's chic and casual goddess and Erté's regal women, with their lavish, intricately-patterned costumes and their elongated figures which manage to be thin and spindly, yet also majestic and commanding. I must also mention Francis Cugat's manner of incorporating the female form into her background in an unnatural and eerie, yet beautiful way.

I hoped to intertwine elements from all of these artists to create a set of illustrations which have unity and encapsulate the artistic philosophies behind the Art Nouveau and Art Deco movements, but my book is definitely not completely tied up in its art. Just as Blake did, I experimented with word placement on the page, developing my own rationale for how text and image should connect in my *Songs of Innocence and Experience.*

Blake's poetry and illustrations operate together in an extremely intricate way: sometimes, his text and image work together, and sometimes they seem to be independent of each other – each telling a different story. Blake also developed his own set of symbols (exhaustively catalogued in Damon's *Blake Dictionary*): images and shapes that participate in his intricate mythos and symbolism. [8] For example, for Blake, the triangle represents Newton, rationalism, and Enlightenment. Similarly, I tried to develop my own set of symbols for my *Songs*, attributing meaning to staple images from the Art Nouveau and Art Deco periods.

The twelve poems, themselves, were comprised of five

to nine stanzas each containing four rhyming lines forming synchyses. I attempted to encapsulate the feel with which Blake imbued his *Songs*. His voice in *Songs of Innocence* is that of a child coping with a harsh world by romanticizing the most horrific elements – innocently explaining the world in a way which the child can rationalize. Perhaps a good comparison for Blake's *Songs of Innocence* is the child's song "Ring around the Rosy," which has a sing-song, playful tone which is completely unaware of the gravity of the content. I gave my *Songs of Innocence* the same kind of childish voice which misunderstands bad things and reinterprets painful subjects.

Blake's voice in *Songs of Experience* is that of a slightly older, wiser character who is painfully aware of the harsh realities of his world, but consciously chooses to find beauty in it, nonetheless. Blake's tone in *Experience* reminds me very much of Emily Dickinson's tone. Her poems voice an infinite sadness and complete awareness of the world and the woes it carries. However, unlike writers who imbue their works with gripping pathos, Dickinson does not dwell in these feelings, but rather attempts to find levity in the morose and beauty in death. Both my *Innocence and my Experience* deal with topics such as death, enslavement, pain, and longing, but the two sets of poems differ in the speaker's approach to these subjects in degree of awareness and understanding of the situation.

MICHAEL PHILLIPS' "ILLUMINATED PRINTING"

During Spring quarter of my sophomore year at Stanford, I wrote the twelve poems under the kind tutelage of Jones Lecturer and former Stegner Fellow, John Evans. I chose fonts for the two books of *Songs* and arranged the stanzas in their fonts on 3 x 5 inch templates in Microsoft Paint. I printed the 33 plates and drew my illustrations around the words. I inked the illustrations and scanned them into .jpg files. I then departed for Edinburgh, Scotland, where I etched and printed *Songs of Innocence* with Professor Michael Phillips at the Workshop of Edinburgh Printmakers. Professor Phillips is one of the very few people to

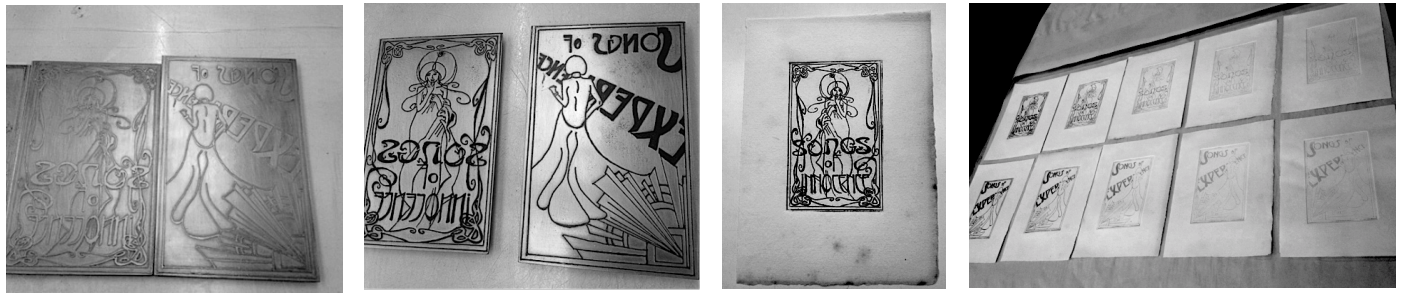**Figure 2.** Eduardo Garcia Benito, for *Vogue* (1926). Courtesy of Condé Nast.

Figure 3. (left) Final etched title plates to *Innocence* and *Experience* (2012).
Figure 4. (mid left) Inked title plates, ready for printing.
Figure 5. (mid right) First run of the title page to *Innocence* and *Experience* (2012).
Figure 6. (right) We ran the plates through the press multiple times. The first runs are on the left.

have successfully attempted to recreate Blake's printing method. He gave me tutorials on how Blake prepared, etched, and printed his plates – including how he mixed his inks, how he inked and wiped the copper plates, and how he prepared his paper.

I etched nearly all of *Songs of Innocence* with Professor Phillips using a method that he has perfected over many years. (See Fig. 3.) [9] We printed using a deep blue ink which Professor Phillips mixed with his own pigments and linseed oil. We printed on 560mm x 760mm 150g GSM WSH & Co. Soft Wove off-white paper from the 1920s that I chose to fit my project's aesthetic. (See Fig. 4.) We ran the inked plates through a press three times, getting three prints from each inking. The first inking was strong, the second slightly less, and the third, almost imperceptible, but with embossing. (See Fig. 5 and 6.)

GARAGE-BASED MODERN "ILLUMINATED PRINTING"

As one might deduce from the less professional look of the later prints, I etched and printed the *Songs of Experience* plates on my own, using a slightly cruder, makeshift technique in an improvised "studio" space in my garage. I scanned my images, converting them into .jpg files. Using Microsoft Word, I reversed the image and used a laser printer to print the .jpg files on peel-and-press paper (laser printer ink is an acid-resistant substance). I then ironed the peel-and-press paper onto pre-cut copper plates (which I took pains to clean and polish), transferring the image onto the plates. (See Fig. 7.) I filled in any areas where the ink jet ink did not completely stick to the plate with a tar-like acid resis-

tant substance procured from Professor Phillips, and applied to the plate with a thin brush. (See Fig. 8.) For a cheaper fix, this tar can be substituted by the similarly acid-resistant ink of a permanent marker.

I then exposed the copper plates to sunlight for several hours, as UV radiation strengthens the acid resistant substance. Once this was done, I submerged the plates in plastic tubs of ferric chloride acid. The process of actually etching the plates (leaving them in the ferric chloride, taking them out of their acid baths to wipe sediment off, and doing numerous amounts of touch-ups to the very thin lines) took anywhere from 6 to 10 hours per plate, but left me with a relatively thinly-etched relief copper plate. (See Fig. 9.) I inked the plates with a dauber and printed my plates using a small press on the leftover pre-wetted WSH & Co. wove paper, using a small press at the Flatbranch Print Studio in my hometown of Columbia, Missouri.

CONCLUSION

My experience has allowed me a glimpse into the inscrutable mind and genius of William Blake. Speaking as someone who has admired his talent from the moment I started studying him, I must say that working on my own set of *Songs* has given me a completely newfound respect for Blake. I "cheated" so many times in my reproduction of his process – using a computer font and word processor to achieve clarity and visibility of my text, instead of Blake's painstaking process of mirror-writing; using acetate, transfer paper, ink jet ink, and a UV-emitting machine instead of manually applying an acid resistant substance; using

Figure 7. (left) A plate with peel and press transfer paper affixed to it.
Figure 8. (right) Applying an acid-resistance substance to areas where
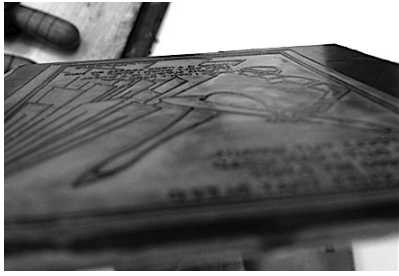
Figure 9. A plate, fully etched to 0.7mm.

ferric chloride acid (a softer, slower-acting acid which allows the etcher more control over the final product) instead of the highly corrosive nitric acid which Blake used; and choosing to etch the copper plates thinly and, therefore slightly more easily. If one leaves the copper in the acid for too long, the part that should be covered with acid-resistant substance and, therefore immune to the acid, becomes undercut. The solution to this problem is either to etch for shorter periods of time (the easier method I used) or to etch for longer periods, but to continuously and carefully reapply the acid-resistant substance to individual letters and in pools surrounding the text. Blake, of course chose the latter option.

I experienced firsthand, how much labor went into this project – I spent many hours writing, editing, thinking, illustrating, preparing the plates, redoing the preparation of certain plates, etching, re-etching, inking, re-inking, printing, and water-coloring. Reflecting on how much, by using modern technology, I simplified the actual work that Blake did, it is a breathtaking compliment to Blake's genius, ability, patience, persistence, and desire to produce something beautiful no matter the personal sacrifice and no matter the recognition he would (or in his case, would not) get.

It is not often the case that in an academic setting we can formulate creative responses to academic research. I relished the opportunity this project afforded me of not only being able to synthesize research in several fields – on William Blake's poems, on his printing methods, and on Art Nouveau and Art Deco – but to also in experiencing practical applications of my research. Instead of writing an academic paper on William Blake or on Art Deco, I was writing and illustrating a set of poems inspired by both subjects, and I therein discovered a wildly different and compelling new arena in which my research could manifest itself. It was exhilarating to see academic research not only within the confines of an ivory tower, but also alive and breathing on a page of my prints.

Critically analyzing a poet from a distance, as far as time and intimacy are involved, should make us all, to some extent, uncomfortable. Are we attaching meaning to his work that he would have rejected, are we
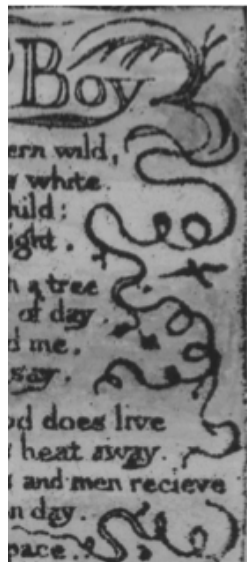

Figure 10. Detail from Blake, "Little Black Boy." Copy L. (1795). Courtesy of the Yale Center for British Art.

ignoring aspects on which he would have had us concentrate? I flatter myself that enacting Blake's etching and printing technique has shortened the distance from which I analyze him. Having attempted to replicate his work, I feel attached to his process, a comrade in arms. For example, on at least one point, I feel I can make an informed perceptive judgment: we must not become too distracted teasing out an intricate symbolism behind the curlicues, birds, and other bits of flora and fauna which permeate the margins of Blake's works. (See Fig. 10.)

When I was illustrating my *Songs*, I eschewed the "busy" feel that I believed these marginal figures created on Blake's plates. My aesthetic involved a lot of negative space – a great cause of stress while printing. It is nearly impossible to ink, with a dauber, such a thinly-etched plate with so many negative spaces, without getting ink in the negative spaces – a predicament which entails wiping the plate clean and re-inking all over again. (See Fig. 11.) The fact that these features were actually technically necessary – crutches that alleviated much of the stress from the already laborious task of inking the plate without getting any ink into the negative spaces – is a deduction I would never have made had I not attempted this project.

How can we hope to understand the poetry we study, the art we love, without first understanding the constraints of their form – without understanding that what appears superfluous, may have been necessary – that what might seem to us a "significant choice of words," could merely have been a last metrical resort of a writer anxious to finish a stanza. I would encourage my fellow Humanities students to demythologize the artists and writers they study, by studying and replicating their artistic process. If you are studying Pope's *Essay on Man*, write your own heroic couplets; if you are interested in Edo period Japanese woodblock prints, take a print-making course. The awe their genius inspires causes us to view writers and artists as gods among men, but we must also conjure them as men and women who got tired, as we do – who weigh one word over another for hours, then give up and use a completely different one. The process of considering the technical aspects behind works of art – immersing yourself completely in its creation – is both an invaluable experience that will give you a further appreciation of

Figure 11. Example of the difficulty of inking such a thinly etched plate with so many negative spaces.

the work you study, and also, I would posit, a necessary hurdle for scholars of the Humanities to attempt before we can hope to speak with an authority on our subjects.

ACKNOWLEDGEMENTS

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Sarah T. Weston graduated with distinction and honors from Stanford University in 2014 with a double major in English Literature and Art History. As an undergraduate, Sarah pursued three summer research projects with generous funding from Stanford's UAR grants, for which she was recognized with a Dean's Award for Academic Accomplishment. Her honors thesis on William Blake and 18th Century English theater garnered Stanford's Robert Golden Medal for Excellence in the Humanities, as well as the Kennedy Thesis Prize. Sarah is currently continuing her work on Blake, pursuing a Masters in Eighteenth Century and Romantic Literature at the University of Cambridge with the support of a Beinecke Scholarship. At Cambridge, she has received two Mountford Humanities Communication Prizes, has given several lectures, is co-organizing the Cambridge Eighteenth Century and Romantic Studies Graduate Conference, volunteers for the Fitzwilliam Museum, and is trying to learn change-ringing. In those brief snatches of time when she is not thinking about William Blake, Sarah enjoys writing, painting, playing the piano, and visiting museums.

"NO HESITATION" by Kate Nelson
LAURIE RUMKER & MICROBIOLOGY

> **"THERE WAS NO HESITATION, NO AMBIGUITY IN MY MIND WHEN I HAD TO PICK AN OLOGY PROJECT."**

When Laurie was in fourth grade, her teacher assigned the class an "ology project." The students had to take something they were interested in, make it an "ology," and present it to the class. They could turn anything into an "ology," leading some students to present on topics like "puppy-ology." Laurie instantly knew what she wanted to do: "There was no hesitation, no ambiguity in my mind when I had to pick an ology project." She chose microbiology.

Laurie immediately set to work, going around her school taking culture swabs from the bathrooms, water fountains, and door handles. She grew the bacteria on agar-filled petri dishes and presented them to the class. Though Laurie doesn't remember the first time someone told her there were little organisms that exist beyond the resolution of the world we can see, she wishes she did. By fourth grade she wasn't only interested in the bacteria themselves, but also the relationship between humans and bacteria. This curiosity has taken Laurie from her fourth grade ology project to her undergraduate honors thesis.

Laurie is now a senior majoring in Human Biology. Since her sophomore year, she has worked in the Relman Laboratory in the Microbiology and Immunology Department of the Stanford School of Medicine, where she has studied the human microbiome: all of the microorganisms that live in and on the human body. "Our microbiota play really important roles in our health," she explained, "from making vitamins that we can't synthesize ourselves, to educating our immune system and helping us resist pathogens."

Laurie's work focuses on understanding how our microbiota change over time. She's been investigating the stability of the gut bacterial community and its response when challenged with a perturbation. Anytime we take antibiotics to wipe out an infection, we also challenge the "good" bacteria. In Laurie's current research, she's recruited participants to go through a more mechanical perturbation of their microbiome called PEG-induced diarrhea (PID). This involves drinking four liters of fluid to mechanically wash out the gastrointestinal tract.

Surprisingly, Laurie says it doesn't take a lot of pitching to find participants eager to sign up for the study. Since she's analyzing bacterial genomic data, not human genomic data, she gets to share her results with the study subjects, and they get to learn more about this important but enigmatic component of their bodies and health. Laurie collects microbiota samples from the participants for ten weeks before and after the PID. Using these samples, she can learn what species are present by analyzing the taxonomic composition, what their functional potential is through metagenomic analysis, and what the products of their functional activities are through metabolomics. All of these analyses are helping Laurie figure out how our gut communities respond to this type of disturbance.

Though it might seem like processing and analyzing all of the samples involves a lot of delayed gratification, for Laurie, that isn't always the case. While concentrating microbial DNA from samples for her analyses, there's sometimes enough DNA to form a tiny white pellet at the bottom of the tube. One time Laurie's DNA pellets were too small to see and she thought she had lost her entire data set. But at the end of the protocol, when she resuspended the DNA and took a sample, it was there. Her reaction? "Science works. It's incredible."

The ultimate gratification comes from being able to apply an understanding of microbiome disturbances to future studies and clinical applications. Whether she's swabbing water fountains or concentrating microbial DNA, Laurie's motivation comes from both the end goal and the process: "Even the small steps I can get a lot of enjoyment out of because I delight so much in the scientific process, which I think also harkens back to my curiosity-driven upbringing."

natural sciences

The effect of burrow location on a reef flat on shrimp goby levels of activity

Melissa Do

Stanford University

Gobies, benthic fish of the family Gobiidae, are an integral part of coral reef systems around the world. These fish share a mutualistic relationship with blind snapping shrimp and are important prey for many commercially significant fish. For this reason, the actions of gobies have implications on the larger scale of the coral reef ecosystem. This study explores the effect of the location of a goby-shrimp burrow on a reef flat on the level of goby activity. The study site on the reef flat at Heron Island, Australia was divided into three zones: the inner reef flat, the mid-reef flat, and the outer reef flat. These zones differed in their amount of sand and coral cover. The activity of randomly chosen gold-speckled shrimp gobies (Ctenogobiops pomasticus) throughout each zone was recorded over the course of six days and was analyzed. There was no significant difference in activity levels between zones, but the data shows a general trend that, with a bigger data set, may convert to a significant difference between the location of a goby-shrimp burrow and the level of goby activity outside of the burrow. Shrimp gobies in sandier zones of the reef flat were observed to be more active than those which had burrows in areas of greater coral/algal coverage.

INTRODUCTION

Fringing reefs are unique habitats and face different problems from ordinary reefs due to the nature of their structure and composition. Fringing reefs are characterized by a often having a shallow back-reef, or reef flat. A main factor reef flats have to contend with is tidal action, which causes a host of problems, such as damage to marine organisms due to desiccation (Maragos et al., 1996). Furthermore, they experience more exposure to higher light intensities, UV rays, and higher temperatures than other coral habitats; have particularly low levels of nutrients (Jones and Endean, 1977); sustain the most damage from runoff, turbidity, and sediment accumulation (Field et al., 2008); and are easily affected by anthropomorphic activity (Baker et al., 2008). Marine animals living in this area must be adapted to these intense conditions.

Gobies, of the family Gobiidae, are small, benthic fish that are commonly found on the seafloor of reef flats and eat micro-invertebrates and planktonic algae by filtering them from the sand. Gobies have a unique mutualistic symbiosis with alpheid shrimps (Fig. 1). Alpheid shrimps are blind shrimps that build burrows in the seafloor and eat the invertebrates and detritus they find while sifting through sediment (Karplus, 1987). Of the more than 2000 species of gobies around the world, about 100 species have been observed to form a symbiosis with about 20 species of alpheid shrimp (Karplus, 1987). In this mutualistic symbiosis, the shrimp digs and maintains a burrow that the goby uses as a shelter from predators, while the goby alerts the blind shrimp of potential predators through physical communication (Karplus 1979, 1987). Gobies warn their shrimp partner in one of two ways: tail flicks or head first entries (Karplus and Thompson, 2011). Either of these two responses to potential dangers elicits the shrimp, which continually has an antenna touching the goby, to follow the goby and seek shelter inside the burrow.

Gobies and their shrimp partners are important to the coral reef ecosystem because they serve as prey for many different predators. Gobies are an important food source for commercially caught fish such as cod (Lederer et al., 2006). Moreover, gobies and blind shrimp assist in churning and mixing up the sandy seabed. This allows nutrients and food for other marine life to cycle through to the surface of the seafloor (Hopley, 2011). Since gobies have a critical role in the marine food web and in their mutualistic relationship with alpheid shrimp, their activity level on the reef flat affects many different marine organisms. For goby

Figure 1. Gold-speckled shrimp goby (Ctenogobiops pomasticus) and the pistol shrimp with which it shares a mutualistic relationship.

predators, the more active the gobies, the more prey available for consumption. For the shrimp, the more active a goby is, the greater the chance of it being eaten, and the more vulnerable the blind shrimp becomes (Nelson, 2005; Thompson 2005). In addition, as climate change continues to affect coral reefs (Baker et al., 2008), it is important to understand how the changing reef structure affects the activity of these shrimp gobies since they are contributors to reef health.

The purpose of this study is to look at how the location of a goby-shrimp burrow on a reef flat affects the level of goby activity. The activity level of gold-speckled shrimp gobies at the reef flat at Heron Island, Australia was recorded and analyzed to investigate how gobies living in three different zones of the reef flat varied in their activity level. "Activity" was characterized by how often the goby departed from its burrow, how often it returned after leaving, and how long it spent away from the burrow. The zones were divided into the sandy inner reef flat, the coral/algal dense mid-reef flat, and the intermediately sandy outer reef flat. The heterogenous back-reef at this island permits an understanding of how different habitat composition in each zone affects how active gold-speckled shrimp gobies in that area are. The level of goby activity may be representative of the external pressures, or lack thereof, caused by their burrow location.

METHODS

LOCATION AND ZONE STRATIFICATION

This study was conducted at Heron Island (23"45'S:151"92'E), an island in the southern Great Barrier Reef 70 km east of Gladstone, Queensland, Australia. This small island is a part of the Capricorn Bunker Island group and is surrounded on all sides by a very diverse, fringing reef. For this study, the activity of gold-speckled shrimp gobies (Ctenogobiops pomasticus) and their snapping shrimp partners was observed. Goby-shrimp burrows are found throughout the reef flat at Heron Island. The reef flat is visibly divided into three zones (Fig. 2): the sandy, coral-less inner reef flat that extended about 15 m from the shore at high tide; the coral dominated mid reef flat about 30 m from

Figure 2. Location of the zones of the reef flat at Heron Island, Australia used in this study. The reef flat is divided into 3 different areas: the inner reef flat, the mid-reef flat, and the outer reef flat.

Figure 3. From top to bottom: inner reef flat, mid-reef flat, and outer reef flat of the study site at Heron Island. Clear differences in habitat composition in each zone are visible. The inner reef zone is sandy and has no coral and algae. The mid-reef zone has dense coral/algal cover. The outer reef zone has an intermediate amount of coral/algal cover.

the shore; and the sandy outer reef flat with few corals about 60 m from the shore (Fig. 3). These zones were used as a basis for where to observe the activity of the goby and shrimp.

Data Collection (Goby Activity)

Twelve random goby burrows were selected within each zone during one week in late October 2014 . For a burrow to be selected, the goby needed to have been observed fleeing into the hole for shelter when disturbed or frightened. GoPro video cameras were placed outside each burrow to record the goby and shrimp activity. These cameras were placed behind or to the side of the burrow entrance so as to not scare the fish with the presence of a foreign object placed directly in front of the burrow. The cameras were placed about an hour after each high tide in order to control for the effect of tide level on the activity level of the gobies. This was a particularly important detail to adhere to because many goby-shrimp burrows in the inner reef flat zone are exposed to the air during low tide. The burrows were recorded for 13 min each. The first 2 min and the last 1 min of each video taken were not analyzed to account for any disturbance caused by setting up or retrieving the camera.

In addition to video footage, supplemental direct observations were also taken at each burrow while the cameras recorded. This is to account for the fact that gobies occasionally swim out of the camera frame. Visual observations were taken with as little disturbance as possible from the surface of the water for the duration of each recording.

Data Collection (Sediment Depth)

The sediment depth of each zone was measured by using a metal rod marked in millimeters and a plastic tube. The tube was placed on the seafloor surface and the rod was dropped inside. Afterwards, the tube was removed and the depth of the rod was recorded. This method was repeated 10 times per zone in randomly chosen areas of each zone. Sediment depth was averaged for the three different reef flat zones. An analysis of variance, ANOVA, was used to compare the depths in each zone.

Behavior Analysis

The video footage was analyzed and goby activity was documented. Goby activity was measured by how often the goby left and how often it returned to its burrow within the 10 min period. Activity outside of 15 cm from the burrow entrance was considered as the goby leaving the burrow. The total amount of time, measured in seconds, the goby was away from its burrow was also measured. Only one goby was tracked if the burrow was inhabited by two gobies. If a goby left and did not return to the burrow by the end of the 10 min period, the total amount of time away from the burrow was recorded up until this time. Time measurements were taken to the nearest 5 sec. Extra information was recorded as to whether the goby was roaming, foraging, resting, displaying territorial behavior, or guarding the burrow. Shrimp activity was identified as whether or not the shrimp was seen digging. If the shrimp was not seen, it was assumed that the shrimp was in the hole.

Goby activity in and out of the burrow was recorded for the three different reef flat zones. ANOVA was used to compare each zone.

RESULTS

Goby Activity

The average amount of time gobies left their burrows did not vary much between the three zones (Fig. 4). There was a lot of variation between the number of times the gobies left within each zone. Some gobies would leave multiple times, while many did not leave their burrows at all, especially among the mid and
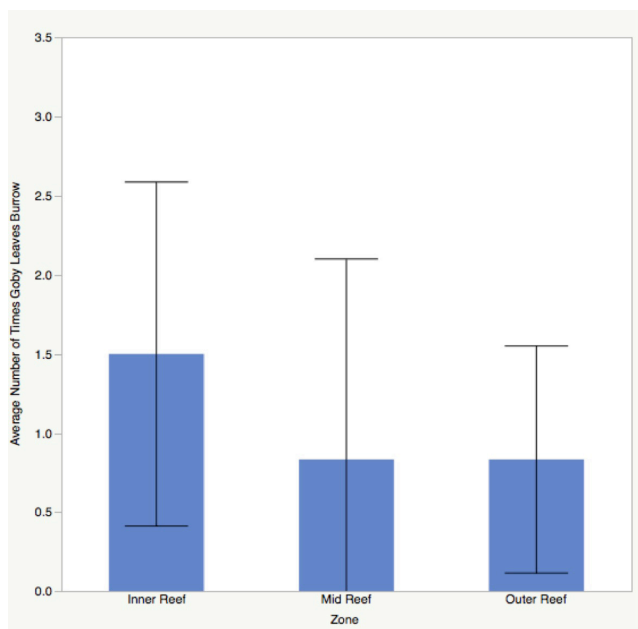
Figure 4. The average number of times a goby left its burrow between the three different zones of the reef flat at Heron Island, Australia: the inner reef flat, mid-reef flat, and outer reef flat. Error bars are in standard deviations.
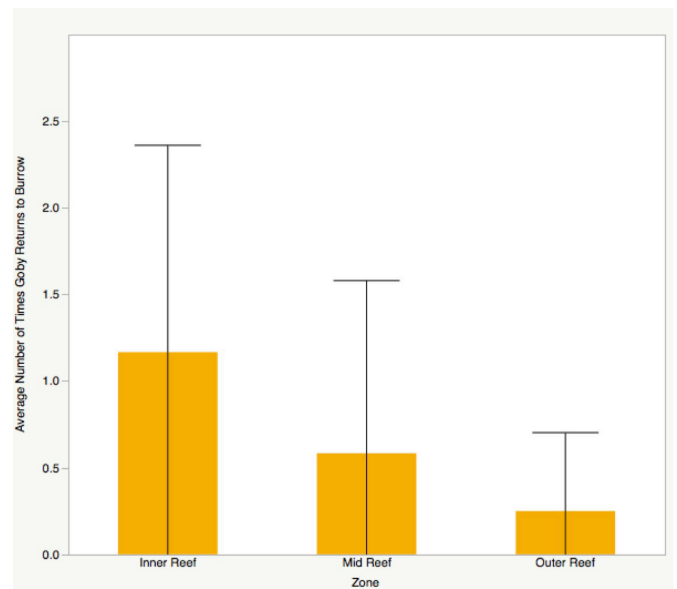
Figure 5. The average number of times a goby returned to its burrow after leaving. Comparisons are between the three different zones of the reef flat at Heron Island, Australia: the inner reef flat, mid-reef flat, and outer reef flat. Error bars are standard deviations.
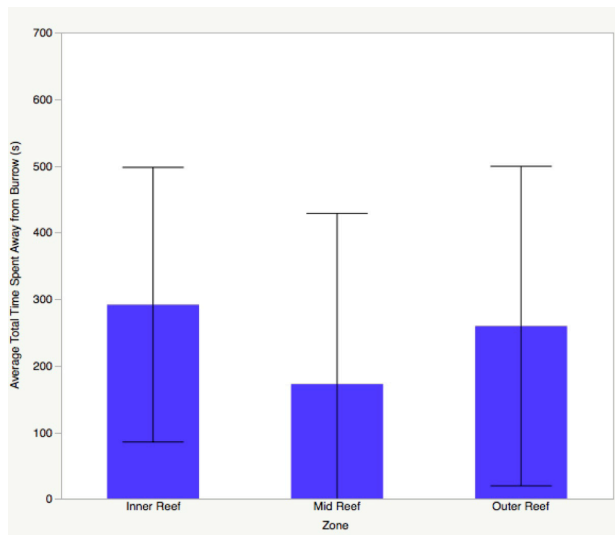
Figure 6. The average total time goby spent outside of its burrow after it left. Comparisons are between the three different zones of the reef flat at Heron Island, Australia: the inner reef flat, mid-reef flat, and outer reef flat. Error bars are standard deviations.

Figure 7. Bar graph comparing average sediment depth per zone The three different zones of the reef flat at Heron Island, Australia are: the inner reef flat, mid-reef flat, and outer reef flat. Error bars measured in standard deviations.

outer reef flat. Gobies observed in the mid and outer reef left their burrows on average the same number of times, 0.83 times per goby. Gobies in the inner reef zone left slightly more often at, on average, 1.50 times per 10 min period per goby. There was no significant difference between the number of times the gobies left their burrows between the three zones (p = 0.2143).

The average number of times gobies returned to their burrows notably varied between the three zones (Fig. 5). There was a lot of variation between the number of times the gobies returned to their burrows after leaving within each zone. Some gobies would return a few times, while some gobies did not return at all, particularly in the inner reef flat. Gobies in the inner reef flat returned an average of 1.17 times to their burrow after leaving it. Gobies in the mid-reef returned nearly half as many times with an average of 0.58 times per goby observed. Gobies in the outer reef did not return much at all within the 10 min period and averaged only 0.25 times per goby that departed from its burrow. There was no significant difference between the number of times the gobies returned to their burrows between the three zones (p = 0.0659). However, with a p-value close to 0.05, the results were close to being statistically significant.

The time gobies spent away from their burrows when they left differed between the inner and outer reef and the mid-reef, but these differences were not significant (p = 0.4468) (Fig. 6). Gobies in the inner and outer reef flat spent an average of 291.67 sec (about 4.86 min) and 259.58 (about 4.33 min), respectively, in total away from their burrows during the 10 min period. In contrast, gobies in the mid-reef zone spent an average of 172.5 sec (about 2.88 min) away from their burrow.

Sediment Depth

There was no significant difference between sediment depth in the three zones (p = 0.7879) (Fig. 7). Overall, there was not much variance in the sediment depth within each of the three zones. The average sediment depth of the inner reef, mid-reef, and outer reef was 29.2 mm, 30.9 mm, and 28.5 mm, respectively.
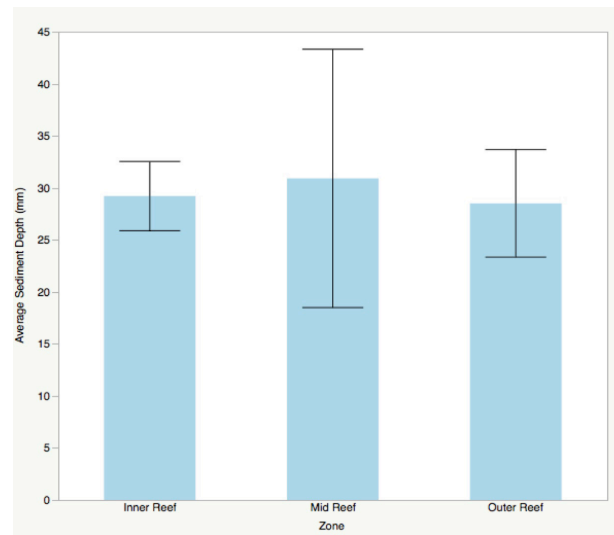
Direct Observations

Supplemental direct observations permitted the collection of a more complete picture of the gobies' activities outside of the burrow as the gobies occasionally strayed outside the view of the camera. Gobies that left their burrows were observed to stray only a few centimeters to several meters away from their burrows. Outside of the burrow, the gobies were observed either roaming or feeding. Once in a while, some gobies displayed territorial behavior towards smaller gobies. Gobies that did not leave their burrow were observed resting at the burrow entrance, either partially in the entrance or fully outside of the entrance, and only moved once in a while to reposition their vigilant stance. It was only when gobies were at the entrance were their shrimp partner seen and observed digging and moving sand outside of the burrow. It was also observed that the gobies never left the burrow when the shrimp were digging. The shrimp were never seen outside of the burrow during the course of this study. On occasion, some gobies were observed participating in the upkeep of the burrow by using their mouths to move sand from inside the burrow to the burrow entrance or by removing small pieces of algae and marine plants that had become lodged in the burrow entrance. Shrimp partners were not observed when gobies exhibited this behavior.

DISCUSSION

Findings

Although analyses of variance, ANOVAs, revealed that the results of this study were not statistically significant, there was a growing trend seen in the data in each graph relating to goby activity. The main trends found were that gobies in the inner zone left their burrows more often than those in the mid and outer zones, gobies in the outer reef flat zone returned less often to their burrow, and gobies spent more time away from the burrow in the sandier areas of the inner and outer reef flat compared to the coral and algal dense mid-reef zone. With a larger sample size for

each zone, the trends observed in the results of this experiment could have resulted in more significant outcomes than what was originally found.

Sediment depth was measured to determine whether it could be a factor in explaining the difference in the composition of the three zones. Increased sedimentation results in greater sediment depth, increased turbidity, and more sediment accumulation on corals. Excessive sedimentation adversely affects physical and biological processes in a reef by hindering access to sunlight for photosynthesis (Fabricius, 2005). According to the results of this study, however, it was not a factor. Coral/algal cover could therefore be a more significant factor in causing the zonation seen at the study site at Heron Island. Previous research found that goby-shrimp populations benefitted from low levels of coral cover and declined when there was too much coral coverage (Lewis, 2012). This may give insight as to why gobies in the outer zone returned to their burrows the least amount of times after leaving it compared to gobies in the other two zones. In the outer zone, there was an intermediate amount of coral and algal cover, which may have been an ideal amount of coverage that could have promoted both more foraging and protection from predators for the gobies.

In this study, the mid-reef zone had a greater density of coral and algae compared to the inner and outer reef flat. Coral attracts marine life due to the greater amount of resources among the coral and algae, namely in the shelter and food sources they provide (Bellwood and Hughes, 2001). These fish in turn provide a food source for larger marine organisms; hence more predators are found in coral dense areas as well (Beukers and Jones, 1998). Higher levels of predation may be the reason that gobies were less active in the coral and algae covered mid-reef zone and that gobies in the more sandy inner and outer zones of this study spent more time away from their burrow. The more active a goby is, the more chances there are for the goby to be preyed upon. Yanagisawa (1984) found that in areas of lower predation, shrimp and gobies travelled farther from their burrow. Gobies in the sandier areas, like the inner and outer reef flat, have more opportunities to roam farther and more frequently since the lack of coral in these zones means there are less fish in general inhabiting these areas and thus there are less predators that can potentially eat the gobies. Furthermore, gobies and alpheid shrimp eat micro-invertebrates that may be attracted to areas of more coral and algal coverage. It is possible that gobies in the mid-reef area where there was greater coverage may not have been as active because food is so readily available due to the proximity of the goby-shrimp burrows to the surrounding coral and algae. Consequently, gobies would not have to travel much or too far while foraging to find food.

A crucial detail of the mutualistic symbiosis between gobies and blind shrimp are that the gobies warn their shrimp partner when a threat is near (Karplus and Thompson, 2011). Greater predation on gobies therefore has very large implications for their shrimp partners. Nelson (2005) has shown that shrimps deprived of a goby partner spent almost twice as much time with burrow maintenance than activities—such as foraging—more necessary for growth, survival, and fitness. Burrow maintenance consists of keeping burrow entrances and burrow pathways clear (Nelson, 2005). Foraging occurs when the shrimp searches for food outside of the burrow (Nelson, 2005), mostly in the presence of goby partner (Thompson, 2005). In addition, shrimp burrow less when alone and without a goby partner. Burrowing consists of digging and expanding a burrow and allows the shrimp to uncover additional food (Thompson, 2005). Higher levels of activity increase the risk of a goby being preyed upon. Without a goby partner for protection, a shrimp suffers decreased fitness because it is less able to forage until it finds a new partner. Moreover, greater goby activity level leading to more goby predation could cause more shrimp predation because the blind shrimp can no longer be warned of danger until another goby partner is found.

> **Gobies in the inner zone left their burrows more often than those in the mid and outer zones, gobies in the outer reef flat zone returned less often to their burrow, and gobies spent more time away from the burrow in the sandier areas of the inner and outer reef flat compared to the coral and algal dense mid-reef zone.**

Limitations

During the course of this study, there were several limitations that prevented the attainment of concrete results that fully reflected how the location of goby-shrimp burrows on the reef flat affect the level of goby activity. Firstly, time was an especially limiting factor while this study was conducted. The collection of more data would permit a more accurate representation of the effect of the goby-shrimp burrow location on the level of goby activity. In addition, there were several instances during data collection in which the goby either did not leave or re-emerge from the burrow. This occurred throughout all three reef flat zones. These data points introduced much variability and a greater range within the data for each zone. The collection of longer footage would permit more accurate representation of the level of activity of gobies throughout the three zones by potentially recording greater occurrences of goby departures and returns and also of the total amount of time the gobies spent away from their burrow after they have left it.

Next, this study did not consider certain other factors that could have affected goby activity level due to limited time and and data gathering opportunities. Such factors include the density of goby-shrimp burrows in each zone, the proximity of burrows to one another, the possibility that there was not a shrimp in the burrow with the goby, and, in particular, the effect of storm activity on the level of goby activity. During the length of this study, there were a few stormy days during which there was rain and high wind speed that resulted in higher levels of turbidity as well as in many of the goby-shrimp burrows being covered

by sand. Such disturbances have been observed to reduce goby-shrimp levels of activity (Woodby, 2012). It is possible that all of the aforementioned external factors could have had an effect on the level of activity of the gobies and shrimps in this experiment.

Another limitation to this study deals with the goby-shrimp burrows. Goby-shrimp burrows are known to have multiple entrances (Takegaki and Nakazono, 2000). When the gobies in this study left their burrows, it is possible that they left one burrow entrance to go to another burrow entrance. It is also possible that the gobies did not re-emerge because they exited through a different burrow entrance. Such occurrences would have been very difficult to determine as goby-shrimp burrows can be very extensive (Takegaki and Nakazono, 2000) and it would have been difficult to identify whether the individual goby at another entrance was the same goby or a different one. Furthermore, there was no way to tell if the burrow had a shrimp living inside with the goby since the alpheid shrimp are quite elusive (Karplus and Thompson, 2011; Nelson, 2005) and since it is also possible to find gobies living in a burrow without a shrimp partner (Takegaki and Nakazono, 2000). These limitations with the goby-shrimp burrows could have affected the level of goby activity observed.

Additionally, this experiment was limited by the variation in the level of goby activity throughout the day. Previous research found that there was a significant correlation between goby-shrimp activity and tide level and that goby-shrimp activity peaked at high tide (Woodby, 2012). Furthermore, another study found that goby-shrimp activity peaked during midday to late afternoon (Kalkus, 2013). However, during the length of this experiment, high tide shifted from the afternoon to the early morning. This made the extent to which either factor, tide height and time of day, had on the level of goby activity unclear. These factors were not accounted for in the results, but they may have affected goby activity levels as well. Comparisons between activity levels during morning and afternoon high and low tides would need to be analyzed for any effects these different external factors might have on activity levels

Future Research

Very little data was recorded on the level of alpheid shrimp activity in this study because it is very difficult to observe the activity of the shrimp. They often stay inside the burrow hole and are not as frequently and visibly seen being active, especially if no goby is present (Karplus and Thompson, 2011; Nelson, 2005). This made it difficult to accurately record possible varying levels of shrimp activity throughout the three different reef flat zones in this experiment. In general, little is known about the details of the goby-shrimp partnership and even fewer studies have focused on the blind shrimp due to their elusiveness (Karplus and Thompson, 2011), so there exists many opportunities to try to look at alpheid shrimp activity in future studies.

It is assumed that, in the mutualistic relationship between gobies and blind shrimp, the alpheid shrimp is primarily responsible for creating and maintaining the goby-shrimp burrow (Karplus and Thompson, 2011; Nelson, 2005; Takegaki and Nakazono, 2000; Thompson, 2004; Karplus, 1987, 1981). There has only been one instance officially recorded of a goby participating in burrow construction by removing mouthfuls of the mud from inside the burrow and ejecting it at the entrance

(Karplus and Thompson, 2011). However, video footage from this study supports that observation and evidence was found that many gobies on the reef flat at Heron Island also "dig", by taking mouthfuls of sand and depositing it at the entrance, and maintain the burrow, by using their mouths to remove pieces of algae that become lodged in the burrow entrance by the water current. Since no shrimps were observed when gobies displayed this behavior in the video footage, it is possible that gobies can maintain an already established burrow without a shrimp partner. More research on this observed behavior may allow greater insight into the role of the goby in the goby-shrimp partnership.

CONCLUSION

This study has looked at some of the different underlying factors that can affect the level of goby activity on different areas of the reef flat and has discussed the numerous opportunities to look at different aspects of goby and shrimp behavior. Many studies have looked at the morphology of goby and blind shrimp species, but much is still unknown about their behavior and ecology (Karplus and Thompson, 2011). Since gobies and their shrimp partners depend on coral reefs to survive and since they are an important part of the greater coral reef ecosystem as a food source, it is important to continue researching their behavior, especially as climate change continues to affect coral reef habitats around the world (Baker et al., 2008) and therefore threaten to disturb the activity and behavior of both the gobies and shrimp as well. It is necessary to study the different components of coral reef ecosystems that contribute to reef health in order to better understand and find solutions to the effects of increasing environmental stressors on these habitats.

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Assessment of Left and Right Lateral Ventricular Enlargement in Patients with Alzheimer's Dementia

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The incidence of neurodegenerative diseases, such as dementias, has steadily increased worldwide with dementia of Alzheimer's type (DAT) being the most prevalent form worldwide. Clinico-pathological evidence suggests that Alzheimer's Dementia (AD) begins many years before cognitive symptoms begin to surface. Hence, biomarkers are required to assist in early identification of AD in order to implement disease-modifying therapies designed to preserve cognitive function. Ventricular enlargement has been associated with AD and may act as a potential marker for quantifying the neuropathological change associated with mild cognitive impairment (MCI) and AD. We analyzed 3T brain magnetic resonance imaging data from a diverse distribution of 74 subjects composed of control, MCI, and AD patients. We found that an increase in ventricular volume was associated with the progression of Alzheimer's disease. Specifically, ventricular volumes of Alzheimer's subjects were higher than that of control patients. Lateral ventricle analysis was conducted with two novel semi-automated segmentation methods followed by quality assessment of the ventricular surfaces via the Hausdorff distance metric. The FS+LDDMM method obtained a Hausdorff distance lower than the FreeSurfer method when compared to the manual segmentation labels. This result illustrates that FS+LDDMM is an automated method that has a high degree of accuracy and can be used in the place of manual segmentation, while FreeSurfer should only be used for estimating preliminary segmentation labels.

The incidence of dementia in western societies has steadily increased, predominantly affecting the elderly. Dementia of Alzheimer's type (DAT) is the most prevalent form of dementia in western countries that entails cognitive and behavioral impairment [1]. Alzheimer's is a progressive, irreversible disorder that encompasses the deterioration of neurons leading to short-term and long-term memory deficiency. Other symptoms of Alzheimer's disease include, but are not limited to, disorientation, mood swings, poor judgment, irritability, and overall decrease in quality and longevity of life [2]. Although Alzheimer's is incurable, early detection can be beneficial in improving the overall well being of the affected patient. [3]. Therefore, it is important to develop specific biomarkers that can potentially be utilized to pick up the signs of neurodegeneration pre-symptomatically, and hence aid in the early detection of AD.

The progression of AD has been shown to exhibit multiple subcortical structural changes that can act as biomarkers. Morey et al. (2004) illustrated that there is accelerated hippocampal atrophy at the AD and mild cognitive impairment (MCI) stage compared to normal aging. MCI describes a patient that suffers from noticeable cognitive impairment and a higher risk of developing dementia. This atrophy occurs as a result of normal aging, but the rates in MCI and AD stages are higher [4]. Poulin et al. (2011) found progressive atrophy in the amygdala as the disease advanced from MCI to AD [4]. In addition, Nestor et al. (2008) found that the lateral ventricles were known to enlarge as Alzheimer's progresses [5]. All of these studies demonstrate that specific subcortical structure atrophy can be a promising biomarker for pre-symptomatic disease as it can be detected at an early stage. This study focuses on the left and the right lateral ventricles to compare the plausibility of using ventricular volumetric changes as an effective biomarker for the early detection of AD.

Automatic algorithms for segmentation of structures in the brain are commonly used for volumetric analysis, since manual segmentation is an extremely time consuming process and inefficient for segmenting large datasets. However, it is crucial that automatic segmentations be quality controlled with manual corrections to provide a more accurate representation of the volume of the lateral ventricles. Image segmentation methods follow varied image processing constructs. The two most common type of methods are where 1) the segmentation is performed on the image data (direct segmentation) and 2) ground truth labels are transferred via a registration algorithm (registration based segmentation). FreeSurfer, a well known automated brain MRI segmentation pipeline, provides labels for the subcortical and cortical structure. FreeSurfer acts as a brain imaging software package that allows for functional brain mapping and is often used to provide initial segmentations before proceeding to other steps [6]. The combination of the FreeSurfer
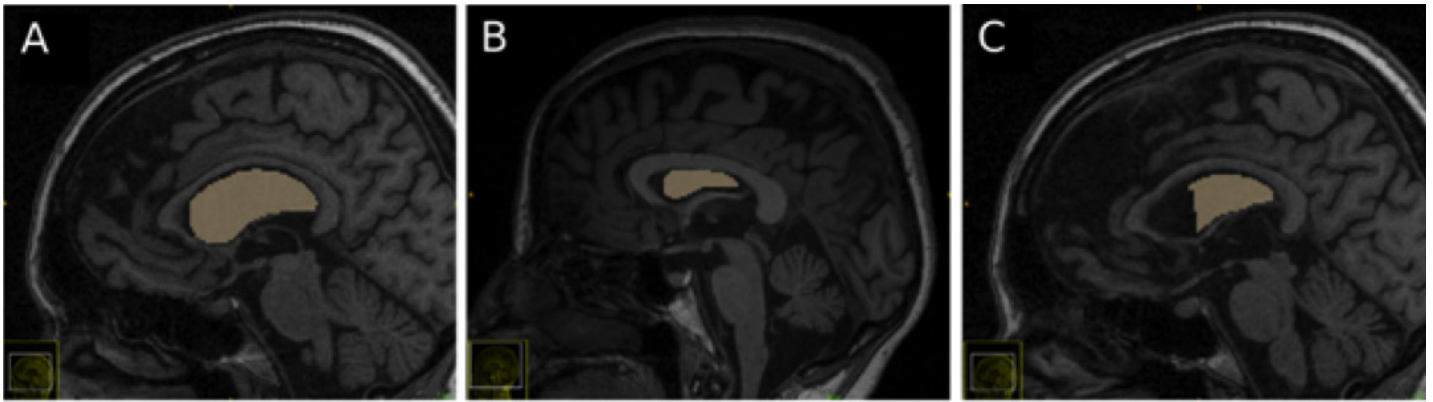
Figure 1. The figures above present examples from the three grades in the rating criterion for error in automated labeling. A signifies minor corrections, B signifies moderate corrections and C signifies major corrections.

method with Large Deformation Diffeomorphic Metric Mapping label (FS+LDDMM) has shown improvement in segmentation accuracy over FreeSurfer labels [7]. A FS+LDDMM pipeline uses FreeSurfer outcomes as initial labels and improves segmentation accuracy by the transfer and fusing of ground truth labels from multiple atlases to obtain final labels. [8]. In order to investigate volumetric properties for large data sets in the future, an efficient segmentation method should be in place. Hence, we evaluate the performance of FreeSurfer and FS+LDDMM as viable automatic segmentation methods, in which we anticipate the FS+LDDMM to be as accurate as the manual segmentation labels.

This study analyzes the volumetric changes in the lateral ventricles across CN, MCI, and AD subjects. We hypothesize that control subjects will have a significantly lower volume compared to the AD subjects. Moreover, we anticipate that the MCI subjects will able to illustrate a progressive volume increase as the disease develops. This information could lead to a better understanding of the disease and may enhance our ability to manage the disease appropriately. Finally, we assessed the performance of automatic segmentation methods with expectations that the FS+LDDMM method may be accurate enough to replace manual segmentations

METHODS

For this study, a cohort of 74 patients was selected from The Australian Imaging, Biomarker & Lifestyle Flagship Study of Ageing (AIBL) database [9]. This data set provides 3 tesla (3T) magnetic resonance images (MRI) of each patient. The 74 subjects that were analyzed in this study were categorized as control (CN) subjects (n=25), mild cognitive impairment (MCI) subjects (n=25) or AD subjects (n=24). The median age was 71.3 with a minimum of 60 and a maximum age of 80. The number of males and females selected were equally divided with 37 males and females, respectively.

A 3 tiered rating scale was developed to quantify the accuracy of the left and right lateral ventricles segmentation from observing the labels overlaid on the MR images and the level of corrections needed in each of the views (sagittal, axial and coronal views). Each of the 74 subjects were classified through the rating scale as requiring either minor corrections, moderate corrections or major corrections . Figure 1 displays a slice of the right lateral ventricle through the sagittal view and how each subject was typically classified using our visual rating scale. The number of subjects that required minor correction was 10, moderate corrections were 39 and major corrections were 25. The subjects were manually
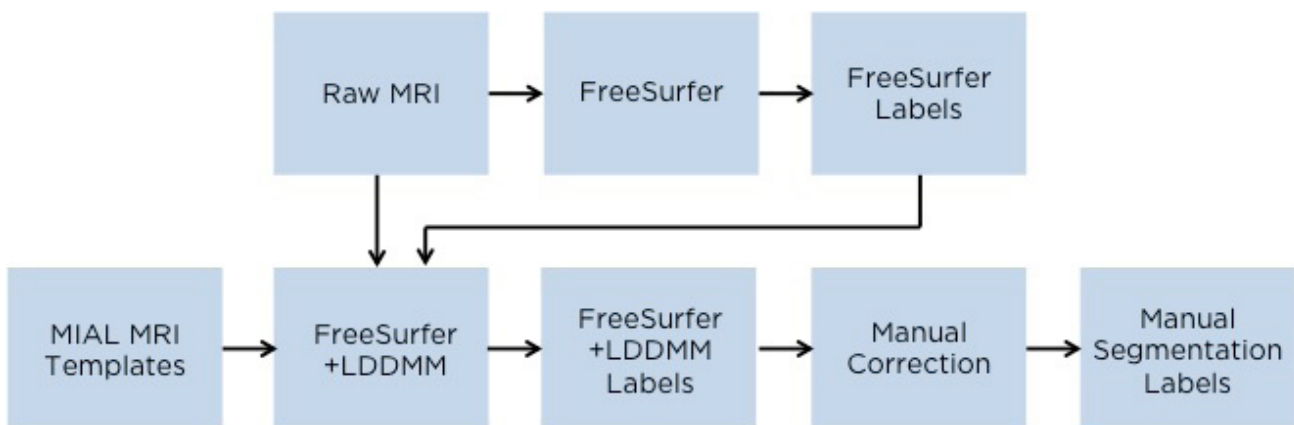

Figure 2. Block diagram representation of the segmentation methods: FreeSurfer, FS+LDDMM and manual segmentation. The Raw MRI was inputted into FreeSurfer to provide with FreeSurfer Labels. The FS labels in conjunction with the Raw MRI were used to provide FreeSurfer+LDDMM labels, which would be then corrected manually to provide manual segmentation labels.
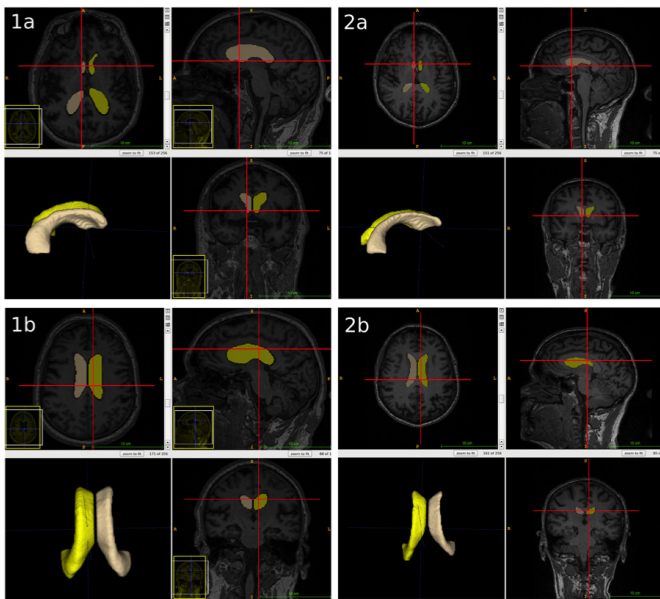
Figure 3. The Figures above present examples AD and Control subjects in 4 different views (coronal, axial, sagittal, and 3D). 1a and 1b shows an AD patient, while 2a and 2b shows a control patient that was corrected via ITK-SNAP Software. The yellow structure illustrates the left lateral ventricle and the beige is the right.

Figure 4. The figures above are a representation of the lateral ventricular enlargement in Alzheimer's patients versus control. A & C signify the lateral ventricles of an AD patients, while B & D signify the lateral ventricles of a control patient.

corrected using a specific lateral ventricle segmentation protocol to ensure that lateral ventricle segmentations were an accurate representation of the actual structure in each individual patient [10].

For the raw MRI data, FreeSurfer, a publicly available automatic segmentation tool, was utilized for its ability to segment the subcortical structures in the brain. This was followed by the combination of FreeSurfer method with FS+LDDMM to improve the overall accuracy [7, 11]. All the subjects that required corrections for their segmentations were manually corrected via ITK-SNAP Software using a standard lateral ventricle segmentation protocol [12]. The entire process is illustrated in Figure 2. Furthermore, all of the data was split between two experienced raters. Figure 3 displays the ITK-SNAP Software and a visual comparison of the lateral ventricles between the control and AD patients in 4 different views (sagittal, axial, coronal, 3D).

Protocols for delineating lateral ventricle shape accurately from MR images were based on previously established anatomical definitions [10]. The protocol included manually correcting the lateral ventricles from the FS+LDDMM segmentations in the sagittal view with subsequent review in both the coronal and axial planes in ITK-SNAP. The inferior and the posterior horns of the lateral ventricles were excluded as the atlases used for multi-atlas fusion in the FS+LDDMM registration methods for segmentation were from a different cohort and included the removal of these structures. All subjects that required corrections were manually corrected via ITKSNAP software [12]. Figure 4. Illustrates the lateral ventricular enlargement and shape differences in AD patients versus control patients.

The left and right lateral ventricles were analyzed independently. The post analysis using the extracted segmentation data was conducted in MATLAB [13]. The ventricular volume was obtained for all subjec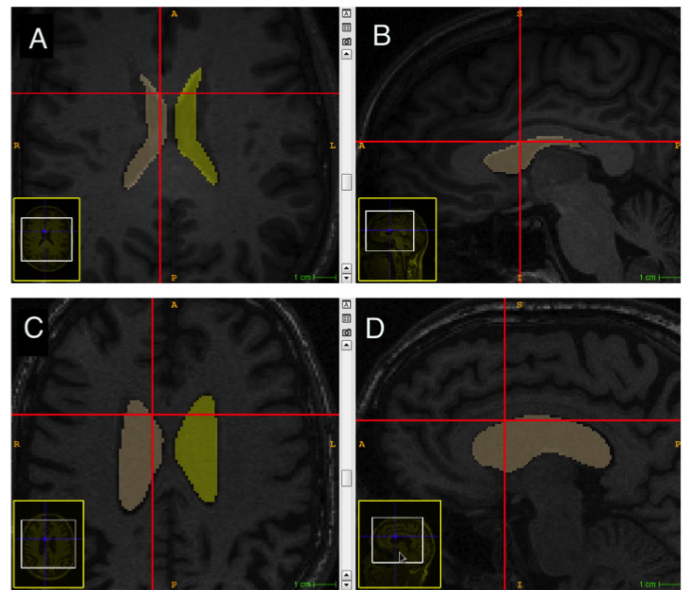ts. Further analysis included conducting a two-sample t-test with a confidence interval of 1% to test for the statistical difference in the ventricular volume values between control, MCI and AD subjects. The null hypothesis (h = 0) signified a lack of difference in mean ventricular volume between the two groups of data being compared, while the alternate hypothesis (h = 1) signified a difference in mean ventricular volume.

Furthermore, symmetrized Hausdorff Distance (HD) was used to evaluate the performance of the segmentations by analyzing the distance between the automatic and the manual method. HD defined as

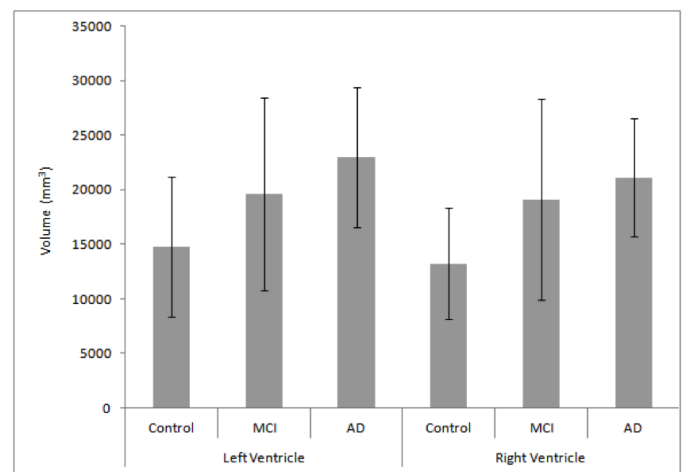$$hd(A, B) = \text{mean}_{a \in A} \min_{b \in B} d(a, b)$$

Figure 5. Mean and Standard Deviations of Volume in both the left and right lateral ventricle in Control, MCI, and AD patients. The vertical black lines represent the standard deviation of the mean volumes.

is the directed Hausdorff distance where d(a, b) is the Euclidean distance between two points on the two different surfaces. To symmetrize this metric we use the following:

$$HD(A, B) = mean[hd(A, B), hd(B, A)]$$

The Hausdorff distance gives an upper bound on the mismatch between the contours of the segmentations.

RESULTS

Figure 5 presents the mean and standard deviations of volume for both the left and right ventricles and for all groups of subjects. The grey bars represent the mean volume in mm3, while the thin vertical lines with the horizontal ends represent one standard deviation above and below the mean. The mean volume for control subjects is lower than the mean MCI volume for both ventricles. Moreover, the mean volume for MCI subjects is lower than the mean AD volume for both ventricles. Although it is important to note that the standard deviations are quite high (5400-9200 mm3) for all mean volumes in all subjects and in both ventricles.

A two-sample t-test was conducted on the data set to identify the statistical difference between ventricular volume values between the various subject groups. Table 1 presents the statistical comparisons between mean volumetric values for all subject groups. Specifically, the p-values and T-statistic were calculated for the left and right lateral ventricles. The null hypothesis in the two-sample t-test was rejected at a p-value < 0.01. The results from the test attained a statistical difference (p < 0.01) in the mean volume between Control and AD subjects for both the left and the right ventricle. Moreover, a statistical difference is also noted (p < 0.01) when comparing the mean volume between control and MCI subjects and MCI and control subjects for both ventricles. A negative T-statistic for all groups of subjects demonstrates that

	Left		Right	
	P value	**T-statistics**	**P value**	**T-statistics**
Control Vs. MCI	0.1010	-1.634	0.0330	-2.198
MCI Vs. AD	0.2220	-1.236	0.4160	-0.820
Control Vs. AD	0.0020	-3.255	0.0004	-3.786

Table 1. Results presented for P values and T-statistic of two-sample t-test comparing mean Volume for the left and right lateral ventricles.

the first group listed in each pair has a volume less than the latter.

The Hausdorff Distance was calculated between the automatic methods vs. manual across the different subject groups on both sides of the lateral ventricles. Figure 4 presents a boxplot for the HD across all 74 subjects. For all subject groups, the median HD for manual vs. FS was higher than the median value for manual vs. FS+LDDMM. The readings for manual vs. FreeSurfer also displayed a skew to the right with an exceptionally wide range.

In regards to the comparison between manual vs. FreeSurfer+LDDMM, a range of 0.05mm to 0.25mm illustrates high spatial overlap. Moreover, when comparing manual vs. FreeSurfer, a range of 0.45mm to 1.65mm was observed, which is not optimal for an automated method.

DISCUSSION

The left and right lateral ventricles volumes were extracted and analyzed. From our results, we found that the volumetric difference between CN and AD was statistically different, and there was a consistent increase of volume across the subject groups (Figure 5). However, despite an increase in MCI volumes,
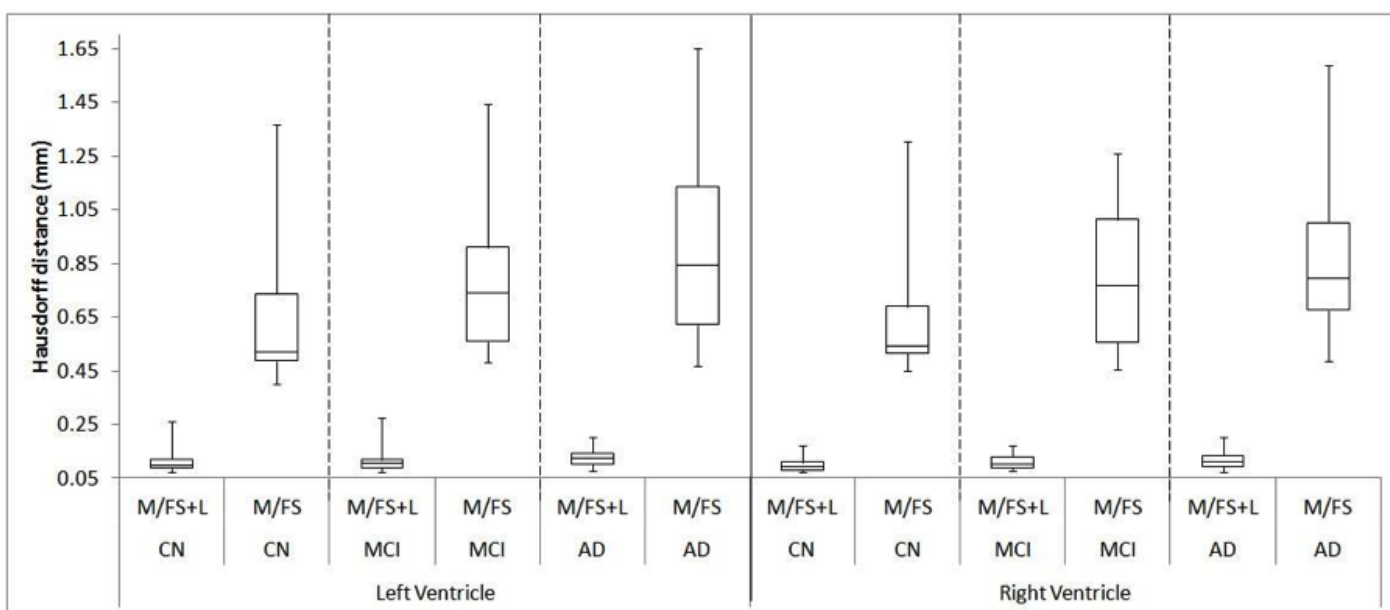

Figure 6. The figure above shows the Boxplot for the Hausdorff Distances the left and right lateral ventricles. The boxplot presents the range of distribution with a thin vertical line through the box. Horizontavl bars above and below this line represent the minimum and maximum values. While the box itself with the vertical lines is bounded by the 25th and 75th percentiles of the distribution and the median is shown via a horizontal line in the box. The M/FS+L signify comparison between manual and FS+LDDMM segmentation methods, while the M/FS signifies comparison between manual and FreeSurfer segmentation method.

this increase was not statistically significant when compared to both CN and AD subjects (table 1). This illustrates, that volumetric changes can be seen as a subject progress to mild cognitive impairment, but this change is much more evident as the subject is diagnosed with AD.

Due to the use of multiple large data sets, the study also evaluated the accuracy of different types of automated segmentation methods. Specifically, FreeSurfer and FreeSurfer+LDDMM were compared for segmenting the lateral ventricles. Figure 6 displays the Hausdorff distance we computed for the automatic methods compared to manual segmentation, across the various subject groups. Across all disease groups (CN, MCI, and AD) we obtained results that suggest that the FS+LDDMM method to be substantially close to the manual tracing. This result yields confidence in our intent to substitute manual segmentation with automatic processing when it comes to larger datasets. Larger datasets require a great deal of time and commitment and thus are often considered impractical to manually segment. With promising results from the automated process, it would be extremely beneficial the automated method which is more efficient.

Furthermore, there is an overt disparity between the manual vs. FreeSurfer segmentations. The Hausdorff distance between manual and FS+LDDMM across all subject groups provided a very small distance that ranged from 0.0739mm to 0.276mm. Conversely, when examining the distances between manual and FreeSurfer, a much larger range of 0.400mm to 1.65mm was observed. Figure 6 also displays large standard deviations, notably when comparing the manual to FreeSurfer. Overall, this clear distinction in accuracy illustrates that the FreeSurfer+LDDMM algorithm should be used over FreeSurfer. Segmentation methods can be used to draw valuable conclusions from MRI data, and it is of the utmost importance that these methods be as accurate as possible.

RECOMMENDATIONS

In conclusion, the volumes for CN and AD subjects were significantly different. In addition, the MCI subjects displayed an increase in lateral ventricle volumes but this increase was not statistically significant. Overall, our study followed an expected trend of a volumetric increase from CN, to MCI, to AD. Furthermore, when comparing the FreeSurfer+LDDMM segmentation method to FreeSurfer, the FreeSurfer+LDDMM method illustrated a high level of accuracy on par with the manual segmentation.

A variety of reasons could be attributed to the lack of volumetric significance between MCI versus the CN and AD groups. One factor could be due to the small sample size used for the study, which could potentially result in large standard deviations amongst the subject groups. By using a large sample size, the outliers can easily be identified which can result in smaller standard deviations and possibly a statistical difference in volume between the groups. Furthermore, MCI subjects can be further divided into MCI converters and non-converters. This will allow us to analyze specifically which subjects would eventually develop AD, and those that would not. Further studies that can be conducted are analyzing the effect of age on the shape and size of the lateral ventricles. In addition, the studies could become more specific by analyzing the effects of aging only on selected lateral ventricle subfields (the posterior horn, inferior horn and the frontal horn) and the change they experience as the disease progresses.

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NATURAL SCIENCES

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Bridging the Past and Present: Performing Arts as Nontraditional Sources of Musculoskeletal Stress

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Osteoarchaeologists and clinicians are increasingly engaging in cross-disciplinary communication, helping one another identify new musculoskeletal stress markers in the human body. However, this mutual dialogue between the past and present regarding activity-induced stress has traditionally remained restricted to osteological studies of laborers, farmers, soldiers, and ancient homonids. By examining the case studies of the violinist, the ballerina, and the cellist, I argue for an integration of nontraditional activity patterns into the possible range of motions considered by both bone specialists to be markers for musculoskeletal stress. This appreciation for the injuries sustained by performing artists helps to increase the archaeologist's imagination of possible musculoskeletal etiologies and activity patterns. Moreover, the enhanced understandings of human bone growth and remodeling serve not only to inform archaeological studies, but also to improve upon the care and therapy provided by clinicians to modern performing artists.

Osteoarchaeologists reconstructing ancient activity patterns from skeletal data are limited in the populations they can consider. The selected skeletal series of interest is ideally chronologically consistent, genetically homogenous, supplemented by historical records and archaeological artifacts, and well-preserved enough so that lifelong activity changes can be distinguished from any confounding taphonomic, or post-mortem, effects (Meyer et al., 2011). Unfortunately, excluding the select few cases of ancient cemeteries, such rigorous requirements for skeletal data are rarely met in the field. The lack of statistically viable musculoskeletal markers for ancient populations restricts the osteologist's ability to make population-level assertions. Indeed, these simple criteria have been ignored by studies lumping together individuals spanning several thousand years and different continents for the purpose of making more convincing claims about activity patterns.

To accommodate the lack of readily available ancient data, osteoarchaeologists should instead focus on expanding modern studies of activity patterns. Modern studies have the advantage of being able to identify individuals with very similar skeletal stress patterns derived from known physical activities. In addition, there is usually ample information available about the modern individual's life history (i.e. at what age the individual began the physical activity in question, the individual's family history with the activity, the individual's genetic composition in relation to the rest of the population, etc). More specifically, the trend in modern and ancient skeletal studies must shift away from establishing sweeping occupational categorizations and instead towards identifying acute traumas resulting from smaller scale and repetitive daily activities. Traditional studies of construction workers and other heavy-duty laborers, for instance, can be enhanced through considerations of more unique and characteristic musculoskeletal traumas encountered by workers such as athletes and performing artists.

PAST AND PRESENT IN DIALOGUE

While osteology as a tool has long been shared by clinicians and archaeologists, the channels of communication between the two practitioners still remain largely undefined. Indeed, in *Lingual Cortical Mandibular Defects (Stafne's Defect): An Anthropological Approach based on Prehistoric Skeletons from the Canary Islands*, J.R Luckacs asserts that "the lack of cooperation between clinical practitioners and students of human osteological variation precludes the collection of data on the distribution of this trait [lingual cortical defects]…that may lead to new insights regarding its aetiology." (Lukacs and Martin, 2002). Lukascs describes a classic example of miscommunication between specialists of the past and present: a mandibular defect has already been established in modern cases by clinicians, yet the defect's potential as a non-metric variant for the analysis of population movements remains largely foreign to many archaeologists who do not frequent medical forums.

Current characterizations of modern activity related changes are largely garnered from reports by physical therapists interested in injury prevention and performance enhancement. Subjects are most often identified as soldiers, construction workers, butchers, and athletes. Much less common is the documentation and medical care of performing artists, despite the fact that performing artists commonly exhibit many archaeologically relevant musculoskeletal stress markers such as epicondylitis (Tennis Elbow), temporomandibular joint disorders, and metatarsal stress fractures. By examining the connections between these three artistic stress markers and their ancient analogues, I hope to motivate future musculoskeletal research

of contemporary artists while demonstrating a general need for diverse modern population studies in the osteoarchaeological sphere.

CASE STUDIES

True to its form, perhaps the greatest benefit osteoarchaeologists can draw from modern analysis of artists is an expanded imagination of possible tasks and physical activity that ancient people performed. In *The Interpretation of Skeletal Muscle Sites: A Statistical Approach*, John E. Robb contends that "when not supported by historical or ethnographic evidence, such interpretations [of ancient activities] may say more about our own culturally-defined…categories than about actual activities in the past." (Robb, 1998). Indeed, archaeological hypotheses are often clouded by confounding variables such as cultural biases and taboos, gender normative activity assignments, and the continuously evolving global environment (Meyer et al, 2011). Therefore only by continuously disrupting our modern biases can we begin to see skeletal stress patterns from vastly different and more comprehensive lenses.

Below I explore the violinist, the cellist, and the ballet dancer as interesting cases of musculoskeletal patients with archaeologically relevant stressors.

The Violinist

Outi Kovero and Mauno Kononen characterized common musculoskeletal complaints of violinists in *Signs and symptoms of temporomandibular disorders and radiologically observed abnormalities in the condyles of the temporomandibular joints of professional violin and viola players* (Kovero and Kononen, 1995). After intense playing, violinists often experience temporomandibular joint (TMJ) pain and clicking caused by the prolonged flexion of the head and shoulder required to hold the violin. These problems are frequently aggravated under heavy stress and repetition. In a study of 16 professional violinists and 10 violists (all of whom had played on average 29 years), 27% reported clinical TMJ pain. In addition, 19% of the instrumentalists described audible clicking noises from the jaw. When these results were compared to a control group of non-players with similar age and gender distribution, the players were shown to have more frequent clinical signs of TMJ and clicking than non-players. Despite the symptomatic variations between the players and controls however, there were no statistically significant radiological differences between the mandibular condyles of the two groups.

This structural similarity is important to consider when interpreting temporomandibular joint disorders (TMD) in historic, non-musical arenas. M. F. Oxenham and J. Whitworth, for example, noted the global frequency of ossesous concavities and overall signs of osteoarthritis in the temporomandibular joints of 435 skeletons of known age, sex, and ancestry in *Frequency, Location, Morphology and Aetiology of Osseous Mandibular Condylar Concavities* (Oxenham and Whitworth, 2006). The final conclusion for the possible etiology of the condylar concavities was attributed to regressive remodeling of an otherwise still immature joint, supported by the fact that the frequencies of concavities covaried inversely with age. The frequency of concavities was also proposed as a possible age-at-death assessment method analogous to pubic symphysis morphology, should enough forensic and bioarchaeological samples be collected.

These two papers highlight a perfect scenario where modern clinical trials can support archaeological studies. The lack of significant radiological differences between mandibular condyles of violin players and non-players suggests that the presence of osseous concavities is independent of activity related stresses and more a measure of natural aging, thus supporting the age-at-death assessment method proposed by Oxenham and Whitworth. That is, a professional violinist would not be expected to have more concavities than someone else her age even though she routinely places more stress on her TMJ. Of course, more research is needed to account for confounding gender, genetic, and cultural differences, but it is apparent that even an introductory discussion of unique modern activities in the archaeological context has yielded some fruit.

Another example of TMD mentioned in the archaeological context can be found in *Mandibular Fracture and Dislocation in a Case Study from the Jewish Cemetery of Lecena, in South Iberian Peninsula,* where S. De Luca examines a new temporomandibular articulation formation after dislocation of the fracture condylar processes in an adult female. Though this condylar remodeling process is a result of fracture and different from the violinists' reported TMJ pain and clicking, a comparison of the two studies still invites further dialogue concerning the relationship between TMJ pain and TMDs.

> **The trend in modern and ancient skeletal studies must shift away from establishing sweeping occupational categorizations and instead towards identifying acute traumas resulting from smaller scale and repetitive daily activities.**

The Ballet Dancer

The rigorous training of classical ballet dancers often leads to overuse injuries arising from the accumulation of multiple minor traumas. Walter Albisetti reports specifically on *Stress fractures of the base of the metatarsal bones in young trainee ballet dancers.* (Albisetti et. al, 2009). In an examination of 150 trainee ballet dancers aged between ten and 21 years, nineteen dancers were found to have stress fractures in either the second or third metatarsal base, resulting in midfoot pain and tenderness. The fractures were believed to have been caused by a variety of factors including poor nutrition, forefoot varus, poor ankle joint dorsiflexion, and the usage of hard training surfaces. In addition, nine of the nineteen dancers with stress fractures further suffered from pronated foot or "over-pointed foot," which forced the ballerinas' center of gravity to fall in front of the toes—resulting in greater stress on the tarsometatarsal joints and further fracture

at the tarsometatarsal level. Finally, the ten female ballerinas and nine male ballet dancers reported that the tarsometatarsal stress fractures occurred after three to six months of menstrual abnormalities, stress-induced eating disorders, weight loss, and intensification of their training regimen.

Examples of metatarsal stresses also appear frequently in the archaeological record. In *Evidence of Stress Fracture in a Homo antecessor Metatarsal from Gran Dolina Site*, L. Martin-Frances presents a palaeopathological analysis of the right fourth metatarsal in an early hominin (L. Martin-Frances et. al, 2013). The external lesion observed on the fourth right metatarsal was identified as a stress fracture comparable to ones documented in soldiers and athletes, indicating that the stress fracture was likely to have arisen from strenuous, chronic, excessive, and/or continued stress during the remodeling phase of osteoclastic activity. After considering the information gleaned from the ballerina study, we can supplement the etiology of metatarsal stress to encompass both acute and chronic pressures at the balls of the feet.

Similarly, Nancy C. Lovell and Aaron A. Dublenko point out an interesting case of metatarsal arthritis and accessory articulations in their study, the *Further Aspects of Fur Trade Life Depicted in the Skeleton* (Lovell and Dublenko, 1999). The described metatarsal accessory articulations are generally associated with the kneeling or squatting required in canoeing, which produces a hyperdosiflexion of the toes. While the hyperdosiflexion motion of the toes toward the shin is opposite the toes-outward, pronation motion characterized in Albesetti's ballet study, Lovell and Dublenko can still benefit greatly from comparing metatarsal stress fracture with metatarsal arthritis on a broader, activity-related scale. In addition, the extra behavioral information supplied by the ballet dancers regarding their pre- and post- injury habits suggests that metatarsal fractures may result from nutritional deficiencies and weight loss in addition to heavy overuse.

The Cellist

In *Luigi Boccherini and the Barocco Cello: an 18th Century Striking Case of Occupational Disease*, R. Ciranni and G. Fornaciari submitted Boccherini's body remains to external and radiological examination to identify the acquired repetitive strain injuries (RSI) corresponding to his cello playing. (Ciranni and Fornaciari, 2003). Among the RSI recognized were rhizoarthritis of the thumb, severe chronic epicondylitis of the left elbow, lesions to the vertebral column, and *genu valgum*, or "knock knee". (The sites of cello playing-induced RSI's were determined through observation of a live performance of Boccherini's *adagios*.) Among these RSI's, of particular interest for comparison is epicondylitis, commonly known as tennis elbow (lateral epicondylitis) or golfer's elbow (medial epicondylitis), due to its frequent citations by other papers. Epicondylitis is a disease which arises from continuous and repetitive use of the muscles and tendons in the elbow. In the case of the cellist, it is the result of the sweeping right hand bowing motions and fingerboard support required to sustain the neck of the cello.

In addition to being a clear musical indicator of activity related stress, epicondylitis is also referenced in several historical contexts. C. Y. Henderson enumerates such a situation in *Occupational Mobility in 19th Century Rural England: The Interpretation of Entheseal Changes*, comparing populations of farmers, skilled workers, and women (Henderson et. al, 2012). While census records with occupational data for these populations do exist, the records lack information on seasonal changes in occupation and on the specific activities of females. With regards to the female demographic, the high frequency of hand and wrist entheseal changes (EC) among female skeletons was correlated to both lateral and medial epicondylitis. Furthermore, the study cited modern clinical studies of "construction industry, meat cutting and packing, and other work involving repetitive and forceful movements" to draw parallels to possible causes of 19th Century female epicondylitis: cleaning, doing laundry, fetching water, and other domestic duties.

Epicondylitis is also described by P. Havelkova in *Entheseal Changes: Do They Reflect Socioeconomic Status in the Early Medieval Central European Population?* (Havelkova et al, 2012). Here, the presence of EC at the medial epicondyle of certain male humeri, along with textile and iron descriptors in their graves, led researchers to believe that those specific males were perhaps craftsmen working with cloths or metals. By exploring epicondylitis through multiple perspectives, researchers can reach a more complete understanding of the range of physical motions that might cause the disorder. For example, epicondylitis has been shown to arise from both vertical arm movements, as in heavy construction and doing laundry, and from sweeping horizontal motions such as cello or tennis playing. Thus study of the cellist in an archaeological setting invites future research to clarify the differences in horizontally- and vertically-induced EC changes.

DISCUSSION

Despite the benefits of increased communication between clinicians and osteologists, there are also natural limitations that arise when using clinical trials to support archaeological narratives. As society becomes more and more mechanized, daily activities requiring heavy stress to be placed on human bones are less common, thus affecting the contemporary mosaic of musculoskeletal changes (C. Meyer et. al, 2011). Even athletes who train with weights similar to those used by ancient peoples do not have to hunt or farm for their food outside of the gym, and hence do not have the same continuous patterns of activity-related stress. A second limitation of modern clinical trials is that the results of a modern trial could erroneously correlate an EC change to an activity that is clearly refuted by historical and archaeological data. Finally, some critics point out that many modern day instruments and equipment did not exist in the past, and thus archaeologists' comparisons of past and present are innately biased by contemporary society.

It is thus important to clarify that, in these three case studies, I do not necessarily draw commonalities between modern performing artists and ancient peoples to prove that the performing arts have been emulated in some historic way. I do not imagine past soldiers to have marched *en pointe* or for a whole population of milk maids to have been cello virtuosos. Instead, the overall intention of this study is to emphasize the value of increased dialogue between clinicians and osteoarchaeologists given the naturally limiting conditions of human osteoarchaeology. Clinicians and osteoloarchaeologists should collaborate to standardize the professional terminologies and techniques used to describe pathologies; the present lack of standardization has restricted the intercourse of knowledge. For example, osteoarchaeologists can stand to benefit from a vast array of radiological equipment and other hospital devices used by clinicians to characterize bone development and healing; however, there are few undergraduate and graduate schools of archaeology that emphasize formal training in medicine and technology. On

the other hand, the osteoarchaeologist's access to dry bone and histologies can supplement the radiological techniques employed by clinicians. In addition, both clinicians and archaeologists appear to be preoccupied with their own temporal categorizations of relevant occupations. Modern researchers are concerned with modern occupations as ancient researchers are concerned with ancient occupations. Yet we have already shown that many individual patterns can be traced to a variety of modern and ancient activities. Finally, the practice of using occupation to categorize skeletal data is itself a source of bias; an individual may have held different occupations in his/her life, leading to an overlap in musculoskeletal stress markers (Cardoso and Henderson, 2012). Therefore a consideration of unique and isolated activities from both modern and ancient lenses, especially activities resulting in identifiable musculoskeletal changes, is a good way to reduce the overall occupational bias.

As demonstrated through the case studies, a standard activity-related change such as epicondylitis can be explained through a wide range of activities: musical, athletic, and/or agricultural. To form an accurate link between the past and the present, then, we must move away from characterizing only traditional occupations as the sole causes of morphological changes in the musculoskeletal system. Studying epicondylitis through the lens of the cellist, for example, allows researchers to break down a well-known pathology into a radically different biomechanical stressor. This disruption of modern biases allows archaeologists to reconsider movements at the basic level and derive new hypotheses for the etiology of common activity-related changes.

CONCLUSION

By moving towards identifying characteristic small scale activities instead of general occupational categorizations, osteoarchaeologists can better understand the nuances of skeletal change. An introductory look at the violinist, the cellist, and the ballet dancer, along with common musculoskeletal disorders encountered by both the artists and ancient peoples, reveals that a consideration of unique, modern activities may elucidate additional complexity, which is currently overlooked by standard methods. Through consideration of the temporomandibular joint in multiple contexts, we show how histology can enhance radiology. We see also that the ability to interview modern patients can also help clarify the etiology of disorders. Furthermore, as seen in the case studies regarding metatarsal fractures and epicondylitis, an appreciation of different modern stresses and their resulting musculoskeletal effects can inspire and expand the range of ancient activities proposed by archaeologists. Ultimately, human

osteoarchaeologists greatly benefit from an increased dialogue with physicians and clinicians, allowing both parties to optimize their data collection and analysis.

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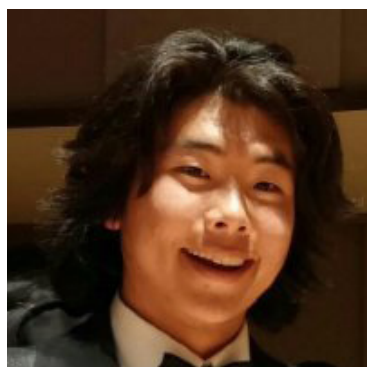
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