



Volume 6  
Spring 2007

# SURJ

Stanford Undergraduate  
Research Journal

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Stanford Undergraduate  
Research Journal

Volume 6, Spring 2007

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## Editor's Note

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This Spring 2007 Issue represents the sixth consecutive year in which the Stanford Undergraduate Research Journal has successfully published the work of outstanding undergraduate student researchers. SURJ seeks to present research papers that reflect rigorous academic inquiry across all disciplines, including humanities, natural sciences, and social sciences. Unique in its mission, SURJ continues to be the only entirely student-run organization that is dedicated to showcasing undergraduate academic research of such breadth and depth.

This year marks the first time SURJ has expanded publication to a nation-wide pool of research. In order to preserve our focus on research conducted by undergraduates at Stanford, we chose to select and publish only three papers written by students at other institutions, which can be found in the last feature section of the journal. We believe that these truly excellent pieces serve to highlight the tremendous diversity of undergraduate contributions to knowledge both at our campus as well as at those around the country. In future years, we hope to expand our nation-wide publicity efforts and further broaden the reach of SURJ as we maintain our commitment to promoting the communication and exchange of ideas.

Our editorial staff has also worked hard in other ways to improve the quality of the journal. Although all editorial and production decisions were ultimately made by our student staff, this year we solicited the assistance of Stanford faculty members, many of whom routinely serve on the boards of peer-reviewed research journals in their respective fields, to guide the peer-review process within SURJ. A faculty panel from such diverse disciplines as computer science, classics, chemical biology, and anthropology spoke to our staff about how they review academic literature, and helped us formulate sound paper selection criteria. We strove to ensure that each paper published in this issue of SURJ represents work that is novel, interesting, relevant, methodologically sound, and well-written.

SURJ continues to collaborate with the Undergraduate Admissions Office, which again sent out copies of the journal to high school students interested in research. In addition, SURJ staff members and copies of last year's journal were present at every research symposium hosted by Stanford's Undergraduate Research Programs this year. Our Special Features section continues to highlight student projects on campus in a series of articles which emphasize the research process, from the formulation of research questions to the collection of data to the presentation of results. We hope that these stories will inspire other undergraduates to create and pursue their own research endeavors.

On behalf of the entire 2006-07 SURJ Editorial and Production staff, we would like to thank you for taking the time to read the Spring 2007 Issue. Without your readership and the tremendous support we receive from the Stanford community, we would not be able to produce and distribute such a large volume of journals to every undergraduate residence, library, and academic department on campus. We would also like to extend a special thanks to members of our faculty panel for so generously donating their time and insight this year.

We hope that you enjoy reading about the phenomenal work that has been produced by the undergraduate researchers who are published in this issue of SURJ, and will join us in celebrating their achievements.

Sincerely,

Vineeta Agarwala and Jeff Park

Editors-In-Chief 2006-07

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## Special Features Presents:



### Exploring the Research Process

Stanford is world-renowned as a leading research institution. Most people associate this cutting edge research with Stanford's stellar faculty, many of whom have been responsible for famous discoveries and inventions including recombinant DNA and Modern Portfolio Theory. What is perhaps underappreciated, however, is the substantial involvement of undergraduates in many research projects across campus. In many cases, this involvement is not limited to simply contributing to ongoing faculty projects, but actually includes independent inquiry. In this issue, the Special Features section aims to provide a glimpse into the diversity of undergraduate research experiences. We do this by exploring the steps, strategies and techniques of the research processes of six Stanford undergraduates.

We are very excited to be showcasing work from across the spectrum of academic disciplines: our highlighted students are studying topics as diverse as nanowires, medieval philosophy, child labor economics, chemical polymers, and business in China. While each of these research projects is unique, they share a common pathway of investigation. Each researcher is motivated by a compelling question and must develop a methodology to probe it, which entails meticulous collection and analysis of primary data. Next, several of these students have worked to develop imaginative new applications for their research findings. And finally, some researchers have found innovative ways to present their results. We hope you will enjoy reading about these research projects - they may even inspire you to set out on your own research journey!

## Motivation:

### Studying the Economics

#### of Business Relationships with China

Michael Tamkin

While it is often said that the world is changing so rapidly that ideas and information become outdated almost instantly, one student experienced this truth and ultimately used it to his advantage. Brian Koo, a senior Economics major, has had a long-standing interest in learning about how business is conducted in China and determining what type of product does well there. Brian originally began working with Professor Ward Hansen to study the economics of the Internet, with a special focus on China. He was interested in creating a Facebook-like project for China when he was a sophomore and just beginning his Economics major. However, there were essentially only two classes that covered the Chinese market. One was International Economics, a class that takes a large scale view on the world economy, and the other was East Asian Economics. Brian took Economics 139D, a directed reading study, and gathered research on the Chinese Internet. Yet it was very difficult to get current information. "I wanted to study

"With a topic that changes this fast, doing this kind of research **told me more** about how actual business works in China **than I could have ever learned in class alone.**"

really practical aspects of the Internet in China, such as looking at how many users they have and projections about development in the next couple of years. The problem was that the Chinese government only releases data every four to five years so that the official data was out of date," Brian said. "In order to get more updated data, I read current articles about Yahoo in China and Google in China. Also, Chinese students in Stanford were a great resource. Many students wanted to go back to China because the Chinese government gives incentives for start-ups and provides seed money." He visited China twice to obtain interviews and used Skype to talk with people in China in order to discover the efficacy of doing business in China.

Brian shifted his focus during his junior year so that he could evaluate how Korean corporations are developing strategies to expand into the Chinese markets. "Since Korean business is important to my family, I wanted to write a senior thesis that would have personal relevance and teach me about how Korean companies are conducting business in China. At the time, many Korean companies were moving into China. When I went to Korea, I focused primarily on manufacturing companies since they were the most established at the time," said Brian. He began working

with Economics Professor Geoffrey Rothwell on his senior thesis, "A Study of Korean Corporation's Strategies for Expanding into the Chinese Market: Focus on the Strategy for Distribution Channels." Brian developed assumptions about Korean markets in China and tested them through interviews, transaction theories, and a general literature review. During his interviews with businessmen in approximately one hundred and fifty Korean companies doing business in China, Brian asked questions about government regulation, product differentiation, distribution channels, funding and money movement, infrastructure, labor costs, and intellectual property. "I discovered that when the companies first entered the Chinese market, they were very labor intensive. The first Korean company manufactured stuffed toys. Yet now many companies are moving into more capital-intensive areas. Since capital-intensive companies in the United States are currently doing business in China, Korean companies need to respond," Brian said. He recognizes the often delicate balance that must be maintained when trying to set up a Korean business in China. Establishing personal networks is important as well as finding an agent in China to work as part of a joint venture. All of the Korean companies he studied preferred direct investment instead of importing. He also discovered that the Chinese consumer has very diverse buying habits and that it is important to pick the correct kind of buyer when designing a product.

Brian's research and entrepreneurial spirit has inspired him to create the Silkroad Institute, a new company devoted to teaching American students Mandarin Chinese that will be in the market soon. He named the company for the famed path that opened up exploration and exchange between the East and the West. According to Brian, "the demand for learning Mandarin is growing around the world. For example, it is viewed as essential for Asian students to learn Chinese." In the United States, many schools are starting to offer Chinese instruction and the College Board is starting AP Chinese this year. However, American students who want to learn Chinese currently face several challenges, especially given the necessity for personalized instruction in learning different speaking tones. "In the United States, having a good tutor costs \$60 per hour and a great tutor can cost \$100 per hour," Brian said. "Also, American students often have trouble working with Chinese teachers who only stay in America for one to two months and are often much harsher than American teachers." Brian's solution is to use e-learning, inspired by the model of the most successful Korean online test preparation company, Megastudy. "The Korean achievement entrance exam market is extremely hot because the exams are so important in deciding students' futures."

Brian said. "In Korea, since broadband access is so diffuse, there used to be many e-learning companies, but now Megastudy has a very efficient model. The founder of Megastudy used to teach 500 students at a time, and there was a huge waiting list for his classes. He decided to go online using video recordings, and Megastudy now has about 3 million students."

Brian currently has an eight person team of Korean web design engineers, Chinese content developers, and American marketers. He has also been reaching out to find the best teachers of Mandarin in the United States, such as teachers who are used by Google to teach Chinese to its employees. One unique aspect of the Silkroad Institute's service is that it also includes a cultural component to complement the students' knowledge of the language and provides them with practical knowledge. "The student not only learns Chinese but also learns about China," Brian said. "For example, we have video packages about sites and attractions made by a team in China, and for around five dollars a lesson we can let people see Shanghai before they go there." Brian also plans to offer lessons in more fun activities,

such as "how to ask a girl out in China or how to ask about local clubs." Because there are thirty million people in the world learning Chinese, Brian plans to expand across the United States as well as to India and Europe.

Brian's research into the Chinese market aided him in the process of starting a company. "Although we don't have

"Brian's research and entrepreneurial spirit has inspired him to create the Silkroad Institute, a new company devoted to teaching American students Mandarin Chinese."

an entity in China right now, we do have a team that talks to the government for content and also does research for us. We need to understand the Chinese product and labor markets." China is changing so rapidly that even as he completes his thesis this year, Brian has gotten e-mails detailing how a certain regulation had been changed. Probably the most useful part of his thesis is "the knowledge gained from doing personal interviews and actually getting to know people," Brian said. "I got to know

important businessmen and contacts in the Chinese government. With a topic that changes this fast, doing this kind of research told me more about how actual business works in China than I could have ever learned in class alone."



Brian Koo is a senior majoring in Economics with honors. His honors thesis is about the strategies of Korean corporations for expanding into the Chinese market, focusing on the strategy for distribution channels. Coming from Korea, Brian is interested in business in Asia, especially the Chinese market. He created his first startup project in his sophomore year working on wireless technology and social networking service. Currently, he is running a company named Silkroad Institute that provides Chinese language training over the internet. After graduation, Brian is going to continue his study at the Stanford GSB focusing on Entrepreneurship and Global Management.

## Methodology:

### Strategies for

### Nanowire Research

Phuong Hoang

Among other things, a good scientist must have the ability to step back and look at how their research fits into the bigger picture. For a nanowire researcher, this can be quite a formidable task. After all, nanowires are what their name implies: wires of dimensions on the order of a nanometer, or one-billionth of a meter. For comparison purposes: the width of a human hair is approximately 80,000 nanometers. Although this scale can be difficult for the average person to grasp, nanowire specialists have long

**“Using nanowires, we can potentially make really small, maybe more efficient transistors.”**

posited the potential for nanowires to completely transform electronics. For example, because of their infinitesimally small size, nanowires could be used to connect tiny components into extremely small circuits, rendering our current microchips obsolete. Currently, there are several research groups at Stanford studying nanowire technology, especially in the Department of Materials Science and Engineering. Junior Terry Hou conducts research with Paul C. McIntyre, an associate professor in the MSE department. An MSE major himself, Terry has been a member of the lab since summer '06, working directly with graduate student Paul Leu.

Q: What is your research topic and how does that fit into your lab's broader goals?

My research topic is in 2D arrays of silicon-oxide-encased germanium nanowires. Germanium is a semiconductor not unlike silicon, but because it has higher electron mobility, it has a much faster response time than silicon. Once the germanium wires are encased in silicon, we can study their electron transport properties. Ultimately, these 2D arrays can be used to make really small and efficient field-effect transistors, which are important in many electronics applications. The McIntyre lab itself is interested in the synthesis and characterization of materials, especially for nanometer-scale device structures.

Q: How did you get involved with nanowire research?

I joined the lab through the MSE VPUE program last summer. I just read the lab description and thought it would be a good way to learn more about the electronic properties of materials. I was also excited to be working with germanium, which is the new frontier for semi-conductors. The research I'm doing right now is at the cutting-edge – germanium has the potential to replace silicon

so there was, and still is, a sense of excitement in that I'm involved in something pretty novel.

Q: What experiments or studies have you done so far?

I spent last summer and much of this school year working with Paul Leu to develop a good polishing/cleaning method for the samples. One of the more difficult things about this project is polishing the nanowires to very fine vertical resolutions once we've deposited the silicon oxide on them. This involves using chemical mechanical polishing, where we mount the sample onto metallic pucks and then use felt pads under a solution of polishing slurry, which consists of super-small beads of colloidal silica, to get rid of nasty edges and to planarize the samples. This was very difficult for me, since my background in electronics and mechanical engineering did not prepare me for the delicacies of germanium. Germanium oxidizes very easily in air and germanium oxide is very sensitive to a lot of chemicals and corrodes very easily. It's even more difficult for us to work with it because of the fact that we're working with such small materials, which are even more sensitive and harder to manage – damaging chemicals can chew through the germanium wires very quickly because they are so small.

As of now, we are designing masks using L-edit, an integrated circuit layout editor. The germanium nanowires are grown from gold catalysts particles, which we typically drop cast onto the silicon substrate. However, this means that wires grow in random locations on the substrate. Using the masks designed in L-edit with photolithography techniques, we can define where the growth regions are on the substrate.

Beyond defining the growth patterns of the wires, I'm using conductive atomic force microscopy (AFM) to obtain electronic transport measurements for the nanowires. Also, AFM allows our lab to examine the surface topography of the sample as well to see how well the polishes are going.

Q: How has your research project evolved in the time you've spent working on it?

When I started on the project, we basically just wanted to see if it could work – if we could add the silicon oxide to the germanium and grow the wires. Professor McIntyre had the idea, and simply wanted to see if this was feasible. Now that we've seen that we can grow the wires, our goal is to grow them preferentially. The project has grown and snowballed into a lot of other projects. These new directions are exciting and they're important for

helping us characterize the wires so that we can eventually in the near future apply them beyond the research lab. One thing that I've learned doing this is that there are not a lot of huge leaps or Eureka moments involved in this kind of research. Patience is definitely the key. But every accomplishment is a little victory and I feel like we're making very good progress in our work.

Q: What are some potential applications of the nanowire research you're doing right now?

The most obvious thing is the production of very small 2D arrays that can be used to make field-effect transistors, which are basically your modern microchips, used in computers and other electronics. Using nanowires, we can potentially make really small, maybe more efficient transistors.

A particularly exciting application would be in the area of biosensors, which is a device that uses a biological component, such as a protein, as a sensor. For example, our germanium wires encased in silicon oxide have little trenches where fluid can flow. The germanium surface can potentially be functionalized to bind certain proteins such that we can take biological samples and flow them through the fluid channels. Certain proteins within the sample



*This is an image of a germanium nanowire with the gold catalyst particle still attached to the tip surrounded by silicon oxide. This image was taken under SEM after CMP and cleaning.*

would bind to certain characteristic sites (for example, conducting or non-conducting), and we can use the binding of the proteins to analyze whether person has a particular protein in their blood or not. This can have potential diagnoses functions. Although this application is a long ways off yet, it is extremely exciting and motivating for scientists working at the nanoscale level.

Q: How would you describe your overall undergraduate research experience?

It's been great: I've gained valuable research experience that is at the cutting edge of science right now. I've been exposed to tons of different tools and processes and I've learned how to use and characterize techniques as an undergraduate

that a lot of people are not exposed until graduate school. The tools I use regularly are used in many of areas of industry and research, which definitely will give me a leg up later on if I decide to go to graduate school or if I decide on a career in a related field. My lab experience has definitely given me a better idea of what life will be as a graduate student, and even in future careers. On a more immediate level, I learn things in lab that I can apply to the classes that I take, which is really great.



Terry Hou is a junior from Chattanooga, Tennessee. Outside of nanowire research, Terry is interested in martial arts, cycling, mountain biking, traveling, working on cars, and sky-diving. He is a Materials Science and Engineering major, with a concentration in Electrical Engineering. He plans on co-termining after graduation.

## Data Collection and Analysis:

### Looking into the Economic

#### Causes of Child Labour

Savil Srivastava

How to tackle the issue of child labour has consistently stumped policy makers. The United Nations and the International Labour Organization consider it a system of economic exploitation and have denounced its practice in the Convention on the Rights of the Child. Yet, even now, decades after child labour was first recognized as a serious human rights issue, there is little consensus on even its root causes, let alone the solutions which governments and societies must adopt to tackle it.

Pawel Krolkowski and Pamela Sud are two Economics majors at Stanford who chose to work towards a greater understanding of this issue. They are each pursuing a line of research that explores a question in the fight to tackle child labour. Their motivations stem in part from their childhood backgrounds. Pawel, who grew up in South Africa and Pamela, who would often visit her father's home in India, had both witnessed first-hand children being compelled to work during their childhood. They both chose different paths in pursuing their research questions. Pamela did a month of fieldwork in an industrial town in India to obtain her own reliable data set to analyze. In contrast, Pawel focused more on analyzing existing data on child labour in Ghana seeking to obtain a new perspective on what causes child labour in Ghana. This article sheds light on how both these approaches have led to new findings and considerably enriched Pawel and Pamela's college lives.

#### The Experience of Primary Data Collection: Examining the effectiveness of the non-formal school experiment in Jalandhar, India

India has the largest child labour workforce in the world and both the Indian government and the United Nations have taken steps towards curbing this practice. Child labour also becomes a hindrance in achieving universal primary education since the children are unable to attend formal schools during their operational hours. As a measure to educate these children, the government began a program to fund "non-formal" schools that would be run by Non-Governmental Organizations (NGOs). These schools are provided with government funding and guidelines, but are operated on the ground by the NGOs. Each group of schools makes special accommodations to working children. The schools in Punjab hold classes in the afternoon (after the regular school hours) to allow the children to work at home in the morning and evening and attend school in the afternoon. The children receive supplemental nutrition in the form of a snack, in addition to a

small stipend equivalent to about five cents per day. The mid-day meal and the monthly stipend serve as incentives for the parents to forego some of the income and send the children to school after they have contributed some work. However, despite this plan having been implemented for six years, there had been no study done on how effective the schools were proving to be in fulfilling their mission. Pamela's study aimed to judge how well these schools were faring.

During the summer before her junior year, funded by a Chappell-Lougee research fellowship, Pamela spent a two months gathering data for her research in the north Indian industrial town of Jalandhar. Jalandhar has a thriving sports goods industry and many of the balls for the recent soccer world cup were sourced from this city. Pamela sought out to investigate the efficacy of non-formal NGO run schools for child labourers in this town. During the course of her research, she visited 38 of the families of these children with a detailed questionnaire seeking to understand not just whether the schools were successful in spreading education to the child labourers, but also trying to understand the root causes of any failure or success.

Her interest in this project initially arose during one of her trips to India. She had expressed her interest in working on child labour and had visited several of the Child Labour Project schools nearby her family home.

Pamela's survey area covered 27 non-formal schools in Jalandhar. Half the students enrolled worked to stitch together soccer balls and the rest worked as daily wage labourers, rickshaw drivers, and construction workers. As preparation for the summer, Pamela enrolled in Sociology 183 Qualitative Methods in Social Science Research. This class gave her insights into how to design the surveys she would require together data on the child workers and their parents. It also gave her guidelines to recognize the point at which enough data had been gathered and deciding when to stop collecting further data. In preparation for her stay in Jalandhar, she initiated the step of hiring two surveyors to gather basic information about her sample set of students. Their mandate required them to collect household data on over 400 child labourers and obtain

basic data pertaining to their performance in school, their family background and their education plans for the future. The survey also asked teachers to give their opinion on each student's future educational outlook.

After assessing the initial household data, Pamela was able to formulate an interview protocol in order to gain more insight into particularly surprising aspects of the household data.

She spent time visiting not only the schools but also the homes of the students to increase her understanding of the socio-economic background of the students she was surveying. The questions she asked sought to specifically unearth the root causes of why or why not the students may not be continuing their studies after graduating from the informal schools and enrolling into the formal government-run schools. The students were asked why they might have dropped out: was the cause health, financial or academic performance related? She also interviewed students who graduated from the Child Labour Project schools and are still studying in higher education. Data on health within the family and the parents' education levels and siblings' education levels were also collected.

Pamela is still in the process of analyzing her data for her senior thesis, which she hopes to complete by next year. She gave us a small peek into her findings by talking about one interesting result that is already emerging. Present literature

on child labour and its causes points to a simple correlation between people being poor and their children working. However, Pamela's findings indicate that variability in income is a much stronger indication of schooling rather than absolute level of income. Her data reveals no significant correlation between child labor and parental income level. She claims that there is a greater correlation between child labor and income stability. Since the people she surveyed had almost no access to credit and insurance facilities, one of the biggest income destabilizers became health problems. If the parent was taken ill, then s/he would not be paid for that period, leading to a significant loss in income and they would also have to dish out relatively significant sums for the treatment. Situations like these would cause the parents to send their children to work in order to create a buffer against an uncertain future for which they felt inadequate to financially plan for. The potential policy implications include providing access to credit markets, health insurance, mechanisms for saving, and microfinance investment opportunities.

Another interesting realization was that many parents found these non-formal schools to be more attractive than the formal government schools. The government schools were free in name and not in spirit, since parents were still required to pay for books, uniforms and exam fees. The non-formal schools paid for these. They went further and provided a meal for the students, as well as better quality instruction from the teachers. As a result, the

schools were also becoming substitutes for the formal government schools, rather than complementing them. This had led to complications for the NGOs who faced increasing attendance and static funding.

One of the primary reasons for doing fieldwork is the possibility of gaining a new fresh perspective on issues. While talking about her experience, Pamela revealed that she had several epiphanies during her fieldwork. She arrived in Jalandhar at the start of the Stanford summer session in July. In India, however, by the time July arrives the summer is soon over and the rainy Monsoon season begins. The heavy downpours would often overwhelm the drainage system of this industrial town and the streets would often be waterlogged. This led to some interesting experiences including occasions when she had to travel in a cycle-rickshaw through water that rose up to her knees!

At times like these, schools were forced to shut down and their activities would be severely disrupted. As an external observer, she felt that she wouldn't have been able to predict events like these without actually visiting the area. She

was also pleasantly surprised that everyone she interviewed was easily willing to reveal details about their income and expenditures and prospects for the future. This she felt was perhaps one of the largest cultural differences she encountered from American society. She also debunked the myth that the children were forced to work by their parents simply because their parents did not value education. In fact, she asserts that the parents she met were very highly motivated to have their students educated.

Pamela is searching for the best means she can take to influence child labour education policy through her research. She says, "I sometimes feel very removed from very real problems on the ground in Punjab – I want to apply my research to allow these children to be educated." She continues in an optimistic light hoping that she is able to give some kind of meaningful feedback to the NGOs and the government. She hopes that her research may one day lead to a policy paper or even lead her to work on the credit constraint problem, which the people she met in Jalandhar faced.



Pamela (bottom row, second from left) visited the homes of the children in Jalandhar, India to conduct her interviews.



### Effect of Income and Religious Affiliation on Child Labour in Ghana

What role does indigenous culture and its values play in determining whether a child in a family works? What parameter does one choose to represent cultural values? What does the present body of knowledge say about family income levels and incidence of child labour? Pawel Krolkowski was inspired to pursue his research when he found that no one had really answered these questions. His research focuses on Ghana aiming to understand whether there was a cultural factor, which led to child labour. His path in pursuing this question led to some interesting developments, which give us an insight into the unexpected ways of the research process.

Pawel first found guidance in two classes he enrolled in. In the winter of his Junior year, his class on Labour Economics introduced him to the economics of child labour through the study of a simple household time-allocation model. This piqued his interest in child labour and sparked in him a curiosity to understand its root causes. The class was taught by Professor Pencavel who impressed upon Pawel the importance of data, in terms of its integrity as well as the nuances of the way it was gathered. Pawel also attended the Economics Junior Honors Seminar. Professor Rothwell encouraged the class to concentrate on both literature review and data design. With this guidance, Pawel began thinking about what specific question to pursue. He knew he "wanted to do something in Africa" and he has always had "a heart for Africa". He chose to focus on South Africa and obtained a data set from the International Labour Organization (ILO) to analyze. The question remained: what parameter could he choose to represent cultural values? Pawel says that he looked at some other child labour research papers and considered all the parameters that had been discussed by previous authors to obtain some perspective and direction. This eventually led him to choose 'religious affiliation' as his focus parameter, and he investigated how the incidence of child labour differed with differences in religious affiliation.

Pawel then went on to perform tests on his data set. It was only after already spending a few months on this data set that a major flaw emerged. He realized that the basis on which data was collected would have rendered his analysis ineffective. When the surveyors had collected information, they first asked families whether their children worked. Then, only if the families answered the first question positively did they proceed with the rest of the



Children attending a non-formal school in Jalandhar, India

questionnaire. This presented a major insurmountable hurdle for Pawel whose research question demanded data from even those families where children did not work. Thus all his efforts had to be abandoned. However, this did not discourage Pawel enough to abandon his project completely. He then decided to search elsewhere in Africa for similar data and narrowed down on Ghana. Pawel found that Ghana's stable governmental institutions meant that there was reliable data available for his research.

Pawel also faced an endogeneity problem with his econometric model. The variable used to capture the household's standard of living was "monthly household expenditure" (comma) which had been queried in the data set he was using. It is clear that this decision variable is jointly determined with the decision of sending (or not sending) a child to work. In particular, if a child is sent to work, the monthly household expenditure would rise because the child brings resources into the household. This would, perhaps incorrectly, suggest a positive correlation between the probability that a child works in a given household and the monthly expenditure of that household. As a result Pawel was forced to use an instrumental variables procedure in his analysis.

His on-going research already reveals a couple of interesting results. Pawel finds that, holding other factors constant, children affiliated with monotheistic religions (different denominations of Christianity, and Islam) are less likely to work than those affiliated with a traditional African religion, no religion, or some other religion not specified by the survey. Further, Pawel finds that, after controlling for the endogeneity described above, a 1 percent increase in monthly household expenditure leads to a 0.22 percent decrease in the probability that any one child in the household works. Although this is re-assuring, because it suggests that richer households have a smaller incidence of child labor, it makes clear that policy makers wishing to reduce the incidence

of child labor in Ghana cannot simply wait for the standard of living to rise, because this could take decades to address the child labor problem. For example, even if every household in Ghana experienced a 100 percent increase in their monthly household expenditure, the incidence of child labor would only fall by approximately 20 percent. Direct intervention is needed to curb the child labor problem.

Pawel hopes to complete his research analysis by the time he graduates this June. Speaking about his research he says that it has given him an invaluable insight into what research at the graduate school level is like. He says he wants to pursue further studies in Development Economics and adds: "I want to help people out basically".

Children affiliated with monotheistic religions are less likely to work



Pamela Sud is a student of Economics and Spanish from Reston, VA. Her main interests lie in international development and international health. She became interested in child labor issues through her visits to India growing up and got the opportunity to pursue research through a Stanford Chappell-Lougee grant. Pamela is a Resident Assistant in Burbank this year and also led an Alternative Spring Break trip on sustainable development. She hopes to pursue further studies in international development through a Masters or PhD program after Stanford.



Pawel Krolkowski is a senior at Stanford, working towards two degrees: a Bachelor of Arts in Economics and a Bachelor of Science in Applied Mathematics (Mathematical and Computational Sciences). Pawel became interested in Economics in high school. He has a particular heart for developing countries, which is founded on his life abroad, especially his experiences in South Africa, where he lived for almost 10 years. Pawel will be attending the University of Michigan (Ann Arbor) next year, in pursuit of a PhD in Economics.

## Applications:

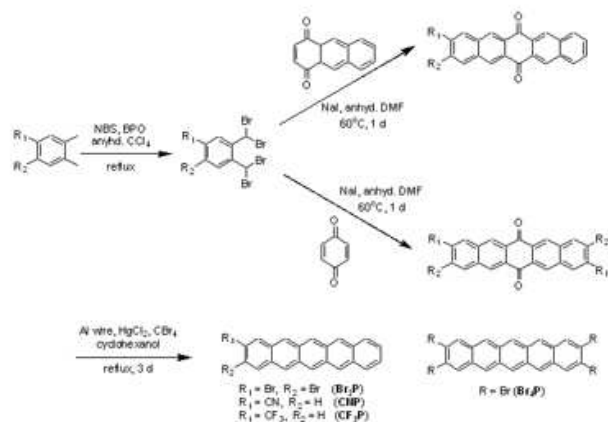
### Bending Over Backwards to Study Organic

#### Molecules for Flexible Electronics

Elizabeth Kao

One of Stanford's most populous series of classes, organic chemistry is required for biology, chemistry, and chemical engineering majors alike. Along the way, students encounter the reactions of Diels-Alder cyclization and reduction. But besides hearing about them from lecture and doing a few experiments on them in lab, Michelle Senatore has used these reactions significantly to produce the key molecules of her honors thesis project on

Professor Bao's research focuses on the creation of devices, or electronic components, whose novelty stems from their origins in organic materials, rather than from the traditional, inorganic, silicon-based transistor. Following synthesis of the semiconducting organic compounds, devices are fabricated, characterized, and patterned to give rise to integrated circuits. Scientists in Professor Bao's lab apply the organic semiconductors that they make to chemical and biological sensors, solar cells, as well as flexible plastic electronics, the project that Michelle works on. Previous advances with involvement from Professor Bao in the subfield of plastic electronics include electronic paper, an improvement on computer screens for reading purposes, since the electronic paper reflects light as ordinary paper does. Electronic paper is thin and flexible, which are two qualities that motivate further research in plastic electronics.



Synthetic scheme of pentacene derivatives.

organic thin-film field-effect transistors (OFETs). Having enjoyed her research experiences in high school and early in college on creating organic molecules for light-emitting diodes, "mixing materials together, seeing the pretty colors, and spilling things all over the place," Michelle sought to apply the chemistry she was learning in her classes to research in a lab that worked with organic syntheses leading to "cool technological applications." After talking to Dr. Zhenan Bao, an associate professor in the chemical engineering department, Michelle found a direction that combined her scientific interests of chemistry and electronics.

derivatives in the literature," says Michelle. Pentacene has high localized electron density in the central ring, making these positions highly reactive and unstable in air and sunlight. Part of Michelle's project is to substitute electronegative groups such as bromine, cyanide, and trifluoromethyl groups on pentacene's terminal rings to reduce the molecule's reactivity. Such changes to molecular structure are accompanied by changes in solubility, stability, and electronic properties for what was previously pentacene.

After shadowing the postdoctoral fellow with whom she would work, Michelle began to learn the specific synthetic techniques involved in generating the pentacene derivatives. As her postdoc put it, "exactly correct procedures" are required to achieve pure

products at high yields. All of the reactions Michelle had to perform were sensitive to air, light, and water, so she had to attach them to nitrogen lines to maintain inert conditions. Many research projects meet challenges in getting a desired result, and for Michelle, this came when she was attempting to add bromine groups to pentacene precursors through radical bromination. Repeatedly low yields prompted her to ask for advice on how to troubleshoot the reaction, and her postdoc suggested that she adjust her solvent to compound ratio. The increase in concentration brought about the necessary collisions for the bromination step of the reaction to occur, and instances like this reinforced to Michelle that "usually, you're never hopelessly stumped; if you don't know what to do, then solutions can be found from asking more experienced people for help."

Michelle took two quarters and a summer to master the intricacy of these syntheses, but once she did, she was afforded a great deal of versatility in terms of the molecules she could create. Starting with substituted benzene rings, Michelle performed a Diels-Alder cyclization to obtain quinones, which afterwards, she reduced to pentacene derivatives that were monosubstituted, disubstituted, or tetrasubstituted with bromo, cyano and trifluoromethyl groups. Around the time she completed her syntheses, she started working with a new postdoc, expanding her project to include device characterization of her molecules. Having worked out the synthetic steps for all six molecules that she created, Michelle set out to purify her "crude pentacene derivatives," to test their quality as OFETs.

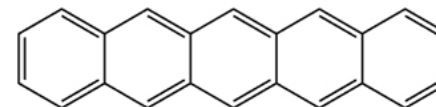
In order to evaluate the electronic properties of her pentacene derivatives, Michelle fabricated top-contact OFETs by placing the compounds on a silicon substrate. While doing so, she varied the temperatures of deposition to characterize the devices with the aim of determining how differently substituted pentacene derivatives and the temperature of deposition affect OFET mobility, or how well the electrons are transported throughout the device. Assessing the mobility of devices produced from dibromopentacene and cyanopentacene, Michelle found that the dibromopentacene devices displayed higher mobilities than the cyanopentacene ones at all temperatures, and that higher temperatures increased OFET mobility. She seeks to repeat this process with her other molecules, recognizing trends in substituent-electronegativity

and temperature of deposition as they relate to the mobility of the fabricated devices. When her project is complete, Michelle will write her honors thesis, culminating in a presentation at the end of the year.

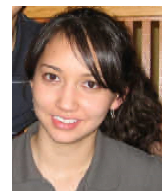
Michelle first presented a poster of her project at the Symposium for Undergraduate Research and Public Service (SURPS) this past fall. Later, with Professor Bao's encouragement, she submitted an abstract to the 2006 Annual Meeting of the American Institute of Chemical Engineers, held in San Francisco, which included topics in chemical engineering such as renewable energy, catalysis, and organic electronics. As a result, Michelle was invited to present her research on organic electronics alongside professors, industry experts, and graduate students. "It was a great experience, speaking about my work in a hotel room before well-established professors," Michelle remarks. "I met scientists from the University of Washington and Berkeley, and put faces to names of important people in chemical engineering."

The success of Michelle's project has notable long-term implications. Unlike traditional silicon-based transistors, which require high processing temperatures, organic molecules such as pentacene derivatives can be deposited at lower temperatures, and are stable in solution, allowing for "inkjet or reel-to-reel printing" of circuitry onto flexible substrates such as plastic. These printing methods of constructing circuits over large areas are quick and inexpensive, contributing to the appeal of utilizing OFETs in addition to their lightweight quality, making them useful for flexible computer displays, for instance. In continuing to tune molecules like pentacene, the use of organic electronics will become more widespread.

Reflecting on her experiences over the past several years, Michelle recounts how she has followed a schedule of attending classes in the morning, then being in lab all afternoon, with homework completed at night. "My junior year was the hardest," Michelle remembers, since she had to work in the lab during the evenings at times, too. Michelle comments on the amount of drive necessary, saying, "You have to like your research to go to lab every day; when I'm there, I'm really happy and think that it's worth it." Believing herself to be "made for graduate school," Michelle plans to realize her goals in another facet of flexible electronics research – organic solar cells – at UC Santa Barbara in the fall.



Pentacene, an organic semiconductor.



Michelle Senatore is a Chemical Engineering major from Houston, TX. She became interested in materials chemistry research after a summer program at the University of Texas at Dallas and an NSF REU (Research Experience for Undergrads) at The University of Houston. She has been working in Professor Zhenan Bao's lab since Winter 2004 and is currently preparing an honors thesis based on this research. Following graduation from Stanford, Michelle will attend The University of California Santa Barbara for a Ph.D. program in materials. In her free time she enjoys serving in student groups such as Stanford's chapter of AIChE (American Institute of Chemical Engineers) and the Judicial Panel, as well as exploring the Bay Area.

## Presentation:

### Making Medieval Philosophy

#### Accessible for Everyone

Michael Tamkin

For a student doing research in medieval philosophy, senior Donny Bridges displays the many attributes of a Renaissance man. From transcribing treatises in their original Latin, preparing etymology exercises, developing interactive studies of gothic handwriting, and even tracking down leading scholars as they are about to leave the country, Donny plays many roles in the development of Bartholomew's World.

Slated for completion at the end of 2007, Bartholomew's World is an interactive website, sourcebook, and teaching module that aims to introduce high school students to medieval Latin.

Students and teachers can access the site's lessons at <http://bartholomew.stanford.edu>, and pilot programs are underway to use the program in high schools. According to Donny, Bartholomew's World is "designed for high school students who have taken Latin but are not ready to tackle Cicero. This is a very interdisciplinary project and we want it to be exciting and educational for high school students. They will also gain exposure to lots of philosophy." Donny's involvement in the project began last June. "I was looking through the URP and VPUE grants available for Philosophy. It worked out perfectly because Professor Wood was looking for a student to help launch the project. I had the opportunity to have an impact; I helped determine the structure of this important teaching tool," Donny said.

The project team consists of Philosophy Professor Rega Wood, several former Latin teachers, a graduate student, and Donny. As the only undergraduate, he describes his role as "sort of the youth infusion to ensure that it is accessible to students."

According to Donny, "we started with a book and a dream—the dream of allowing students to improve their Latin (and their English) and having access to these texts." The "book" and inspiration for the project, *On the Properties of Things*, was composed by the thirteenth-century scholastic scholar Bartholomew the Englishman. It was an early type of encyclopedia written for the general public around 1240. Bartholomew wrote on subjects such as God and angels, birds and reptiles, geography and astronomy, providing a

kind of survey of medieval knowledge and thought. "Bartholomew had huge volume and breadth in his writing," Donny says. "We actually had an ophthalmologist look at his description of the eye, and it is incredibly accurate."

Building upon *On the Properties of Things'* wide coverage of topics, the team then set out to find excerpts by Bartholomew's contemporaries writing on similar topics. After Professor Wood recommends an article by a certain author, Donny's task is to find the work in the original Latin and transcribe it. If no translation is available, Donny might have to translate it by himself or with the

help of a graduate student. Although he has only taken one year of Latin, he comments that "the work is pretty accessible. The vocabulary of medieval Latin is simpler than classical Latin, and the grammar is easier." The next part of the project is to create etymology exercises based on the text so that students can learn English words that have their roots in medieval Latin. Donny took a class last summer with fourth-year Classics Ph.D. Bill Gladhill, and now consults SAT preparation materials to find words that will be most useful to students. "The research was done through etymology websites and also by reference to the Oxford English Dictionary," Donny said. "This section of the site helps students see how unfamiliar words come from Latin. We found some very interesting connections. The word 'nubile,' for example, comes from the word for 'cloud,' so that it literally means 'unveiled.'"

Donny's next task is to create a paleography exercise that teaches students how to read medieval writing. "We allow students to look through old manuscripts to see what it is like to look at actual texts," Donny explained. "Using scanned texts, we let kids see what an actual scholar would do to create a modern edition of a work. If you read a translation of Aristotle or Aquinas it might seem cut and dried, and people might not understand the challenging process of making them available in reliable editions and in English translation."

Each lesson in Bartholomew's World also includes links to other resources and introductions by noted scholars in the field. "I've been collecting lots of imagery for the site, such as finding an

image of a book binding that was made in the fourteenth-century, searching for architectural images, and making sure that they are authentic," he said. "I do a lot of searching in order to find what will be interesting to show to students. It's easier to find images and links for better known authors." The site currently features authors such as Bonaventure, William of Auvergne, Thomas Aquinas, and Richard Rufus of Cornwall. It also features topical articles grouped in sections about "Human Science," "Divine Science," and "Natural Science."

Donny explains that although the work can be difficult, it often presents unique opportunities. "For much of the philosophy we looked at, there are no modern translations. Bartholomew's work was last translated in 1547, so I was able to work in Special Collections in Green Library with a manuscript from 1547," he said. "As our teaching tools evolved, we used shorter excerpts of text and more explication to indicate the work's significance and make it more accessible. It was a moral victory every time we completed a lesson."

The project is currently being shown to professors in the Stanford Classics Department and a teacher's reference guide is

also under development. The team is reaching out to high schools to test the lessons, and Donny also envisions it as a more general resource. "The module has enough structure so teachers can do a whole lesson, but it is also flexible enough to allow students to use it on their own," he explained. "Thanks to funding by the National Endowment for the Humanities, it will be accessible to anyone."

He describes his overall research experience very positively. "I'm a Philosophy major, but I hadn't read much medieval philosophy," he said. "It is interesting to see the historical roots of the works we study. If I were to go to graduate school in Philosophy, I would like to keep up with this work. It has also been great to interact with a professor." While some students may be unfamiliar with research in the humanities, Donny believes that it offers a chance for valuable study. "I would definitely recommend Philosophy research because it allows you to go so much deeper than a ten-week course. It is good that there is so much that can be done with one topic. The opportunities are definitely there, you just have to be active in looking for them."

**"We started with a book and a dream—the dream of allowing students to improve their Latin and their English and having access to these texts."**



An illumination of King David from *Missale Romanum* [Bologna, 1360].



Donny Bridges is a graduating senior double majoring in Philosophy and Political Science. He has been a member of the Stanford Debate Society for four years, and in addition to working as a research assistant, he coaches debate at a local high school. After Stanford, he plans to go to law school after taking a year or two off to do public interest work. He enjoys long walks on the beach, candlelit dinners, and clichés. He would like to thank Rega Wood for all her help and support and for not telling the police where he's hiding

## Perversion, Adoption, and Cult Symbology: Tracing the Distortion of Recycled Images

Jennifer E. Bullock, Stanford University

Che Guevara is perhaps the most reproduced image in the twenty-first century. A figurehead of Latin America political symbology, he has recently made the transition from underground to mainstream among U.S. hipsters, appearing on CD covers, t-shirts, movie posters, and a wide range of paraphernalia in between. The irony is easily visible: Guevara, a noted Communist who spent much of his life fighting U.S.-backed imperialism in Cuba, represents the antithesis of American consumer culture which currently embraces his icon voraciously. Yet his image has evolved into a wide ride of connotations, ranging from the kitsch to the rebellious, appearing in European Neo-Nazi rallies and Buddhist gardens in Big Sur. What is it about this image that so facilitates such shameless malleability? And more importantly, what is so perpetually fascinating about Guevara himself? Guevara represents the concept of a “recycled symbol” – that which has been espoused by an unlike group for its vague similitude and in the process acquires new connotations of its own. Enlisting Che as a metonym to trace the literal abstraction of his image from black-and-white photograph to the well known red-on-black visage, a surprising number of conclusions arise that relate to the very nature of capitalism and the so called “liberal agenda” itself. The tendency of capitalism to embrace its own counter-culture, as well as the function of symbols in our society as mute vessels into which we inundate with personal significance, all become visible through an examination of personal interviews, “Che-site” surveys, and analytical research.

*A day will come when, by means of similitude relayed indefinitely along the length of a series, the image itself, along with the name it bears, will lose its identity. Campbell, Campbell, Campbell, Campbell.*

–Michel Foucault, on Andy Warhol (54)

Che Guevara is perhaps the most iconic visage in Latin American history. Since his death he has been stretched onto car windows, slapped onto notebooks, and printed on t-shirts. His visage will appear sometimes unexpectedly, gazing from a stop sign or alarmingly looming above on a billboard. He commands books, movies, and countless paraphernalia. His face overwhelms – young, dark, and provocative, conveyed through thick black lines against a red background. In Latin America, he has been elevated to the status of a progressive martyr and revolutionary figure of all that is Anti-Imperialist. He is woven into the very fabric of American pop culture, appearing on Santana shirts and Madonna albums as a signifier of underground cool. He is sold in spiritual gift shops, punk rock stores, and trendy boutiques in California. In Europe, Neo-fascists espouse his militant message by depicting his photograph on their flyers, and

in 2004, Gael Garcia Bernal converted Che into a sex symbol through his portrayal of the Argentinean in the film *The Motorcycle Diaries*. Indeed, Che’s constituents are so varied as to be unclassifiable by any single descriptor, and certainly not united through their mysterious connection to el Che.

These sometimes ironic dissimilarities of purpose highlight the peculiar moment in which an image becomes “recycled” and adopted by varying paradigms and groups. The phenomenon of Che’s oft reproduced image can be placed in the contextual framework of the larger tension between certain images and their capacity to influence their audience. This relationship receives further discussion in Susan Sontag’s *On Photography*, in which she goes as far as to call for a restrictive *ecology of images*, and cautions against the saturation of our society with such potent pictures, arguing that “images anesthetize” the viewer against true poignancy. Che faces a similar dilemma – that which has been torn from its context or history now faces the surreal experience that Sontag claims “makes everyone a tourist in other people’s reality, and eventually in own’s own” (Sontag 57).

French philosopher Jean Baudrillard even quantifies the successive transformations that “hyperreal”<sup>1</sup> images may undergo: from that which reflects

reality to that which distorts it, finally entering a state in which the image bears no relation to the thing, becoming “its own pure simulacrum” (Baudrillard 5). Che represents this concept of a “recycled symbol” – that which has been espoused by an unlike group for its vague similitude and in the process acquires connotations of its own (Hine 2). This adoption, however, is facilitated in part by the image itself – certain particularities in the structure of Che’s biography lend themselves to malleability. From a leftist perspective, Che is a nostalgic expression of revolution, a mute signifier of hope and change from a vintage era. The right regards him as a dead guerilla now enlisted by teenage hippies in an ironic form of political protest. But these associations are common ones. Brush them aside, and one asks not what he means but what gives his image such weighty presence in our minds? (Zizek 71). Why are we so captivated by Che? What is it about his image resounds so solidly throughout the fickle tastes of history as a hero, while other of his Communist compatriots such as Fidel Castro or Joseph Stalin have failed to achieve iconic celebration? How does Che find such spectacular success in provoking empathy, especially “...among the spoiled youth of the affluent West” (Falcoff 5)? At the heart of this question, we find a strange amalgamation of fashion and protest, of shirt-sporting symbolic protestors and “spoiled youth” buying into the t-shirt craze with at best a vague awareness that they are now involved in something *edgy* and *cool*.

The result is as much a commentary on the manipulative agenda of advertising as it is on the image itself. Enlisting Che as a metonym to trace the literal abstraction of his image from black-and-white photograph to the well known red-on-black visage, a surprising number of conclusions arise that relate to the very nature of capitalism and the so called “liberal agenda” itself. The ability of capitalism to exploit its own opposition, as well as the function of symbols in our society as mute vessels into which we inundate with personal significance, all become visible through an examination of interviews, “Che-site” surveys, and analytical literature regarding the nature of recycled icons.

Despite the copious amount of photographs taken during his lifetime, Che’s icon as we know it derives from

an Alberto Korda photograph taken in 1967. Che was attending a funeral service for the victims of the La Coubre, which involved the explosion of a ship carrying munitions, alleged by some to have been CIA-orchestrated. The image was taken seven years prior to Che’s death, and in the photograph a somber thoughtfulness emanates through the grainy black and white tones of Korda’s Kodak Plus-X camera. Already the image is diluted when stripped of its context: Che, adorned in military garb and a Communist beret, appears formal and suggests some revolutionary activity – far different from the drab proceedings of a civil memorial. Yet the distortion of Che’s image does not literally happen until eight years later, after the Irish artist Jim Fitzpatrick reduces the photograph to thick, black lines and sets it against an emblazoned red background. The more pensive timbres and shadows of the picture vanish, and the expression mysteriously acquires a look of defiance and resolution. The decision to place Che’s face against a red background is as visually jarring as it is deliberate, and thrusts the image into the limits of its subversive potential. With this depiction, Che is literally disassembled into a mute vessel ripe for exploitation. Thomas Hine explores this phenomenon fueled by a mixture of globalization and technology: “this used to be local: a matter of copying the neighbor who sews well or parodying a cousin who walks funny. What’s special now is that the advertising, news and entertainment media have created and disseminated a stock of images whose potency transcends local boundaries, and computer technology has made it easier for people to use and manipulate them” (Hine 1). Indeed, the potential significance for Che as a metonym becomes broader as the texture of the image is manipulated. The literal disassociation of the image from the photograph gives the symbol an abstract quality that simultaneously establishes its validity as an icon.

The image has attained fluidity – now the respective sites that manipulate the symbol may be examined. Che’s presence as a socio-political hero in Latin America serves as our first context. His involvement in Bolivian and Cuban revolutions granted him entrance into the canon of Latin American revolutionary heroes, and the vast majority of people who sticker their cars with his image are acutely aware of

Che’s identity (Gonzalez & Salazar 232). Vargas Llosa explains the attraction, claiming that the cult of Che protests a “myriad of oppression, social injustice, and acknowledges the inequities in today’s world” (Vargas Llosa 20). In contemporary times, Che is directly associated with anti-U.S. sentiments and especially embraced by the poor, the disenfranchised, and the dissident (Hodges 200). Yet even the symbolic meaning of this protest fluctuates in countries such as Argentina, Che’s homeland. In Buenos Aires his image is prevalent enough to represent something akin to national pride, while in Cuba, Che is espoused as a countryman and national hero. In Mexico and Venezuela, leaders such as Fox and Chavez accrue political popularity by issuing anti-American statements and associating themselves with many of the principles Che today represents. Latin American embracement of Che, then, represents the truest representation the revolutionary could hope for, and marks the initial departure of the icon into the world of the abstracted.

Yet it is not until Che drifts into other cultural spheres does his image acquire a bizarre mixture of affiliations. A number of neo-Nazi groups in Europe currently display his image in their posters, despite Che’s pronounced hatred of fascism and racism (Mamatas 1). In the Caribbean, Che is sold streetside with predominately Rastafarian paraphernalia. These discrepancies have not gone unnoticed, and recently the *BAF*, a French humor group, tellingly documented their romp through the Paris city streets as they hunted Che-shirt wearers and assaulted them with questions of his background.<sup>2</sup> Though these comedians had right-wing motivations and firmly believed in the ignorance of their targets, their act of satire protests the bastardization of the symbol in ways that extend far beyond a handful of clueless Frenchmen. One man lists his admiration for Che due to the fact he is “macho,” while another claims he likes him “for the music.” “But don’t you realize,” the humorists counter sweetly, “that Guevara hated rock music? That he denounced all who listened to it as liberalized bastards?” Immediately the shirted man sinks into a fog of confusion, mumbling an empty response. This experimental protest displays how the functional qualities of the symbol itself are uprooted upon the introduction of

extraneous, and in this case, complicating, information. It is only in the absence of complete and provocative detail does Che attract “non-traditional” supporters, and only after he has been reduced to a static and mute image might one fathom he stands for *music*, or a similarly imposed construct. It appears then that Che, and perhaps most symbols, must function in a *vacuum* to be truly effective. As Sontag observes: “To photograph people...turns people into objects that can be symbolically possessed” (Sontag 14). In this possession lies the capacity for personal significance and interpretation. Indeed, details of Che’s biography were unappealing to the Frenchman – he did not know, nor did he care about Che’s dogmatic regards towards music as a Communist. Here is visible the literal crux that separates a symbolic image from a celebrity or a concrete icon – symbols are malleable, and upon emancipation from the shackles of biographical detail, they are quite easily inundated with significance in accordance to human preference.

Perhaps the fiercest dialogue occurring today between the espousers and scoffers of the symbol takes place among those that convert the guerilla into a Warholish image of popular fashion. Nowhere does Che find more dotingly angstful embracement than in the hungry palates of American culture. The relationship, already a dubious one due to Che’s outspoken criticism of American imperialism,<sup>4</sup> timidly began in the sixties, after Andy Warhol assumed credit for a stylized reproduction of Korda’s photograph. Che’s popularity rose to new levels after the release of the popular film *The Motorcycle Diaries*, which features a thoughtfully vacant Gael Garcia Bernal playing a slightly more attractive and romanticized Che than historical literature would have us believe. Especially in the wake of this film, shirts, stickers, and posters bearing Che’s face became the penultimate accessory. While most teenagers considered their t-shirts as political dissidence of the general variety, many failed to realize the irony involved in embracing a communist revolutionary who had dedicated his life towards fighting capitalism, and therefore the privileged lifestyles led by the majority of his U.S. supporters.

The remarkable thing about the icon is that, in spite of bastardization by pop culture, Che retains a highly controversial

political message. Prince Harry, upon being photographed wearing a Che shirt, received much condemnation for his choice in message.<sup>5</sup> As recently as December of 2006, Target Corporation pulled a CD carrying Che's visage from their shelves after an uproar by critics condemning him as a totalitarian symbol.<sup>6</sup> In 2005, musician Carlos Santana wore a Che shirt to the very public Academy Awards Ceremony, and encountered immediate criticism from fellow musician Paquito D'Rivera. D'Rivera condemned Santana for carelessly supporting the "butcher" responsible for the murder of D'Rivera's cousin in a Cuban prison camp.<sup>7</sup> Some sociologists agree this trend is a distressing one: "The presence of Che Guevara's image in Western popular culture is... a frightening reminder that communism and its crimes against humanity, contrary to National Socialism in Germany, have not been unequivocally condemned by a 'Nuremberg'-type trial" (Elena Bonner qtd in Vargas Llosa 6). Has Communism's residual nature rendered it obsolete, and therefore, *vintage*? Just as eighties clothes are back in style – dug up like some curiosity from the obscure depths of one's closet – has Che, too, become incorporated into American fashion – dug up from the depths of Socialist literature *because* of his off-beat esotericism? Regardless of *why*, his popularity among the American youth remains oblivious to more sinister connotations that historians voice.

The dilution of Che's bibliographical flotsam can best be seen upon examining the *specific venues* that bring him into contact with the U.S. consumer. The first and most prolific of Che's appearances occurs in the nationwide store Hot Topic. Hot Topic sells various counter-culture shirts, logos, and goods of rebellion and music amidst the setting of a suburban mall. As paradoxical as the chain's identity might be, the stores are quite popular, and the Che shirt has become a profitable item. Hot Topic's target audience is fairly broad; among teenage groups they cater to a variety of stereotypical labels – "goths," "punks," "hipsters," and "indie rockers," all convey a description of the clientele. So what might these very disparate groups of shoppers, unified in Hot Topic by nothing save the desire for something "underground," value in the image of Che? His involvement in

Cuban Prison Camps, weak physical health, and known hatred of U.S. imperialism – all facts seemingly at odds with his patrons at Hot Topic – are erased completely in the simple black strokes of his printed visage. Even more intriguing, the store markets and its hip intellectualism and informed taste in music. Yet one does not see the wry "Che brought to you by capitalism" shirts available. So the intellectualism for sale at Hot Topic is not, then, without some social self-awareness and lust for "cool". Che's metonym underscores capitalism in its most bizarre and powerful manifestation – as that which voraciously incorporates even a dissenting counterculture.

The second venue that offers itself for exploration is that of a small outdoor gift shop in Big Sur, California. The region is renowned for its spectacular camping, upscale hotels, and reportedly good energy, and attracts various meditators, hikers, and big spenders. The customers of the store are typically middle aged to older, and the goods constitute an even more varied accumulation than those found in Hot Topic – a bedlam of Tibetan Prayer Flags, Aboriginal didgeridoos, glass ornamenture, Peruvian grass mats, healing stones, and garden plants. A collection of items related to growth, spirituality, travel, and "hippie" lifestyle sit in harmonious sublimity. Above them hangs a wooden Che Guevara painting, penetrating as ever – and available for the enticing price of forty dollars. This appearance is perhaps more unsettling. Che is indeed a symbol of rebellion, but growth? Spirituality? Is his incorporation a tribute to the basic hope for human freedoms for which he struggled? There is something petulant, young, and free-spirited about Che that at once seems comfortable aside a "therapeutic crystal." The recycling of Che in Big Sur presents a site perhaps the farthest removed for his original abstraction in Latin America – Che is being sold for his *already abstracted* associations with liberation. Therefore, the more abstracted the icon develops, the more surprising its contexts become. In part, these icons serve as base reflections of movements around them. Truly, "the vast maw of modernity has chewed up reality and spat the whole mess out as images" (Sontag 86).

The recycling of icons also contains a backlash that offers up an interesting question - how does one protest

a bamboozled protest? The Internet is providing a literal space in which protesters of the Che image can do just this. Smaller online stores such as cafeexpress.com offer Che shirts satirizing the Communist by displaying a dollar sign on his beret, and the words "brought to you by capitalism" beneath his image. Another shirt contains Che's image with the words "I know nothing about this person." Similarly, an online blog farcically offers the choice between a JP Morgan and a Stalin shirt as a proper alternative for the image hungry affluent youth.<sup>8</sup> All of these websites actively provoke a comical protest that directly confronts a conflict that engages liberal and fashionists alike: the dilution that plagues all recycled images.

Comedy has not been the only recourse for the hijacked icon. Che's close friend and holder of photography rights, Diaz Gutierrez, filed suit against Smirnoff Vodka in 2000 for their use of Che in an advertisement.<sup>9</sup> Gutierrez cited that it was "disrespectful" to the ideals that Che embodied to use his image for the purpose of selling alcohol. Yet do these "counter-protests" really accomplish anything but the backward transition of the image? If we really are to regard Che as an icon, we should resolve that he entered the public sphere the moment Korda encapsulated him in a photograph, beginning a journey *away* from his role as a dynamic and complex being.

How then, do we reconcile the tension between the natural drift of these icons away from their individuation with the rational groups that resist this? This abstraction of the meaning relates less to Che himself and more to the concept of recycled images as a form of protest. Thomas Hines states in the *New York Times* that these cultural symbols essentially allow people to "make statements" with less accountability, which essentially results in a distillation of the message in consideration (Hine 4). Yet what lies at the core of the Che protest? In today's image-obsessed society, the embracement of leftist images – the Che shirt, the "No Bush" stickers, the anarchy sign – serve as the simplest manner of conveying a politically charged message to an unlimited audience. The connotations that these graphics embody immediately alert the crowd to the viewer's leftist opinions – in short, an *easy statement* without the *commitment*. Hine asserts that

"entertainment media has created and disseminated a stock of images whose potency transcends local boundaries" (1). The nature of globalization and fadism would then imply the Che craze is inevitable, perhaps to the groans of his followers. Hines even goes as far to assert that "part of what's involved in quotation and appropriation is just plain laziness" (4). Here one must be careful to differentiate between Che as a craze and the *subversive Communist movement* that Che symbolizes to others. Even observing such distinctions, this laziness of appropriation is precisely what engenders Che's more absurd associations, and echoes Jean Baudrillard's critique of a consumerist society drowning in its own meaninglessness.<sup>10</sup>

The appropriation of symbols in today's society is just as much a tool of liberal intellectualism as it is of languid and bourgeois protest culture. Che's image serves as a paradigm of the distortion many public figures experience when offered to the tastes of mass culture. Tracking the different enlistments of Che as a variant of "protest," in fact underscores the crux of every protest – dissidents attempt to gain legitimacy by espousing politically charged symbols, even if at times they are forced to "tweak" the original message of that symbol. However, capitalism serves a particular role in the recycling of Che. Capitalism's tenants of consumption and individual assertion effectively assist in assimilating any counterculture into the "system" of consumption and reproduction. Capitalism, then, remains the sole societal system that is capable of devouring even its opposition through espousing it by way of printed t-shirts and other celebratory ornaments. The recycled image of Che Guevara depicts this ability acutely. This capacity calls into question the very potency of Guevara's recycled state and highlights the ingenious and insidious nature of capitalism; as Audre Lorde observed, "The master's tools will never dismantle the master's house."<sup>11</sup>

At the nucleus of the symbol lies the acute nostalgia Che embodies for most consumers. The desire for the radical and transformatory – a romanticized freedom that contrasts sharply with the mundane life experienced inside a cubicle or a classroom – compels us to return the icon with perpetual fascination. The genius lies in the advertisement of the image itself, which

has been elevated to that of a metaphorical *Rorschach test* – a stock image in which the viewer inevitably imprints whatever desire (be it Anarchy, Nazism, or Growth) already unconsciously attached to the symbol. The embracement of Che through his innumerable advertisements relates the very root of our captivation with his ferocious image. The great effort spent reproducing and commercializing Che is a method of sheltering us, the viewer, from the provocative and scathing implications Che contains for our own lives. His image is tamed in the two-toned colors and made digestible for popular consumption, and only through this obfuscation may the viewer escape an inexplicable infatuation with Che. Consumers are not the unhappy dupes of capitalism – it is capitalism that provides a venue in which consumers can compartmentalize that which is terrifying and captivating. Che has fallen victim to manipulations of advertising inasmuch as we, his audience, remain victimized and disturbed by his presence.

If nothing else, this paper will only support the claim that only so much can be conveyed in a descriptor, a bibliography, an image – and the vast spaces that are left unsaid – those lost when printed on shirts and reduced as icons – are the very ones that leave room for interpretation, modification, and ultimately manipulation. Whether one views this process as a transition or a dilemma is a matter of preference – it is most certainly inevitable. Ernesto "Che" Guevara's personal life was tremendously influential, but it is his icon that has effectively outlasted as well as outspoken him. Be it Che or anyone else, the examination of icons and their cult symbology provides a telling navigation through the development of each figure's abstraction. When put into dialogue with those that resist this organic process, the essence of protest rhetoric becomes apparent: the use of vintage icons inevitably leads to further distortion of the icon. However, fashioned or not, people have been magnetically returning to Fitzpatrick's graphic image of Che for over forty years, continuously captivated by the mute and unapologetic visage, which, in any context seems eager to remind us: *Hasta la Victoria Siempre*.<sup>12</sup>

#### Notes

1. Baudrillard enlists this term to signify an image (which can be reproduced unendingly) of an object supposedly

having meaning but which in fact has none.

2. In his book *The Sublime Object of Ideology*, Slavoj Žižek refers to pictures of the Titanic as a kind of "petrified forest of enjoyment" and links our fascination to these images as "an attempt to domesticate the Thing by reducing it to its symbolic status."

3. This video clip, titled *La BAF purge Guevara des rues de Paris*, is available on YouTube.

4. This is apparent in a number of Guevara's own essays, especially "On Global Justice."

5. Britain's *The Sun* published a sensationalist expose of this event entitled "Prince Harry Havana Laugh" in 2006.

6. Investor's Business Daily published an editorial comparing Che merchandise with Hitler backpacks and Pot Pot cookware; in December of 2006 all Che CD covers were removed from Target shelves.

7. This apology is visible in the April 2005 *Santana News Archive* online.

8. From an anonymous satirical blog reacting to the experience of seeing a woman carrying a Che purse, while unaware of its significance.

9. The Associated Press covered the lawsuit in August and September of 2000.

10. Baudrillard expands upon the triviality of media-infused life in his books *Consumer Society* and *Simulacra and Simulations*, as well as in *America*, in which he describes the U.S. as the "only remaining primitive society."

11. While typically associated with feminist or civil rights context Audre Lorde's famous quote finds new application in Guevara's case.

12. This phrase serves as the closing line of Guevara's final letter to Fidel Castro, and in English translates to "Until Victory Forever."

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## Silent Journeys: Semiotics of Caesurae and Temporal Suspension in Schubert's Instrumental Music

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In this paper, I explore the moments of meaningful silence and timelessness that so frequently punctuate the musical landscapes of Franz Schubert. For this purpose, I employ a theory of musical semiology espoused by Jean-Jacques Nattiez in his 1987 *Musicologie Générale et Sémiologie*. Nattiez's theory advocates multiple levels of analysis working synthetically as a tripartition, which comprises the following: the poietic dimension, which accounts for the composer's intentions and the process of symbolic creation; the esthetic dimension, which informs the receiver's interpretation and reconstruction of the perceived symbol; and the trace dimension, or analysis at the neutral level, which aspires towards an objective description of the symbol's "immanent and recurrent properties" (Nattiez 12).<sup>1</sup> This semiological discourse proves particularly useful for an analysis of Schubert because, while the poietics underscores the remarkable extent to which Schubert projected his own "Wanderer" persona into his music, the esthetics enables us to address the music's controversial reception and issues of performance practice.<sup>2</sup> With this comprehensive methodology in mind, we will approach an understanding of Schubert's use of caesurae and temporal suspensions with regards to both their formal and ideological principles.

*Heard melodies are sweet, but those  
unheard  
Are sweeter; therefore, ye soft pipes, play  
on;  
Not to the sensual ear, but, more endear'd,  
Pipe to the spirit ditties of no tone...*

- John Keats (1795-1821)  
"Ode on a Grecian Urn"

### Expansions of Time and Proportions

In Schubert's music, the effect of timelessness occurs either through the absence of sound – for instance, a caesura – or the prolongation of sound, such as a gesture lengthened by a fermata, an unmeasured trill, or a degree of repetition that, by virtue of its circularity, temporarily inhibits our impression of passing time. This kind of seemingly non-directional organization has engendered much criticism among theorists and performers alike. On March 1, 1826, a reviewer of Schubert's *Sonata in A minor*, D845 for the *Allgemeine Musikalische Zeitung* initially praised the work for its imaginative flair, but then continued as follows:

That these [melodic and harmonic] inventions are often wonderful and even more wonderfully set up ... that seems easy enough to grasp; by the same token ... with [certainty] of the importunate and partially odd harmonies ... the present

writer hardly knew where things were leading and, moreover, had to shake his head a bit (Montgomery 40).

Even though the trite remark from this particular critic that he "had to shake his head a bit" might at first appear devoid of any value, a semiological discourse encourages us to extract as much informative potential as possible from an esthetic perspective, especially one hailing from a primary source. In simply admitting dissatisfaction with the obscure trajectories in Schubert's music, this writer has revealed that many listeners in the early 19<sup>th</sup> century, upon hearing a piece of music for the first time, still clung to the ideal of immediate comprehensibility. Schubert lived in the wake of over a century of tonal-harmonic codifications, with giants such as Haydn and Mozart having set towering precedents for what would become the 'desirable' parameters for thematic development and formal proportions. Only two hundred years after the deaths of these composers can we take advantage of our telescopic view of the 19<sup>th</sup> century and pronounce Schubert's non-directional tendencies as progressive and having undoubtedly influenced the compositional styles of later composers such as Robert Schumann, Liszt, Tchaikovsky, and Dvořák.<sup>1</sup> In defense of Schubert, Charles Rosen explains that

Schubert ... often tries to evade the sense of a directed goal in just those places that we are accustomed to think require a real sense of direction. This destruction of large-scale direction ... can be the occasion for some of Schubert's greatest inspirations .... Appreciating Schubert's conception here, nevertheless, forces us to revise our habitual expectations of tonal form ... it is part of an idiosyncratic process which has suspended any conventional feeling of pressing forward in classical development (Rosen 19).

Rosen aptly points out that the lack of momentum in Schubert's music constitutes a problem only insofar as it defies the expectations of the listener. This poietic-esthetic dialectic captures the conflict between the composer's innovations and the centuries of pre-existing standards that breed listeners who adapt too slowly to appreciate such innovations. Indeed, some have even argued that Schubert's music fails to please because it does not adequately imitate, in Rosen's words, the "directed goal" and "feeling of pressing forward" inherent in nature and humanity. We will return to this last point in a later section, in which we will see how theorists such as Theodor Adorno have insisted that timelessness in Schubert, as much as time itself, is just as compelling and relevant a metaphor for the human condition.

Let us take a close look at Schubert's *F minor Impromptu*, D935/1. Even most musicians who extol the affective subtleties and rhetorical power of this piece would testify to its unusual extent of internal repetition. Its macrostructure, a straightforward three-themed binary form with coda, demonstrates its large-scale redundancy, while the *appassionato* sections most effectively exhibit the points of small-scale repetition.<sup>2</sup> This results in a profound stillness achieved in the first *appassionato* section (Ex. 1). The right hand plays a hypnotic accompanimental line that communicates an instant sense of timelessness on all three semiological levels. In itself, the circular contour of these repeated four-note figurations conveys the unceasing pattern of departure from and return to the locus pitch that occurs on each downbeat. Regarding the poietic process, this type of accompaniment bears a broader personal significance for Schubert because he utilizes a similar idiom in some of his

more programmatically explicit works, such as the popular *Gretchen am Spinnrade*.<sup>3</sup> Lastly, the esthetic dimension in this case remains the most difficult to quantify, although, if performed with sufficient skill and conviction, the passage should signify for the listener a sort of cessation of time.

Beyond the local levels of timelessness, the sheer length of the first *appassionato* section, both halves of which repeat in their entirety, effects the release of time through its own surplus. If we commend the wakeless beauty of the theme's first iteration, then to condemn its repetition should seem positively absurd. Arthur Godel reckons that

the length of a work ... was not a defect or an accident of the compositional process, but a conscious objective: a kind of extended journey along which the audience could not only examine but *reexamine* certain specific interludes and experiences while moving constantly ahead in time (Montgomery 43).

To complain that the *appassionato* theme is long-winded or to avoid observing the repeat would contradict both the poetic and esthetic integrity of the music. In his discussion of the associations between Schubert's music and 19<sup>th</sup>-century visual arts, Montgomery looks at C. D. Friedrich's *Der Mönch am Meer* (Fig. 1a), about which he remarks:

Perhaps the greatest of Friedrich's open, non-framed paintings is *Der Mönch am Meer* (Monk by the Sea, 1809 or 1810). Here the image of timelessness is represented by a seemingly limitless sea and earth, offering almost no sense of proportion except for one fragile human figure (Friedrich himself?) who traverses the sand (Montgomery 58).

Just as Friedrich expands the proportions of his backdrop to express the infiniteness of time and space, so Schubert repeats both halves of the first *appassionato* because the brevity of a single statement cannot encapsulate the magnitude of its message. How many respectable artists would dare bemoan, upon scrutinizing Friedrich's painting, that there exists around the monk *too* much space, *too* many square inches of clouds and sky? Verging on the ridiculous, the figure below shows *Der Mönch am Meer*

with strips of the horizon removed from all sides, delineating precisely the way in which distorting an art form's proportions swiftly destroys its essence (Figure 1b).

András Schiff lends his insight as a performer to our esthetic considerations, instructing us to "trust the composer and the work and play it accordingly, or not play it at all. Schubert's sonatas are not a second too long – it is only certain people's patience that is too short" (Schiff 197). Even with this in mind, we will have difficulty believing that Schubert's music stands infallible; his manuscripts expose his infamously hurried and sloppy notation, inconsistencies with accidentals and dynamic markings, and other editorial nightmares (or dreams-come-true). And though we should not idolize his music as icons of untouchable genius – even Schiff, a great admirer of Schubert, has asserted that rewriting some of Schubert's questionable passages is sometimes acceptable – nor should we brush aside a piece of music because it fails to provide instant comprehension or gratification, a notion that perpetuates an imbalanced poietic-esthetic dynamic in which the composer carries the full burden of communication.<sup>4</sup> As Adorno tells us,

It is human emotion that animates works of art. There is no other way to understand the equilibrium between the subjective and objective elements of a



Figure 1a. C. D. Friedrich, *Der Mönch am Meer* (1809/1810)

lyrical structure. The lyric creator does not pour feelings directly into forms, but rather uses feelings as a means of getting to the truth in its minutest crystallization (Adorno 8).

Adorno appeals beautifully to the need for, among all three semiological dimensions, a cooperative integration through which the artist gives birth to the artwork as surely as posterity sees to its survival and evolution.

#### Silence as Metaphor

At this point, having examined the formal relevance of our topic, we have cause to venture into a more abstract semiology of silence. During various points in Schubert's music, the flow of sound ceases entirely. In the *Andante con moto* of the "Great" *C major Symphony*, the opening lone oboe, upon having reiterated its perambulatory melody so many times, seems to wander into a place of crisis towards the end of the movement. Not knowing how to tear away from its melodic



Figure 1b

pattern, it reaches a cataclysmic breaking point: a diminished *fff* chord, appropriately ambiguous in its harmonic orientation so as to convey confusion, erupts from nearly every instrument

(Ex. 2). The measure of silence that follows is a desperately needed moment of recuperation. Thereafter, the opening melody never appears in full. Instead, imbued with a deeper pathos, it appears only in fragments, modally transposed and divided amongst several instruments with the oboe sadly incapable of reclaiming its monodic voice.

In his 1928 article "Schubert", Adorno compares the temporalities of Schubert's music to human experience and mortality:

There you have the Schubertian dialectic: it absorbs with all the force of subjective interiority the fading images of an objective presence in order to rediscover them in the smallest cells of any musical realization ... [The circularity of *Schöne Müllerin* and *Winterreise*] lies in the timeless path between birth and death, as dictated by blind nature. And traversing it, the wanderer ... Schubert's themes wander just like the miller does, or he whose beloved abandoned him to the winter. (Adorno 10).

The musical trace symbolizes the journey itself and the poietic and esthetic processes represent the composer's and listener's respective undertakings of this journey. Adorno also compares the roaming nature of Schubert's music to the open-ended atmosphere of natural "landscapes":

Harmonic shifts replace developing transitions like changes in lighting exposing a new part in the landscape, that itself entails as little development as any earlier part; and here too, in development sections, motivic unpicking of the themes – exploiting for the sake of dynamic sparks their every little element – is renounced, and the recurrent themes are disclosed progressively (Adorno 11).

According to Adorno, the organization of Schubert's music can be likened to a collage, which informs the fierce juxtapositions between key areas and themes in addition to the most fundamental dialectic between

sound and silence. None of these changes require anticipation or preparation, for they seek neither to trace a linear progression nor to soften the shock of the unexpected. In the same way that human life is defined by both gradual and sudden transformations, so Schubert's music presents both sorts of transformations without apology. A final sentimental outlook from Adorno teaches us the following:

Salvation happens in the tiniest move, in the transformation of the minor third to the major; these are in such proximity that the minor third, once the major has appeared, turns out to have been its mere shadow ... Reconciliation that comes from submission had absolutely nothing to do with Schubertian consolation, which means the hope to an end to life's deadly confusions ... The themes are ranged timelessly in death's landscape, and in a comforting way music fills time regained, far from any deathly end, with the premature steadfastness of eternity (Adorno 13).

In the end, Adorno's metaphor for Schubert's music, though fraught with the reckoning of extinction, need not be an unhappy one. The music gives rise to thoughts of mortality but then sets out to confront it head-on, thus bringing into light the definitive confrontation between music and its own shadowy symbol. For the listener, this comprises a paradox in the esthetic experience, for we fear the existential implications of the music but take solace in its dignified protest against them. Susanne Kogler, who had read and expanded upon Adorno's philosophy, gracefully remarks that

beauty and love only exist at the rim of silence, appearing in tears and gentle wind. Song itself – representing lament and emphatic presence – becomes the only possible evidence of the actual existence of what in fact is not directly present. In his composition Schubert reveals the responsibility of the artist in general: it is his task to depict love and beauty while being aware of the uncertainty of their existence (Kogler 92-93).

Few symbols, if any, can even begin to approximate this level of relevance to

the human condition in all of its glorious complexity. And while a semiological discussion hardly seems necessary for such a self-sustaining principle, we should recognize that we experience the same kind of doubt when we confront one of Schubert's gaping caesurae as we do when we face the mere idea of death. But once again, whereas we seem helpless to evade our own fates, music "objects to the transitory nature of human existence" (Kogler 90); because music has the ability to resurrect itself after a deathly silence, such silences become in retrospect valuable lessons urging us to appreciate music all the more.

One of Schubert's favorite places to inject silences is towards the beginning of a work, often after only a fleeting declamation of a single phrase or gesture, such as in the opening movements of his two piano trios, the *Trio in B-flat major*, D898 Op. 99 (Ex. 3) and the *Trio in E-flat major*, D929 Op. 100 (Ex. 4). While these silences may simply serve rhetorical and performative purposes – that is, to rally the three players together with a coordinated gesture and decisive pause, a common practice in 18<sup>th</sup>-century chamber music – they may also signify Schubert's attempt to elevate the beauty of musical continuity later in the movement by presenting an initial tinge of uncertainty. Dieter Schnebel says, "The joy of the returning of time is overwhelming, as well as the opportunity offered again: *outwitted ephemerality*" (Kogler 90). Each phrase, whether introducing fresh sounds or revisiting familiar ones, represents a precious musical offering. As such, Schubert teaches us never to take music – or life, for which it stands – for granted.

We should also consider the *Allegro moderato* of Schubert's "Unfinished" *Symphony in B minor*, D. 759, as anyone who hears this symphony cannot deny the sense of wonder that arises when the somber introduction in B minor unexpectedly yields to the lifting G major theme. Schubert, however, gives us reason to think that this theme is too good to be true, with its persistent *pp* suggesting that perhaps the melody is but a short-lived illusion. As if to show us that this could be the case, Schubert suppresses the melody mid-phrase with a heart-stopping silence in m. 62, broken afterwards only by tremendous *sforzando* chords (Ex. 5).

*A Journey's End*

One of Schubert's most famous silences occurs in the first movement of the beloved *Sonata in B-flat major*, D960, in which a caesura in m. 9 spurs a second statement of the opening theme, which, after a pensive trill in m. 19, launches into a comfortably prolonged phrase (Ex. 6). Schiff delivers a charming (though somewhat melodramatic) diatribe against insensitive listeners who fail to grasp the "magic" of this pause:

Silence is the beginning and end of music. Schubert knew this and his sonatas are full of rests and longer pauses, such as the one in bar 9 of the first movement of D960. There is always somebody in the audience who seizes this opportunity; I am eagerly waiting for the first time in my life when nobody will cough at this point. The rest is crucial; it represents silence after the mysterious murmuring of the bass trill and one careless cough spoils the magic of it. We might just as well stand up and go home. Do coughers ever think of this? Rests are there to be observed and one often hears pianists who pedal through them. It's a great mistake because it confuses the meaning of the music (Schiff 204).

Listeners, then, should realize that their esthetic contribution becomes an active and even poetic one during the course of a performance, such that, for instance, the quieter the collective atmosphere in the audience, the more poignant the pause in this sonata and the more convincing its portrait of doubt.<sup>5</sup> In our semiological discourse, there exists no fourth wall between the performer and the listener during a live performance, as there should appear only the synchronous integration of all levels of the tripartition. As a closing note, we should acknowledge that, while each listener obviously hears and interprets the music in his or her own way, the concept of pluralized esthetics likely applies to silence even more than it does to sound. Into the gulfs of silence we project our own fears and hopes, possibly similar to but more likely different from those of other listeners. In this way, the most profound silences become the most powerful Rorschach tests, and as such, pave way for some truly unique musical experiences.

The feverish rate at which Schubert

composed, along with his penchant for the Romantic topos of Death, should intimate that a certain *memento mori* always haunted him and his craft.<sup>6</sup> As Newbould eloquently remarks,

The sheer intensity with which his [Schubert's] creative light burned in his last months, coupled with the ever-widening scope of his vision, encourages awestruck posterity's eager anticipation of what might have followed (Newbould 410).

And yet, as Schiff points out,

It's useless to contemplate what he [Schubert's] could have written had he lived longer. Instead we should be eternally grateful for what he so generously gave us (Schiff 208).

Just as we do not question what sounds can fill a caesura – or at the very least, that we do not expect any real answers to such questions – so we should honour the premature silencing of Schubert as something that compels us to appreciate more intensely his surviving output. Each piece of music that Schubert completed stood for another triumph over transience, an accomplishment that lamentably eludes the capacity of mortal beings. In this respect, music will always represent a greater force than both its creators and receivers. It seems fitting, then, to close with this final quote by Adorno:

Schubert music brings tears to our eyes, without any questioning of the soul: ... how stark and real is the way that the music strikes us. We cry without knowing why, because we are not yet what this music promises for us. We cry, knowing in untold happiness, that this music ... [promises] what one day we ourselves will be (Adorno 14).

With Schubert's prolific oeuvre in mind, we cannot help but envision this ever-youthful artist having composed at a lightning pace as he raced against time itself. And yet, in spite of his endemic haste, artistic frustrations, and lifelong anxieties, his music always breathes with an infinite patience that has proven to be as timeless as his legacy.

**Notes**

1. Nattiez tells us that "Molino proposed the name *niveau neutre* [neutral level] or *niveau matériel* [material level] for this trace" and that "the word 'esthetic' was Valéry's neologism" (Nattiez 12). He goes on to say that "enjoying, contemplating or reading a work, musical performance, as well as scientific and analytical approaches to music, are, de facto, situated on the side of the esthetic" (Nattiez 12).
2. Although trace level analysis seems appealing in theory, its practicability is limited as all analysis relies to some extent on our experience and a fundamental basis of comparison. On the subject of the crisis of 19th-century theory, Nattiez states that "the harmonic language belonging to a given music-historical period or composer is not comprehensible unless mediated by a metalanguage that explains it. There are no musico-harmonic phenomena per se; they are accessible to us only because they have become the object of a process of symbolization that organizes them, renders them intelligible. To speak of a 'crisis of theory' is to admit that the tools used to describe the phenomena of a particular era are, once the material has reached a certain developmental stage, no longer sufficient" (Nattiez 217). In effect, Nattiez admits to the impossibility of isolating a symbol and its medium from their socio-historical contexts and the abstractive hermeneutics that define them.
3. his 1894 article, "Schubert's Music", Antonín Dvořák touchingly speaks of ways in which various 19th-century composers – Schumann, Liszt, Brahms, and even Wagner – were influenced by Schubert's music.
4. This kind of three-key (trimodular) or three-theme schema appears in many of Schubert's keyboard sonatas and, to an even greater extent, in the sonatas and chamber works of Robert Schumann. For a clear example, see the first and fourth movements of Schumann's Klaviersonate in F minor, Op. 14 ("Concert sans orchestre").
5. The sense of circularity in Gretchen am Spinnrade is achieved through the spinning ostinato accompaniment (representing Gretchen's wheel) as well as the redundancy of the text itself, which repeats the opening strophe two and half times: *Meine Ruh ist hin, / Mein Herz ist schwer / Ich finde sie nimmer / Und nimmermehr* [My peace is gone, / My heart is heavy, / I will find it never, / Never again].
6. In "Schubert's Piano Sonatas", Schiff discusses how a passage in the final movement of Schubert's Sonata in C minor, D958 has "never sounded right" to his ears. However, as general rule, Schiff seems to abstain from rewriting Schubert's music for performance unless it is a matter of autographic ambiguity.
7. As a brief aside, we should admit to the irreparable hypocrisy around which the Western concert-going etiquette has been built. That applauding between movements of a work is still met with disapproval and shushes for the supposed reason that it interferes with a performance's holistic continuity, but how much truer this must hold for a round of hacking coughs and other bodily noises that stir throughout a performance and especially flare into the foreground when the music stops! To argue that coughing is an action that cannot be suppressed must be doubly ridiculous, for the same argument could be made even more convincingly for applause. For those who adore Schubert's "Great", how natural would it really be to hold back applause at the end of the first movement if there were no custom or precedent for such conduct?
8. In "Schubert's Illnesses", a concise and well-documented essay, Peter G. Bevan discusses Schubert's physiological and mental maladies, including several

episodes of depression.

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**Examples**

Example 1. Schubert, Impromptu in F minor D935/1 (mm. 69-84).



Example 2. Schubert, Symphony No. 9 in C major, D944: II. Andante con moto (mm.239-259)

Example 3. Schubert, Trio in B-flat major, D898 Op. 99: I. Allegro moderato (mm. 1-8)

Example 4. Schubert, Trio in E-flat major, D929 Op. 100: I. Allegro (mm. 1-9)

Example 5. Schubert, Symphony in B minor, D759: I. Allegro moderato (mm. 48-69)

Example 6. Schubert, Sonata in B-flat major, D960: I. Molto moderato (mm. 1-20)



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## Poets on the Threshold of Empire: The Door, The Mistress, and The Refusal in Latin Love Elegy

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The Latin love poets of late Republic and Augustan Rome assumed a stance and issued a voice significantly at odds with their culture. Still today, interpretation of the inverted gender dynamics and seemingly emasculated role, which these predominantly male poets characteristically broadcast, proves problematic. Responding, in part, to a body of contemporary criticism, skewed to focus on the elegists' supposedly misogynistic misrepresentation of Roman women, I argue that, considered in the contexts of both history and poetic expression, the elegies represent a different spirit entirely. Rather, as the Republic crumbled under the weight of its own rapacity, only to be replaced by a zealous, hegemonic reassertion of Roman ideals, the elegists antagonized the cultural mandates that constrained male experience. With particular attention to the poetic texts of Catullus, Propertius, and Tibullus, I propose that the specific images of the door and the refusal of a call to arms, recurring alongside the more commonly debated image of the mistress, form the elegiac arsenal, with which these poets interrogated the prescriptions of *vir* ("real man") and the thrust for empire. Today, when, again, the tenor of leadership in many countries worldwide encourages a male identity, honed to the purposes of aggression, the elegies, reconsidered, prove unexpectedly resonant.

"[P]oetry is more than fantasy and is committed to...trying to say something... about the human condition. Therefore, a poem...is no more at liberty to violate what the [poet] takes to be the spirit of his history than it is at liberty to violate what he takes to be the nature of the human heart. What he takes those things to be is, of course, his ultimate gamble... Historical sense and poetic sense should not, in the end, be contradictory."

- Robert Penn Warren  
- Forward to *Brothers to Dragons*

The image of a prostrate male, braying dejectedly and clamoring for admittance outside his beloved's door, evokes mixed sympathies. The implication that a domineering seductress lurks inside, who manipulates her lover's sanity by barring his entry, might portray the man in a relatively forgiving light. More likely, however, this scene leaves the impression that the male, alternately deriding and imploring the female in anguished, submissive, and pitiful terms, is completely humiliating himself. In Rome during the 1st century BCE, such a reversed powerplay between an elite male and an unyielding mistress would have been simultaneously

comic, repugnant, and grave. On the man's part, such conduct would constitute a blatant show of "*mollitia* ('softness');" in short, this man would be the antithesis of the "Roman *vir* ('real man')...hard in every sense" (Skinner 212).<sup>1</sup>

Yet, as Republic gave way to Empire, the erotic elegists willfully assumed this subservient, emasculated position - each one broadcasting the first-person voice of the abject lover, denied access. The inversion of gender-assigned roles within the dynamic of an illicit affair leads some critics of Latin elegy to conclude that the elegists "set an especially seductive trap for historians of women's lives in antiquity" (Wyke 12). This view seems to assign the poets a convoluted motive in a deliberate effort to overthrow the legitimacy of late Republic and Augustan elegy as specifically poetic discourse, in which male poets interrogated the cultural mandates that shaped male experience.

Considered in the framework of crumbling Republic and rising Empire - the contexts, firstly, of civil war, when Roman aggression and dueling ambitions ravaged a territorial, political, and social landscape, and, secondly, of burgeoning imperial thrust, when one "venerable" leader undertook the reconstruction of an impenetrable superpower - the elegies suggest something other than the poets'

intent to typify the Roman female. By inverting gender dynamics, opposing civic expectations, and assuming emotional and vulnerable positions, they dramatize the powerplay of dominance and submission that dictated the broader Roman experience. In so doing, the elegists challenge the codes that idealized, and thus constrained, the Roman male, rendering him an effective tool of empire, perhaps, but a virtual imposter in human relationships.

Here, I explore the compelling recurrence of the poetic images of the door, the mistress, and the call to arms in the elegies of Catullus, Propertius, and Tibullus and the way in which, through these images, the elegists draft culturally relevant and outspoken metaphors, which provide a bold exposé of the male, compromised by an ideology and bent on conquest. I consider the sociopolitical climate that gave rise to these images, and with emphasis on the poetic texts, I examine the way in which the elegists, through consistent conjuring of these specific images, assert a countercultural message as they stand on the threshold of Empire.

### Hegemonic Zeal

By the time of Octavian's defeat of Antony and Cleopatra at Actium in 31 BCE, a century of civil wars had eroded the moral and civic values, which defined and stratified Roman society (Skinner 204). Reflecting on the Catiline conspiracy of 63 BCE, the historian Sallust describes the Republic's decline from one in which "morals...[and] justice prevailed" to one in which "avarice subverted honesty, integrity, and...honorable principles" until "the state was entirely changed and the government became insupportable" (*Conspiracy of Catiline* 9,10).

An atmosphere, then, in which "shamelessness, corruption, and rapacity" prevailed over "modesty, temperance, and integrity," surrounded Catullus as his poetry emerged, defining the starting edge of distinctly late Republic/Augustan elegy (Sallust 10,11; Mulroy xi). Moreover, the social collapse - brought on as "the lust of dominion...[and] extensive empire" grew into a "rivalry for glory...[and] love of irregular gratification...and...luxury" - provoked an equally extreme recovery attempt (Sallust 2,7,13). During the period of social reconstruction, pursued by the newly proclaimed Augustus 35 years

later, Roman ideals were reasserted with hegemonic zeal. Thus, severe fluctuations in cultural climate and tone of leadership - all linked to power, prestige, and passion - encompassed the period in which elegy emerged.

Further, Cassius Dio's account of Augustus addressing the male citizens illustrates the extent to which sexuality, morality, and the Roman ideal of masculinity were confiscated by the state and molded to serve the imperatives of empire-building (Roman History LVI). Not only Augustus' words, but also his peculiar blocking of the event, suggest the very images of the door, mistress, and call to arms, which figure in the elegies. Segregating the married and unmarried men into separate wings of the Forum, Augustus proclaims:

...[I]s there anything better than a wife... to leave behind...mad passion...[or] a child... to leave behind... so that you ...need not fall into the hands of aliens...? [F]or the state, for whose sake we ought to do many things that are distasteful... how necessary it is...if...all the world is to obey you, that there be a multitude of men...to protect what we have with all the greater zeal...Therefore, men - for you alone may properly be call men - and fathers...I love you...I...bestow... prizes... [and] distinguish you further by...honours and offices...(qtd in Cassius Dio LVI)

The images emerge in the striking difference between this address and that given to the unmarried, sequestered in the separate wing:

O, what shall I call you? Men? But you are not performing...the offices of men. Citizens?...[T]he city is perishing. Romans? But you...are bent upon destroying... the entire Roman nation... introduce customs...which... lead to the extermination of all mankind...I have increased the penalties...in order that through...fear...you might be brought to your senses...to the obedient I have offered...greater prizes...[so] that you might be persuaded to marry and beget children... [I] is [n]ot...creditable that... the name of Romans be blotted out... I... realize that there are disagreeable... things incident to marriage and the begetting of children...[Yet] the advantages [are]... more... compelling ... Therefore, if you

really hold me in affection...be eager to become men and fathers... that you may not only share [my] title but also justify it as applied to me. (qtd in Cassius LVI)

Clearly, Augustus is justifying the *Lex Iulia de maritandis ordinibus* and the *Lex Iulia de adulteriis coercendis*. The first Julian law, regulating marriage among the elite and limiting marriage across class boundaries, and the second, posing penalties for adultery, suggest the degree to which mistresses were feared as civic complications and threats to empire (Skinner 206). Thus, with marriage unsatisfying and adultery unlawful, the chances of reciprocal intimacy between men and women, especially of equal rank and background, seemed slim. Moreover, the tenor of the address attests to the tenor of leadership; Augustus issues a challenge that seems provocation for mounting a counter-attack. First, he reinforces the split in his camp, rewarding one side, while penalizing the other. Also, he stipulates how the disenfranchised can gain entry through the door to manhood, privilege, prestige, and even immortality. Further, he inextricably links male sexuality, civic duty, and global dominance; "mad passion" is to be "restrain[ed]," while true virility must render service to the empire. To do otherwise would be to "destroy the entire Roman nation" and "exterminat[e] all mankind." By "bestowing prizes... and offices" on those who subdue their desire in fruitful marriage, Augustus prompts "rivalry for glory" and "estimat[ion] of friendship... according to interest" (Cassius LVI, Sallust 7,10). Further, Augustus issues a call to arms, linking the need for successors to the expectation that Romans must fall in the pursuit and protection of Empire. Yet, despite his battle cry tenor, Augustus, in his address to the unmarried - who he essentially reduces to the status of mistresses - sounds himself like an abject lover, braying on the threshold. His own subjugation to an obsessive desire for empire emerges, and, ultimately, he appeals for affection - an affection between men that had far more significance in Roman society than that between a man and woman (Oliensis 151-55). Significantly, Augustus links this affection to the men's commitment to become *real men* and further links their being *real men* to the validity of his own manhood.

Thus, erotic elegy emerged in a period of transition, marked, first, by the turmoil of falling Republic, and then, by Augustus' stringent attempts to restore a political, civic, and moral order, befitting the pursuit of Empire. In a culture where impenetrable *vir* signified the elite male's physical inviolability and prescribed the full range of conduct, which confirmed his civic dominance, (perceived) masculinity was at the heart of every issue. In a poetic spirit, then, as Rome stood on the threshold of Empire, the Roman male stood at the door, leading either to a deeper understanding of his nature or to a continuation of Roman terms. Considering the culturally forged link between sexual and sociopolitical dynamics and the reality that male passion was usurped by the hegemon, particularly poets might have viewed Empire as an especially demanding mistress. Moreover, a call to self-restraint, disguised as morality, was a call to *vir*; the call to *vir* was a call to serve the thrust of empire; and the call to empire was an ever-present call to arms. In effect, the call was to perpetuate the dynamic of dominance and submission that inspired the Roman existence.

#### Refusal of the Call to Arms

The elegists refused this call on various levels and to different extents. As elite males, they were obliged to uphold the civil and political terms of citizenship. Further, as poets, they faced a tradition in which poetry either glorified the achievements of state or fell into the category of comedy and satire (Whigham 26). Yet, the form and content of elegy marked a departure from ordinary satire and the epics that celebrated legendary wars. Even within patronage relationships - governed by a constellation of values, including *foedus* ("good faith"), *fides* ("integrity"), *pietas* ("loyalty"), *officium* ("service"), *gratia* ("favor"), and *amicitia* ("profound mutual friendship") (Hurley 133, Lyne 24, Oliensis 151-55) - the elegists antagonized, ridiculed, and/or blatantly rejected sociopolitical institutions. As elegy progresses from Catullus through Tibullus, this poetic stance moves from attacks on the ludicrous workings of society and politics to outright "*recusatio* (refusal)" of war and pleas for peace (Katz *xix*).

Catullus responded to a political climate - defined by the aspirations of Caesar and Pompey, the powers of the

triumvirate, and the implications of the Catiline conspiracy (Mulroy *xix-xxvi*) - by issuing pointed attacks on key figures. In *Poem 29*, referencing Caesar's military advances and his commander Mamurra, Catullus expresses an unambiguous view of the leadership and its goals. Repeating the refrain "[y]ou are enthralled by loot, lechery & the political game," he condemns Caesar for "squander[ing]" what the Gauls and Britons "once possessed," leaving them to "shake in their shoes." Further, he characterizes Mamurra as "overindulged...a debauched instrument... a Noblest Pederast." Caesar is sarcastically addressed as "an unusual general" pursuing "an unusual campaign" and accused of allowing the "Intolerable Mamurra" to "stalk from bed to bed" and "dribble" money and countries through his "fists". These are cutting indictments of the link between money, sex, and politics, which characterized the Catullan context.

Similarly, Catullus berates supporters of the triumvirate in characteristically colloquial and crude terms. He instructs Caesar to be "duly revolted" by "pin-headed Otto's unattractive pate... loutish Erius's half-washed legs... Libo's smooth & judicious farts... Sufficio's old man's lust turned green" (54) Elsewhere, Caesar and Mamurra are referred to as "a peerless pair of brazen buggers" and "heavenly twins'/erudite in the skills of the one divan, each/as voraciously adulterous as the other" (57) Here, Catullus uses explicit sexual references, which mark both men as effeminate and penetrable, in order to make the pointed assessment that they are politically unsound. At least poetically, Catullus holds the call to civic duty in contempt.

More explicitly, Propertius refuses to commemorate "heroic armed bands...Remus' beginning...the pride of lofty Carthage...[the] wars... of...Caesar." Instead, he claims "[t]he girl alone erects my genius," and "writhing against one another...[i]s our battle." He admits that to write love poems is to have "an effeminate book come to his lips" (2.1). As such, his countercultural stand is unambiguous in terms of poetic expectations, perceived masculinity, and war. Elsewhere, his condemnation of war is more clear: "If everyone agreed to sail through life... hammered from plenty of wine...the fighting ship would not exist...and Rome...

would not be...exhausted/from letting down her hair in victories over her own" (2.15). These lines, appearing in the context of a poem addressed to his mistress in bed, indicate that Propertius contemplates love, sex, war, and Rome simultaneously.

On one level, he refuses the call to civic duty by choosing a lover's life; however, his reference to Rome's "victories over her own" is especially significant. Propertius' poems suggest that he originated in Umbria. As a child, he would have experienced the plunder of Perusia by Octavian and the redistribution of the surrounding areas (Katz *xvii*) - a trauma he may be referring to when he writes, "when Roman discord hunted her citizens/this was especially painful for me, my Etruscan soil:/you allowed my relative's limbs to go abandoned" (1.22). No wonder he declares his refusal: "conquered nations are worth nothing in love...Where will I get sons to offer for triumphs of the state?/None from my blood will be a soldier" (2.7).<sup>3</sup>

Similarly, Tibullus issues unambiguous views of war; however, it was not his refusal of the call, but rather his experience fighting as a military tribune under his patron Messalla's command, that left an indelible impression (Lee *xiv*). His elegies seem the receptacle for emotions at odds with his culture and for his inquiries into the nature of war and death. He asks: "Who invented the terrifying sword?/ War that day...opened a short cut to grim death...do we turn against ourselves/the blade intended for wild beasts?/Rich gold - the fault lies there.../Now I am dragged to war" (1.10.3-7,11-13). Tibullus feels compromised by the spirit and duties of conquest. With characteristic lyricism, he laments, "[o]thers can be brave in arms/ and...cut down the opposing leaders.../What madness to join forces with sombre Death in war!/Her threat is close, and unperceived her coming" (1.10.29,30,33-34). Here, he superimposes his dread of death itself onto the culture of omnipresent, inevitable war.

Further, asking "is not the true hero the man slow age surprises/in a little hut with children around him," Tibullus culls together several references, which distinctly characterize his refusal of the call to immediate culture (1.10.39-40). While his fear of dying on the battlefield is already clear, now implicit is his refusal of a life of wealth and prestige. This mixed anxiety emerges repeatedly, as he claims

"Wealth let others gather.../and occupy great acres.../scared...in contact with the enemy/ their sleep put to flight by the blare of trumpet calls" (1.1.1,2,3-4). Tibullus indicates that the price of conquest is personal peace. In Augustan Rome, his particular response - "glory has no charms for me" - would have been considered effeminate and countercultural (1.1.51,57). Moreover, Tibullus references the rural life and a return to former ideals. This nostalgia is reinforced as he closes, capping his refusal with "let Peace attend the fields. White Peace in the beginning/led.../In peacetime hoe & ploughshare shine while rust in the dark attacks/the soldier's cruel weapons" (1.10.45, 49-50).<sup>3</sup>

In essence, the elegists' refusals criticized a culture of violence, greed, and deception. By appropriating the terms of war and politics, they demonstrated that, to a poet's sensibility, the implications of civil unrest, conquest, and ineffectual socio-moral codes had deeply personal ramifications. In refusing, then, the elegists established their distinctive rules of engagement; in declining one set of arms, they picked up others.

#### The Mistress

The context of the mistress and the illicit affair was the centerpiece of the elegiac arsenal. Yet, this context was not an elegiac contrivance; rather, the presence of Roman wives of elite status, involved in affairs, and of a demi-monde of influential courtesans is well documented (Skinner 203, Lyne 10). In a society where male desire, passion, and sexuality were confiscated to serve a passion for conquest; where male self-control was deftly linked to national stability and strength; and where the concept of impenetrable *vir* dictated a culture, overrun with sexual overtones, and a social hierarchy, based on dominance and subservience, the mistress and the illicit affair seem an obvious and relevant poetic choice (Skinner 195-96).

On one level, the affair duplicated a dynamic of deception and tenuousness already present in the sociopolitical sphere. On another level, considering that marriage was not prescribed to provide mutual emotional satisfaction, the affair represented a context in which opposite genders might align sexual desire, emotion, and intimacy. On a third, metaphorical level, the dynamic of dominance and

submission, operating between lover and beloved personified the principles on which the thrust for empire also operated. By inverting the gender prescriptions so that male is subservient and female dominant and, further, by assuming this submissive role in first-person voice, the elegists took on an emphatically personal exploration of male emotional experience. To have retained the dominant, self-restrained position, would have been to stay locked in the prescriptions and implications of *vir*; for either gender to begin a transformation, *vir* had to be escaped.

In Catullus, this emotional escape is self (male)-centered, and his elegies to Lesbia articulate his vacillation through a personal emotional range. It is significant to note that Catullus is credited with being the first Greek or Latin poet to focus in first-person perspective on a single love affair and to produce a collection of pieces, relating that experience (Lyne 21). Also, Lesbia herself is generally accepted as being Clodia, sister of a tribune and wife of the consul Metellus, whose influence, prominence, and prowess were legendary to the degree of being specifically addressed by Cicero (Lyne 15). In a society marked by civil disorder and weakening class divisions but dependent on patronage and the myth of *vir*, such a simultaneously overt and covert power dynamic aroused male anxieties (Skinner 203). These are the anxieties that Catullus first exposed and navigated.

In his love for Lesbia, Catullus admits that his is “a mind drowned in its own devotion” (75). He declares to his beloved that there is “no love-faith found so true/as mine in you” (87). He consciously subjugates his emotional integrity to a “hopeless & wasting love” and “compulsive desire” for a woman, who “loads him ... with her curses” (91, 92). Further, while immersing himself in his vulnerability to a mistress, who is “extraordinarily vindictive,” he cherishes that “she remembers [him], and...more pungent still...the wound/ripening” (92). In essence, Catullus would rather suffer his beloved’s intensity than her “mindless silence” (92); he craves a union that, in spite of its sadomasochistic qualities, has emotional impact. While these depictions express egocentric male desire and cast the mistress as one-dimension and antagonistic, they more significantly display a male

who is desperate to experience authentic emotion.

Thus, Catullus is not only subservient to a particular woman, but moreover to the emotional experience of love itself (Hurley 125). This subservience, willfully endured, gives rise to ambivalence (Greene 1). While professing that Lesbia “invests life for Catullus/with...sweet reason” (68), he reveals that his is a “[r]eason blinded by sin” and that he “cannot think tenderly of” his beloved (75). Catullus is caught in a bind of morality, prescriptions of masculinity, and determination to be subjugated to emotional intensity; he is as conscious that his love is adulterous as he is that love is annihilating. Moreover, by specifying a third person - Catullus - he constructs a distance between poet and poet-lover that indicates that the emotional man is under examination (Greene 4). The mistress, then, is not the instigator of Catullus’ distress, but a participant in a predicament that is itself a catalyst for his self-awareness. The negative voice of his ambivalence suggests that love - “this malign... paralysis” - is his antagonist and that he is his own antagonist, who “protract[s] this pain” and does “not resist [him]self in mind” (76). Only by strength of will over emotion can he regain “precondition of sanity” and “make [himself] whole again” (76). Ironically, he would not then be whole; he would again be *vir* without emotion.

The elated, hopeful voice of Catullus’ ambivalence, however, infuses his mistress and their union with ultimate significance. He claims to have loved Lesbia “not as men love their women/but as a father his children.” Within this illicit, defiant union - when Lesbia “confessed only to Catullus in love” and he responded with a father’s love - he believes they experienced a mutual emotional bond (72). This same cross application of value-laden concepts occurs again, when Catullus claims “[n]o loyalty so great was ever found in any pact/[a]s was on my part, in my love for you” (87). Here, the Latin translation becomes particularly important: *nulla fides ullo fuit unquam foedere tanta/quanta in amore tuo ex parte reperta mea est*. By employing *fides* (“good faith” in terms of fidelity) in juxtaposition to *foedus* (“good faith” in a business or political pact), Catullus explicitly indicates that his bond to Lesbia exceeds even that of the highly exalted

treaty or contract, which was pivotal in Roman society (Hurley 132-33).<sup>4</sup>

Again, Catullus attempts to capture this sense of ultimate significance when he refers to his affair with Lesbia as *aeternum hoc sanctae foedus amicitiae* or “this eternal pact of hallowed friendship” (109). *Amicitiae* signifies the revered loyalty, existing between men in the patron-client relationship. The idea is strengthened by the proximity of the words “pact,” “eternal,” and “hallowed” (Hurley 131-34). In essence, Catullus is employing value-laden terms, generally serving a male context, to express the intensity he experiences in an illicit affair. The irony is self-evident: an illicit union, by definition, cannot be honored as a revered pact in ultimate good faith (Skinner 120). Yet, there are no terms to convey his depth of feeling. Nevertheless, Catullus shows an attempt, however ironic or impossible, to achieve in his love-union.

Propertius, with his mistress Cynthia, wants to establish reciprocity on very different terms. Like Catullus, Propertius immerses himself in the “madness” of “overextended love” (1.5.1.6). Yet, his extreme emotional swings are expressed far more passionately, and he is extravagant in detailing his anguish. Propertius lacks Catullus’ ambivalence; he submits wholeheartedly to a mistress, “who shackles the raging spirits of strongmen,” and to Love, who “casts down [his] look of constant pride” (1.5.1.1). As a self-professed “slave...to suffering,” he seems, specifically, to want Cynthia to join him at the depths of his misery. When “fate seizes [him] with so much pain,” he rails against her for “com[ing] lazily to him in his terror” and “decorating her breasts.” Instead, he would have her “we[ep] to the deserted seas” like Calypso, “a wreck.” His undisguised passive-aggressiveness bursts forth as he cries, “You’ll hurt from my pain...Let my death be a warning” (1.15). The only reciprocity that Propertius finds convincing is an equal intensity of pain and abandonment. Perpetuating the cycle, he then distrusts her tears and ridicules her “eyes/deformed with crying” (1.18).

Yet, despite his obsession with the dynamics of jealousy, betrayal, and contempt, Propertius “warn[s]...in favor of continuous love” and claims “Cynthia was the first...will be the last” (1.20.1.12). While being “disgraced in [her] love,” he

nonetheless pleads, “however you are, let the woods echo my ‘Cynthia’” (1.18). Yet, his euphoria when he believes “[s]he’s staying...she loves me, and through me, my beloved Rome/[w]ithout me, she’ll see no exotic kingdoms” seems particularly desolate when set against his line “[y]ou alone are my home, you, Cynthia...my parents” (1.8B.1.11). This reminder that Propertius survived Octavian’s plunder of his homeland and witnessed the abandonment of his relatives’ unbursed bodies puts his preoccupation with betrayal in perspective. In this light, it is understandable that he would crave reciprocity in the form of an equal capacity to suffer. Moreover, it is understandable that - with his mistress, who he has and does not have only at extremes - Propertius would reenact a cycle of conquest, betrayal, and abandonment, which for him had personal as well as citizenship dimensions. His mistress is his family - forever lost and found and lost again - and with her he is forever gaining and losing access to the exotic, beloved kingdom.

By comparison, Tibullus casts his mistress Delia as a confidante through whom he can revive a sense of idyllic, basic calm. Declaring that “the love-possessed are sacred, safe to wander...to fear no ambush,” he “pray[s] that love be mutual” (1.2). Having “resigned the right to wealth,” he craves nothing more than “to listen to the wild winds/and contain a mistress in tender embrace!...to pursue sleep in safety” (1.1). In light of his military career and traumatic aversion to the “wounds... slaughter... and sudden Death” of war, it again seems understandable that Tibullus would want to achieve a sense of stillness and security with a woman (1.3).

Yet, the pastoral serenity, low expectation, and visions of mythic and “tender love” woven through his elegies (*Books I & II*) are juxtaposed with explicit references to “plunder,” “stab[s]...in the back,” “smouldering pyres,” and “grief-smitten cheeks” (1.3.1.1.1.2.1.10). His desire for Delia to - “simply as you are, in long-haired confusion/ run to meet me” - expresses his need for innocence, transparency, and joy to be restored (1.3). Yet, he admits his “words are daydreams” and that he is seen as “slack and ineffective” (2.2). His love for Delia is convoluted with overwhelming fatigue, depression, and dread of a “wickedness [that] lies hidden

deep in the night” (1.3). Deeply divided, Tibullus employs his own style of passive-aggression, asking Delia, “let me gaze at you, when my last hour comes/hold you as I die, in my failing grasp/Delia, you will weep for me...give me kisses with bitter tears/Yes, you will weep” (1.1). For, as an elegist, Tibullus is after all a “[s]lave to a mistress...held in chains/and never... does Love relax the chains” (2.4). So, although he appeals to Delia as a childlike co-conspirator - “be bold and trick the guard... dare... withdrawal by stealth” - he has spent “weeping vigils” at her door and perceives her as “tempt[ing] him] to do evil” (2.4). “Do not scare me with your footsteps,” he pleads (1.2). Tibullus is a man depleted and traumatized by the thrust for empire; with his mistress, far from every institution he detests and has renounced, he looks for peace.

#### The Door

It seems uncanny, yet apt that this image of the door would recur in the work of all three elegists, exposing the compromised male position as Rome stood on the threshold of Empire. Yet, it was part of the elegiac experience to stand, barred, on doorsteps, and the elegists were “people to question a door’s knowledge of...things” (67).<sup>5</sup> In conversation with Catullus, the door confirms his impression of the rapacious state of affairs in the late Republic: “listen./The virgin lifted/across this threshold was/bogus, the groom not the first to/finger her, and his short/swordhinge like a strip of limp beet!...never cocked navelwards. And worse. Grandpa /defiled his own son’s sheets/polluting the fallen house.” Catullus responds in cutting sarcasm, “Egregious parent to ejac/ulate in his son’s private vulva!” Still, his door goes on, “I have often caught... whisper[s]...I am sans ears/sans tongue” (67). To catch whispers, but be unable to hear or repeat them not only exemplifies Catullus’ ambivalence and witticism, but moreover issues a deeper indictment of a culture fully compromised.

“Doorway, even crueller than my mistress within,” Propertius pleads in characteristic pitch, “why are you so silent, your hard gates closed to me?/Why don’t you ever open up and admit my passion?” It is worth considering that he is making a statement somewhat larger than his immediate situation. Always spurred by

betrayal, Propertius notes that his mistress “is not swayed to abstain from her fame/and lives more shamefully than her era’s usual excess,” while he faces “warnings to the excluded.” And the door “takes no pity on [his] human sufferings.” Could exclusion be his era’s greatest excess? “If only my words, piercing some crack...” (1.16) - an essential aspect of the Roman male is, indeed, his lack of a voice.

Tibullus’ threshold is both “cruel” and “consecrated.” He will “not hesitate to fall down on [his] face...[and] beat [his] wretched head/ against the holy door for his guilt.” He knows he must be guilty, for even the “sound of quiet water can’t bring sleep.” Again, it seems worth considering what emotions a Roman soldier brought back from the battlefield; only a few lines earlier, Tibullus references “the man who...chose, the fool, to follow arms and plunder...[to] drive...prisoners in their crowds before him” over a woman’s love (1.2). Tibullus had been that man.

Eva Cantarella writes, “the Roman male was condemned to a life of maleness” (qtd in Skinner 212). As Augustus surveyed the debris, left by a century of civil wars, and seized the Roman psyche, it was a sentence upon which the restabilization of culture and empire depended heavily. Yet, the erotic elegists, sensing an altogether different opportunity, rattled the bars of *vir*. Their elegies represent a refusal of the concepts of male impenetrability, which, while honing men for the purposes of empire, left them ill-equipped to assert a more complex, autonomous, and authentic personality. By drafting the defining terms of their culture into the personal and defiant context of the illicit affair, the elegists exposed the dynamics of love and of empire - both hinging on powerplays of dominance and submission - as mutually reflective metaphors. Moreover, by inverting gender roles and immersing themselves in emotional experience, the elegists antagonized the cultural assumptions that circumscribed a false and insufficient male identity. In every sense, they were the “O, what shall I call you? Men?”, self-sequestered in an experience quite apart from that of the “properly called men... love[d]...praise[d] ...and distinguish[ed]” by the hegemon (qtd in Cassius Dio *LVI*). Rejecting the persona of impenetrability, the elegists stood on the threshold of empire, craving a multidimensional experience of

both maleness and intimacy that exceeded "the greater rewards..for displays of excellence," promised by empire.

#### Notes

- I. My further use of the term impenetrable vir refers and is indebted to Skinner's initiation of the concept as exemplified here, p.212, *Sexualities in Greek & Roman Culture*, 2002.
- II. All Propertius quotes are cited, using Poem numbers, and are taken from the translations of Vincent Katz in *The Complete Elegies of Sextus Propertius*, Princeton University Press, 2004.
- III. All Tibullus quotes are cited, using Poem numbers, and taken from the translations of Robert Maltby in *Tibullus: Elegies*, 3rd ed. with Introduction by Guy Lee, Francis Cairns Ltd., 1990.
- IV. Catullus' lines as they appear here are as qtd in *Hurley's Ancients In Action: Catullus*, Bristol Classical Press, 2004, where Hurley fully discusses the implications of these terms in reference to Poems 76, 87, 109.
- V. It is significant to note (as I explore in the extended writing) that the metaphors of door, mistress, and refusal of the call to arms appear with equal strength and much added wit and dimension through the elegies of Ovid.

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## Modeling and Simulation of TEA-Sensitive Potassium Conductances in Primary Vestibular Afferent Neurons

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The following project utilized a computational approach to analyze one of the foremost components of vestibular afferent neuron potassium conductances. The activation dynamics of tetraethylammonium-sensitive potassium currents, the most abundant type of potassium conductance in these neurons, were modeled using the computer program NEURON according to channel descriptions reported in Chabbert et al. (2000). Steady-state components of the potassium conductance were fitted with a Boltzmann equation while dynamic states were modeled using various exponential equation forms describing the relationship between voltage and the time constants of the current. Comparison of the data extracted from a single exponential equation, 2<sup>nd</sup> through 4<sup>th</sup> order exponentials, and a double exponential equation yielded the conclusion that the dynamic constituent of the TEA-sensitive potassium conductance ( $I_{TEA}$ ) is composed of both a slow and fast component; a double exponential equation fit to Chabbert's  $I_{TEA}$  data was consistent with the family of dynamic curves presented in his paper and thus accurately accounted for both aspects of the conductance's time course. The complexity of the double exponential representation of  $I_{TEA}$  required the use of NEURON's high-level language program NMODL. An NMODL-customized model of spiral ganglion neuron conductances was acquired from descriptions reported in Hossain et al. (2005) and was used to investigate whether or not the  $I_{TEA}$  conductance described by Chabbert could be reproduced using NMODL spiral ganglion potassium channels. Subsequent simulations revealed that a complete re-creation of  $I_{TEA}$  was limited both by the inability of the potassium channel model to account for the voltage-dependency of the time constant as well as its inability to account for both slow and fast components of the conductance's dynamics.

The vestibular system consists of a set of interconnected canals and otolith organs (the utricle and saccule) which serve to translate rotational and linear accelerations, respectively, into neuronal impulses. Located within the utricle, saccule, and ampullae swellings of the semicircular canals are vestibular hair cells, structures with bundles of stereocilia and a kinocilium that move within the endolymph filling the organs (Fig. 1). The high potassium and low sodium concentration of the endolymph which fills the membrane space immediately surrounding the bundles, and the high sodium and low potassium concentration of the perilymph fluid surrounding the basal portion of the hair cells establish the ionic environment that drives the transduction of mechanical stimuli into neuronal signals.

The hair cells isolated for the experiments completed by Chabbert et al. (whose data was used for the following analysis) originated in the superior branch of the vestibular nerve innervating the utricle and ampullae of the superior and lateral semicircular ducts. These hair cells located

in the semicircular canals are embedded in a sensory epithelium called the crista while its hair bundles extend into the cupula, a gelatinous mass spanning the width of each ampulla that prevents the flow of endolymph (Fig. 1 Left). Rotational movement of the head displaces the viscous endolymph fluid within the vestibular system, causing the cupulas of the ampullae to move with the flow of fluid. Within the otolith organs, hair cell tips are covered by a gelatinous layer and otolithic membrane- a fibrous structure overlaid with crystals of calcium carbonate (otoconia). Deformation of the cupula or otolithic membrane subsequently distorts the conformation of the hair cell bundle within; movement of the stereocilia towards the kinocilium opens mechanically-gated channels at the tips of the bundles, allowing for the influx of potassium and ensuing depolarization of the hair cell.

Once a depolarization has occurred, voltage-gated calcium channels located in the basal region are activated, further depolarizing the cell until calcium-activated potassium channels allow for the out-flux of potassium ions and eventual re-polarization (Fig. 2). Movement of the

stereocilia away from the kinocilium tightly seals the mechanotransduction channels of the bundle and hyperpolarizes the cell.

Neurotransmitter release (commonly in the form of glutamate) accompanies the rise in intracellular calcium in pre-synaptic hair cells and excites adjacent afferent neurons. Type I hair cells, commonly located in the center of the ampulla crista, are surrounded by calyx afferent nerve fibers that experience increases and decreases in the occurrences of action potentials according to the degree of bundle stimulation. Type II hair cells are most frequently found on the peripheral regions of the crista and connect to bouton afferent nerve fibers whose action potentials occur in quick rises and decays. Recent research has identified the foremost ionic components of primary vestibular afferent conductances, among which are three voltage-dependent potassium currents, a TTX (tetrodotoxin)-sensitive sodium current, and a voltage-dependent calcium current composed of L-, N-, P/Q-, R-, and T-type channels. TEA-, DTX (dendrotoxin)-, and BDS-I (blood depressing substance)- sensitive potassium currents have been described in detail by Chabbert et al. (2000).

A better understanding of current and channel mechanisms and of overall conductance can help neuroengineers to design and produce accurate devices to aid in various vestibular disabilities. Among the useful approaches to studying the vestibular system is the method of producing accurate models and simulations of its various mechanisms. Producing a mathematical description of vestibular conductances (and more specifically those of primary vestibular afferent neurons) that is consistent with any given data provides a means to quantitatively describe specific ionic currents. The following research utilized a computational approach to investigate the nature of TEA-sensitive potassium currents (the most abundant form of potassium conductance); descriptions provided by Chabbert et al. (2000) were analyzed and described mathematically to ascertain the most consistent manner of modeling the current within the limitations of the modeling and simulation program NEURON. A consistent model of ITEA would produce answers as to how post-synaptic afferent neurons respond kinetically to the release of neurotransmitters from pre-

synaptic hair cells and how subsequent activation of potassium channels affects the  $I_{TEA}$  conductance of primary vestibular afferent neurons.

**Methods**

The TEA-sensitive potassium current ( $I_{TEA}$ ) was selected for further study because it is the primary component of potassium conductance in afferent neurons. Chabbert et al. (2000) provided the greatest amount of detail concerning the potassium conductances and thus served as the primary source of information for the following research concerning primary vestibular afferent neuron conductances.

The potassium channels were found to contain four kinetic components: an activation state (m) and inactivation state (h), both of which were further broken down into a steady state (indicated by an *inf* descriptor) describing the relationship between the neurons' relative activation and test potential and a dynamic state (indicated by a *tau* descriptor) describing the voltage-dependent activation and time-dependent inactivation of the neurons. Quantitative descriptions of the  $I_{TEA}$  dynamic state were gained from experiments performed in which postnatal mice neurons were subjected to a holding potential of -100 mV and subsequent 150-ms depolarizing pulses ranging from -80 mV to +30 mV in 10 mV increments. Within NEURON, the Channel Builder was used to customize a potassium channel with activation and inactivation states described by the information contained in Chabbert et al. (2000). However, because inactivation was not observed during the 150-ms pulses, very limited descriptions of the inactivation current were provided and only the activation element of the currents was fully analyzed. An unspecified "single Boltzmann equation" and "single exponential equation" were utilized in the article to model the characteristics of the TEA-sensitive potassium current illustrated in the Figure 5 diagrams Aa and Ab of Chabbert et al. (2000) (Fig. 3).

A detailed mathematical description of the conductance's kinetics was not provided; discovering the equations that suited each component of  $I_{TEA}$  was necessary to fully and accurately model the conductance within NEURON. Information to construct Boltzmann equations fitted to the steady activation

and inactivation states in graph Ab and Bb was provided in Chabbert et al. (2000) (including values various parameters- see Appendix I); a reconstitution of the data for graph Bb was done to verify the accuracy of the inactivation component and was accomplished by extracting data points from the given figures using the computer program ImageJ. The points along curve Bb were collected in pixels then transferred to Excel and converted into their corresponding voltage and  $I_{TEA}$  values through a regression analysis. An equation was initially formed using MATLAB to generate a curve of voltage versus normalized current identical to that shown in graph Bb and based on the values provided in the paper. The extracted values were inserted into the derived Boltzmann equation to check for consistency. The points displayed in graph Bb were consistent with those retrieved using the equation, thus verifying that the Boltzmann derived for the  $I_{TEA}$  inactivation state through MATLAB was of the correct form (Fig. 4).

The dynamic component of the  $I_{TEA}$  current was analyzed in a similar manner: points along each curve in the Aa figure family of curves were extracted using ImageJ (Fig. 5) and were fitted individually with single exponential equations in MATLAB (see below) as described in

$$y = A \left[ 1 - \exp^{-\frac{t}{\tau}} \right]$$

Chabbert et al. (2000) (Fig. 6, Left). After comparing the fitted time constants  $\tau$  (the time it took for the current to reach 2/3 its maximum amplitude in ms) and maximum current amplitudes (nA) with Chabbert's given data, the extracted values were further fitted with 2<sup>nd</sup>, 3<sup>rd</sup>, and 4<sup>th</sup> degree exponential equations of the same form in MATLAB (see Appendix III and IV). The initial single exponential equation fit was incorporated into the dynamic state component of the customized  $I_{TEA}$  channel in NEURON. After embedding the  $I_{TEA}$  channel into a soma using the parameters described by Chabbert (see Appendix I), simulations were run to test the accuracy of the voltage and current relationships ( $G/G_{max}$  vs. voltage and current amplitude vs.

time) as compared with those presented in Chabbert et al. (2000).

The original sets of data points from the family of dynamic curves were further fitted to a double exponential equation through the mathematical program Igor (Fig. 6, Right); two time constants were produced in accordance with a Hodgkin-Huxley representation of potassium conductances as including a slow and fast component to the currents' overall time constant (Hodgkin 1952; see Appendix IV).

$$1^{st} \text{ Order Exp. Fit} \quad \text{Double Exp. Fit}$$

Due to the complicated nature of the resulting double exponential equation for each curve and the limited nature of the Channel Builder interface, NMODL- a high-level computer language used to expand NEURON's library of mechanisms- was necessary to specify a potassium channel whose dynamic component consisted of two time constants. An NMODL template modeling the conductances in spiral ganglion neurons (whose slow-activating, noninactivating currents are similar to  $I_{TEA}$ ) was found in a journal article by Hossain et al. (2005). Chabbert's parameters were first incorporated into Hossain's km potassium NMODL code; the resulting hybrid channel was then inserted into a NEURON soma. Simulations were run and voltage and current relationships were displayed on graphs to determine if Chabbert's  $I_{TEA}$  conductance could be reproduced in Hossain's Hodgkin-Huxley-style potassium channels (which would be present in the spiral ganglion neurons neighboring the primary vestibular afferent neurons). Actual implementation of the initial double exponential curves (fitted to the data extracted from Figure Aa of Chabbert et al. 2000) was not accomplished; only implementation of Chabbert's parameters in the similar Hossain potassium channels was achieved.

Once relationships were obtained describing the steady and dynamic states of the conductance, the maximum conductance  $g_k$  and rate constants  $\alpha$  and  $\beta$  (see Appendix V) for a +30 mV voltage jump were altered in the Hossain NMODL code until the resulting time constant and maximum current amplitude displayed in NEURON was consistent with the +30 mV data provided by Chabbert et al. (2000).

Using those values for  $g_k$ , Ra, and Rb, a time point was recorded for a chosen amplitude on the NEURON dynamic curve for each voltage jump (+30 mV to -20 mV) and compared to the theoretical time point from the reconstituted Chabbert data (theoretical time points were determined by evaluating the corresponding double exponential equation in MATLAB for the chosen amplitude point). Ra and Rb were altered until the curve passing through the time point on the NEURON interface was consistent with the curve passing through that same time point on Chabbert's graph Aa. The result would express how close the  $I_{TEA}$  time constants were in the km and kv channels to those time constants described by Chabbert.

The NEURON current graphs for each voltage were fitted with double exponential curves in Igor to determine if the Ra, Rb, and  $g_k$  fits were consistent with Chabbert's data. After observing the inconsistency of the double exponential fit to the Hossain/Chabbert conductance data, the points were then fitted with a fourth order exponential equation (as described in Hodgkin and Huxley (1952) - see Appendix V) and a single exponential equation in Igor for further comparison (Fig. 7).

**Results**

The complexity of the TEA-potassium conductance's dynamic state resulted in several attempts at accurately modeling the relationship between time constants and current amplitude. While the steady state Boltzmann equation fit remained constant throughout each trial simulation, numerous exponentials were tested and compared against one another to determine the mathematical description that, when modeled in NEURON, provided the most accurate representation of the current's dynamic component.

The data extracted from Chabbert's family of curves in graph Aa (detailing the nature of the  $I_{TEA}$  dynamic state) was initially fit with a single, 1<sup>st</sup> order exponential equation (Fig. 7, Left). Application of the equation yielded an inconsistent fit to the reconstituted data (when compared with Chabbert's family of curves in Aa of Fig. 4) and when implemented in NEURON's Channel Builder, resulted in simulations with current amplitude versus time graphs

with a maximum current amplitude higher than described by Chabbert and a time constant for each voltage jump (from a holding potential of -100 mV) lower when compared with Chabbert's data. Data given by Chabbert et al. (2000) specified a  $\tau$  of 5.1 ms for a voltage jump of +25 mV; the  $\tau$  retrieved from the data fitted to single exponential equations was only 2.5 ms. A maximum amplitude of more than 4 nA was recorded from NEURON's simulation for a +30 mV jump with an actual 2.7 nA maximum amplitude (as ascertained from the data extracted from Chabbert's Aa family of curves). Implementation of both steady and 1<sup>st</sup> order exponential dynamic states in NEURON's channel builder thus yielded current versus time graphs whose curves displayed inaccurate time constants and too-large maximum amplitudes for all voltage jumps. Before implementation in NEURON, maximum amplitudes of the first order exponential fits were observed to be lower than the reconstituted data on the graph comparing the fit and extracted data (Fig. 7, Left)- this difference from NEURON's maximum amplitude results may be the result of incorrect implementation of the inactivation component of  $I_{TEA}$  in NEURON's Channel Builder.

Second, third, and fourth order exponential equations (see Appendix III) decreased the slope of the fitted curves by decreasing the initial rate of amplitude change for each voltage jump and also resulted in inaccurate mathematical descriptions of the current's time constant (or dynamic component) (Fig. 9).

The second approach to developing a consistent mathematical description of the  $I_{TEA}$  dynamic element utilized the computer program Igor to fit the extracted data points with a double exponential equation of the form (see below), where  $y = G/G_{max}$ ,

$$y = y_0 + A_1 e^{(-inv\tau_1)x} + A_2 e^{(-inv\tau_2)x}$$

$y_0$  = maximum current amplitude (nA) for a particular voltage jump,  $A_1 =$

$$I_{TEA}(V, t) = \bar{g}_k (V - E_k) [a_{fast} m_{fast}(V, t) + (1 - a_{fast}) m_{slow}(V, t)]$$

contribution of the slow  $\tau$  to the overall conductance, and  $A_2 =$  contribution of the fast  $\tau$  to the conductance (see Appendix III). The result was two time constants to completely describe the slow and fast components of the potassium conductance. The mathematical fit of the equation to the extracted data was consistent with the family of dynamic curves provided in graph Aa of Chabbert et al. (2000) and thus showed the accuracy of applying the Hodgkin-Huxley theory of multiple dynamic elements to the data collected by Chabbert through the relationship (seen below) where  $a_{fast}$

$$a_{fast} = -0.0005V^2 - 0.023V - 0.4781$$

describes the contribution of the fast  $\tau$  component to the overall conductance and is described by a polynomial fit to  $A_1$  versus V data for the double exponential equation fit (see Appendix IV).

Insertion of Chabbert's parameters into Hossain's potassium channels resulted in a consistent +30 mV curve when an altered maximum activation rate (Ra) value of .0038 (/ms) and maximum deactivation rate (Rb) value of .0038 (/ms) were used to replace Hossain's Ra and Rb constants in the provided NMODL code. A maximum conductance of 191 S/cm<sup>2</sup> resulted in consistent maximum amplitudes for all voltage jumps. To determine the mathematical nature of the conductance curves displayed in NEURON when simulations were run with Chabbert's data incorporated into Hossain's potassium channels, various exponential equations were again fitted to the data displayed in NEURON using MATLAB and Igor. When the curves displayed in NEURON's current graph interface were fitted with double exponential equations, the resulting values for  $\tau_1$  and  $\tau_2$  differed greatly from those given in the consistent double exponential fit to the data points extracted from graph Aa; the slow component of the time constant was perceived to be too fast while the fast component of the time constant was too slow. For the +30 mV voltage jump curve,

$\tau_1$  (the slow component) was

evaluated using a double exponential fit to be 10.391 ms while  $\tau_1$  (the slow component of the time constant) was approximately .945 ms. When Chabbert's parameters were applied to Hossain's potassium channels, however,  $\tau_1 = 5.598$  ms while  $\tau_2 = 5.450$  ms. The maximum current amplitude values remained consistent for all voltage jumps using Hossain's NMODL code.

Because the NMODL code customized by Hossain et al. utilized single exponential equations to describe the maximum activation and deactivation rates of its potassium and sodium conductances (through the equation type

$$g_k = \bar{g}_k n$$

, it was then hypothesized that a 1<sup>st</sup> order exponential equation fit to the data extracted from the Chabbert-Hossain conductances would provide a better, more consistent fit than the double exponential equations. Accordingly, a single exponential fit to the data extracted from NEURON's simulation graphing windows provided the best mathematical description of the amplitude versus time curves. Fourth order exponential equations (specified by Hodgkin and Huxley as correctly describing many potassium conductances- see Appendix V) resulted in inaccurate fits to the data, as was expected due to the nature of the Hossain potassium channels (as described above).

**Discussion**

The final Boltzmann and double exponential equations described through data extraction and mathematical fitting in Igor and MATLAB best represent the steady and dynamic states of the activation component of a TEA-sensitive potassium conductance (as compared to a 1<sup>st</sup> or higher-order exponential description of the current) in primary vestibular afferent neurons. The dynamic state of  $I_{TEA}$  is comprised of fast and slow elements resulting in the necessity of two different time constants to completely and consistently describe the rate of change in current amplitude during a voltage jump from a holding potential of -100 mV.

When implementing Chabbert's  $I_{TEA}$  parameters using a spiral ganglion neuron potassium channel, the NMODL code could not fully reproduce the family

of curves seen in Chabbert's graph Aa, as the code did not completely describe the dependent relationship between voltage and the rate constants  $\alpha$  and  $\beta$ ; an accurate description of both would have yielded a more accurate description of amplitude changes over time and thus more consistent time constants. The consistency of the first-order exponential equation fit to the data was consistent with the fact that the mathematical descriptions used to customize the potassium channels in the NMODL code provided in Hossain et al. (2005) utilized an activation variable raised to a single power, thereby giving rise to the equation:

$$g_K(t) = [g_K(\infty) - (g_K(\infty) - g_K(0))e^{-t/\tau_n}]$$

Future investigations could address those aspects of the potassium conductance that were overlooked during the above project. Due to the lack of complete inactivation during the analyzed 150-ms time periods, the inactivation component of the potassium conductance was not examined. A complete description of its attributes would expand the understanding of how to best describe the  $I_{TEA}$  conductance in its entirety. The initial double exponential fit to the data points extracted from graph Aa was not directly modeled in NEURON (this could be achieved by customizing an NMODL code specifying the channel's characteristics).  $I_{TEA}$  parameters were only applied to similar spiral ganglion potassium channels customized in NMODL by Hossain et al. (2005). In order to create a more complete model of primary vestibular afferent conductances, other foremost currents (such as the sodium and calcium currents previously described) in addition to the complete potassium conductance could be incorporated into morphologically-accurate models. Subsequent simulations could give further insight into the kinetic nature of primary vestibular afferent neurons following the reception of neurotransmitters from pre-synaptic hair cells.

**Acknowledgments.**

I would like to thank Dr. Larry Hoffman and Dylan Hirsch-Shell of the UCLA Vestibular Neuroscience Research

Laboratory for enthusiastically sharing their time, resources, and boundless knowledge of the vestibular system as I completed my summer research. Their insight and support helped me to shape my project into an endeavor that heightened my interest in and appreciation of computational neuroscience. My research was supported by NSF IGERT grant DGE9972802 through the UCLA Brain Research Institute.

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**Figures**

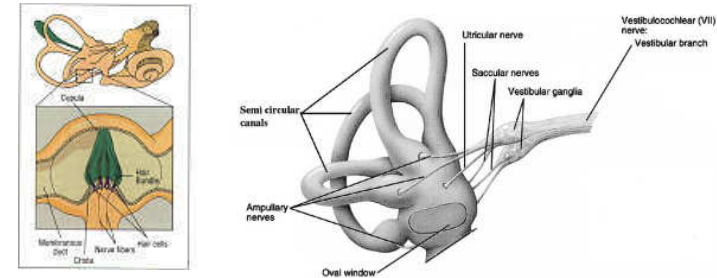


Fig. 1. The vestibular system enables an individual to maintain balance during head translation or rotation by sending signals from hair cells to the brain and muscles. Left: Hair bundles in the cupula (paperairplane.mit.edu); Right: Morphology of the vestibular system (www.qmw.ac.uk)

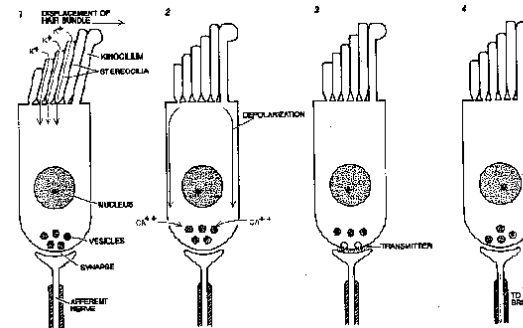


Fig. 2. Depolarization of hair cells and neurotransmitter release (www.paperairplane.mit.edu); head movements result in neuronal signals through deformation of the hair bundle, the opening of ionic channels, depolarization, and neurotransmitter release across neuron synapses

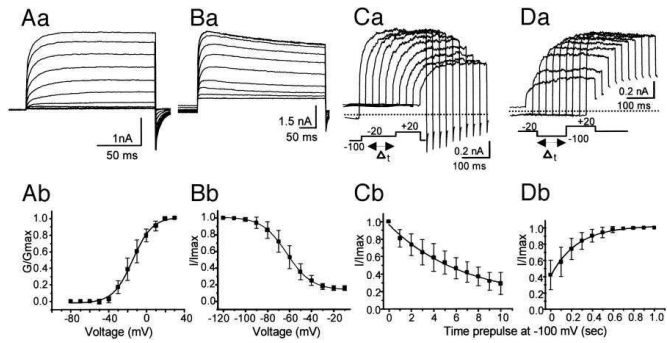


Fig. 3. Figure 5 of Chabbert et al. 2000; "Electrophysiological characterization of the high-threshold, slow activating and inactivating TEA-sensitive K<sup>+</sup> current." The above figures describe the activation and inactivation characteristics of the ITEA current by comparing current amplitude and time (Aa, Ba, Ca, & Da), normalized conductance and voltage (Ab), normalized current and voltage (Bb), and normalized current versus time (Cb & Db).

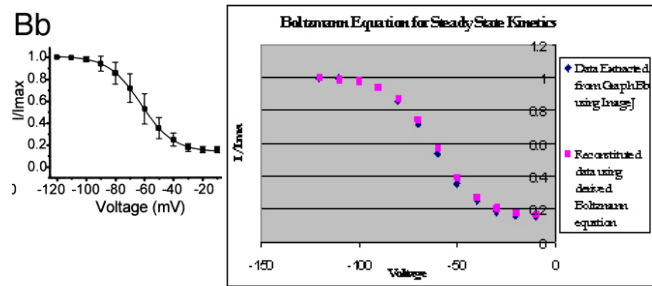


Fig. 4. Left: Graph Bb from Chabbert et al. (2000); Right: Curve points extracted from graph Bb were converted into the corresponding voltage and I/I<sub>max</sub> values (blue diamonds) and compared to values generated using the derived Boltzmann Equation (pink squares); the similar data sets confirmed that the Boltzmann equation accurately represented the curve in Figure Bb

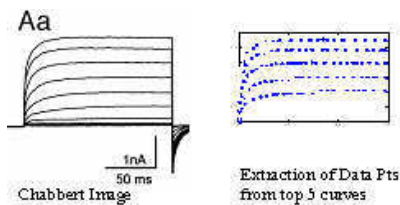


Fig. 5. Extraction of Data points from diagram Aa using computer program ImageJ; lines of graph Aa were converted into pixel points (seen on right) to be fit with mathematical equations in MATLAB and Igor

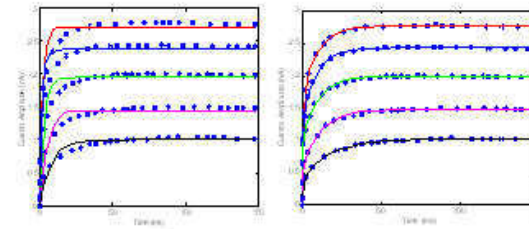


Fig. 6. Left: First order exponential fit to extracted data points; Right: Double exponential fit to extracted data points; The misalignment of lines and points on the left show that the equation does not accurately represent the data, while the equation used to produce the curves on the right does

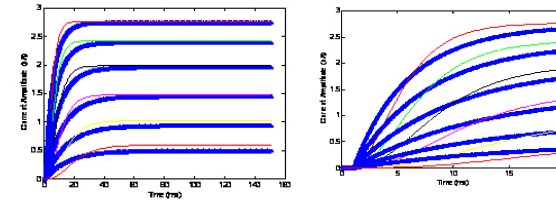


Fig. 7. Left: Fourth order exponential equation fit to blue reconstituted data points from Chabbert's ITEA conductance in Hossain's km and kv potassium channels; Right: First 20 ms of Left graph

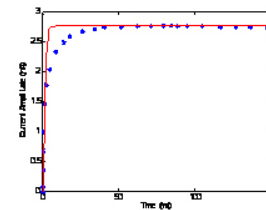


Fig. 9. Fourth order exponential equation fit to the reconstituted data from a +30 mV voltage jump in Chabbert's Aa family of curves



**Appendix**

**I. Parameters described in Chabbert et al. (2000):**

- Temperature  $T$  298 K (25 degrees Celsius)
- Cell diameter 12.5-25  $\mu\text{m}$
- Max conductance  $g_K$  0.0405 S/cm<sup>2</sup>
- Equilibrium potential  $E_k$  -83.2 mV
- Intracellular  $[k]_i$  135 mM
- Extracellular  $[k]_o$  5 mM
- Holding potential  $HP$  -100 mV
- $\frac{1}{2}$  activation potential  $V_{1/2}$  -14.5 ms
- Cell capacitance 9-32 pF

**II. Equation forms used to specify kinetics of potassium channels in NEURON:**

- $\text{inf}_m = \frac{G}{G_{\text{max}}} = \frac{1}{1 + e^{-k(d-V)}}$  Boltzmann equation for steady state; example is Boltzmann equation for activation component of  $I_{\text{TEA}}$
- $EX: \frac{G}{G_{\text{max}}} = \frac{1}{1 + e^{-\frac{(V+14.5)}{10.2}}}$
- $I_{\text{TEA}} = \tau = Ae^{k(V-d)}$  Dynamic state exponential equation

**III. MATLAB and Igor equation fits to extracted data points:**

- $I_{\text{TEA}} = I_{\text{MAX}} [1 - e^{-(t/\tau)}]$  First order exponential equation; example is the 1<sup>st</sup> order exponential fit to the reconstituted data of family of curves from graph Aa  
 $EX: t = 5.0216e^{-0.0416t}$
- $y = A^{1/2} [1 - e^{-(t/\tau)}]^2$  Second order exponential equation; example is the 2<sup>nd</sup> order equation fit to the reconstituted data from graph Aa at a voltage jump of +30 mV  
 $EX: y = 2.77^{1/2} [1 - e^{-(t/\tau)}]^2$
- $y = A^{1/3} [1 - e^{-(t/\tau)}]^3$  Third order exponential equation
- $y = A^{1/4} [1 - e^{-(t/\tau)}]^4$  Fourth order exponential equation
- $y = y_0 + A_1 e^{(-\ln v \tau_1)x} + A_2 e^{(-\ln v \tau_2)x}$  Double exponential equation; example is the double exponential equation fit to the reconstituted data from voltage jump +30 mV from graph Aa  
 $EX: y = 2.766 - .005e^{-.096x} - 1.741e^{-1.058x}$

**IV. Data after fitting reconstituted points with various exponential equations:**

| Voltage (mV) | Max Amp (nA) | Tau (ms) |
|--------------|--------------|----------|
| 30           | 2.6992       | 1.8745   |
| 20           | 2.3645       | 1.6725   |
| 10           | 1.9469       | 2.9893   |
| 0            | 1.4468       | 5.1250   |
| -10          | 0.9928       | 7.7274   |

Time constants and maximum amplitudes of 1<sup>st</sup> order exponential equation curves fitted to extracted data points from graph Aa (voltage jumps +30 to -10mV)

| Voltage (mV) | Max Amp (nA) | A <sub>1</sub> (slow) | A <sub>2</sub> (fast) | Tau <sub>1</sub> (ms) | Tau <sub>2</sub> (ms) |
|--------------|--------------|-----------------------|-----------------------|-----------------------|-----------------------|
| 30           | 2.7656       | -0.9954               | -1.741                | 10.3913               | .9455                 |
| 20           | 2.4259       | -1.1502               | -0.9815               | 8.7214                | .3771                 |
| 10           | 1.9883       | -1.042                | -0.7950               | 10.0179               | .4486                 |
| 0            | 1.4791       | -0.8741               | -0.5645               | 12.9512               | .3224                 |
| -10          | 1.0264       | -0.5801               | -0.2976               | 19.6336               | 1.7596                |
| -20          | 0.6032       | -0.3353               | -0.2074               | 31.5457               | 2.8432                |

Time constants, maximum amplitudes, and contribution of fast and slow components of time constants (A<sub>1</sub> and A<sub>2</sub>) after extracted data points were fitted with a double exponential equation (voltage jumps +30 to -20 mV)

**V. Equations describing potassium conductance kinetics as found in the theory of A. L. Hodgkin and A. F. Huxley (1952):**

- Basic Hodgkin-Huxley kinetics defines a current by its rate of conductance multiplied by the driving force behind it (described as the difference between the membrane's equilibrium potential and its current voltage; the greater such a difference, the larger the driving force of ions across the cellular membrane).

The basic form of a Hodgkin-Huxley conductance used to describe  $I_{\text{TEA}}$ :  $I_{\text{TEA}} = g_k (V - E_k)$

- A potassium conductance with 4 states was described by Hodgkin and Huxley as conforming to the equation:

$$g_k = \left\{ (g_{k\infty})^{1/4} - (g_{k0})^{1/4} - (g_{k0})^{1/4} e^{(-t/\tau_n)^4} \right\}^4$$

- Rate constants  $\alpha$  and  $\beta$  where  $n = \frac{n_\infty}{\tau_n}$  where  $n$  = the proportion of particles in a particular position,  $\alpha_n$  describes the transition of the gating element from the open to closed position, and  $\beta_n$  described the transition of the gates from the closed to open position

$\beta_n = \frac{(1 - n_\infty)}{\tau_n}$

$n \xrightarrow{\alpha} 1 - n \xleftarrow{\beta}$

- Expressions for  $\alpha$  and  $\beta$  versus voltage:
 
$$\alpha_n = \frac{0.01(V+10)}{e^{\frac{V+10}{10}} - 1}$$

$$\beta_n = 0.125e^{\left(\frac{V}{80}\right)}$$
- $n_0 = \frac{\alpha_{n0}}{\alpha_{n0} + \beta_{n0}}$  The resting state of  $n$  (when  $V = 0$ ).
- A change in the resting potential is described by:  $n = n_\infty - (n_\infty - n_0)e^{(-t/\tau_n)}$ 

$$n_\infty = \frac{\alpha_n}{\alpha_n + \beta_n}$$

$$\tau_n = \frac{1}{\alpha_n + \beta_n}$$
- A description of the conductance with rate constants that vary with voltage (and not with time) and where 4 = number of different gates:
 
$$g_k = \bar{g}_k n^4$$

$$\frac{dn}{dt} = \alpha_n(1-n) - \beta_n n$$

Or alternatively  $\frac{dn}{dt} = \frac{n_\infty - n}{\tau_n}$



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## Chess 2.0: A Web Experiment in Collaboration

Michael Fischer, Stanford University

Online collaboration is rapidly becoming an important means by which information is gathered and created. In the research presented in this paper, a methodology is presented for measuring how well people are able to collaborate creatively online. To accomplish this task, an online collaboration platform is created called Chess 2.0. In this devised game, open to all online players, each individual submits their best move. At the end of a unit time, the server tallies each move and the move that received the most votes, the majority move, is played. To determine the strength of such a majority rule strategy, we devise an experimental game played according to the rules of Chess 2.0. We find that play is better than the average strength of the individuals playing. Thus collective wisdom in the sense captured by Chess 2.0 can produce a game of chess that is better than one would expect given the playing skill of each of the individual players. We hypothesize about the reasons for this phenomenon.

Online collaboration is becoming an important method for both gathering and generating information. To better understand and measure the effectiveness of creative collaboration, an online collaborative chess environment called Chess 2.0 is created in which a democratic or majority rule method is used to determine the moves of the game. The main idea of Chess 2.0 can be summarized as a democratic chess game in which everybody plays against everybody.

In this devised game, which is open to all online players, each individual player submits their best move (see Figure 1). At midnight of each day, the server tallies the moves submitted by each participant and the move that receives the most votes is played. We refer to this move as the majority move. The board is then flipped and the process is repeated every 24 hours until a checkmate is established by one side or the other. During the course of a game, different players may come and go; there is no expectation that any or all of the individual players play through an entire game. Each individual player submits a move without the knowledge of any other player's moves. Nevertheless, we view this game as an example of online collaboration, not in the active sense of individuals discussing various moves with each other, but in the passive sense of a collaboration that benefits from the collective knowledge of a group with its individual members acting independently from one another.

Chess 2.0 was designed as a platform to examine, evaluate, and

benchmark how well groups play in a collaborative environment. In this paper we describe how Chess 2.0 was designed and then used to promote collaboration. We discuss an experiment devised to determine the strength of collaborative play as compared with the average play of the individual constituents of the group and discuss how this experiment can be further extended.

### Background

In his book, *The Wisdom of Crowds*, James Surowiecki describes how a crowd at a county fair almost exactly guessed the "slaughtered and dressed" weight of an ox [1] (see also [3]). What is remarkable about this example is that the crowd was able to pool their collective knowledge and experience to create a better guess than that of an individual expert. While the problem posed in this example has an exact solution that can be compared to the group's average estimate, other more subjective examples reveal that this type of group problem solving may be applied to a wider range of problems.

With the advent of the Internet, people are able to collaborate in innovative ways. For example, websites such as Wikipedia use the Internet as a medium to facilitate a kind of passive collaborative model in which participants only weakly interact with each other. Nevertheless, the final online product is viewed as the result of extensive collaboration between large numbers of individuals. In this collaborative model, the output of the crowd, namely, the Wikipedia articles,

is more difficult to benchmark than the example of the ox inasmuch as determining the excellence and the accuracy of these articles is more difficult to determine than the weight of the ox. However it is still possible to benchmark this subjective output using more traditional sources such as the *Encyclopedia Britannica*. In such an effort, in 2005 Nature conducted a study of 42 randomly selected science articles from both the *Encyclopedia Britannica* and Wikipedia. In this study, 162 errors or omissions were found in the Wikipedia articles as compared to 123 in the *Encyclopedia Britannica* articles [2]. Thus in the Wikipedia collaborative effort, as far as the accuracy of the crowd goes, it was found to be less accurate than that of the standard encyclopedia. However, other possible benchmark comparisons such as number of articles, depth and breadth of articles, and currency and excellence of articles may be different.

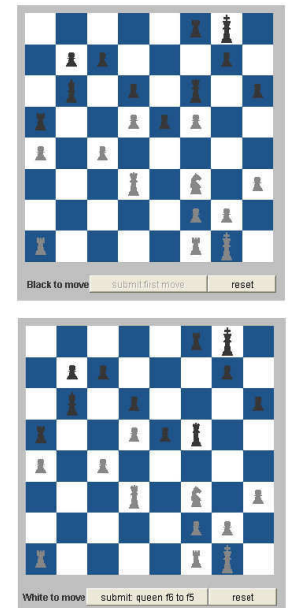


Fig. 1. An example of the board configuration before and after the player moves

In our research, we set out to see how well groups are able to collaborate to play chess according to the rules described above. In so doing, we devise a quantitative measure of creative content, namely, of how well a collaborative game of chess is played. Thus to some extent we are benchmarking collaborative effects of creativity over the Internet. Such endeavors, unlike the accuracy of encyclopedia articles, are more difficult to evaluate. Other websites, such as YouTube, which are centered on an individual's creativity being shared worldwide, measure success of entries by how many times the content is viewed.

#### Theory Behind Chess 2.0 Implementation

An online chess environment is created where players submit what they determine is their best move. The entire system is a Java applet so that the user does not have to download any program. The chessboard only accepts legal chess moves. When the user submits a move, the applet connects to a CGI script written in Python that writes the move to a file. At midnight, the move that receives the most votes is played and the file that contains the current state of the chessboard is updated to reflect the new state of the board.

Chess 2.0 is designed to keep collaboration productive by using diverse individual opinions. Surowiecki [1] claims that for a crowd to be wise, individuals should bring a unique set of experiences and opinions to the crowd, individuals should not be influenced by others in the crowd, individuals should be decentralized, and finally that there

should be a system for creating a collective decision from individual responses. Chess 2.0 was designed to maintain these axioms. Inasmuch as individuals play independently and therefore are not influenced by others in the crowd, individuals are decentralized. Chess 2.0 then provides a set of rules to make a decision based on the aggregate of individual responses.

To generate enough traffic to get data, Chess 2.0 is constructed as a Google gadget. The gadget allows Internet users to place Chess 2.0 on their website or homepage, as seen in Figure 2. Chess 2.0 can most easily be found by searching Chess 2.0 in Google Gadgets.

During the course of a typical cycle, approximately 150 moves are submitted. To obtain statistically significant results, if less than 100 moves are submitted over the course of a day, voting is continued for another day. If there is a tie between top-ranking moves, voting is also continued for another day.

As expected, players' moves tend to cluster around a small number of moves. As a typical example, Figure 3 shows one instance in which a few moves gathered significantly more votes than the other submitted moves. Additional statistical research is needed to determine if the distribution of moves at each point in the game are described by a normal distribution or by some other probability distribution.

#### Benchmarking, Results, and Conclusions

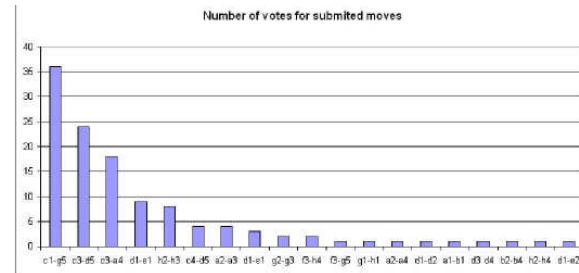
In chess, as in many other games, there are several different rating systems that allow players to be ranked against one

another. One of the most popular chess rating systems is the ELO rating system (see [4] and the references therein). To measure the ability of the crowd using the ELO rating system, benchmark games were set up so that instead of "everyone playing everyone," a virtual group was set up to play against a chess computer with a known rating. For this purpose the chess program Shredder Classic 2, which has a maximum ELO rating of 2400, was used.

It is useful to keep in mind that in chess, a particular move, a sequence of moves, or a particular game, cannot in and of itself be given a rating. Ratings only can be inferred from series of wins, draws, and losses among a group of players. A good analogy to this situation is the rating of tennis players, in which each player's rating is determined by how well that player does when playing against other players with known ratings. Another good analogy is to that of the appraisal problem of evaluating the value of a property in real estate, which is solved by considering the market value (or selling price) of comparable properties. In like manner, the ELO rating is a relative rather than an absolute rating, since it is determined by evaluating players relative to other players.

To evaluate Chess 2.0, a series of games were played against a computer chess program that was initially set to play at an ELO rating of 1200, an approximate average of all rated players (a rating of 1500 is considered the average rating of a club player). A program was written so that a virtual group of 81 players with ELO ratings ranging from 800 to 1600 in increments of 10 played Chess 2.0 against the central computer. Thus the average ELO rating of this group of robots was also 1200. If the group won or lost, its rating went up or down, respectively, according to the formulas given for the ELO rating system and the rating of the chess program was reset to the new group rating. This process was continued until the groups' rating was stabilized. This program was devised so that the skill and ability of group play with a group of players with known ratings could be quantified relative to their average playing skills.

After several series of games, the rating of the group stabilized at an average of 1242 with a standard deviation of 24 points (assuming a normal distribution around the average). Thus in this preliminary series of results, we have found that Chess 2.0 plays better than the average of the individual players. Thus in this limited model, Surowiecki's thesis that the crowd can produce results that exceed



the individual's efforts is confirmed. Thus collective wisdom in the sense captured by Chess 2.0 can produce a game of chess that is better than one would expect given the playing skill of each of the individual players.

As a possible explanation of this phenomenon, we note that using the rules of Chess 2.0 deviations from average play tend to decrease. Thus, for example, since the move chosen is the majority move, in a game played with Chess 2.0 there are fewer very good moves and fewer very bad moves as compared to an individual playing at the same rating. However, there is some asymmetry in a game of chess in the sense that making a bad move (for example, a blunder) often tends to end the game quickly whereas making a comparable good move does not. Thus a game played with less deviation from the norm is more stable and continues on longer than a game played with larger deviations from the norm. Since a bad move tends to end a game more quickly than a comparable good move, games with little deviation from the norm will tend to have a higher average rating than games with larger deviations from the norm. Since the rules of Chess 2.0 tend to damp out deviations from the norm, this explanation could potentially provide a mechanism for why a Chess 2.0 game exceeds the average play of its players. Other explanations may be possible and we are currently evaluating them.



**Michael Fischer** is a Junior at Stanford University majoring in computer science. He is interested in the theory of collaboration and how it can be applied to the Internet to promote innovation and creativity with large groups of people. Michael is also interested in applying computer science to problems in physics and mathematics. He plans to continue his computer science studies in these areas as well as in robotics, computer vision, and fiber optics. Michael's email address is [mfischer@cs.stanford.edu](mailto:mfischer@cs.stanford.edu).

play than expected.

Along the same lines, it would also be interesting to study if a group of robotic players that mirrors a group of human players with known ratings produces the same results when playing Chess 2.0. Here the goal would be to understand if group play benefits from the human component, bringing with it as it does individuals with different backgrounds and diverse experiences.

Finally, we would like to explore if the results of this research can be used to improve the output of other creative endeavors. Thus we would like to find other applications in which passive online collaboration, such as occurs in Chess 2.0, leads to improved creative content.

#### Future Research

Using Chess 2.0 as a model, we intend to study other questions regarding collaborative play. One area that we intend to explore is what effect distributing the individual playing skills of the robotic group while keeping their average skill constant has on their play. For example, in one extreme, what happens to the group play rating if 40 robotic players play at the 1600 level, 40 play at the 800 level, and one plays at the 1200 level. Here the goal would be to quantify how changing the mix in the groups' makeup, while keeping the average constant, affects the skill of group play. For example, given a fixed average of individual players, perhaps there is an optimal distribution around this average that produces the highest group play rating.

In order to bring in a human component to benchmark Chess 2.0, another avenue for future experimentation would be to apply this model to a large chess club where the ratings of the individual members are known with some good degree of reliability. This group would then play against a chess computer using the majority rule strategy for moving. The rating of the group playing with this strategy could then be determined as compared with the average rating of the group to see if this type of group play also produces better

#### Acknowledgements

Chess 2.0 won the First Place Award in the Yahoo! Hack Day competition at Stanford University in 2006. I would like to thank Yahoo! for this recognition. The author would also like to thank the editors Julian Hong, Daniel Jachowski, and Justin Solomon for several helpful suggestions.

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**Fig. 2.** The Chess 2.0 gadget added to a users web page. This allows users to easily get started in the game.

# Biomechanical Testing of Epitenon Suture Strength in Achilles Tendon Repairs

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Recent evidence that early, active mobilization protocols following Achilles tendon repairs increase recovery speed and strength makes surgical repair strength critical to positive outcomes following Achilles ruptures. While previous Achilles research has focused on core repair techniques, no past literature has reported testing of core repairs augmented with epitenon sutures, which have been shown to increase the strength of repairs of flexor tendons of the hand. In our study, five matched pairs of human Achilles tendons were severed and repaired using a Krakow locking loop core suture. The epitenon suture was added to one tendon randomly chosen from each pair. All specimens were mounted onto an MTS testing machine and loaded to failure. Addition of epitenon sutures significantly increased the force necessary to produce a two mm gap as compared to core sutures alone by 74%, and it increased the average load to failure by 119%. Also, initial tendon stiffness was 173% greater in tendons reinforced with epitenon sutures. This study demonstrates that greater resistance to gap formation, approximation of tissue ends, and tensile strength were achieved by the addition of an epitenon suture. Clinical relevance may be improved healing by decreased gap formation at the repair site and a lower risk of adhesion formation.

Surgical repairs of Achilles tendons, coupled with the impact of the initial injury that led to rupture, entail much tissue damage. Furthermore, postoperative immobilization increases muscle atrophy as well as a weakening of plantar flexion strength.<sup>1,2</sup> For those patients who undergo surgical repair, postoperative early mobilization protocols are common.<sup>3,4,5,6,7,8</sup> Surgical repair with anatomic approximation of the ruptured tendon segments is especially important for young and active patients; it is desirable to use repair techniques that maximize repair strength and minimize recovery time.<sup>9,10,11</sup> There is a lack of firm consensus on which suturing technique leads to optimal recovery, despite multiple reports on different types of sutures, diameter of the suture, number of sutures used and stitching method.

A common goal of past research has been to determine which core repair techniques provide the greatest tensile strength and resistance to gapping, while minimizing the injury inflicted on the tissue from the repair. This will theoretically allow for earlier recovery of range of motion and decrease in healing time. Mortensen and Saether,<sup>12</sup> Watson et al.,<sup>13</sup> and Jaakkola et al.<sup>14</sup> have all used biomechanical testing to compare the ultimate tensile strength of Achilles tendons repaired using various core suture techniques.

Extensive studies have been performed in flexor tendon lacerations in the hand. The use of a supplemental epitenon

suture has been shown to increase ultimate tensile strength and reduce gap formation in flexor tendon repairs regardless of which core suture is used.<sup>15</sup> Additionally, epitenon sutures have been shown to prevent fraying at the ruptured tendon ends and thus reduce the risk of bulge or adhesion formation, while not impairing tendon gliding.<sup>16,17</sup> The use of epitenon sutures has therefore become standard protocol for repair of flexor tendons of the hand, but this technique has not been previously reported in the literature for surgical repair of Achilles tendon ruptures.

The purpose of this study was to evaluate the effect of epitenon sutures in Achilles tendon repairs. We hypothesized that the use of a supplemental epitenon suture would increase the initial stiffness, load at two mm, and failure strength of repaired Achilles tendons, given the past success of the epitenon suture in flexor tendons.

### Materials and Methods.

Five matched pairs of Achilles tendons were harvested from fresh frozen human cadaver lower extremities by sectioning at the musculotendinous junction and distal insertion at the calcaneus. Scalpel incisions simulated tendon ruptures four cm from the calcaneal end, the point of greatest hypovascularity.<sup>18</sup> Each severed tendon was repaired using the Krakow locking loop procedure with nonabsorbable No. 2 Ethibond suture. First described in 1986,

the Krakow technique consists of a series of at least three interlocking suture loops that run along the sides of each tendon end.<sup>25</sup> In addition to the Krakow core suture, a simple running epitenon suture was added using 4.0 nylon sutures to five of the tendons, one from each pair. Right and left tendons were randomized into groups in order to prevent sampling error.

Each tendon was mounted onto a materials testing machine (MTS 858, MTS Systems Corp, Eden Prairie, MN) with soft-tissue clamps at the proximal and distal ends

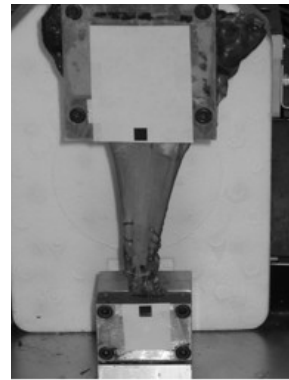


Fig. 1. Achilles tendon with epitenon sutures added loaded onto the MTS machine prior to testing.

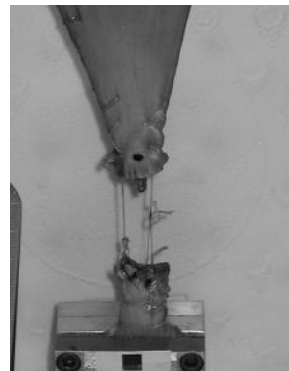


Fig. 2. Achilles tendon without epitenon sutures after loading to failure on the MTS machine.

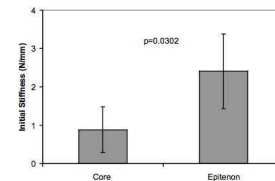


Fig. 3. The average initial stiffness of the tendons when the tensile force was applied was significantly greater for the epitenon-reinforced specimens (left) than for specimens repaired with core sutures alone (right). ( $p < 0.05$ )

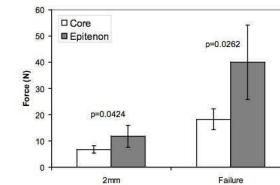


Fig. 4. Average force required to produce a two mm gap (left) and to cause tendon failure of one cm gap or suture failure, whichever occurred first (right). Forces were significantly higher upon addition of epitenon sutures. ( $p < 0.05$ )

(Figure 1). After removing the slack from the tendons they were loaded in tension at a rate of 20 cm/min to beyond the point of failure. The force versus displacement was plotted, and the initial stiffness was calculated by linearly regressing the curve starting at a tare load of 5 N up to 2 mm of additional displacement. The point of 2mm displacement was used to determine the force needed to produce a 2mm gap. The failure force was recorded as either the point at which a large decrease in the force during testing was observed or at a maximum of 1 cm displacement from the 5 N tare load. To ensure that the differences between the core and core+epitenon groups were not a result of differences in tendon size at the repair site, the failure load was normalized by the cross-sectional area to find the failure stress. The initial stiffness, force required to generate a 2mm gap, failure force, stress at a 2 mm gap and the failure stress were compared between treatments using a two-tailed paired Student's t-tests ( $\alpha = 0.05$ ) to identify significant differences.

### Results

Epitenon sutures significantly increased the initial stiffness of the repaired tendons. As shown in Figure 3, the initial stiffness of the core group of tendons, repaired with the Krakow technique alone, was  $0.88 \pm 0.60$  N/mm whereas for the core+epitenon reinforced tendons, the stiffness was  $2.40 \pm 0.97$  N/mm ( $p = 0.0302$ ).

Figure 4 shows the 2 mm gap and the failure forces for the core and epitenon sutures. On average, core tendons alone supported  $6.77 \pm 1.38$  N versus  $11.76 \pm 4.16$  N for core+epitenon-reinforced tendons ( $p = 0.0424$ ). For tendons repaired using core sutures alone, the mean force to failure was

$18.27 \pm 4.0$  N. The mean force to failure for tendons with core+epitenon sutures was significantly higher,  $40.00 \pm 14.14$  N ( $p = 0.0262$ ).

### Discussion.

A common goal of past research has been to determine which core repair techniques provide the greatest tensile strength and stiffness, while minimizing the injury inflicted on the tissue from the repair.<sup>14,12,12</sup> Surgical repairs of Achilles tendon ruptures must provide adequate strength to allow for healing and commencement of early active mobilization protocols. Early range of motion is desirable to reduce muscle atrophy and tendon elongation that often result from extended periods of immobility.<sup>19,20,21,22,23</sup> This will theoretically allow for early range of motion and decrease in healing time. Previous investigations have used biomechanical testing to compare the ultimate tensile strength of Achilles tendons repaired using various core suture techniques.<sup>14,12,13</sup>

However, there are no published reports on the use of supplementary epitenon sutures. Extensive studies have been performed in flexor tendon lacerations in the hand. The use of a supplemental epitenon suture has been shown to increase ultimate tensile strength and reduce gap formation in flexor tendon repairs using Kessler, Tsuge, Bunnell, and Ketchum core techniques.<sup>15</sup> It increases both ultimate tensile strength, which epitenon sutures increased an average of 38%, and gapping resistance, which was increased 165% upon addition of epitenon sutures, were significant regardless of which core suture was used.<sup>15</sup> Additionally, epitenon sutures have been shown to prevent fraying at the

ruptured tendon ends and thus reduce the risk of bulge or adhesion formation, while not impairing tendon gliding.<sup>16,17</sup>

Our findings are in accord with earlier studies that have shown epitenon sutures to increase ultimate tensile strength and gapping resistance in flexor tendons of the hand. Epitenon sutures are worth investigating separately in the Achilles, despite the previous flexor tendon literature, as the two tendon types are vastly different in size and must withstand markedly different forces in vivo. In both tendons, the initial stiffness is of particular importance, as gap formation at tendon rupture sites can lead to adhesion formation and prevent healing<sup>15</sup> and can attenuate the tendon, reducing the strength of the tendon once it is fully recovered.<sup>13</sup> Previous Achilles literature on core suture strength has not reported two mm gapping resistance, which we believe should be considered in future evaluations of surgical repair techniques because of the risk of adhesion formation at even small gap distances. Even without a gain in ultimate tensile strength, reduced gap formation and fewer adhesions could potentially improve recovery time and strength.

Flexor tendon studies of the hand have concluded that the benefit of increased strength afforded by the epitenon suture outweighs any possible drawbacks associated with increased exposed suture material or punctures, as epitenon sutures do not increase work of friction or impair tendon gliding.<sup>21</sup> These studies are in accord with the clinical investigation by Aoki<sup>20</sup> that demonstrated effective post-operative healing in the Achilles following the use of epitenon sutures. Procedurally, the running suture is quick and easy to add to more complex core sutures,<sup>16,26</sup> which makes the epitenon suture even more clinically relevant and feasible to implement.

The running epitenon suture was especially effective at attenuating smaller loads, as evidenced by the dramatic 173% increase in initial stiffness. The epitenon sutures on average increased the force necessary to create a two mm gap by 74%, a statistically significant increase. By comparison the increase in the load to failure in the current study was 119%, also significant. The next step in this line of study can be to test the failure profiles of Achilles tendon repairs with and without epitenon sutures when subjected to multi-cyclic fatigue failure, which will more

accurately simulate the stresses placed on the Achilles tendon by activities of daily living such as walking. Such studies will hold great clinical relevance for more everyday sustenance of Achilles repairs. Our study highlights the benefit of the epitenon sutures at improving failure and gapping strength under single cycle large loads, as patients may experience when they return to more strenuous activities that place higher loads on the Achilles.

Our results demonstrate that the epitenon suture repair adds strength and reduces gap formation in repairs of the Achilles tendon. These results can be applied clinically to improve surgical outcomes for this common operation.

#### Acknowledgments

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## Mapping Cognition: Intrinsic Connections of the Dorsolateral Prefrontal Cortex in *Macaca fascicularis*

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Neurobiologists have long known that structural differences can reflect complex cognitive and emotional processes, especially in the prefrontal cortex. It has long been suspected that an area as complex and important as the primate prefrontal cortex must be divided into functional systems; however, the precise nature and organization of these regions has still not been found by a century of investigation. Structural studies may prove invaluable in trying to uncover this mystery as individual areas are better understood through imaging techniques or lesion studies; the delineation of architectonic areas and of the connections between them can be used to string together how these areas interact and operate to subservise tasks. Architectonic and axonal tracing studies have suggested the orbital and medial prefrontal cortex is organized into two distinct networks or systems, with each network processing different tasks crucial to higher-level cognition. This study uses similar techniques to identify intrinsic prefrontal connections of the dorsolateral prefrontal cortex (DLPFC); the results suggest the DLPFC may be organized into three systems with distinct connections. Besides beginning to establish DLPFC connections in relation to the rest of the prefrontal cortex, this information also allows the functions of DLPFC areas to be surmised.

The prefrontal cortex (PFC) extends from the rostral tip of the brain to the premotor cortex, and can be divided into three parts: the orbital wall, the medial wall, and the dorsolateral prefrontal cortex (DLPFC). The orbital wall rests just above the eyes, the medial wall is roughly perpendicular to the orbital and lies along the midline of the brain, and the remaining areas can be grouped as the dorsolateral prefrontal cortex (see figure 1). These areas are generally associated with cognition, executive function, and are involved in a multitude of heterogeneous tasks, such as planning, object assessment, and emotion. Architectonic mapping by Brodmann, Walker, and Vogt and Vogt have delineated physical subdivisions within each wall and previous injection studies (with what chemical?) by Price, Carmichael, and Ongur have shown that neuronal connections between these subdivisions can be organized into networks that may handle distinct functions -- each network is composed of architectonic areas that preferentially connect to each other and not areas of another network. Two such networks involve areas of the orbital and medial prefrontal cortex, or OMPFC<sup>2</sup>. However, the OMPFC networks do not exist in isolation and have many sub-cortical as well as cortical connections. How exactly the OMPFC relates to the

rest of the prefrontal cortex, especially the dorsolateral wall, needed to be examined. While there have been many studies on the dorsolateral wall, it is unclear as to how the DLPFC is organized specifically and how it may influence the OMPFC.

#### The Orbital Medial Prefrontal Cortex

The OMPFC seems to be an emotion-processing sector. It is situated in the prefrontal cortex, an area surmised to be predominantly in charge of executive function. Specifically, the orbital and medial networks encompass 22 anatomical areas in the prefrontal cortex<sup>3</sup>. The orbital network is composed of areas on the orbital surface, while the medial network encompasses the medial wall and ventromedial corner of the frontal lobe (see figure 2). In addition, a region in the lateral part of the orbital cortex (area Iai) is connected within the medial network<sup>4</sup>. Areas 13a and 12o have connections to both networks, perhaps serving as communication between the two (see figure 2). In addition to prefrontal connections, both networks also have extensive reciprocal cortico-cortical connections with other parts of the brain.

The orbital network receives sensory inputs from the olfactory, gustatory, visual, and somatic sensory systems while the medial network receives

visceral and motor input; in conjunction, the two networks may serve to integrate sensory and motor information. These inputs all seem to be related to food or food-related stimuli, because olfactory and gustatory sensations are senses uniquely designed to be stimulated by food, and visual, somatic, visceral, and motor systems are all involved in eating and digestion<sup>3</sup>. Eating is closely tied to the reward system in the brain, and this may be why a predominantly food-related portion of the brain developed into an emotion-processing sector.

The OMPFC is involved in the important task of guiding behavior, mood, and emotions. Axonal tracer experiments have shown reciprocal projections between the OMPFC and limbic structures such as the amygdala, hippocampal formation, entorhinal cortex, and the perirhinal cortex, structures that are integral to emotional processing and memory; there are also indirect connections from the OMPFC to the thalamus, which controls motor movements and receives auditory, somatic and visual

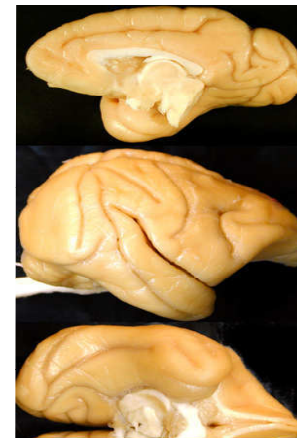
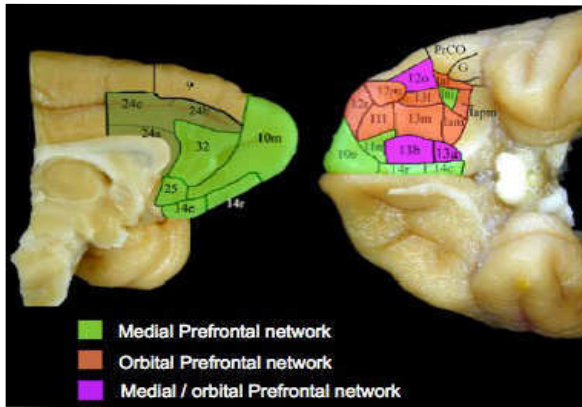


Fig. 1. Medial, Lateral, and Orbital Views of the Brain. The medial, orbital, and lateral views of the brain (in descending order) with the rostral end of the brain on the right and the caudal end on the left. The prefrontal cortex is the area extending from the rostral tip of the brain to the arcuate sulcus and includes premotor area 6 and frontal eye field area 8 just behind the sulcus (the arcuate is the "c" shaped sulcus on the right quarter of the lateral view of the brain).



Michelle Shepard is a senior majoring in Human Biology, with a concentration in Sports Medicine. She has been active in research with the Departments of Sports Medicine and Orthopedic Surgery and would like to thank Drs. Chou, Matheson, Fredericson, and Garza for their guidance. Michelle will be commissioning as a Second Lieutenant in the United States Air Force in June and looks forward to serving as a physician in the USAF after she completes her medical training. Outside of the classroom, she enjoys sports, meeting with RUF, and taking her dog to the beach at home in Southern California.



**Fig. 2. OMPFC Networks.** Networks on the orbital medial prefrontal cortex. The brain image on the left is a medial view, the one on the right shows the brain as viewed ventrally. Image taken from Carmichael, ST. and Price JL. Architectonic Subdivision of the Orbital and Medial Prefrontal Cortex in the Macaque Monkey. *J. Comp. Neurol* 1994; vol 346: 403-434.

sensory signals<sup>9</sup>. Additionally, case studies on individuals with prefrontal lesions have shown that damage to the OMPFC can result in personality alterations, cause deficiency of emotional response to stimuli, and may render patients unable to make responsible decisions<sup>2,10</sup>.

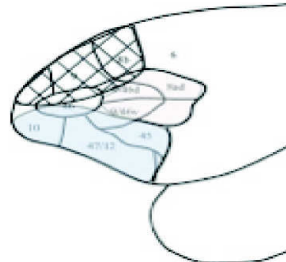
Besides behavioral differences in patients with damage to the OMPFC, activity changes in these areas have been noted in patients with major depression disorder (MDD) and bipolar disorder (BD). Areas of the medial prefrontal cortex show increased activity (measured as increased blood flow) in patients with MDD, and cortical areas 25 and 32 also show changes in BD patients<sup>11</sup>. Patients with familial mood disorders also have abnormal activity patterns and even structural differences in the OMPFC<sup>12</sup>, as well as a reduced number of glia in Brodmann area 24<sup>13</sup>.

**The Dorsolateral Prefrontal Cortex**

The DLPFC includes eight areas, the premotor cortex and the frontal eye fields respectively (see figure 3). It has been associated with working memory, visuo-spatial function, abstract thinking, and executive control. Recent architectonic studies and discrepancies between human and monkey brain structures have led to revisions of Brodmann and Walker's original

architectonic maps; for instance, area 12 is recognized as a conglomeration of four distinct areas, designated 12o, 12l, 12m, and 12r<sup>14</sup>, and area 47 in humans exhibited the same connections and laminar pattern as area 12 in monkeys<sup>15</sup>, now commonly referred to as area 47/12. Cortico-cortical connections have also defined DLPFC areas. Portions of the DLPFC receive inputs from auditory, somatosensory, premotor, limbic, visuospatial, and visual areas, making the region as a whole a multimodal region. However, it contains few truly polysensory neurons; the DLPFC exhibits a high level of regional variations. For instance, the mid-principal sulcus region receives a number of afferents from premotor area 6, which controls the trunk of the body; the caudal premotor areas, meanwhile, show reciprocal connections to premotor areas that control the head and neck as well as the trunk<sup>16</sup>.

Several theories concerning the role of the DLPFC exist. While the DLPFC is known to play a part in delayed visual spatial tasks and working memory, it is unclear as to its overall function. Barbas advocates a dorsal-ventral system bisected by the principal sulcus. She suggests that dorsal areas use their visual inputs in localization and ventral areas in pattern recognition. This is supported by



**Fig. 3. Dorolateral Prefrontal Cortex Areas** The lateral view of the brain with areas outlined and labeled. Hypothesized regions of the DLPFC are delineated (the ventral is cross-hatched, caudal is in pink, the ventral is in blue). Image modified from Price JL. *The Prefrontal Cortex*. In: *Neurobiology Of Autism In The Post-Genomic Era*, Moldin S and Rubenstein J (eds.) CRC Press, 2006 pp. 205-226.

variations in motor inputs and visual areas associated with recognition<sup>17</sup>. Petrides argues for a rostral-caudal progression, in which the rostral tip of the brain, area 10, monitors areas caudal to it, specifically areas 46, 46/9, and 9, which in turn monitors various sensory functions. Areas 10, 46/9, and 9 have been reported to receive many of the same inputs from the retrosplenial cortex, cingulate, and multimodal superior temporal sulcus and have been shown to play an executive role in spatial perceptual, mnemonic, verbal and semantic tasks. He argues that although many believe the mid-DLPFC to be the center for working memory, (lesions to this area have demonstrated reduced ability of selection and judgment tasks requiring working memory, working memory could be an auxiliary function for "a system for the conscious active control of planned behaviour and cognition"<sup>18</sup>, a much more general task. With additional knowledge of the connections to and from the DLPFC, perhaps one, or part, of these theories can be validated.

**DLPFC and OMPFC**

Besides exhibiting extensive intrinsic prefrontal connections, the DLPFC has connections to the medial and orbital walls. In general, areas with connections to the medial wall are dorsal to the principal sulcus while areas with orbital connections are ventral. Specifically, areas 9, area

46 rostradorsal of the principal sulcus, and the dorsal part of area 8 (area 8b) generally appear to have connections to medial areas 12 and 1ai, and areas 6, 45, and the ventral part of 46 seem to be connected to orbital areas. However, there are also areas of the DLPFC that do not have connections with the orbital or medial wall<sup>1</sup>. This region, including parts of 6 and the caudal part of 8 (area 8a), are more caudal and generally have connections with visuospatial-related cortical areas in the parietal cortex. This would imply that there are three separate regions of the DLPFC. The hypothesized regions are delineated in figure 3. Unfortunately, while many tracer and functional studies have been performed, the borders, connections, and, ultimately, the functions, of these regions remain indistinct. This study is an attempt to clarify some of these issues using retrograde and anterograde tracers, which respectively travel from the axon terminals to the axon body and vice versa from the area the tracer was injected into the brain.

**Pre-preparatory Procedures**

Slides of Macacca fascicularis brains with retrograde and anterograde tracer injections in the DLPFC were examined and analyzed for this study. All animal protocols were reviewed and approved by the Animal Studies Committee of Washington University in St. Louis School of Medicine.

Coordinates of the chosen brain were established to identify brain structure and injection points using information from magnetic resonance imaging (MRI) scans and atlas coordinates. After precise injection coordinates had been identified, injections of biotinylated dextran-amine (BDA), floral ruby (FR), lucifer yellow (LY), fast blue (FB), or diamidiro yellow (DY) were made in the desired sites (see figure 4). The monkeys were deeply anesthetized and perfused fourteen days after the surgery and series of coronal sections of the brain were stained, processed, mounted onto slides. Dr. Joel Price and Dr. Kadharbatcha Saleem performed the above initial preparation.

**Procedure: Plotting of Labeled Neurons**

For each injection, slides from the rostral tip of the brain to 14 microns caudal were chosen to be examined; each slide was one micron away from adjacent examined slides. Outlines of the brain stem

were traced using a microscope digitizer system that had encoders attached to the microscope stage and was interfaced with a personal computer (AccuStage, Shoreview, MN) on 50x or 200x power. The sections of the brain were then examined for labeled cells under 400x magnification. Bright field, dark field, and fluorescence view were used depending on the stain type. Each labeled cell was plotted as a dot in the corresponding coordinates of the image.

**Identifying Labeled Structures**

Cortical boundaries and visible structures on the original slide were traced by hand on to the plotter image using camera lucidae techniques. Structures visible on adjacent Nissl stains are traced onto the plotter image. The finished images were analyzed to determine the location and number of labeled neurons.

**Results**

All of the tracers used were able to show retrograde labeling; injections I and J used tracers which also showed anterograde labeling, shown in green on the results chart (see figure 4 and 5).

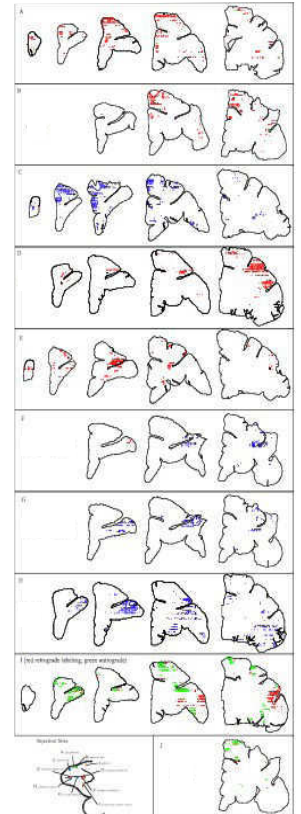
**Dorsal Injections**

The dorsal injections in area 9 (A and C) show consistent labeling in areas 9 and 24 (especially areas 24a and 24b), and also more ventrally on the medial wall in areas 32 and 10m (see figure 4). In addition, there is label in the lateral part of the orbital cortex, in areas 12o and 1ai. Together, these areas all belong to the medial prefrontal network; the orbital areas 12o and 1ai form the lateral part of this network. Other areas of the medial network situated at the ventromedial corner of the frontal cortex (areas 11m, 13a, and 14r/c), do not seem to be involved.

The caudal-most of the dorsal injections (B) is in area 8b, and shows a somewhat different pattern of labeling. There are substantial numbers of retrograde labeling in areas 9 and 24c, but relatively little or no labeling in more ventral parts of the medial prefrontal cortex (areas 24a/b, 32, and 10m). Area 8b therefore appears to be less related to the medial prefrontal network, and may be part of a different cortical system.

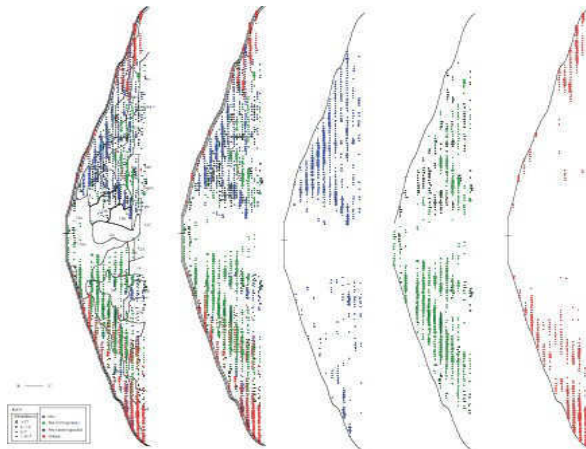
**Injections Along Principal Sulcus**

Injections D and E are in the



**Fig. 4. Table shows labeled neurons from each injection, represented as dots on each coronal section.** Sections progress from rostral to caudal, with approximately three micrometers between each section. Injection sites are shown in solid lines on coronal slices and also shown on the lateral view of the brain at the bottom.

dorsal bank of the principal sulcus, one at the rostral end (area 46d) and one at the caudal end (area 9/46d). The complimentary labeling pattern between the two cases confirms Barbas' results that inputs to areas along the principal sulcus vary from rostral to caudal, and Petrides and Pandya's suggestion that these regions



**Fig. 5.** Flatmap. In order to more easily present the data rostral-caudally, three injection series were chosen and presented in a flatmap. Using a Cartesian coordinate system, the ventral tip of each coronal section was positioned at (slide number, 0) and points along the layer IV of each coronal slide were correlated to a y position, with the frequency of labeled neurons in every 0.5 cm section of the coronal slide marked on the corresponding system coordinates. Here, the flatmaps are presented individually by injection (three on the right), overlapped (second from the left) and overlapping with brain areas delineated (far left) for clarity.

Blue dots (third from left) represent labeling from injection H, green dots (fourth from left) injection A (green with black edges area retrogradely labeled cells; the rest are retrogradely labeled and show inputs to injection areas), and red dots (far right) from injection D. Note that labeling largely does not overlap and appears to be complementary.

represent two different architectonic areas (46d vs 9/46d). Retrogradely labeled cells from the more caudal injection D extended rostrally in the dorsal bank of the principal sulcus (area 46d) and in area 9. In contrast, injection E labeled cells in areas 10m, 10o, and 11m, as well as in the fundus of the principal sulcus. These areas are largely adjacent but complementary to the areas labeled by D.

Injections F and G are in the middle and caudal part of the ventral lip of the principal sulcus, in area 9/46v, and both have similar patterns of label in the frontal cortex. Both have label within the principal and arcuate sulci, but little in other prefrontal areas. (There is some label in areas 24c, 9, and 10o with injection G)

Injection H is also in the ventral lip of the principal sulcus, but further forward in area 46. Labeled cells are found mainly in the ventrolateral convexity, in area 47/12, and also in the orbital cortex

(in areas 11l, 47/12r, 13m, 1am, and 1apm). These areas all belong to the orbital prefrontal network.

#### Ventral Injection

Injection I is in the ventral arcuate sulcus and involved both areas 45 and 8av. Retrogradely labeled cells were found mostly in ventrolateral area 45 and orbital areas 11l, 12m, and 13l; apart from area 45, all of these are part of the orbital network. This pattern of labeling resembles that seen with injection H. In addition, there is label in area 8a, both dorsal and ventral, probably due to the involvement of area 8a in the injection.

#### Dorsal Caudal Injection

The last injection is the most caudal injection in area 6, a premotor region. It showed very little rostral labeling, implying that it gets inputs from more caudal regions. However, areas

adjacent to the injection area such as area 24c showed labeling.

#### Discussion

These results suggest that, to a limited extent, the dorsolateral prefrontal cortex can be divided into three distinct regions, dorsal, ventral, and caudal. Rostral-caudally, the results may be better seen on the (see figure 5), where three injections (all in the same monkey) were chosen: injection A into the dorsal area 9, injection D in the caudal area 9/46d, and H from the ventral area 46. The intrinsic prefrontal labeling from these injections shows relatively little overlap (see figure 5). In addition, when comparing inputs across regions, labeled areas seemed complimentary; projections from area H avoided regions where area A had extensive connections. The same reciprocal relationship seems to be true of area D. These results, in addition to the similar patterns of labeling from other injections in each region, suggest that the three regions of the DLPFC may form three distinct networks, a dorsal system with substantial interaction with the medial network, a ventral system with significant interactions with the orbital network, and a caudal system that primarily interacts with areas caudal to the prefrontal cortex. However, previous data implies that dorsal and ventral DLPFC regions are not merely extensions of the medial or orbital network. For example, functional studies have suggested that the ventral region is related to visual object assessment and memory, rather than to food related tasks.

More conclusive evidence for this delineation could be made with the addition of extrinsic prefrontal connections. It is unclear where the precise borders between these areas are; while area 9 shows significant associations with the medial network but area 8B does not, suggesting that area 8b should perhaps be exempted from the dorsal region. Injections ventral to the principal sulcus, including at least areas 46v and 45, can be grouped together by their avoidance of the medial prefrontal network, and their connections to orbital network areas. This conclusion is in agreement with Barbas' (1985) report that injections dorsal and ventral to the sulcus (including both the lips and banks of the sulcus) show distinct labeling patterns. The caudal region is not substantially connected

to either medial or orbital networks, or to the dorsomedial and ventrolateral regions. Additionally, label from caudal injections is found rostrally within at least the dorsal bank of the principal sulcus, suggesting that the caudal region extends rostrally within the principal sulcus than was previously thought. An injection into the rostral dorsal bank of the sulcus did not label connections to orbital, medial, dorsal, or ventral regions, but did label cells in the caudal region. It is likely that the area 46 will need to be further subdivided to reflect these distinctions.

#### Future Work

Much work still needs to be done in the prefrontal cortex. The borders of the three proposed regions need to be defined more precisely, especially the rostral-caudal extent of the hypothesized caudal region. While a general relationship between the DLPFC and the OMPFC has been proposed here, it is far from specific. Additionally, the DLPFC is known to receive many inputs from non-prefrontal cortices, and these sensory inputs may better serve to define regional variations. Finally, the function of the prefrontal cortex, and the DLPFC in particular, is far from definitive. MRI, fMRI, and behavioral studies targeting the prefrontal cortex would also offer a better understanding of its organization and would go a long way towards solving this mystery of cognition.

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## Lagging Behind: Romania's Democratic Quality under Neocommunist Governance, 1989-1996

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"And it is not until they have been led into a thousand mistakes in matters most essential to their lives and liberties, and are weary of suffering, that they can be induced to apply a remedy to the evils with which they are oppressed. It is only then that they begin to conceive and acknowledge the most palpable truths..."

- Cesare Beccaria,  
*Of Crimes and Punishments*

After a dramatic electoral race, Traian Basescu became the President of Romania in December 2004. Basescu, the pro-democratic candidate of the Justice and Truth Alliance (JTA), defeated Adrian Nastase, the neocommunist nominee of the Social Democratic Party (SDP). The presidential confrontation's decisive moment occurred live on national television, in a pre-electoral debate.<sup>1</sup> At one point, Basescu told his opponent that "we [politicians] cannot have the same mentality fifteen years after communism's collapse [and] you prove to me, every day, that you are incapable of understanding that institutions must be allowed to function autonomously" (qtd. in Simonca 1). This phrase was disarming in its undeniable sincerity: Nastase remained speechless, while Basescu knew that he had won the hearts and minds of most Romanians.

From 1989 to 1996, neocommunists have dominated the Romanian political arena, prompting many scholars to question the Revolution's democratic origins (Codrescu 206). Romanian democracy emerged under contentious circumstances: small exclusivist elites executed dictator Nicolae Ceausescu and organized the National Salvation Front (NSF), "the new structure of state power" (Stoica 18). Leaving aside the Revolution's historical controversies, analysts should focus more on assessing the consequences of Romania's hesitant break with its communist past. As Michael McFaul points out, European countries that experienced regime change

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former members of the defunct Romanian Communist Party (RCP) that became involved with nominally-democratic political organizations after 1989.

In order to quantify neocommunist policies' impact on democratic quality, one may use the process-tracing method, which "attempts to identify the intervening causal process—the causal chain and causal mechanisms—between an independent variable and the outcome of the dependent variable" (Bennett and George 206). Seeking to explain the discrepancy in Freedom House scores between Romania and other Eastern European countries, this study's process-tracing approach analyzes two key elements of Romania's transition—neocommunists' repression of political dissent and their creation of weak institutions—assessing in each case the impact of incumbents' political culture on democratic quality.

### Romanian Exceptionalism: Adapting Dahl's Model

Having defined the most important variables and the method of analysis, one should briefly describe the causal chain between incumbent elites' political culture and democratic quality. In *Polyarchy*, Dahl constructs a model of the links between the beliefs of political activists, their actions, and regime-type. If democratic quality approaches zero for authoritarian regimes and its maximum for liberal democracies, it follows that the regime-type spectrum relates to different values of democratic quality. Dahl's model applied to Romania thus suggests that the totalitarian legacy of the Ceausescu regime has largely influenced neocommunists' political culture and actions.

With respect to Romanian communism's features, one should note that the state intervened constantly and brutally in citizens' private realm. Communist propaganda targeted all members of society, regardless of age (Tismaneanu 206). For Ceausescu, the state's mission was to make citizens "aware of their mission [and] urge them to unity" (qtd. in Gallagher 60). If ordinary citizens were subject to such aggressive propagandistic practices, party members' lives gravitated only around the RCP. Following the 1989 revolution, the primary destination of these former communists was the NSF, which "inherited a significant proportion of the

Communist Party's membership, leaders, assets and ideological baggage (Sandu 31; Hollis 268). Inglehart argues that "once established, [political cultural] orientations have a momentum of their own, and may act as autonomous influences on politics and economics long after the events that gave rise to them" (17). Considering neocommunists' deep indoctrination, one may claim that Ceausescu's totalitarian legacy endured with the NSF well beyond the 1989 Revolution.

In addition to shaping former communists' political culture, Ceausescu's terrible legacy paved NSF's way to power in the 1990 and 1992 elections. The tragic events of the 1989 Revolution revealed Romanians' deep hatred for the tyrannical regime that had imposed irrational hardships on its citizens.<sup>4</sup> In this context, people's electoral support for neocommunists appears paradoxical. However, Romanians did not associate the new ruling elites with their past, but with the merit of overthrowing Ceausescu. In *Problems of Democratic Transition and Consolidation*, Linz and Stepan brilliantly argue that the neocommunist victory came as no surprise given the totalitarianistic nature of the former regime (344). Ceausescu's extreme personality cult had conveyed the idea that he was the only one responsible for people's low standards of living. Ion Iliescu, leader of the NSF, won the Presidential elections of 1990 precisely because he was able to exonerate himself and his collaborators from any mistakes of the past and pose as the country's savior after the dictator's execution. Iliescu quickly abrogated many of Ceausescu's odious decrees, legalizing abortions and opening up the borders (Linz and Stepan 360). Following these measures, his popularity reached incredible heights.<sup>5</sup>

By contrast, the democratic opposition was unconsolidated and lacked authority in the postcommunist context. Ceausescu did not tolerate any form of opposition and persecuted all dissenters by putting them in prisons or mental hospitals (Linz and Stepan 353). Since they were only freed after the Revolution, they returned to the political arena tardily, having little appeal to the population because they had not participated in Ceausescu's overthrowing. Ironically, the 1989 Revolution granted more transitional authority to the neocommunists that

deposed him than to the people who had suffered for decades because of their democratic political beliefs.

### Neocommunist Repression of the Democratic Opposition

After discussing Romania's exceptionalism with respect to its transition and subsequent democratic quality, one may turn to the process-tracing of neocommunist governance. As early as 1990, the Iliescu regime engaged repeatedly in undemocratic treatment of the opposition through both bureaucratic and violent means. The neocommunists tried to convey the impression that they were abiding by democratic rules, because they wanted to provide legitimacy to their social-democratic appearance. Upon close analysis, their actions are characteristic for totalitarian actors that endeavor to silence political dissent by any means possible.

Most often, the NSF and its successor parties acted against the opposition through bureaucratic mechanisms that affected democratic participation and competition. On January 23, 1990, the NSF's Council—acting as a provisional government—decided to transform itself into a political party and run in the upcoming electoral race (Stoica 23). Enjoying complete authority over Romania's political scene, the NSF decided unilaterally on the timing of elections, leaving little room for the democratic opposition to organize a proper campaign. Conversely, organizing was easy for Iliescu and his colleagues, who "appropriated the remnants of the communist administrative system and effectively substituted the RCP's control over it with its own" (Stan 43). The NSF could easily promote and propagate its electoral messages because it "maintained control over the allocation of radio frequencies, licenses for TV broadcasting, and access to television programming" (Verdery 111). The party also had a monopoly over advertising in public transportation and its members systematically destroyed the posters and flyers of the democratic opposition (Marincus 28). Most notably, the NSF engaged in electoral bribing by giving each peasant an agricultural terrain of at least 53,000 square feet (Marincus 28).

At the same time, the Iliescu regime violently repressed political opposition under the façade of protecting

public order. . . On January 28, 1990, several opposition parties organized a massive protest against the NSF decision to become a political party. In response, Iliescu instigated miners from the Jiu Valley to come to Bucharest and disperse the opposition, in order to protect the so-called new democratic regime (Tudor 1). Special security forces joined the miners in their violent actions, destroying buildings of opposition parties and beating to death many supporters (Deletant 42). As this scenario recurred during the early 1990s, opposition leaders were often arrested and denied fundamental rights to habeas corpus and legal defense.

The NSF's repression of the opposition—through both institutional and violent means—negatively affected participation, competition, freedom, and equality. With respect to the former two, the NSF guaranteed universal suffrage, but "a good democracy must ensure that all citizens are in fact able to make use of these formal rights" (Diamond and Morlino 23). At a *de jure* level, Romania had proportional electoral representation; still, any organization that opposed the neocommunists faced insurmountable *de facto* challenges in trying to reach the public. Furthermore, since people could not assemble to criticize the government and risked losing their lives for expressing dissent, one may argue that the state did not equally protect individual rights and liberties, but favored all the yes-men that sustained neocommunist policies. Overall, the Iliescu regime's lack of toleration for political opposition suggests that Ceausescu's legacy of totalitarianism was largely preserved in the political culture of NSF members.

### Weak Political and Judicial Institutions

From organized violence to the creation of shallow democratic institutions, Iliescu and the NSF did not stop short of anything that consolidated their power. Neocommunists deliberately constructed a state system that incorporated very weak checks and balances on the government. In theory, Romania is a semi-presidential Republic, with a powerful Parliament that can counterbalance executive power. However, both the President and the cabinet have powers that can overrule Parliamentary decisions: the President has the right to veto any piece of legislation, while the

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cabinet can enforce emergency ordinances.<sup>6</sup> Furthermore, elected members of the Parliament (MPs) enjoy judicial immunity for the entire duration of their mandate. With respect to the judiciary, the criterion for becoming a member of superior courts was professional experience; hence, former communist magistrates still dominate the supreme institutions of Romania's judicial system (Mungiu-Pippidi 61).

Originating in elites' totalitarian mentality, inadequate checks and balances on state-level actors have impaired horizontal accountability and have weakened the Romania's rule of law. Particularly between 1989 and 1996, the judicial system has applied laws discriminatively based on people's political orientations, which encouraged generalized corruption. Citizens' freedom and equality of rights suffered under Iliescu's regime and people gradually lost their trust in judicial actors. Keeping in mind the link between the rule of law and equal enforcement of citizens' rights, one may argue that neocommunist's inadequate institutional reforms had persistent negative effects on multiple dimensions of democratic quality.

#### Alternative Explanations and Nuances

Using the method of process-tracing, this paper briefly discussed neocommunist leaders' essential policies in transitional Romania and pointed out their effects on various dimensions of democratic quality. However, one should also analyze the role of institutions in Romania's transition and their possible effects on democratic quality. Far from making purely autonomous policy decisions based solely on their political culture, actors were heavily influenced by both democratic and totalitarian institutions: while the former mainly shaped actors' choices of *de jure* institutional design, the latter influenced neocommunist's early informal practices.

In line with previous arguments, one should accept that the neocommunist political culture incorporates deeply-entrenched social norms that influenced elites in choosing to repress opposition groups or alter the incipient democratic political system to weaker and more ineffective forms. In other words, the communist mentality's persistence in the post-Revolutionary setting suggests that communist institutions were preserved—as informal rules—even after Ceausescu's

downfall. By contrast, neocommunist changed the *formal* institutions of the state in broad accordance to democratic standards, especially following the adoption of the 1991 Constitution. To fully legitimize their authority, these elites had to appear social-democratic and ultimately adopt formally-democratic institutions. One may speculate that mass protests could have overthrown the NSF rule had it not abided basic democratic standards.

In that sense, institutions had a deeper influence on long-term stability and the ultimate increase in Romania's democratic quality at the end of the 1990s. Linz points out that Constitution drafting and the new regime's initial agenda—two key focuses of this study—are crucially important for democratic consolidation (40). Considering the neocommunist's impact on democratic quality and their totalitarian tendencies, one may wonder why democracy did not break down in transitional Romania. The explanation involves both external institutional pressures and internal democratic habituation. Romania applied for membership in the EU in 1995 and maintained close relations with the International Monetary Fund (IMF) and the World Bank since 1990. Marincus argues that "the switch of direction toward market economy was practically imposed by financial institutions, which conditioned loans on the progress of reforms" (22). McFaul further highlights the importance of International Organizations (IOs) for democratization, stating that the Romanian regime "increasingly became more democratic as [it] sought membership in Western institutions such as the European Union and NATO" (90). Hence, external institutional pressures may partially account for the downward trend in Romania's Freedom House ratings. A complementary explanation relates to the neocommunist's habituation with the democratic game, meaning the process of actors' internalizing democratic norms when participating in a democratic system (Rustow 337). Likewise, one can argue that neocommunist gradually became more open-minded when they understood—most starkly, with the 2000 electoral victory—that elections and other democratic mechanisms can work to their advantage. The Romanian example proves that external and internal democratic institutions can influence actors' behavior and, consequently, a country's democratic

quality.

#### Conclusions

Although one should consider these positive effects on democratic quality, one must not overvalue their importance. At least in the short term, neocommunist mostly acted according to their deeply-rooted totalitarian political culture. Once again, Freedom House ratings verify this hypothesis, showing only a slight downward trend across time and a fairly consistent democratic gap between Romania and other Eastern European countries. This essay attempted to show that the neocommunist's direct actions negatively affected Romania's freedom, equality, electoral competition and participation, vertical and horizontal accountability, responsiveness, and rule of law. Granting that recycling elites can be highly detrimental to democratic consolidation, especially where previous regimes have been totalitarian, analysts need to stress the importance of imposing international and domestic laws that ban former officials' access to the transitional political scene. In order to prevent a vacuum of human capital, such lustration laws should not purge *all* former members of a despotic party, but only its high-ranking elites.<sup>7</sup>

The international community should help peoples emerging from ruthless dictatorships in their transitional processes. While respecting the sovereign domestic visions for reconstructing these societies, international powers have the responsibility to assure that recycled elites cannot harm democracy after the collapse of totalitarian regimes. Although some may consider these recommendations as inconsistent with fostering democratization, the long-term benefits of restricting former elites' participation to the transitional political scene—and implicitly affecting democratic quality by formalizing unequal participation—far outweigh the costs of allowing them to shape fragile new democracies.

#### Notes

1. This debate was broadcasted four days before the Presidential runoff and 1,415,000 people watched it (Simonca 1).
2. While all other Eastern European democracies reached ratings equal to or below 2.5 as early as 1991, Romania's rating remained greater or equal to 3.5—equivalent to a partially free or hybrid regime—up until the democratic opposition won the 1996 elections (see figure 1). Freedom House scores are from <http://www.

freedomhouse.org>.

3. This essay builds upon and particularizes Dahl's model of political culture, taking into account both the roles of both actors and institutions in Romania's transition. See figure 2.

4. Ceausescu's objective was to repay all of Romania's foreign debt, so he boosted agricultural exports. As a result, the daily per capita calorie intake fell from 3259 in 1980 to 2930 in 1988 (Frausum, Gehmann, Gross 1).

5. Iliescu won the 1990 elections with more than 85% of the popular vote (Stoica 23). He was reelected both in 1992 and 2000, which confirms his long-lasting popularity among many Romanians.

6. See Romania's Constitution from 1991, <http://www.constitutie.ro/const1991.htm>

7. An extreme form of purging took place in Iraq after the fall of Saddam Hussein, which created more instability and undermined democracy. For a comprehensive analysis of this process, see Larry Diamond, *Squandered Victory*.

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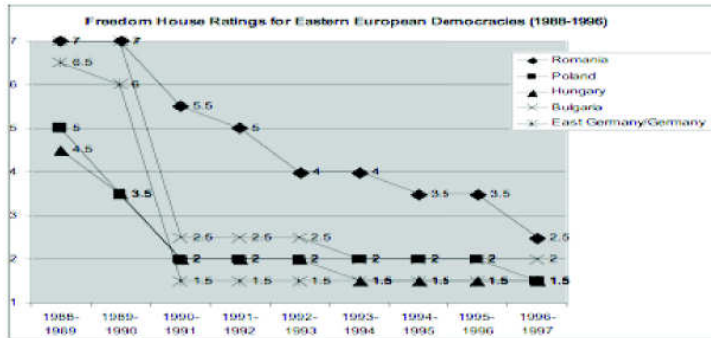


Fig. 1: Freedom House scores for new democracies in Eastern Europe (1988-1997)

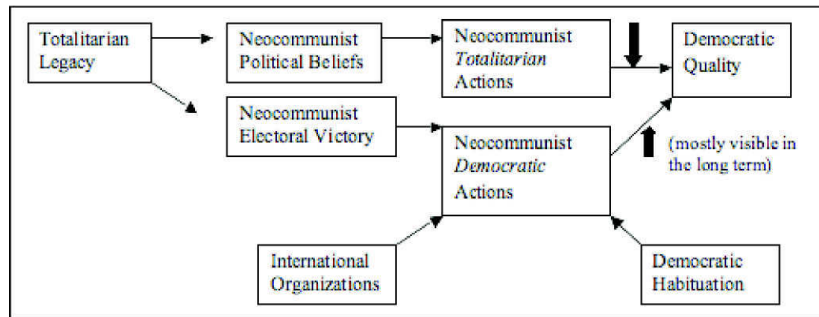


Fig. 2: Romanian democratic quality in transition



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## Patenting and the Varying Enforcement of Covenants Not to Compete: A Comparative Analysis of Silicon Valley and Route 128

Jon Casto, Stanford University

Within Silicon Valley's external economies of scale, skilled employees move rapidly between competing firms. Literature attributes this dynamic to the entrepreneurial culture that took root in Silicon Valley in the 1950's, beginning with the "Grandfather" of Silicon Valley, Fairchild Semiconductor. Recently, scholars are paying attention to the role the enforcement of covenants not to compete play in dictating employee mobility within external economies of scale – and subsequently culture. For instance, in Massachusetts, employers can invoke covenants not to compete to reduce employee mobility and the associated costs that firms bear through employee flight. Conversely, under California law, such covenants are effectively impossible to enforce.

Defying the conventional wisdom behind intellectual property regimes, Silicon Valley's success is an intriguing instance in which limiting a firm's control over its human capital and subsequent intellectual property may ultimately encourage innovative activity. The paper seeks to discern a relationship between varying enforcement of non-competes and patenting, predicting a negative relationship in which invalidated covenants not to compete result in higher patenting rates. Ultimately, the data analyzed is congruent with this prediction, but because of the limited scope of the statistical analysis, the results cannot conclusively discern the nature of the relationship or the degree of true innovation versus patenting.

"Except as provided in this chapter, every contract by which anyone is restrained from engaging in a lawful profession, trade, or business of any kind is to that extent void."

California Business and Professions Code Statute 16600

"To this day, a poster of the Fairchild [Semiconductor] family tree, showing the corporate genealogy of the scores of Fairchild spin offs, hangs on the walls of many Silicon Valley firms. This picture has come to symbolize the complex mix of social solidarity and individualistic competition that emerged in the Valley. The tree traces the common ancestry of the regions semiconductor industry... The importance of these overlapping, quasi-familial ties is reflected in continuing references, more than three decades later, to the 'fathers' (or 'grandfathers') of Silicon Valley and their offspring, the 'Fairchildren.'"

AnnaLee Saxenian, Regional Advantage: Culture and Competition in Silicon Valley and Route 128

History demonstrates that the numerous factors determining which paths

former employees through covenants not to compete has led to a high degree of new firm creation relative to firm creation under strictly enforced covenants.<sup>2</sup> The importance of Silicon Valley's laidback, job-hopping culture should certainly not be discounted, but it ought not necessarily be attributed to chance considering it is likely a product of Statute 16600. Stanford Law Professor Ronald Gilson notes,

"Coupled with the limited usefulness of trade secret law in California as elsewhere, Silicon Valley employers' early efforts to prevent employees leaving to compete with employers' proprietary tacit knowledge failed. Employees learned that they could leave; employers learned that they could not prevent high velocity employment and the resulting knowledge spillover. And that legal infrastructure caused employers, however reluctantly, to adopt a different strategy, one of cooperation and competition..."<sup>3</sup>

technologically innovative industrial clusters follow often fall into place serendipitously. Paul Krugman notes, "given a slightly different sequence of events, Silicon Valley might have been in Los Angeles, Massachusetts, or even Oxfordshire."<sup>4</sup> Not surprisingly, advantageous circumstances rather than carefully premeditated policy can determine the success of innovative activity despite the importance society places on the institutionalized intellectual property (IP) regimes, which are credited for delivering incredible prosperity. By better grasping the different forces at play in the differing contexts in which technology clusters arise, policymakers can better understand the role fundamental IP regimes play, specifically patenting.

Can the above California Statue enacted in 1872, nullifying covenants not to compete between employees and employers, explain the industry churn that distinguishes Silicon Valley in the 21<sup>st</sup> century from the more institutionally rigid Route 128 cluster in Boston? Or rather, are less tangible cultural forces responsible for Silicon Valley's dynamism with their resulting "overlapping, quasi-familial ties" that Saxenian details above? Evidence shows that the relative inability of firms to limit knowledge spillovers by

Alone, cultural explanations are incomplete accounts of economic institutions' characteristics. The tremendous success of Silicon Valley's more entrepreneurial culture and norms should theoretically provide a model for Route 128 to emulate. The later decades of the 20<sup>th</sup> century provided sufficient time for Route 128 to evolve after the risk and rewards of entrepreneurship were legitimized by the likes of Steve Jobs with Apple and Robert Noyce with Fairchild and Intel. Too much revenue is at stake not to adapt! The varying enforcement of covenants not to compete may provide greater insight into the concrete differences that distinguish Route 128 and Silicon Valley.

Defying the conventional wisdom behind intellectual property regimes, this phenomenon is intriguing because it demonstrates in Silicon Valley's success an instance in which limiting a firm's control over its intellectual (human) capital and subsequent intellectual property may ultimately encourage innovative activity. Moreover, the positive externalities associated with agglomeration appear to outweigh the potential dangers of invalid covenants, evidenced by the lack of R&D flight away from Silicon Valley.

The current scholarship analyzing

the varying enforcement of covenants not to compete is understandably occupied with better understanding a relationship between employee mobility and the degree of enforcement, the necessary causal link lending any significance to the issue of patenting. Questions still loom about the nature of the link, specifically under what other conditions it manifests itself. For instance, Fallick, et al. find an effect in certain California industrial clusters but not statewide despite the universality of Statute 1660 in California.<sup>4</sup> The founding of Fairchild Semiconductor dramatically illustrates the importance of understanding the implications surrounding covenants not to compete, because those that begat Fairchild Semiconductor and its offspring (continuing the genealogical analogy) were infamously labeled the “Traitorous Eight” when they left the Shockly Transistor Corporation in 1957.<sup>5</sup>

This paper is concerned not with exploring questions surrounding the causal effect of covenants not to compete on employee mobility rates within a geographic region<sup>6</sup> but rather the impact varying enforcement of covenants has on patenting and IP protection. Do firms patent more without the aid of covenants not to compete? More importantly – and beyond the scope of this paper to conclusively answer – does an effect on patenting indicate increased innovative activity or rather represent increasingly defensive strategies under greater openness, employee flight, and inter-firm dependence?

If weak covenants in fact increase patenting rates, two very different policy implications arise. First, lower quality patents may unnecessarily flood the patent system in the absence of enforceable covenants, empowering “patent trolls” and granting greater monopoly power to firms than is intended by the underlying philosophy of the patent system. Second, if patents can maintain firms’ incentives to innovate despite the absence of covenants not to compete, then policy makers might consider eliminating such covenants all together to capture the associated positive externalities from increased innovation, arising out of higher employee mobility and the subsequent “cross-pollination” among firms.

### Hypothesis and Theory

This paper hypothesizes that high-technology industrial clusters (i.e. Silicon Valley, Route 128) in states that weakly enforce covenants not to compete will experience higher patenting rates per capita than high-technology industrial clusters in states where such covenants are strictly enforced. Without the legal infrastructure to enforce covenants not to compete and the subsequent employee mobility, technology clusters will be characterized by increased patenting at established firms to hedge against the increased risk of losing intellectual property to competitors and new rivals. Moreover, fledgling start-ups with only a patent portfolio to defend themselves in the competitive marketplace will be more numerous under greater employee mobility. In juxtaposition to the defensive patenting hypothesis, increased patenting rates may be a product of forced cooperation and its resulting innovative activity.

In testing this hypothesis, Massachusetts and California law will serve as the independent variables. In court, the interpretation of Massachusetts’ legal code always upholds covenants not to compete. In ten decisions on preliminary injunctions to enforce covenants not to compete between February 1994 and July 1996, injunctions were granted in eight.<sup>7</sup> California’s adoption of English common law, like Massachusetts, in 1850 did not set similar precedents. California courts consistently interpret Statute 166000 literally, nullifying covenants not to compete. Clearly, no endogeneity issues complicate the use California and Massachusetts law as the independent variable, bearing in mind that the pertinent legal codes and precedents were established well before the Silicon Valley and Route 128 technology clusters were ever conceivable.

Per capita utility patenting ratios from 1995-1999 in Boston’s Route 128 metropolitan area (Boston-Worcester-Lawrence-Lowell-Brockton, MA-NH NECMA) and California’s Silicon Valley metropolitan area (San Jose, CA PMSA; San Francisco, CA PMSA; Oakland, CA PMSA and Santa Cruz-Watsonville, CA PMSA) derived from United States Patent Office (USPTO) and United States Census

Bureau data serve as the dependent variable. The dependent variable is consistent with Saxenian’s geographic boundaries of both Silicon Valley and Route 128.<sup>8</sup> Lastly, in addition to patenting rates for all utility patents, this study examines patenting ratios in the top fourteen biotech patent classes because of the particular insight the biotech industry can provide.

Before delving into the strengths and weaknesses of the data, it is important to understand the logic that underpins this paper’s hypothesis as well as the significance in comparing per capita utility patenting ratios – and biotech patenting ratios – between Silicon Valley and Route 128.

Sophisticated regression analysis beyond the scope of this paper is needed to conclusively answer many of the questions surrounding a connection between the enforcement of covenants not to compete and patenting, taking into account factors like firm or industry specific employee turnover rates over time and how different size firms patent. In light of these constraints, this paper’s analysis rests on the complimentary arguments of several scholars, notably AnnaLee Saxenian, Ronald J. Gilson, and Olav Sorenson. It is imperative that their arguments are compelling in order to empower this paper to figuratively connect the dots rather than literally.

In her book *Regional Advantage: Culture and Competition in Silicon Valley and Route 128*, Saxenian offers an extensive comparison of Silicon Valley and Route 128, arguing that Silicon Valley’s high degree of employee mobility and firm specialization – derived from the region’s unique cultural norms – is responsible for Silicon Valley’s relative success in contrast to Route 128’s vertically integrated paradigm. Furthermore, in a key article, Stanford Law Professor Gilson explicitly roots Saxenian’s Silicon Valley culture to the lack of enforcement of covenants not to compete and distinguishes Route 128’s agglomeration economy against Silicon Valley’s “second stage” agglomeration economy, which can more easily reset its innovation cycle.<sup>9</sup> And finally, Fallick, Fleischman, Rebitzky, and Sorenson corroborate Gilson’s hypothesizing with economic analysis, finding that a lack

of covenant not to compete enforcement results in greater employee mobility in information technology (IT) clusters and higher rates of new venture formation, respectively.<sup>10</sup>

Though not widely accredited with influencing Silicon Valley’s and Route 128’s development like universities, venture capitalists and defense spending are, the legal infrastructure dictating covenants not to compete can logically play a tremendous role how these industrial clusters develop by virtue of their external economies of scale – with their pooled skilled labor – in addition to their industries’ high dependence on IP, and implicitly, their skilled workforce. It is completely rational for firms to be concerned what their employees do with their tacit knowledge – hence the existence of covenants not to compete to begin with. Founders of successful, disruptive new ventures are not born with insight into markets and new technologies. Therefore, it is valid to consider how firms react in light of loosing control over their most valuable asset, their human capital. In the same vein, patenting seems like a logical reactionary measure under increased employee mobility, competition, and firm interdependence. To the extent that it can, this paper’s data analysis confirms higher per-capita patenting rates for both utility and biotech patents in Silicon Valley than Route 128.

### An Ideal Natural Experiment

Silicon Valley and Route 128 provide an attractive natural experiment, serendipitously borne out of an 1872 California Statute, to test this paper’s hypothesis. Together, both are leading technology R&D external economies of scale supported by prominent research universities and venture capital firms. Each cluster’s legal code, however, has taken a divergent approach regarding the efficacy of covenants not to compete, allowing academics to better discern the implications of such covenants.<sup>11</sup> California all but abolishes covenants not to compete while Massachusetts vigorously defends employers’ trade secrets.

Adding to Gilson’s and Saxenian’s comparison of Route 128 and Silicon Valley, this paper’s analysis of biotech patenting ratios in Route 128 and Silicon Valley offers

new insight into the impact covenants not to compete have on patenting. The origins of the biotechnology industry are independent of the founding of Silicon Valley and Route 128, which is not true for those regions’ core IT industries. World War II and early Cold War spending can account for much of the IT industry’s growth – and subsequent institutional dynamics – in the critical decades of the 1950s and 1960s.<sup>12</sup> The modern biotechnology industry in the San Francisco Bay Area, compared to the IT industry, has more organic roots in the 1973 work of UCSF Chemist Herb Boyer, Stanford geneticist Stanley Cohen and Stanford biochemist Paul Berg who isolated many of the genetic engineering methods used in the biotechnology industry.<sup>13</sup> In an anecdotal example of different industrial origins, Genentech launched its first product Protropin growth hormone for children with growth hormone deficiency in 1983 whereas a young Fairchild Semiconductor’s sales were predominantly to the military.<sup>14</sup>

Along similar lines, Saxenian’s all-important Silicon Valley IT culture does not necessarily need to penetrate the biotechnology industry, which developed independently of the IT industry within the region’s universities. Genentech and its peers fit nowhere in the incestuous Fairchild Semiconductor family tree. Despite the highly technical nature of their work, biochemists and electrical engineers have little utility in interweaving networks and frequenting the same Mountain View haunts

to collaborate. Sorenson, et al. corroborates biotech’s significance, “Notably, urban areas in states that repudiate non-compete covenants appear to experience much higher rates of new venture formation in the biotechnology sector than do states that permit employers to enforce these contractual provisions.”<sup>15</sup> In understanding Silicon Valley biotechnology firms’ higher patenting rates and greater employee mobility, one should look beyond culture for greater insight.

### Data Analysis Methodologies

This paper’s data analysis is broken into two parts. The first half conducts a chi-squared goodness-of-fit test for the different biotechnology patent class distributions – in absolute and relative terms – in 1995, 1999 and 1995-1999 between Silicon Valley and Route 128. The test is conducted in relative terms (biotech patents/1000 utility patents in a time period) as well as in absolute terms so that trends in overall patenting do not skew either region’s biotechnology patent distribution, resulting in seemingly incompatible distributions. The chi-squared test ensures that this paper is correctly comparing two similar patent distributions. One of the strengths in looking at biotechnology patents is the greater degree of coherency between the top biotechnology patent classes in each region than the top IT patent classes.<sup>16</sup> The chi-squared test was limited, however, by the small sample size: two observed values for

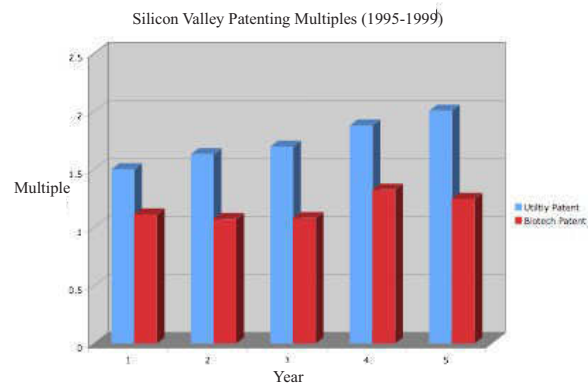


Figure 1a

each patent class in each time period (one for Silicon Valley and one for Route 128). Furthermore, the expected distribution with which the observed distribution was compared was an average of the two, not a distribution rooted in theory or a greater sample size.

The final stage of the data analysis combines metropolitan area USPTO patent data cross tabulated by patent class and year (1995-1999) with U.S. Census Bureau populations estimates from the Route 128 and Silicon Valley metropolitan areas to derive per capita patent ratios. After summing population estimates, patent statistics and per capita patent ratios, the analysis ultimately calculates an average patenting multiple for Silicon Valley relative to Route 128, communicating how many more times per capita Silicon Valley patented than Route 128 in biotechnology and total utility patents.

**Results**

Of the data analysis results above, the most significant are in Figure 1B and Figure 1C. In those figures, one finds that the Silicon Valley average per capita utility patenting multiple to be 1.77, meaning that over the 1995-1999 period, Silicon Valley patented on average 77% more per capita than Route 128! Furthermore, the Silicon Valley average per capita biotech patenting multiple over the 1995-1999 period was significantly smaller at 1.19. Nevertheless, this multiple's importance is great. Both numbers bode well for this paper's hypothesis.

There are two reasons the smaller 1.19 biotech multiple bodes well for the hypothesis that predicts increased patenting under nullified covenant not to compete regimes, despite the muted effect in comparison to the 1.77 multiple associated with total utility patenting. First, the biotech industry is a greater test of the effect varying enforcement of covenants not to compete has on patenting. The 1.19 multiple demonstrates that higher patenting ratios extend beyond Silicon Valley's traditional IT cultural sphere. Second, and most importantly, Boston's share of biotech patenting is proportionally much greater than that of Silicon Valley's; 29% of all Route 128 patents in 1995-1999 were in these top fourteen biotech classes

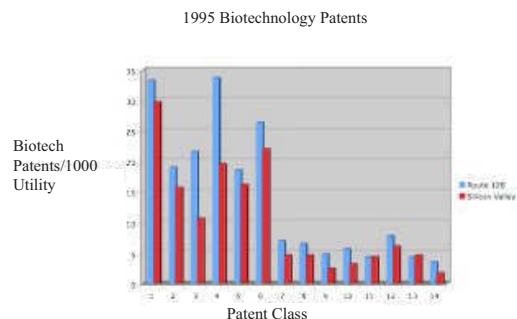


Figure 2a  $\chi^2 = 5.80614071$

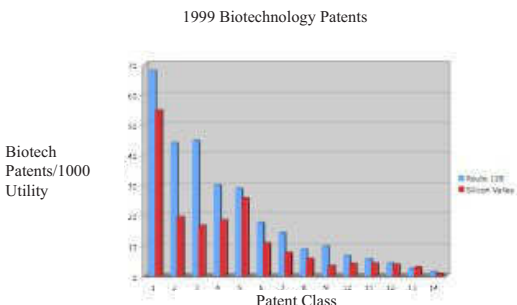


Figure 2b  $\chi^2 = 17.59619984$

compared to 18% of Silicon Valley's in the same time period.<sup>17</sup> Therefore, a Silicon Valley multiple in favor of the hypothesis' prediction demonstrates a clear incidence of greater patenting in light of similarly distributed patent classes and the relative importance of biotech in Route 128's overall patenting.<sup>18</sup>

How can one be sure that this increased patenting is a result of nullified covenants not to compete? This data analysis cannot conclude definitively – as a sophisticated regression analysis might – that higher patenting rates are in fact a result of nullified covenant not to compete enforcement in Silicon Valley. Furthermore, what if the proportion of Silicon Valley's population employed in R&D is precisely 77% greater than the proportion of the population employed in R&D in Route 128, or even more? Then patenting per

capita is effectively the same! This paper's analysis is based on the assumption that population is a rough but appropriate proxy for those employed in innovative activity in the Route 128 and Silicon Valley high-technology clusters.

Again, this is where standing on the shoulders of other scholars becomes imperative. Saxenian stresses the importance Silicon Valley's unique institutional culture of cooperation, specialization and high employee mobility has had in capitalizing on unprecedented external economies of scale. Furthermore, Gilson RJ; Sorenson O, Stuart TE and Fallick B, Fleischman CA, Rebitzer JB offer legal as well as economic analysis linking the distinctive dynamics Saxenian highlights to the nullification of covenants not to compete in California. By treating firms and entrepreneurs as rational actors,

this paper expects that both established firms and new entrants would patent more under increased employee mobility than under less because of new vulnerabilities and opportunities created.

**Conclusion**

Assuming that the nullification of covenants not to compete does increase the incidence of patenting, policymakers are still unable to confidently chart a course of action. Several unknowns remain. Is patenting a result of new firm creation or a purely defensive – rather than innovative – measure? Silicon Valley's success implies the former. Moreover, nullifying covenants not to compete does not guarantee greater innovation even if a relationship does exist while potentially undermining other

facets of the economy. The proper external economies of scale exemplified by the biotech and IT industries need to be in place for high employment mobility to generate worthwhile returns.

Based solely upon the data analysis, this study cannot determine conclusively that the nullification of covenants not to compete in California leads to higher patenting rates in Silicon Valley than in Route 128. Nonetheless, this data in conjunction with causal effects scholars of agglomeration economies detail presents an outcome that is consistent with the paper's logic and offers no reason to reject the hypothesis. The need for greater detail in the analysis, not counterevidence, prohibits this paper from conclusively discerning the nature of a relationship.

**Notes**

1. Krugman P p. 415
2. Sorenson O, Stuart TE, p. 15
3. Gilson RJ, p. 43
4. Fallick B, Fleischman CA, Rebitzer JB, p. 20
5. Saxenian AL, p. 25
6. Numerous academics have examined this link (Fallick B, Fleischman CA, Rebitzer JB, November 2005; Fleming L, December 2005; Gilson RJ, 1999)
7. Gilson RJ, p. 39
8. Saxenian AL, p. xi
9. Gilson RJ, 1999
10. Fallick B, Fleischman CA, Rebitzer JB, p. 20; Sorenson O, p. 32
11. Gilson RJ, 1999; Fleming L, December 2005; Saxenian AL, 1994 all use Silicon Valley and Route 128 in examining covenants not to compete.
12. Saxenian AL, p. 17
13. [http://www.baybio.org/wt/home/Industry\\_Statistics](http://www.baybio.org/wt/home/Industry_Statistics)
14. Saxenian AL, p. 27
15. Sorenson O, Stuart TE, p. 32
16. The top fourteen biotechnology patent classes for Silicon Valley are the same top fourteen biotechnology

**Figures and Tables**

| Silicon Valley Utility Patenting Multiple |             |             |             |             |             |
|---|-------------|-------------|-------------|-------------|-------------|
| 1995                                      | 1996        | 1997        | 1998        | 1999        | Average     |
| 1.500436369                               | 1.630145897 | 1.694480938 | 1.876708235 | 2.003442084 | 1.774368376 |

Fig. 1B

| Silicon Valley Biotech Patenting Multiple |             |             |             |             |             |
|---|-------------|-------------|-------------|-------------|-------------|
| 1995                                      | 1996        | 1997        | 1998        | 1999        | Average     |
| 1.11104049                                | 1.071255067 | 1.079603241 | 1.323732215 | 1.245783287 | 1.189895106 |

Fig. 1C

|   | 1995        | 1999        | 1995-1999   |
|---|-------------|-------------|-------------|
| Absolute Patent # Distribution                    | 16.64161987 | 86.01068487 | 192.7043752 |
| Relative Patent # (per 1000 Utility) Distribution | 5.80614071  | 17.59619984 | 11.39934355 |

Fig. 3. Chi Squared Critical Value for (p=.05, df=13) = 22.36

patent classes for Route 128. (Casto J, Appendix A, December 2006)  
 17. Appendix A  
 18. All three biotech patent (per 1000 utility patents) distributions of the top fourteen biotech classes passed the chi-squared goodness-of-fit test at the 5% level. (Casto J, Appendix A, December 2006)

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Appendix A: Biotechnology and Total Utility Patenting Rates (1995-1999) in Silicon Valley and Route 128

Fleming L, Marx M. Small Worlds and Innovation. Working Paper, Harvard Business School August 2004.

Fleming L. Non-Competes and Regional Inventor Mobility. Working Paper, Harvard Business School December 2005.

Rubin PH, Shedd P. Human Capital and Covenants Not to Compete. *The Journal of Legal Studies* January 1981; 10.

United States Census Bureau: Metropolitan Population Estimates. URL: <http://www.census.gov/popest/archives/1990s/MA-99-03a.txt>

United States Patent Office: Information Products Division URL: <http://www.uspto.gov/web/offices/sci/oeip/taf/mclsstcmregions.htm>



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Jon will spend the summer after graduation in the outskirts of Delhi, India working on a social entrepreneurship project, aiming to empower rural Indians by creating greater employment opportunities through information communication technologies. Come September, Jon will find himself asking: Now what? He is open to any and all suggestions.

## Ethnic Inequality and Civil War

Jonathan Phua, Stanford University

A growing literature in Political Science focuses on the relationship between ethnic economic inequality and civil war onset. Estimating the impact of ethnic inequality on civil war onset is difficult because of measurement error and lack of cross-national data. Existing studies are inconclusive and highly limited due to selection bias. Small sample sizes have significantly constrained the power of statistical tests. We use an original dataset spanning 515 ethnic groups in 99 countries to test the impact of ethnic inequality on civil war onset. We find ethnic inequality is positively related to civil war onset. However, contrary to conventional wisdom, this relationship is weak and is mitigated by other more influential factors like group size and political power.

Conventional wisdom suggests ethnic inequality predicts civil war onset. Stewart suggests that when individual self-esteem is bound up with ethnic identity, ethnic inequality produces grievances that lead to mobilization and civil war<sup>1</sup>. However, recent cross-national studies have been inconclusive due to methodological problems<sup>2</sup> (Fearon J & Laitin D, working paper presented at APSA 1999). Although case studies suggest ethnic inequality increases rebellion by disadvantaged groups, they are not generalizable and suffer from selection bias<sup>3,4</sup>.

This paper will conduct a large-sample study of cross-national ethnic inequality. First, we review the challenges in testing the impact of ethnic inequality on civil war. Next, we attempt to overcome these challenges through a large-N statistical analysis of ethnic inequality and civil war onset. We draw on an original dataset comprising surveys conducted by the Demographic and Health Surveys (DHS) group and research conducted by Laitin, Fearon, Kasara and myself. Finally, we examine the case of the Hutu in Rwanda in order to illustrate other variables that interfere with the impact of ethnic inequality on civil war. Our results suggest that economic disadvantages weakly predict for ethnic rebellion. However, other factors like political power and group size strongly affect observed outcomes.

### Theoretical Review

Political scientists have proposed both rationalist and relative deprivation explanations for civil wars (Sambanis N, presented at Brookings Institution Trade Forum 2004). Rationalist theories argue civil war is likely in states with conditions conducive to rebel organization, such as low income per capita, economic growth

or mountainous terrain<sup>5,6</sup>. These conditions either decrease rebellion's opportunity cost or decrease the capacity of the state, facilitating the mobilization of an insurgent movement. Relative deprivation theories argue that civil wars occur when a sub-state group becomes sufficiently aggrieved to mobilize for political change.

The available evidence supports rationalist explanations for civil war (Sambanis N, presented at Brookings Institution Trade Forum 2004). However, a growing body of literature focuses on ethnic inequality, a type of relative deprivation. Stewart argues that the intersection of economic inequality and cultural differences makes culture a powerful organizing force<sup>1</sup>. Klugman notes that without economic inequality, group identity is likely to be weak<sup>7</sup>. But group inequality may have an impact on individual welfare, deepening grievances. Where the group responsible for inequality has a monopoly on political power, the aggrieved group may seek change through violence.

Empirical tests on this relationship are inconclusive and sparse. Although econometric analysis by Gurr and Moore suggests ethnic inequality increases the probability of civil war, their analysis is purely based on published reports, without rigorous empirical foundation<sup>8</sup>. Using the same data as Gurr and Moore, Fearon and Laitin find no relationship between inequality and civil war, citing both multicollinearity and measurement error (working paper presented at APSA 1999).

Why so few cross-national studies? Humphreys notes inequality data is unavailable for many countries (Harvard Portal on Economics and Conflict, 2002). Our research suggests these countries have vested interests in preventing data-collection. For example, Lebanon's 1926

Constitution allocates government offices using the size of each religious sect. The Lebanese government has had a powerful disincentive against collecting data that could shift this balance of power<sup>9</sup>. Further, these countries are often undergoing political instability that impedes data collection. If data is unavailable for countries suffering precursors to civil war, our tests will suggest the relationship between ethnic inequality and civil conflict is weaker than it is (Humphreys M, Harvard Portal on Economics and Conflict, 2002).

Another reason for the lack of cross-national studies is measurement error. Many countries face problems operationalizing definitions of their major ethnic groups. For example, heterogeneous ethnic characteristics of Mestizos in Mexico make it hard to distinguish between Mestizos, Whites and Indigenous Peoples based on language or region. This makes it difficult to construct good estimates of ethnic inequality with data. Further, large-N cross-national comparisons are based on household surveys that vary in quality, reducing the likelihood that relationships between variables will be found<sup>10</sup>. Stewart and Klugman have proposed broader definitions of ethnic inequality that include political, economic and socio-cultural differences<sup>1,7</sup>. However, it is unclear if a variable will be sensitive to so wide an array of values or if it can be constructed at all.

### Ethnic Inequality and Civil War

Surveys administered by the Demographic and Health Surveys (DHS) group provide a way around these problems. Using factor analysis, they assign individual wealth scores derived from responses to asset-ownership questions. This wealth score cannot be used cross-nationally as it is an ordinal ranking, not a cardinal value. We match individuals to their ethnic groups according to language or religion, following rules developed by Kasara (Kasara K, unpublished research, 2005) and based on a list of ethnic groups developed by Fearon<sup>10</sup>. We then compute the quintile of each individual's wealth score and aggregate by ethnic group, to find each group's mean wealth quintile on a scale of 1 to 5. This procedure creates a sample of 216 ethnic groups across 31 countries, enumerated by the *ethnic group*.

Next, we augment our DHS

quintiles with data on ethnic inequality drawn from Global Barometer Surveys, censuses and published research. Unlike the DHS data, this collection is presented across different measures, including per capita income, mean years of education, poverty incidence, and socio-economic group. We reduce concerns about data quality and cross-indicator comparisons by transforming all the data, including DHS data, into a dummy variable (*adv*) that takes the value of 1 if an ethnic group is advantaged compared to the country-mean in the best available indicator, and 0 otherwise<sup>11</sup>. Our sample increases to 515 ethnic groups in 97 countries. For our dependent variable, we use the Minorities At Risk (MAR) dataset, which assigns a score ranging from 0 (no rebellion) to 7 (protracted civil war) to each ethnic group for each five-year period from 1945 to 1998 based on published reports. We take the highest value across this period and code it as the maximum rebellion score (*maxreb*). We transform *maxreb* into a dummy variable (*rebmean*) by pooling observations in the upper four and lower three *maxreb* scores to guard against misclassifications in the original rebellion coding due to lack of published reports at lower rebellion scores. An examination of cases indicates that scores of four and above fit our intuitive definition of "civil war", like the Afghan civil war or the Diola insurgency in the Casamance.

$$rebmean = \begin{cases} 1 & \text{if } maxreb \geq 4 \\ 0 & \text{if } maxreb \leq 3 \end{cases}$$

Finally, we add country-level and group-level variables from Fearon and Laitin (working paper presented at APSA 1999): GDP per capita in 1985 (*gdp85*), the proportion of a country an ethnic group comprises (*gpro*) and log of country population (*lnpop*). Descriptive statistics for the variables are shown in Table I.

Disadvantaged groups in our sample are engaged in rebellion at almost twice the rate of advantaged groups. *adv* is negatively correlated with *rebmean* at -0.1346 (N=515). Plurality groups are involved in rebellion at half the rate of minority groups, raising the possibility that the question of rebellion does not apply to them because they hold political power. However, the relationship between *adv* and *rebmean* for plurality groups (corr=-0.1981, N=97) is three times as strong as

66

for minority groups (corr=-0.0648, N=418). Of the 12 plurality groups in our sample with positive *rebmean*, only 2 – Hutu-Twa in Rwanda and Shona in Zimbabwe – were politically dominant at the time of rebellion. This suggests that a similar causal mechanism applies to plurality groups as minority groups, and that we should retain them in our sample. A  $\chi^2$ -test of *adv* on *rebmean* for all groups finds a substantively and statistically significant relationship between economic disadvantages and civil conflict (see Table II).

We illustrate this relationship by graphing the mean difference between the *maxreb* scores of advantaged and disadvantaged groups, by country. This index can take values from -7, if every disadvantaged group in the country is fighting a civil war and every advantaged group is not, to 7, if the reverse is true. The more negative the value, the stronger the correlation between economic disadvantage and civil war. If civil war onset were uncorrelated with economic status, we would expect a Normal distribution symmetric about 0 on the x-axis. The negative mean of all country means (mean = -0.57, N=99) indicates that disadvantaged groups tend to rebel more than advantaged groups. This mean rises to -1.1 (N=51) if we include only countries that have experienced civil war. Figure I highlights this relationship for all countries, Figure II illustrates the skew in the left-tail of the distribution of mean differences.

The left-skew of the distribution indicates that more disadvantaged than advantaged groups are involved in civil conflict. However, the distribution also suggests that the bivariate relationship is weak, as it approximates the superimposed Normal distribution. If the relationship were strong, we would expect a more skewed distribution.

We use Ordinary Least Squares regression to control for other variables that may impact the relationship between ethnic inequality and civil war. We use three models. The first uses *maxreb* and the second uses *rebmean* as the dependent variable. The third uses *rebmean* and omits plurality groups. We add country-dummies that take a value of 1 if an ethnic group is from a particular country and 0 otherwise. This specification controls for country and group-specific variables that affect the probability of civil war and lets us examine

the relationship between inequality and civil war at the country-level<sup>12</sup>. The results are shown in Table III.

Model [2] detects a substantive and significant country-specific relationship between ethnic inequality and civil war, controlling for group size, country size, and country wealth. This may be a better model than model [1], as it is robust to small misclassifications of civil conflicts in *maxreb*. However, the *adv* coefficient heavily depends on the relationship between economic disadvantage and civil war for plurality groups (see page 5). *adv* shrinks and loses significance when plurality groups are dropped in model [3]. *gpro*'s coefficient is negative as plurality groups, which are the largest ethnic groups, tend to be economically advantaged (see page 5) and economic advantages are negatively related to civil war onset. Confirming this observation, *gpro*'s coefficient changes sign when plurality groups are dropped in model [3]. Other variables behave as expected: *gdp85* and *lnpop* have negative coefficients, in line with research suggesting that country size and per capita income have positive and negative relationships with civil war onset, respectively<sup>13</sup>. On the whole, our results indicate a weak relationship between ethnic inequality and civil war. But it also suggests other significant factors like *gpro* have a significant impact on civil war onset. We look to the case of Rwanda to illustrate these other factors.

#### Other Factors Affecting Civil Wars: Group Size and Political Power

We study two events in Rwanda's history: the 1959 riots and the 1994 genocide. Prunier observes that mean Hutu and Tutsi family incomes were virtually equal by 1959 with rising numbers of wealthy Hutu and impoverished Tutsi<sup>14</sup>. The ratio of Hutu to Tutsi college enrollment improved from 1/5 to 1/2 between 1932 and 1959. The income of an average Tutsi household in the 1950s was BF 4439, slightly higher than that of a Hutu household at BF 4249. The largest gap was between both Hutu and Tutsi and the Twa, whose average household income was BF 1446. These statistics make it unlikely that ethnic inequality motivated Hutu participation in the 1959 riots.

The attribution of the 1994 genocide to Tutsi subjugation of the Hutus also does not fit economic facts. DHS data from 1992 suggests no significant

discrepancy between their living standards. Although the average Hutu had 3.22 years of education, while the average Tutsi had 5.21 years, 28% of Tutsi had water piped into their homes through a communal tap, while 22% of Hutu had piped water in their homes. In addition, the average Hutu lived 73 minutes from water, while the average Tutsi lived only slightly further - 86 minutes - away. It does not seem likely that ethnic inequality had a large role to play in either the 1959 riots or the 1994 genocide.

In fact, an inequality theory of civil war would predict a Twa rebellion in 1959 and 1994. The average income of a Twa family in 1959 was less than half that of a Hutu family. In 1992, a Twa lived 169 minutes from a water source and had less than 1 year of education. Yet the Twa, comprising less than 1% of Rwanda's population, remained acquiescent. This case supports our statistical model, suggesting the relationship between group size and civil war onset is stronger than the relationship between ethnic inequality and civil war.

We examine the relationship between ethnic inequality, group size, and civil war graphically by plotting the *rebmean* average at every value of *gpro*, for all disadvantaged groups (see Figure III). Although the relationship is not statistically significant, the graph's upward climb suggests at least some support for our observations above: group size does have an impact on the relationship between ethnic inequality and civil war.

Petersen's Resentment theory of ethnic conflict provides a third factor that influenced the 1959 riots: political power<sup>15</sup>. Resentment arises when a group believes it is in unwarranted subordination in a political ethnic hierarchy; the theory predicts it will target the group furthest up the hierarchy it can subordinate through violence. This fits the evidence in 1959 Rwanda. It explains the role of the Twa: smaller, less powerful groups will not use violence, as they know it is unlikely to change the established hierarchy. Tutsis were the politically dominant ethnic group and Hutus came next, hence Tutsis were the logical target of subordinate Hutus. The withdrawal of Belgian authority also predicts for more intense violence, while the clarity of the established ethnic hierarchy predicts violence rather than cooperation. Resentment theory's emphasis on political

power fits our statistical observations. Although political power is hard to statistically test, this case study suggests that economic inequality cannot outweigh the influence of political hierarchy.

#### Conclusion

Conventional wisdom suggests ethnic inequality affects the probability of civil war. A systematic investigation of the data confirms a weak relationship. Factors like group size and possibly political power have a greater impact on the onset of civil war. Further research should guard against problems in causation and examine ethnic inequality against other variables that may predict for civil war.

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| Figures and Tables                 | Mean     | Standard Deviation | N   |
|------------------------------------|----------|--------------------|-----|
| <b>I. Group characteristics</b>    |          |                    |     |
| Mean wealth quintile               | 3.13     | .64                | 216 |
| Plurality groups                   | 3.17     | .39                | 31  |
| Minority groups                    | 3.13     | .68                | 185 |
| Rebmean                            | .12      | .33                | 515 |
| Plurality groups                   | .07      | .26                | 97  |
| Minority groups                    | .13      | .33                | 418 |
| Advantaged groups                  | .08      | .28                | 232 |
| Disadvantaged groups               | .15      | .36                | 283 |
| Adv                                | .45      | .50                | 515 |
| Plurality groups                   | .63      | .49                | 97  |
| Minority groups                    | .41      | .49                | 418 |
| Gpro                               | .18      | .24                | 515 |
| Advantaged groups                  | .24      | .29                | 232 |
| Disadvantaged groups               | .17      | .24                | 283 |
| <b>II. Country Characteristics</b> |          |                    |     |
| GDP per capita in 1985             | 3419.82  | 4251.21            | 444 |
| Population                         | 44935.71 | 127582             | 444 |

Table 1. Descriptive Statistics.

|          | adv    |        | Total  |
|----------|--------|--------|--------|
|          | Disadv | Adv    |        |
| No Rebel | 241    | 212    | 453    |
|          | 85.16  | 91.38  | 87.96  |
| Rebel    | 42     | 20     | 62     |
|          | 14.84  | 8.62   | 12.04  |
| Total    | 280    | 235    | 515    |
|          | 100.00 | 100.00 | 100.00 |

Table 2.  $\chi^2$  test of adv against rebmean. Pearson  $\chi^2(1) = 4.6582$  Pr = 0.031

|                 | [1]                 | [2]                     | [3]                     |
|-----------------|---------------------|-------------------------|-------------------------|
| Depvar          | <i>maxreb</i>       | <i>rebmean</i>          | <i>rebmean</i>          |
| <i>adv</i>      | -.27<br>(.19)       | -.05*<br>(.028)         | -.01<br>(.035)          |
| <i>gdp85</i>    | -.00014<br>(.00011) | -.000038**<br>(.000016) | -.000072**<br>(.000022) |
| <i>lnpop</i>    | .16<br>(.29)        | .06<br>(.044)           | .13**<br>(.063)         |
| <i>gpro</i>     | -.79*<br>(.43)      | -.14**<br>(.066)        | -.29<br>(.24)           |
| <i>constant</i> | 1.87<br>(2.81)      | -.048<br>(.44)          | -.42<br>(.61)           |
| N               | 444                 | 444                     | 364                     |

Table 3. OLS Regression Results. Country-dummy coefficients omitted. Standard errors in parentheses. \*p<0.10 \*\*p<0.05



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## The Genetic Engineering of America’s Farmland: Concerns regarding patentability and the use of intellectual property rights

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### An inducement to create

The extent of patent law’s reach has long been a subject of interpretation and debate. In authoring the 1793 Patent Act, Thomas Jefferson viewed the patent monopoly not as a natural right, but as “an inducement to bring forth new knowledge.”<sup>1</sup> Science, he believed, was the most certain way to further societal progress.

Over the years, courts have broadly interpreted the patent statute, granting ownership over innovations once ineligible for protection. As intended by the framers of the original Act, expansion of the scope of patentability has nurtured the development of scientific spheres like biotechnology, but it has also allowed companies to exert a historically unprecedented amount of control within their industries. In recent cases involving biotech giant Monsanto Corporation, U.S. courts have consistently supported Monsanto’s patents on genetically modified seeds, holding farmers liable for infringement beyond their control.

This raises two questions: first, is it ethical to assign monopoly over a living thing, especially one as fundamental as seed? And second, how far does that right extend? Perhaps there is a line, as Jefferson proposed, where we must separate legitimate protection from abuse.

### Public tradition becomes private practice

In millennia past, seed breeding was not an exact science. Farmers selected and crossed the best-adapted varieties, building upon previous knowledge through experimentation. The trend toward science-based solutions spread to the U.S. from Europe in the 18<sup>th</sup> century, and as the economy grew increasingly dependent upon agricultural exports, the need for production uniformity and higher yields moved seed breeding from farms to centralized public research centers like universities.<sup>2</sup> Today, however, particularly in lucrative areas like commercial crop breeding and biotechnological applications, private agricultural research has — and

continues to — displace public research. In 1995, private investment constituted more than half of the \$20 billion spent on agricultural R&D in the developed world.<sup>3</sup> The major catalyst for this change has been the extension of intellectual property rights to biotechnologies, which has made investments in such projects more lucrative and thus appealing to companies seeking to maximize profits.<sup>4</sup> Although universities still play a role in the research process, their sources of funding too have shifted from being almost entirely public, to largely private, in nature.

Although agricultural technologies like machinery and chemicals have always been protected under the Patent Act, similar patent protections had never been extended to plants on the basis that they were creations of nature, which are not patentable. In 1930, Congress passed the Plant Patent Act (PPA), which permits the patenting of plants, but only those that reproduce *asexually*.<sup>5</sup> Congress had aimed to limit the reach of PPA, but conceding in 1970 that sexually reproducing plants needed some form of protection as well, passed the Plant Variety Protection Act (PVPA), which grants owners an exclusive right to multiply and market varieties of the protected seed for 20 years.<sup>6</sup> Though similar in nature to utility patents (a generic patent category for inventions that perform useful functions), PVPA made two critical exceptions: scientists could use PVPA-protected varieties for research, and farmers would be able to save patented seed for the next harvest.

The biggest change came in 1980, when the U.S. Supreme Court ruled in *Diamond v. Chakrabarty* that a living microorganism could be patented under the utility patent criteria for regular inventions.<sup>7</sup> The U.S. Patent and Trademark Office (U.S. PTO) affirmed and extended this new rule in *Ex parte Hibberd* (1985), which concluded that all sexually reproducing plants were eligible for utility patent protection.<sup>8</sup> Following the ruling,

the U.S. PTO began accepting applications for utility patents on sexually reproducing plants, even though Congress had never authorized the agency to do so.<sup>9</sup> With these revolutionary reinterpretations of the law, biotechnology became a highly attractive and lucrative industry, almost overnight.

### Utility patents v. PVPA

Some university researchers believe that the encompassing of genetically engineered<sup>10</sup> (GE) plants within the meaning of 35 U.S.C. § 101 — the section of the Constitution that enumerates criteria for patentability — is a beneficial change, since it has enabled companies to recoup their research costs, which can easily reach into the tens of millions for the requisite lab research, field testing, maintenance research, and commercialization steps. Without the potential for financial returns, private firms would have no incentive to pursue expensive biotech projects.<sup>11</sup>

Farmers, lawyers and policymakers tend to be less enthusiastic about the changes regarding plant patentability because the statutory exemptions that exist under PVPA do not apply to utility patents. In other words, patent holders can legally exclude use of the patented variety, even for research or agricultural purposes. One of the most controversial outcomes has been the use of this restriction by biotech companies to bar farmers from farming their land in the traditional manner. In fact, Monsanto’s “Technology Use Agreement,” which farmers must sign in order to use Monsanto’s GE seed varieties, *prohibits* farmers from saving seed and replanting it the following season.<sup>12</sup> Instead, farmers must purchase a new supply each year, a highly inefficient practice given that the perfectly acceptable seed from the first crop goes to waste. Those who fail to comply with the agreement terms — whether out of ignorance, negligence or no fault of their own — face serious financial consequences. This controversial agreement has been the basis for Monsanto’s suits against numerous U.S. farmers.

Agricultural law expert Dr. Roger McEwen predicts that the new utility patent rulings on plants will accelerate the movement of germplasm<sup>13</sup> ownership from the public to the private domain.<sup>14</sup> Monsanto already owns 647 biotech plant patents — far more than anyone in the market<sup>15</sup> — and the industry-wide total is only poised

to increase as corporations move to patent any seed that proves economically viable. In addition, the ability of patent holders to exclude researchers from using their genetically engineered plants for research purposes unrelated to the industry's interests has become an impediment to innovation. The only entities able to conduct research using these patents are the collaborating universities which, guided by the desires of the industry, have accordingly shifted away from the production of new conventional seed varieties to focus more heavily on biotech. This aspect has made it exceedingly difficult for farmers across the country to obtain high quality conventional (genetically unmodified) seed.<sup>16</sup> If this trend continues, public research institutions will essentially become an extension of private interests, neglecting the desires of farmers and consumers.

#### Monsanto takes the stand

Although court decisions and legislation throughout the 1980s nurtured the profitable privatization of biotechnology, the real test of strength for GE seed patents came at the end of the 1990s, when Monsanto sued a Canadian farmer, Percy Schmeiser, for infringement of its Roundup Ready® (RR) canola patent.

Monsanto genetically engineers its crops to withstand exposure to Roundup®, the company's trade name for its broad-spectrum, glyphosate-based herbicide. In order to make RR crops resistant to the Roundup, a researcher must locate an enzyme — typically from another plant or bacteria — that is similar to the plant's existing enzymes yet insensitive to glyphosate. The researcher then identifies a location in the host pathway that can be perturbed without rejecting gene uptake and inserts the isolated glyphosate-resistant enzyme into the plant cell, "splicing" (sticking) it next to the original DNA.<sup>17</sup> The plant now possesses an extra metabolic gene that makes it resistant to Roundup, and when the farmer sprays against weeds, only this tolerant RR variety will survive. Apart from its programmed resistance, however, RR behaves and looks no different than a conventional plant.

During the 1990s, neighboring farms began to adopt Monsanto's GE canola, and even though Schmeiser, a veteran farmer, had never purchased the RR seeds, nor signed the requisite Technology

Use Agreement to grow them, tests by Monsanto revealed that 95 to 98 percent of Schmeiser's 1,000 acres of canola crop were undeniably of that strain.<sup>18</sup> Schmeiser speculated that forces of genetic drift had brought RR canola pollen from nearby farms or passing trucks that were transporting seed, leading to a build-up of RR traits in his harvest without his knowledge. He admitted that a portion of the canola grown in 1997 had appeared unusually resistant to Roundup, but he did not make much of this fact. Like many farmers, Schmeiser keeps with the tradition of preserving seed from one harvest to the next, and some of this seed was inevitably mixed up with his regular stock when planting time arrived.<sup>19</sup>

Opinions on Schmeiser's innocence in the case vary. Terry Zakreski, Schmeiser's lawyer, explained that Schmeiser's hired hand had harvested the crop, and when it came time to select the seed for planting, Schmeiser had grabbed whatever was in his truck. The fact that some of the seed might have come from an area where he had sprayed Roundup to test for presence of RR did not occur to him.<sup>20</sup> Others contend that Schmeiser was not as innocent as he purported to be. Roger McEowen, a professor of agricultural law concedes that in the cases brought by Monsanto the prosecuted farmers *did* knowingly infringe. "Monsanto," he said, "is cautious to pursue only those cases it is confident it can win."<sup>21</sup>

Schmeiser's fate was sealed once it had been established that he had not been an innocent infringer: the trial court had ruled that levels of RR canola on Schmeiser's field were statistically high enough to demonstrate that he "either knew or should have known" that RR had contaminated his crop. But what if Schmeiser *had* been innocent? The Canadian Supreme Court clarified that because intent is considered in this type of case, had evidence pointed towards Schmeiser's innocence, the verdict might have gone in the other direction.<sup>22</sup>

#### The innocent infringer

*Monsanto v. Schmeiser* (2004) laid down the important precedent that *mere factual presence* of transgenic matter does not in itself automatically constitute patent infringement, but this holding applies only in Canada. American courts have reached a contrary conclusion, established in the landmark *Monsanto v. Dawson* (2000)

case: the process by which the technology arrives on the farmer's land is irrelevant. Whether through genetic drift, as in *Schmeiser*, or through "mistaken planting," as in *Monsanto v. McFarling* (2002),<sup>23</sup> a farmer is liable *unless* he notifies Monsanto immediately about the presence of the crop. Written opinions for numerous other U.S. cases brought by Monsanto reflect the same view.

This standard is inherently unfair for several reasons. First, how can ownership be granted over something that is both mobile and transformative? In the 2002 case *Harvard College v. Canada*,<sup>24</sup> the Canadian Supreme Court resisted following the U.S.'s footsteps when it struck down a patent on a genetically engineered mouse.<sup>25</sup> If U.S. law accepts that plants are patentable subject matter, then is the *product* of that plant, the seed, also protected? Dr. McEowen argues that one must distinguish between the two, and he cites *Schmeiser* — in which the court had upheld the patent's validity on the grounds that the *genes in and process* for creating the plant were protected, not the plant itself — as the closest anyone has come to defining this distinction. Differentiating between plant and seed, he says, will be crucial to the future of agricultural litigation.<sup>26</sup>

Second, this rule places an affirmative duty on the landowner to report to the patent holder regarding an intrusion.<sup>27</sup> From the perspective of property law, this is completely backwards; a landowner has total rights over his property, and anyone who encroaches on that territory is disobeying the law. In the case of patent infringement, the opposite is true: the one who is encroached *upon* is punished. Policy analyst Bill Freese draws an appropriate analogy: "if a farmer owns cattle, he has the responsibility to keep it from roaming onto others' fields. That's pretty obvious; everyone would agree that it is the farmer's responsibility to others to watch over that cow. Yet, on the patents for biotech seed it is reversed."<sup>28</sup>

But how can a farmer be held responsible for something as arbitrary as genetic drift? One study attempting to quantify the level of gene flow between GM and non-GM sources indicates that this is a complex process dependent on a number of different factors and cannot yet be accurately predicted by experiments. What is known is that cross-pollination

can occur at a considerable distance.<sup>29</sup> Therefore, one is presented with a scenario where the chance of contamination is likely, but there are no statistical measures through which farmers may predict to what extent or *where* this may occur. Should every farmer in every location remotely near a field using GMOs be expected to test his field for RR? Monsanto's solutions to the problems posed by the uncontrollable spread of its technology are woefully inadequate.

Ironically, Monsanto has been claiming injury where, in fact, it is the farmers who are most hurt by the appearance of GE crops in their fields. For organic farmers, the presence of RR seed literally contaminates their entire crop, making it unmarketable. The key issue is therefore one of duty. With ownership comes responsibility, and as owner of these patents, Monsanto should be liable for containing its proprietary technology. Conversely, the duty to uphold patent rights on a GM seed through the meticulous monitoring of one's field places an *undue burden* on the farmer. This is especially true because the only way for a farmer to tell if a genetically modified organism (GMO) has invaded his field is to spray Roundup, which will kill his entire conventional crop.<sup>30</sup> Either way, it seems, the farmer stands to lose.

In litigation against farmers, Monsanto also leverages its Technology Use Agreement, a contract that binds farmers to Monsanto's oversight and mandates a per-acreage-planted fee. The biggest issue seems to be that farmers are not fully informed of their obligations. Often the distributor — the person selling the seed to the farmers — fails to adequately explain the terms of the agreement to the farmer, or simply forgets to bring the contract at all. He makes a sale and, realizing he must still submit a signed contract to Monsanto, forges the farmer's signature after the fact.<sup>31</sup> Regardless of the circumstances, farmers are held financially liable, and if found in breach of contract, some have no choice but to claim bankruptcy. In addition, the agreement also requires that all litigation take place at one of two Missouri courts located in Monsanto's hometown. Needless to say, this puts farmers at an even greater disadvantage.<sup>32</sup>

#### Has genetic engineering delivered?

Proponents of biotechnology

repeatedly claim that commercialization of herbicide-resistant crops has led to a reduction in agricultural herbicide use. However, many opponents argue that these allegations are unfounded and misleading. According to policy analyst Bill Freese, the industry relies on data from the 1990s when there was a slight reduction in herbicide use, whereas now — having developed immunity to glyphosate — new "super weeds" are requiring that farmers use ever-increasing amounts of herbicide to achieve similar results. A study by Charles Benbrook, former head of the Board of Agriculture at the National Academy of Sciences, confirms just this: herbicide use across the herbicide-tolerant varieties of corn, soybean and cotton decreased in the first two to five years of commercial use, but has risen *every year since* for a total increase of 138 million pounds (5 percent) in the nine-year period between 1996 and 2005.<sup>33</sup> This trend carries implications not only for farmers — who now have to make a larger financial investment in growing their crops — but also for consumers and the environment.

The increasing tolerance of weeds has also tied farmers to Monsanto against their will. Rodney Nelson, a North Dakota farmer sued by Monsanto,<sup>34</sup> had switched to growing conventional soybeans for the Japanese market, but RR crops had so heavily saturated the market that other companies hesitated to invest money in new herbicides, leaving the Nelsons with no alternative but to return to RR soybeans. At this point, Roundup was the only chemical capable of exterminating the super herbicide-resistant weeds that had spawned in the area.<sup>35</sup> By tying the functionality of the herbicide to the GM crop, Monsanto has effectively transferred the need for a strong herbicide to seed purchases, keeping consumers addicted to its products in a very underhanded way.

#### Conclusions and the road ahead

By 2004 Monsanto had filed 90 lawsuits against 147 American farmers and 39 small businesses or farms, earning in excess of \$15 million.<sup>36</sup> Nonetheless, seed physiologist Kent Bradford believes that Monsanto does not care about the money it wins from these judgments; what it wants is for farmers to stop using its proprietary technology. In addition, the number of lawsuits brought by Monsanto is quite

trivial when considering the total size of the U.S. agricultural market that uses RR products and the fact that, in many of the cases, farmers were not even required to pay damages because they did not profit from the presence of the RR crops.

The true problem, however, is not a financial one, but a legal one and an ethical one. The issue here is that Monsanto is using its patents as leverage over farmers, and it is wrong. Robert Schubert argues that modern industrial agriculture is in many ways reminiscent of Middle Age European feudalism, under which wealthy lords granted land tenure to vassals in exchange for military service. The only difference is that today's vassals are small, independent farmers, and the landowning lords are agricultural giants that do not own land property rights, but *intellectual* property rights to the genetically engineered seeds that farmers must purchase each year in order to remain competitive.<sup>37</sup>

It is not fair, however, to blame everything on Monsanto. After all, the company is only acting in accord with the law as interpreted by the U.S. Supreme Court. It is therefore the Court's responsibility to overrule that precedent, or Congress must modify the statutory language of 35 U.S.C. §101, the PPA or the PVPA.<sup>38</sup> Granted, many of these consequences could not have been foreseen, and it is likely that even with amendments to legislation similar abuses will arise in the future. The law is not omniscient. But, in fact, that is part of its beauty — a malleability and capacity to shape and *be shaped* by society. The law is precisely what we want it to be. The question remains, however, whether we have the courage and the integrity to change it.

#### Notes

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- Schubert R. Farming's New Feudalism. World Watch Magazine May/June 2005; 11.
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- Chrispeels, 42.
- Plant Patent Act, 35 U.S.C. §§ 161-163 (1930, amended 1954): "Whoever invents or discovers and asexually reproduces any distinct and new variety of plant, including cultivated sports, mutants, hybrids, and newly found seedlings, other than a tuber propagated plant or a plant found in an uncultivated state, may obtain a patent therefor, subject to the conditions and requirements of this title. The provisions of this title relating to patents for inventions shall apply to patents for plants, except as otherwise provided. In the case



of a plant patent, the grant shall include the right to exclude others from asexually reproducing the plant, and from using, offering for sale, or selling the plant so reproduced, or any of its parts, throughout the United States, or from importing the plant so reproduced, or any parts thereof, into the United States."

6. Plant Variety Protection Act, 7 U.S.C. § 2483 (1970) states, "Every certificate of plant variety protection shall certify that the breeder has the right, during the term of the plant variety protection, to exclude others from selling the variety, or offering it for sale, or reproducing it, or importing it, or exporting it, or using it in producing a hybrid or different variety therefrom, to the extent provided by this Act."

7. *Diamond v. Chakrabarty*, 447 U.S. 303, (1980).  
8. The U.S. PTO reasoned that because microorganisms produced by genetic engineering were not excluded from patent protection under 35 U.S.C. § 101 (the section of the U.S. Constitution that enumerates criteria for patentability), the Supreme Court test was concerned not with whether an invention is living matter, but with whether or not it is the product of human ingenuity.

9. CFS, 14.  
10. Process through which genes and segments of DNA are taken from one species and implanted within another.

11. Van Deynze A. Telephone interview. November 28, 2006.

12. CFS, 15.  
13. Genetic resources (DNA) of an organism and collections of that material often used for breeding.

14. McEowen RA, Harl NE. Key Supreme Court ruling on plant patents. *Agricultural Law Digest* 2002; 13: 9-11.

15. CFS, 13.  
16. *Ibid*, 12.

17. Bradford K. Telephone interview. November 27, 2006.

18. *Monsanto Canada Inc. v. Schmeiser*, [2004] 1 S.C.R. 902, 2004 SCC 34, at paras. 4-6.

19. Fox JL. Canadian farmer found guilty of Monsanto canola patent infringement. *Nature Biotechnology* May 2001; 19: 396.

20. Zakreski T. Telephone interview. December 5, 2006.

21. McEowen R. Telephone interview. November 28, 2006.

22. Bereano P, Phillipson M. Goliath v. Schmeiser. *GeneWatch* 2004; 17.

23. *Monsanto Co. v. McFarling*, 302 F.3d 1291 (Fed. Cir. 2002); *Homan McFarling signed Monsanto's technology agreement stating that he would plant the seeds received for only a single season. McFarling ended up saving and replanting some of the seeds, and Monsanto sued for patent infringement. The jury ruled in favor of Monsanto and ordered that the defendant pay damages 120 times the applicable technology fee per bag; appellate court later invalidated the penalty, but the general ruling was upheld.*

24. Living organisms, it ruled, are not patentable subject matter under Canadian law.

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29. Rieger MA, Lamond M, Preston C et al. Pollen-Mediated Movement of Herbicide Resistance Between Commercial Canola Fields. *Science* 2002; 296: 2388.

30. McEowen, 645.  
31. Freese B.

32. CFS, 23.  
33. Benbrook C. Genetically Engineered Crops and Pesticide Use in the United States: The First Nine Years. *BioTech InfoNet* October 2004; 36.

34. Monsanto sued the Nelsons in 1999, charging that they had saved and replanted Roundup Ready soybean seeds. Two years of intense litigation came to an end with an out of court settlement.

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36. CFS, 33-34.

37. Schubert, 10.  
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## Foreign Law in America's Constitutional Cases: A Sword Which Could Strike Both Ways

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Constitutional debate in the United States has now assumed an incredible shape. Liberal constitutionalists, academics, lawyers, and even progressive-minded Supreme Court justices impute much value to foreign law and court decisions (primarily Europe and the United Kingdom), while their conservative counterparts scoff at the entire notion. This neat demarcation of boundaries has lulled some members of the literati into believing that philosophical and ideological inclinations automatically define the weight one assigns to the corpus of foreign and international law. Although tempting, this picture belies a larger truth: the confirmatory and advisory role of foreign law (to help settle domestic disputes) is neutral in theory, but is driven by particular political results. Questions of federal power under Article I of the Constitution, the individual's civil liberties derived from the Bill of Rights, or some other intricate problem imply it is merely an accident of timing that modern progressives support, while conservatives oppose, this role of comparative constitutional law. Tracing the counterevidence from the New Deal's substantive due process days and examining the potential ripples in American law if foreign legal developments eventually change direction, this paper argues that the most efficient solution for progressives is to support comparative constitutionalism, but qualifiedly.

Five decades ago, Sir Isaiah Berlin published a book entitled *The Hedgehog and the Fox: An Essay on Tolstoy's View of History*.<sup>1</sup> In this influential work, Berlin astutely used the animal metaphors to broadcast his perception of the differences between the functional qualities of various legal and moral theorists—and, make no mistake, to delineate their divergent strands of philosophical thinking. Echoing the 7<sup>th</sup> century B.C.E. Greek poet Archilochus, Berlin explained that hedgehogs live out their entire lives entrenched in their vision of one central reality, this irrefutable truth they know as their own. All circumstances must yield to this grand unified theory. Foxes, on the other hand, retain a different perception of things. They put stock in life's multilayered variables to evince a complexity that eludes any particular leviathan of a unitary scheme. In essence, Berlin sought to show that principles cannot be so fickle as to yield to every tempest, but nor must they be so rigid as to be lifeless or somehow disconnected from reality. Engineering the balance in this area of law requires a delicate chisel, not a blunt hammer.

In this paper, I argue that the progressive legal community should privilege *not* the undeterred conceptual mammoth of foreign law as applied to America's constitutional cases but its

practical gifts, limitations, and historical lessons (including the Framers' own "decent Respect to the Opinions of [Human]kind"). In Part I, I trace the potentially large, and presently growing, consequences that adversely affect an over-broad espousal of the role of foreign and international law in American constitutional adjudication. This recent phenomenon is easier to believe in light of the fact that in 2004, 86 conservative members of Congress cosponsored or supported an anti-foreign law resolution, "Reaffirmation of American Independence," in the House of Representatives.<sup>2</sup> The hostile delineation of territories on the role that foreign and international legal principles will play in the United States' domestic constitutional cases — progressives advocating, conservatives opposing — should be reason for pause. In Part II, I use the history of substantive due process as a viable substitute to substantiate the possibilities if, and when, foreign notions of law and justice alter course.

In sum, the assumptions in this paper are not revolutionary; what may be revolutionary (or at least novel) are the inferences those assumptions lead us to. We have long considered these inferences as emotive virtues disconnected from the pithy logic and dispassion that truly "serious" scholars are said to champion. But in this paper I will demonstrate that those

same values represent the denouement of a complex network of inferences.

### I. CONSEQUENCES OF UNRESTRAINED TRANSNATIONAL COMITY

In the near future an ideological shift is likely to supplant the European and global community's legal and political liberalism (relative to the United States) with very conservative ideals. Some would go so far as to say that the election of Christian Democrat Angela Merkel in Germany (on the platform of weakening labor laws, promoting greater deregulation, and supporting social traditionalism) is a sound precursor to the dissolution of the welfare state. The same could be said of the elections of far-right politicians Jaroslaw Kaczynski as Poland's president and Jörg Haider as the governor of Carinthia in Austria. Beyond the West, too, extreme examples exist even in nations with strong democratic credentials. It does not take a contrarian to recognize a fitting *negative alternative*: the 1975-7 Emergency period in India, the world's largest democracy. Although the oppressive Indian regime did not endure in the long run, that Nation's Supreme Court did, in 1976, approve the practices of absolute press censorship, the arrest and detention of Prime Minister Indira Gandhi's opposition leaders, and mass sterilization of the poor, in the name of India's "internal disturbances"<sup>3</sup> — all acts which the Court found *ultra vires* its own authority to repudiate. Perilous path that it is, even a step in this direction is cause for concern. For a moment, entertain the odds that within a generation similar views might gain indefatigable momentum and, subsequently, official status in the United States.

Will American progressives then revert back to emphasizing the fair, egalitarian, individualistic values "original to the American experience," as Justice Kennedy of the United States Supreme Court sagely well-put in his *Roper v. Simmons* (2005)<sup>4</sup> opinion? Most likely so. Undoubtedly, to many legal gurus this paradigm shift will resemble the replacement of liberal pleas for judicial restraint in the early New Deal era by their later calls for vigorous judicial defense of civil liberties. The harsh charge of "ideological inconsistency" might also persist. In fact, this adherence to a singular ideology could even seem necessary in



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an age when categories and foundations govern much of the structuralist world, and anything less is assumed to “decenter” the author, manifest the reader’s burgeoning identity crisis, or both. Becoming, *subaltern studies*, the endeavor touching upon the responses and behaviors of once-marginalized groups in their post-colonial states, is instrumental in this discourse. All said and done, however, keener students of constitutional history will see beyond the blunderbuss. They will find no paradox between the earlier regard for foreign law and the later return to domestic values.

Can this apparent contradiction really be resolved? As noted earlier, the place of foreign law in resolving our domestic questions is advisory, not automatically binding; it helps us discern the optimal remedy for shared legal problems. With a contrary domestic response to the question at stake, that mode of transnational legal analysis occupies only a secondary role in American constitutional deliberations. When the United States’ (or any Nation’s) own values and beliefs—ideally, a sensitive commitment to protect the least powerful against majoritarian encroachments while enabling most democratic experiments—reject a particular individual rights claim, the inquiry ends there. Only when a domestic consensus is recognized is it possible for respected international opinion to *confirm* that consensus. This conscientious parameterization ensures that international law considerations remain subsequent to domestic legal doctrine.

Despite all the hype about the Supreme Court’s recent foray into this territory, never has the Court disputed the basic supremacy of national legal principles and mores over the insight sometimes attributed to foreign laws and court judgments. An example should be illustrative. The Supreme Court’s decision in *Lawrence v. Texas* (2003),<sup>3</sup> holding sodomy laws invalid under the Due Process Clause of the Fourteenth Amendment and overruling *Bowers v. Hardwick* (1986),<sup>6</sup> incurred some ire (including the “Reaffirmation of American Independence” Resolution) for citing, approvingly, four cases decided by the European Court of Human Rights.<sup>7</sup> But that is only half the story. Far from acting *sua sponte*, however, Justice Kennedy’s majority opinion referred to those cases only to rebut the sweeping allusions to “millennia of moral teaching” made by one Member

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of the *Bowers* majority 17 years ago.<sup>8</sup> Furthermore, as Professor Mark Tushnet has pointed out, this “reference signaled the Court’s increasing interest in constitutional developments outside the United States.”<sup>9</sup> On other occasions, opinions issued from the Supreme Court have also referred to the International Convention on the Elimination of All Forms of Racial Discrimination (ratified by the United States in 1994),<sup>10</sup> the Convention on the Elimination of All Forms of Discrimination against Women,<sup>11</sup> the European Convention on Human Rights,<sup>12</sup> the United Nations Convention on the Rights of the Child,<sup>13</sup> and the African Charter on the Rights and Welfare of the Child.<sup>14</sup> Given the kinship between a global vision of law and a mature and constantly evolving understanding of particular legal provisions in the Constitution, a sturdy awareness of both elements is important.

Caution has its place, just as ideology, clearly, has its many limitations, even if these limitations are not immediately suspect. Exceptions drill insurmountable holes into the validity of most absolute philosophies. It is one thing to develop the ideas in the contemplative haven of theory, and something very different to implement them in the real world. The more sweeping and specific a claim, the easier it is to find a counterexample to disprove it. Such a universal phenomenon transcends national and academic boundaries. Realize that in a field as distinct from American constitutional law as statistics is, this remains common knowledge even if its exact materialization is different. That a 99% confidence interval is more likely to be refuted than a less absolute claim, say the more conventional 95%, is considered common sense. If indeed the mathematically-celebrated *law of large numbers* holds true, it may well take generations of iterations and simulations to debunk some claim advanced earlier, however appealing it may originally have seemed. Similarly, for legal theories, often an internal contradiction does not emerge until decades into the process. Rigid originalism, the belief popularly backed by conservatives who propose an interpretation of the Constitution on the basis of the Framers’ *original intent*, is no different. Just like the constitutional applicability of foreign law, it is convenient to a particular faction or view only for a narrow period of time, and not always so seamlessly either. Here Thoreau’s thoughtful admonition,

“Simplify, simplify” does not suffice.

Consider, for instance, present-day judicial conservatives’ displeasure at having to balance their usually-effective theory of originalism with the reality that immediately post-1868<sup>15</sup> constitutional history seems to have permitted, even encouraged, race-based preferences to newly-emancipated slaves in the form of Freedmen’s Bureau (established by the same Reconstruction Congress that passed the Civil War Amendments). The rigidity of categorical color-blindedness was quite foreign to the legislative body guided by a flexible, deconstructive vision, secure in the belief that meanings of texts and concepts constantly shift in relation to myriad variables and that the notion of a singular meaning is illusive to the mental optic.<sup>16</sup> All else being equal, this could not convince a true originalist that affirmative action is inexorably unconstitutional under the 1868 reading of the text. Nonetheless, without demonstrating significant support from the history of that period, many conservative scholars have done just this. They may find an indirect quote or two from civic or educational leaders of that period,<sup>17</sup> but nothing close to a consensus the law ordinarily demands.

The same could be said of yet another contentious topic: federalism and the Commerce Clause in Article I of the Constitution. It is no easier to justify the conservatives’ reticence to address the enormous extent of federal power in the early years of the Republic than it is to deny that the very word “commerce” had its original meaning, its meaning circa 1789, in virtue of *its relations to all other words in the Anglo-American language at that time and place, and in virtue of the world at that time and place* [emphasis added].<sup>18</sup> Since that world no longer exists intact, it seems dubious to confine the impact of the determinative terminology to the conditions that *might* have prevailed in that time.<sup>19</sup> Scholarship casts some doubt on originalism’s doctrinal basis by exposing it for attack as a result-centered expedient. The “death of the author” is instantaneous and necessary, the French literary critic Roland Barthes might say, for the birth of the reader to be realized;<sup>20</sup> conversely, in constitutional law the process is more gradual, if only because more than just abstract and untested theories are at stake. But conservatives are not the only group to

commit logical *faux-pas*.

Liberals, too, are threatened by the multifaceted sword that their current exaltation of international law could prove to be. Professor Laurence H. Tribe points out that the Constitution “invites us...to expand on the...freedoms that are uniquely our heritage,”<sup>21</sup> and proposes a “collaborative inquiry, involving both the [Supreme] Court and the country, into the contemporary content of freedom, fairness, and fraternity.”<sup>22</sup> He is not alone. Many, if not most, mainstream American constitutional scholars share this view. Nor does it demean our society’s fidelity to the Constitution to recognize that we share these basic human intricacies with people across the world. Still, we should exercise caution, such that we do not exhaust our intellectual capital in making this point. By pressing too far ahead without contemplating the manifold effects, what President Wilson called “a large vision of things to come,”<sup>23</sup> we could risk the fruits of our assiduous labors.

The example of *Liversidge v. Anderson* (1942),<sup>24</sup> decided by the English Law Lords in the midst of the formidable World War II, is on point. *Liversidge* stood for the proposition that the Emergency powers in Regulation 18B of the Defence Regulations 1939 enabled the Home Secretary, on the basis of “reasonable cause,” to intern all manner of persons with “hostile associations.” Troubling, but not necessarily devoid of reason, *Liversidge* could just as easily have been cited by conservative American jurists deliberating on the enemy combatants cases, *Hamdi v. Rumsfeld* (2004) (citizens held at the United States Naval Base in Guantánamo Bay, Cuba)<sup>25</sup> and *Hamdan v. Rumsfeld* (2006) (similarly situated non-citizens),<sup>26</sup> to argue that *even* Britain, famous for insisting on legislative authorization throughout the formidable War years, allowed such detentions. Needless to belabor, that outcome and its reliance on comparative knowledge would meet with progressives’ disapproval. Indeed, the factors which should guide liberal constitutionalists are keener than the broad swabs of international law itself. The doctrinal neutrality of substantive due process, which I discuss in Part II, is another prominent example.

Now we have arrived at two remarkable inferences.

First, that foreign law cannot,

or should not, be indiscriminately applied to constitutional cases in the United States.

Apart from the philosophical infeasibility of such enterprises, it is undesirable for a practical reason: the considerable risk that those values at some point in time may well run in a regressive direction. Why? For the rest of the world is not stolid or inert, and to pretend otherwise is tantamount to assuming an unwarranted degree of certainty. Nor are the world’s sociopolitical developments, to which the law is designed to respond, unfailingly unidirectional. These developments may be radically conservative, commensurately liberal, somewhere in between, or led by some calculus difficult for us to comprehend easily. In constitutional law, our unyielding commitment, or even its appearance, to a prescription as broad and vague as foreign law could have unpalatable consequences. By typecasting this novel doctrine as a hallmark of “liberal” or “conservative” decision-making, we confuse procedure with substance. Perhaps to guard against errors of comparable magnitude, almost a century ago Roscoe Pound noted, “Procedure is the means; full, equal and exact enforcement of substantive law is the end.”<sup>27</sup>

Second, we would also do well to remember that dense legal ideology is often weighed down by a sense of distance that prevents the scholar from effectively communicating with the person on the street. Not only do the scholar’s ideas receive scant exposure in the real world, the few thoughts and words that do make it out there tend to fail to address the common person’s plights — as unconscionable as incubation without light, heat, and oxygen, essentials which give the work life and meaning. To understand this is to appreciate that people are not always good logicians; they frequently are emotional beings guided by the short-term gratification that seldom withstands reflective scrutiny. As such, the person on the street is likely to be taken in with the ideology of immediacy and unexamined base instincts if scholars do not revise their populist strategy. And such power hinges on the ability to speak and convince. The power to persuade, what political theorists know as “unobservable power” (for its occurrences are usually lacking in tangible inter-party conflicts), is more potent than power which is borne of a visible conflict.<sup>28</sup> A graspable theory of

human dignity may be our redeemer.

## II. WHEN HISTORY SPEAKS: THE DOUBLE-EDGED SWORD OF SUBSTANTIVE DUE PROCESS

Since we are now only beginning to understand the contours of foreign law’s relevance to our own cases, our sample size is too small. The ambiguous history of substantive due process may be analyzed as an effective proxy.<sup>29</sup> In some ways, these two doctrines — foreign and international law and substantive due process — travel together. Both are controversial. Both are the products of some school of thought deeply concerned with the impact of particular legal principles. The critical difference is that while substantive due process has already been turned on its head to find legitimacy in an area of the law where it initially had no presence (for results that its earliest proponents did not, by most accounts, even conceive of), international law is still biding its time.

In sensational debates, the smoke generated by fire eclipses the details, and it leads to inflexible assumptions about legal theory. This discomfiting smoke does a disservice to the prevailing doctrine as well as to its alternatives, both sound and unsound. There is a natural human tendency to defend a worthwhile principle with all the force and might that one can muster—the “ingenuous and naïve demand for a superlative,” as worded in Professor A.G. Keller’s influential early 20<sup>th</sup> century piece, “Law in Evolution.”<sup>30</sup> However, brakes and limits must be applied to that force; for progressives’ fervent enthusiasm in support of the important role of international law could otherwise hand them a Pyrrhic victory at the end of the day.

Past problems tend to morph into new shapes and dimensions. Just as the application of substantive due process swung both ways, so too can, and predictably will, this debate over international law. When the practical issue of the day was this Nation’s economic self-determination, free from the clutches of *laissez-faire* principles, the ultimate question was quite different from the government’s interest in looking into persons’ bedrooms. Inaugurated by President Franklin D. Roosevelt, the New Deal of the 1930’s sought to return people their dignity in the total human condition, not take it away from them. To fail to see this difference is to see no gap between what

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is democratic and what is antidemocratic. And such a distinction can be drawn only if we understand democracy to be an institution which represents something more than opinion polls and up-and-down votes on all matters affecting life; but as an institution which involves collaboration and conversation in its effort to maximize individual liberty subject to narrowly-defined social constraints.

Yet, many post-New Deal legal theorists did perceive the issue as a matter of strict philosophical consistency. Well, they asked, can the government, consistent with due process, intervene in matters not specifically addressed by the Constitution? A normative construction of the constitutional text discourages an inflexible answer to this presumptuously over-broad question. Rather, we must engage with the text and assume a careful, purposive method attuned to the feasibility and fairness of the challenged government action — or inaction.<sup>31</sup>

The saga of substantive due process was far from over. The question returned to the Court in *Griswold v. Connecticut* (1965),<sup>32</sup> and faced a markedly different world. Whereas past governmental efforts to relieve the common person's hunger and indignity had been rejected by the pre-New Deal Court, now litigation was directed to vindicating the individual's *negative liberties*, manifested by her social choices, including intimacy, individual liberty, and free speech. In particular, the Connecticut proscription against the use of contraceptives was challenged in *Griswold* on the basis that it invaded the constitutional guarantee of privacy. The two remaining Roosevelt-appointed justices who had rallied against the due process doctrine's economic uses three decades ago could not, in good conscience, now give it succor in the socially libertarian context. But the two reacted differently from one another. While Justices Hugo L. Black and William O. Douglas both wholesale rejected the argument of privacy under the seemingly indefinite parameters of substantive due process, Douglas (unlike Black) found that same privilege to exist within the much-debated "penumbras" created by the Bill of Rights.<sup>33</sup>

This is a matter of first impression; and here words and rhetoric should have been chosen carefully. In hindsight, Douglas' reasoning may have

cost us heavily.<sup>34</sup> Even more so than *United States v. Carolene Products Co.* (1938)<sup>35</sup> — despite announcing a similar principle of judicial scrutiny, *Carolene Products* was after all a commercial case where due process analysis is sparingly used — Douglas' opinion in *Griswold* is the bedrock upon which later privacy and liberty decisions have been built. But this has generated a simultaneously corrosive effect. Today whenever the doctrine of substantive due process is used to nullify some invasive piece of social legislation, there are complaints against judicial activism and supposed liberal duplicity.<sup>36</sup> Progressives continue to pay an expensive price for supporting results which, however judicious and correct when viewed independently, *seemingly* stand in contrast to their own past positions. At that point, backtracking or retroactively inserting qualifiers into positions they sweepingly argued decades earlier is neither dignified nor convincing. In the fast world of law and politics, first chances come rarely and second chances almost never. That said, as this example typifies, saying too much could prove more lethal than not saying enough.

There is a lesson to learn from what *Griswold* did say, in lieu of what it should have said. As Justice Potter Stewart would later intimate,<sup>37</sup> there was no need for this circuitous approach to a line of reasoning associated with substantive due process. Nor is there reason to fear any inherent illegitimacy or subjectivity in this analysis. On the contrary, courts often introduce objective criteria to evaluate the constitutionality of legislative choices, a process where they bring their own rational judgment to bear.<sup>38</sup> And, so long as *Marbury v. Madison* (1803)<sup>39</sup> is good law, it is legitimate for courts to do so, within reason. Thus the question should have been more strategically posed: In light of our time-honored republican principles, does the policy in question infringe on the citizen's duty to assume her destiny and to participate fully in civic life, free from purposeless and unequal restraints on her own autonomy? While this approach is not full-proof, it does have the comparative advantage of distinguishing between a "legitimate" and an "illegitimate" claim of liberty. Under this test, a law protective of an industrial worker's health and safety presumptively would survive a "liberty of

contract" challenge (subject to rational-basis review) whereas one burdening harmless private choices would face tougher stricture to satisfy.

Similar questions of American law illustrate the imminent need for a reality-check. Parsing beyond the hackneyed debates in the United States Reports, the time may have come to identify substantive due process as well as the role of foreign and international law as *practical*, rather than just sedentary or academic, doctrines. As the first Justice John M. Harlan recounted in his *Lochner v. New York* (1905)<sup>40</sup> dissent, when the professed *liberty* leads only to adverse effects — such as inflammation of the lungs, rheumatism, and decreased life expectancy — that cannot be what society, at the time of adjudication,<sup>41</sup> understands the term *liberty* to mean. The Court should always have been clearer on that point, rather than staying its own hand in all substantive due process claims raised in *Griswold* and related cases.<sup>42</sup> Had the New Deal liberals championed judicial sensibility and restraint, rather than what has come to mean abandonment, in construing the promise of substantive due process, it is likely that today's progressive arguments would have met with a less skeptical judicial eye and a more conciliatory public response. Ironically, the proper doctrine to rescue the saving grace of times gone mad was most lucidly stated by Justice Lewis F. Powell, Jr., the traditionalist, courtly Virginian who in 1972 became President Richard M. Nixon's third Supreme Court appointee: "[T]here is reason for concern lest the only limits to such judicial intervention become the predilections of those who happen at the time to be Members of this Court. That history counsels caution and restraint. But it does not counsel abandonment..."<sup>43</sup>

Today history is repeating itself, as progressive thinkers are digging their own doctrinal graves with regard to the role of international law in resolving our domestic problems. By making over-broad claims, furthermore, they are alienating the lay person; and defining the scope of this debate with rope which could later tie their hands. An American jurist's respect for international law should provide no definitive comfort to her liberal critics, nor should her categorical indifference to respected international consensus please judicial conservatives. Rather, we should

focus on the precise character and extent of the legal developments abroad. In terms of foreign law's applicability to American constitutional principles, there is much to learn from our ongoing experience with the formulation of substantive due process. If we want to promote integrity for the position of foreign and international legislative and decisional law in our cases, we must be careful not to subject it to these somersaults.

These doctrinal examples show that a constitutional compass of human dignity is a superior alternative that must accompany, on equal footing, our alert consideration of global legal developments. A balanced and flexible respect for comparative constitutionalism, in language that ordinary people understand, can help recalibrate the polity's constitutional vision. This cautionary account privileges the insight that international influences on American constitutional jurisprudence should be achieved through a measured, gradual process. Thus it can be durable.

#### Notes

1. London, 1953: Weidenfeld and Nicolson; New York, 1953: Simon and Schuster; New York, 1957: New American Library; New York, 1986: Simon and Schuster, with an introduction by Michael Walzer.
2. H. Res. 97 ("Expresses the sense...that judicial interpretations of the U.S. Constitution should not be based on judgments, laws, or pronouncements of foreign institutions unless such judgments, laws, or pronouncements inform an understanding of the original meaning of the Constitution").
3. A.D.M. Jabalpur v. Shukla, (1976) 2 SCC 521 (accordance determinative weight to the President's declaration of Emergency against a challenge under Article 21 of the Indian Constitution).
4. 543 U.S. 551 (holding the imposition of the death penalty upon juveniles under 18 years of age to violate the Eighth Amendment's prohibition on cruel and unusual punishments, the Court concluded that "[t]he opinion of the world community, while not controlling our outcome, does provide respected and significant confirmation for our own conclusions.").
5. 539 U.S. 558.
6. 478 U.S. 186.
7. Cf. Dudgeon v. United Kingdom, 45 Eur. Ct. H. R. (1981) [authoritative in all countries that are members of the Council of Europe (21 nations then, 45 nations now)]; P. G. & J. H. v. United Kingdom, App. No. 00044787/98, 56 Eur. Ct. H. R., Sept. 25, 2001; Modinos v. Cyprus, 259 Eur. Ct. H. R. (1993); Norris v. Ireland, 142 Eur. Ct. H. R. (1988).
8. Bowers, at 196 (Burger, C.J., concurring) ("Decisions of individuals relating to homosexual conduct have been subject to state intervention throughout the history of Western civilization. Condemnation of those practices is firmly rooted in Judeo-Christian moral and ethical standards.").
9. Mark Tushnet, "Anthony Kennedy and Gay Rights," A Court Divided (New York: Norton, 2005).
10. Grutter v. Bollinger, 539 U.S. 306 (2003)

- (Ginsburg, J., concurring) (quoting the Convention's endorsement of "special and concrete measures to ensure the adequate development and protection of certain racial groups or individuals belonging to them, for the purpose of guaranteeing them the full and equal enjoyment of human rights and fundamental freedoms").
11. Ibid. United Nations Document A/34/46, Art. 4(1) (1979) (approving of "temporary special measures aimed at accelerating de facto equality" that "shall be discontinued when the objectives of equality of opportunity and treatment have been achieved").
12. Lawrence v. Texas, 539 U.S. 558 (2003).
13. Roper v. Simmons, 543 U.S. 551 (2005).
14. Ibid.
15. The Fourteenth Amendment, containing the Equal Protection Clause, was ratified in 1868.
16. B. Kendrick, The Journal of the Joint Committee of Fifteen on Reconstruction 51 (1914).
17. Cf. Grutter v. Bollinger, 539 U.S. 306 (2003) (Thomas, J., concurring in part and dissenting in part) (quoting Frederick Douglass in What the Black Man Wants: An Address Delivered in Boston, Massachusetts, on 26 January 1865, reprinted in 4 The Frederick Douglass Papers 59, 68 (J. Blassingame & J. McKivigan eds. 1991)).
18. Joseph Biancalana, Originalism and the Commerce Clause, 71 U. Cin. L. Rev. 383 (2002)
19. A leap of faith required of judicial originalists is that no one knows with any certainty whose original intent is dispositive to the analysis. As Professor Biancalana has argued, "First, it is not clear who counts as the author of a constitutional provision. Are the Framers at Philadelphia or the Ratifiers at the various conventions or the voters who voted for the authors of the constitutional text? If a text has multiple authors, whose intent is important? Opponents of the constitution can hardly be considered its authors, but why aren't their understandings of a constitutional provision important? Second, even if an author were identified, it is not clear what is meant by his intention. Is it his expectation of the consequences of adopting the provision and, if so, over what period of time? Is it his desire to preclude a particular state of affairs? Is it his hopes for what the provision might achieve? Is it the principle he hopes to establish? Third, even if the concept of intention in this context could be clarified, it is not at all clear that the meaning of a constitutional provision, or of any text for that matter, reduces to its author's intention conceived of as a mental state." See fn. 18 (footnotes omitted). While we can speculate on science as an academic exercise in Noam Chomsky's class, we cannot retract from a whole trajectory of modern constitutional law on that basis alone.
20. Barthes, "Death of the Author," Image, Music, Text, Hill and Wang Publishers: 1977.
21. Tribe, God Save This Honorable Court 45 (1985).
22. Tribe, American Constitutional Law 771 (2d ed. 1988).
23. Mason, William Howard Taft, in III The Justices of the Supreme Court 1789-1978 2105 (L.Friedman and F. Israel ed. 1980).
24. [1942] A.C. 206.
25. 542 U.S. 507 ("[D]ue process demands that a citizen held in the United States as an enemy combatant be given a meaningful opportunity to contest the factual basis for that detention before a neutral decisionmaker").
26. 548 U.S. \_\_\_ (Military commissions constituted

- by the President of the United States to try detainees held at Guantanamo Bay, Cuba, "violate both the [Uniform Code of Military Justice] and the four Geneva Conventions").
27. Pound, The Etiquette of Justice, 3 Proceedings Neb. St. Bar Assn. 231 (1909).
28. Weber, Economy and Society, Vol. I, Ch. III: "The Types of Legitimate Domination."
29. The Fifth and Fourteenth Amendments to the Constitution state that no person shall be "deprive[d]... of life, liberty, or property, without due process of law." Some constitutional theorists, such as Justice Scalia, construe this Clause to mean that liberty may be taken so long as due process is provided, in keeping with the Justice's earlier article, The Rule of Law as the Law of Rules. See Scalia, "The Rule of Law as the Law of Rules," 56 University of Chicago Law Review 1175 (1989). This disproportionate focus on procedure, a vivid dissipation for the substance of the law, assumes either that procedure will take care of substance, or that the law's substance is closed *cadit* *questio* for judicial inspection, or both. Nonetheless, this view has never prevailed. Rather the Supreme Court has permitted vast governmental leeway for commercial cases, while requiring judicial vigilance in cases of civil and individual rights. The settled axiom is that non-invidious discrimination — in the exercise of a State's police powers — is expected to be resolved through the democratic process. Still, cynical questions of corruption inescapably arise when a legislature imposes protectionist policies to fence out economic competition for one group over another within a particular sector. See, e.g., *Williamson v. Lee Optical Co.*, 348 U.S. 483 (1955) (upholding a law that forbade persons who were not registered optometrists or ophthalmologists from fitting or duplicating lenses for eyeglasses without a prescription).
30. A.G. Keller, "Law in Evolution," 28 Yale L.J. 769 (1919).
31. As the Supreme Court litigant young Joshua DeShaney's story came to underscore in 1989, the State's failure to protect a child from the abuse of his father, of which the government agency was aware, implicated government inaction. Dissenting from the majority's conclusion, Justice Harry A. Blackmun explained his theory of moral ambition in support of relief. See *DeShaney v. Winnebago County Department of Social Services*, 489 U.S. 189, 213 (Blackmun, J., dissenting).
32. 381 U.S. 479.
33. In fact, Douglas expressly rejected the substantive due process theory set forth under the Fourteenth Amendment ("[W]e are met with a wide range of questions that implicate the Due Process Clause of the Fourteenth Amendment...we decline that invitation"), and focused exclusively on the Bill of Rights.
34. This is particularly ironic since Douglas (arguably the great civil libertarian of the 20th century Supreme Court) strongly believed even in those individual rights that are unspecified in the Constitution's text. Opinions authored or joined by Douglas, amassed over his 36-year-tenure, show a remarkable solicitude for the claims of women, political dissidents, the poor, the minorities, the criminally accused, the environmentalists, and other underdogs. See, e.g., *Goesaert v. Cleary*, 335 U.S. 464, 467 (1948) (Rutledge, J., joined by Douglas and Murphy, J.J., dissenting) (women), *Communist Party of the United States v. Subversive Activities Control*

Board, 367 U.S. 1 (1961) (Douglas, J., dissenting) (political dissidents), San Antonio School District v. Rodriguez, 411 U.S. 1, 70 (1973) (Marshall, J., joined by Douglas, J., dissenting) (the poor), Swann v. Charlotte-Mecklenburg Board of Education, 402 U.S. 1 (1971) (minorities), Terry v. Ohio, 392 U.S. 1 (1968) (Douglas, J., dissenting) (the criminally accused in a Fourth Amendment search and seizure case), Sierra Club v. Morton, 405 U.S. 727, 741 (1972) (Douglas, J., dissenting) (the environmentalists seeking to achieve standing to sue in federal court despite having asserted no "individualized harm"), 35, 304 U.S. 144. Footnote 4 of the decision qualified that abridgement of civil liberties must be subject to less generous scrutiny, especially when involving "discrete or insular minorities."

36. Revealingly, in his Lawrence opinion, not once did Justice Kennedy invoke Griswold or its house of privacy built far away from substantive due process. Instead, he began his opinion axiomatically: "Liberty [emphasis added] presumes an autonomy of self that includes freedom of thought, belief, expression, and certain intimate conduct." See Helen J. Knowles, "From a Value to a Right: The Supreme Court's Oh-So-Conscious Move from 'Privacy' to 'Liberty,'" Ohio Northern University Law Review, Vol. 33, 2006/2007, 37. Roe v. Wade, 410 U.S. 113, 168 (1973) (Stewart, J., concurring).

38. E.g., Solem v. Helm, 463 U.S. 277, 290 (1983) (Using "objective criteria" to conduct "proportionality analysis" in an Eighth Amendment case about recidivism of a non-violent felony).

39. 5 U.S. 137 ("It is emphatically the province and duty of the judicial department to say what the law is").

40. 198 U.S. 45, 70-71.

41. While the history and custom of our predecessors two centuries ago are helpful and informative, they are not now, and have never been, the end of our analysis. To state simply, short-cuts will not do. Scholarship casts some doubt on the popular understanding that jurisprudence predicated on English common law invariably delegates the task of legal determination to elected representatives. For instance, in the famous Bonham case (1610), 8 Co. Rep. 113b at 118a, Lord Coke had attempted to hold invalid an Act of Parliament that was inconsistent with common law. Over the years, constitutional or common law review was used mainly to block executive actions rather than the Parliament's prerogatives. There is, naturally, greater legitimacy when the legal system invalidates the decision of a single sovereign than of those collectively assembled to serve the public good. Recent English cases such as Ridge v. Baldwin (1964) AC 40, Padfield v. Minister of Agriculture Fisheries and Food (1968) AC 997, and Anisimic Ltd. v. Foreign Compensation Commission (1969) AC 147, have given close scrutiny to administrative action.

42. Cf. Ferguson v. Skrupa, 372 U.S. 726 (1963), Williamson v. Lee Optical Co., 348 U.S. 483 (1955) (state laws regulating business are subject only to rational basis review).

43. Moore v. City of East Cleveland, 431 U.S. 494, 502 (1977) (plurality opinion).

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## The Limits of Nationalism: Serbia's 1991 Military Mobilization and Resistance to It.

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An examination of the shortcomings of Serbia's attempted general military mobilization in 1991 is conducted. The popular thesis that Serbian nationalism – because of its supposed uniqueness and abnormal predisposition to violence – was the primary force behind the participation of Serbs in the war is challenged. Based on primary military sources as well as secondary analyses of the mobilization, the period is offered as proof of the failure of nationalism to mobilize the Serbian population to participate in organized, collective violence. A brief historical context of the Yugoslav People's Army (JNA) and its transformation into a branch of Serbian power against separatist movements is given. The study finds that considerations like economic self-interest, opportunism and fear of violence were more likely motivations than nationalism was in determining Serbs' participation in military campaigns. More generally, the paper suggests caution about exaggerating the role of Serbian nationalism in determining Serbian behavior and collective action.

Sixteen years after the outbreak of civil war in the former Yugoslavia and eleven years after the worst atrocities in Europe since the Second World War, "Serbia" remains virtually synonymous with nationalist excess. Much of the literature on the tragic events of the 1990s has perpetuated the notion of the uniqueness of Serbian nationalism – the idea that Serbian nationalism is, in one way or another, an anomaly and exception in its unusual aggressiveness, intolerance, aversion to multiculturalism, propensity for violence, expansionist tendency or general "backwardness." Branimir Anzulović's *Heavenly Serbia: From Myth to Genocide* isolates the development of Serbian nationalist ideology from those of other South Slavic peoples to attribute an intrinsically "genocidal" nature to it.<sup>1</sup> Less extreme but somewhat similar approaches are visible in Michael Sells' *A Bridge Betrayed: Religion and Genocide in Bosnia*, in Stephen Schwartz's (and Christopher Hitchens') *Kosovo: Background to a War*, and even in the standard works of distinguished journalist Tim Judah.<sup>2</sup> In large parts, it was this "uniqueness" thesis that gave rise to the clumsy distinction between "ethnic nationalism" and "civic nationalism," the former being the destructive, anti-"liberal," virulent plague infecting the world and the latter being the democratic, multi-cultural, diversity-friendly model exemplified by peace-loving democratic nation-states.<sup>3</sup> Accompanying these approaches is the belief – often quite explicit – that nationalism was a sufficient

and overwhelming source of motivation and action for Serbs. It was the nationalist mentality, the argument continues, that drove Serbs to participate in massive violence and bloodshed. This paper puts this claim to a succinct test.

Investigating what was in the heads of ordinary Serbs in 1991 is no easy task. State propaganda overwhelmingly dominated most media outlets, making content analysis of television and most newspapers highly unrepresentative. Even after the introduction of multi-party elections in 1990, the legacy of the Titoist single-party system was enormous, with the state silencing a vast majority of the population and allowing public visibility and voice only to a faithful minority that met the criterion of "moral-political aptitude."<sup>4</sup> Prior to the establishment of Belgrade's Strategic Marketing agency in the mid-1990s, no private agencies measuring nationalism in public opinion methodically even existed, and the notion of impartial political surveys was largely unheard of. What I rely on here, therefore, is one of the few available windows into the role of nationalism in Serbian collective action in 1991: the response to that year's call for a general military mobilization. Like Churchill's democracy, this indirect approach to testing whether nationalism indeed translated into organized collective violence is the worst possible one aside from all its alternatives.

The prided Yugoslav People's Army (JNA) was a particularly noteworthy institutional symbol of "brotherhood and

unity." Military service was mandatory for young men, who were (as a custom) almost never assigned to their own republics for their terms, making service a formative experience in multi-ethnic cooperation and bonding. The army's composition roughly reflected the overall ethnic distribution: even as late as the summer of 1991, the entire army (recruits, officers and civilians) was 32.9% Serb, 17.5% Croat, 13.4% Muslim, 10.4% Albanian, 9.7% Yugoslav, 6.9% Macedonian, 5.4% Slovenian, 1.3% Hungarian, etc.<sup>5</sup> The ten most important positions in the Ministry of Defense, the military district commands, the Air Force and the Navy were held by one Yugoslav (Veljko Kadijević, famously a son of a Serb father and Croatian mother), three Serbs, two Croats, two Slovenes, and two Macedonians. 38% of the High Command consisted of Croats, 33% of Serbs and 8.3% of Slovenes. Heroically defending the country against (largely fictional) Cold War threats and still glowing from its World War II victories, the JNA enjoyed substantial respect and popularity.

With the collapse of the one-party system, however, the institution was left without a system to defend; what is worse, with the collapse of the Soviet empire, it was left without an enemy to defend the system from. As anti-federalist forces came to power in most of the republics, the army sought a new source of legitimacy. "One obvious course of legitimization," Lenard J. Cohen noted, "was to focus the military's attention upon perceived *internal* threats to state unity."<sup>6</sup> Not unlike individual Yugoslavs, the JNA faced an identity crisis. Traditional rationales for unity were being challenged by ethnic separatist movements, and the army's image as a multi-national pillar of socialist harmony was being replaced with a less flattering one. By the early 1990s, a new *raison d'être* for the military establishment took shape: to crush subversive elements within the federation<sup>7</sup> and to protect a unified, cohesive Yugoslavia. In the wake of elections, the JNA disarmed the territorial defense forces of Slovenia and Croatia. By November of 1990, it effectively became an extension of Slobodan Milošević's power through the formation of a new League of Communists – Movement for Yugoslavia (*Savez Komunističke Partije za Jugoslaviju*, SKPJ). On May 9th 1991, the federal presidency gave the newly-named Yugoslav Army



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(YA) the order to halt "ethnic violence" within Yugoslavia's borders.

Just as Serbs harbored a fondness for the "Yugoslav" identity to a higher degree than other peoples in the federation, they had several reasons to be similarly invested in the JNA to a higher degree than the other nationalities. Firstly, when it came to officers, they were dominant at 54.3% with an additional 9.6% of Yugoslavs who were "originally" Serbs. Secondly, the formal constitutional order was on the side of the Republic of Serbia: secession was illegal, armed resistance to the federation within its borders constituted terrorism, and the constitution obligated the JNA to protect the sovereignty and territorial integrity of Yugoslavia. Thirdly, while Croatian and Slovenian militias (as well as Albanian separatists) were receiving arms and funding from abroad, the Serbian minorities and their defensive militias would have had nothing without support from the JNA. And finally, lest it be forgotten, it was the Serbs who had sacrificed most and died in the greatest numbers in the People's Liberation Struggle that established Yugoslavia and its military order. Serbs insisted on their epic tradition of military excellence and courage, as well as on the weighty fact that "the renown of the warrior is greater among Serbs" than it is among the other south Slavs – decisive reasons to uphold the honorable organization. The relatively high commitment to the army was duly reflected in a study of public attitudes toward financing the JNA in mid-1990, which showed that Serbia and Montenegro had the lowest numbers of people believing the JNA should be receiving "less financial support than now" and had the highest numbers of those believing it should be receiving "more than now."<sup>9</sup> Though officially defending "socialism" against internal subversive threats, it became clear to all the republics as well as to the Serbian leadership itself that the actual line was drawn between the JNA on one side and all the other national military groupings on the other.

Serbian and Croatian militias jointly declared violations of the truce ceasefire on August 23rd, 1991 and called for general mobilizations. On October 5th, the Serbian government called for a full mobilization. Milošević is reported to have said that his only fear was that there would not be enough uniforms for all the soldiers

eagerly waiting to defend their country. Here was a perfect opportunity for that vast Serbian public that voted overwhelmingly for parties with nationalist causes to actually fight for them. At the time of mobilization, 64% of Serbs expressed support for Serbia's fighting for Krajina and Slavonija, two Serb-majority areas in Croatia.<sup>10</sup> Between one fifth and one fourth of them supported parties calling for "Greater Serbia," an entity stretching across Bosnia and into Croatia. Over half of the Serbian electorate voted for leaders in favor of preventing secession by force. Were these widely expressed values translated into organized violence when the opportunity came?

To the authorities' great shock, nothing could have been further from the outcome. "The regime had a stubborn, mass resistance" to its war policy, Milan Milošević noted – far "more overwhelming than the marginalized pacifist groupings" that were thought to be the only ones remaining opposed.<sup>11</sup> In September, only 10-25% of the anticipated response rate was recorded; in December, not even one-fifth of the 100,000 activated reservists were responsive. In Belgrade, where gross numbers of activated men are highest in the republic, municipalities recorded responsiveness of 8%.<sup>12</sup> In Kragujevac, a site of famous World War II massacres and a major center of Serbian national pride, over 6000 men had better things to do than combat a return of Croatian fascism.<sup>13</sup> A military unit in eastern Slavonija (Croatia) was expecting an additional five brigades on the mobilization; it received one and a half. On the strategically-crucial area around Banija and Kordun (where mixed Serbian and Croatian residents were about to be unmixed), an anticipated four military brigades turned into only one. In a recent testimony in front of the International Court of Justice, lawyer Radoslav Stojanović revealed that a meeting of the Supreme Defense Council of Yugoslavia on September 28th 1991 proclaimed that over 100,000 reservists called up by the mobilization had not reported for duty. Another 50,000 had left the ranks of the army and another 40,000 soldiers had defied orders to fight in Croatia. Some 200,000 reservists, in other words, refused the mobilization order. The ethnic breakdown of the people who had refused to fight reflected that of Serbia itself: 70% were Serbs and the rest were national minorities.<sup>14</sup> On top of this,

another 150,000 men emigrated to avoid being drafted, while those who could not afford such a move "opted for internal emigration" and hid with relatives or friends throughout the country instead.<sup>15</sup> For an army that numbered roughly 150,000 in all (including civilians, as well as tens of thousands of officers), these figures were devastating and suggestive of the risk that the Croatian army might outnumber the YA within months.

Frequent and massive rebellions also shook the army's plans. Three revolts were marked in three days in Belgrade in the month of September, including one in the Air Force and one at the Military Medical Academy (*Vojnomedicinska Akademija*). Forty honorable members of the Guard Brigade in Belgrade publicly demanded the resignation of Yugoslavia's Minister of Defense, expressing fury over the battle in Vukovar, the status of soldiers on the frontlines, invalids, combatants' families, etc. One soldier from the Vukovar front drove an armored vehicle all the way back to Belgrade to park it in front of the federal parliament building in protest.<sup>16</sup> On July 2nd, a few hundred mothers of recruits stormed the same building and occupied it for two days, demanding a retreat from Slovenia. Similar protests of restless relatives would occur again in Belgrade, Niš, and Novi Sad as the war progressed. As upheavals swept Kragujevac, Valjevo, Arandjelovac, Ada and Senta, the Belgrade newspaper *Vreme* announced that the situation had reached the level of "total military disintegration."<sup>17</sup> In all, it is estimated that over forty thousand conscripts actively participated in the 1991 rebellions.

Since the regime's resolute policy was that neither Yugoslavia nor Serbia was officially at war in the first place, general mobilization was difficult to manage. Military police units would discretely pick up young men early in the morning at their apartments or sneak up on unsuspecting guests at cafes and clubs late in the night. This miserably failed recruitment procedure was the primary impetus for the reliance on volunteers and para-military formations, which turned out to be the most brutal and shocking actors of the entire civil war. Mercenary armies such as the Četniks organized by ultra-nationalist Vojislav Šešelj, the Serbian Guard organized by opposition leader Vuk Drašković, and the Tigers led by drug dealer and international

criminal Željko "Arkan" Ražnatović were operative both in Croatia and Bosnia. Though these units' proud sponsors insisted that love of motherland and national loyalty attracted the bulk of their volunteers, studies have shown otherwise. Like their Croatian and Bosnian counterparts, these young men were overwhelmingly "recruited from the underclass" and primarily attracted to the prospects of robbery and pillage with impunity.<sup>18</sup> Many did not even care to participate full-time, preferring to enter war areas only on weekends for a brief looting drive followed by an immediate return to Serbia and Montenegro – the so-called "weekend volunteers." From utter poverty, these young men often came to acquire enormous wealth in the wars, "filling their trucks with the entire furnishings of homes and apartments and selling their booty on a flourishing black market."<sup>19</sup> Those from outside Serbia, and especially residents of rural areas, were often involuntary volunteers, caught in the middle of the fighting and given no choice but to join at the threat of death or harm to their families. Far from taking the recruits' nationalist fervor for granted, the unit commanders had to actively instill the proper values: "It was common for the men of this group," Stipe Sikavica found, "to be forced to prove their loyalty by murdering a neighbor of a different national origin." Although actively involved in major phases of the war and although constantly rotating, these paramilitaries often numbered less than 50, commonly were a few hundred strong and rarely ever consisted of more than 1000 volunteers. For all these reasons, these bands do not meaningfully reflect nationalist sentiment, let alone represent it for the Serbs at large.

In conclusion, when it comes to translating values into actions of organized violence, Serbian nationalism did not seem to "walk the walk," if you will. Presidents and parliamentary representatives were elected for their nationalist credentials,

surveys showed support for state violence against separatism, and xenophobic values were endorsed by a majority, but Serbs were not enthusiastic about risking their lives to themselves act on these convictions. Military mobilization was a decisively "top-down" phenomenon, driven by a desperate state encountering both passive and active resistance from its subjects. Coercion and "forced volunteering" were the primary means of conscription, not abstract appeals to ethnic identity. Even when interest in active war-making was shown "from below," it was more often motivated by profit or personal advantage than by nationalist conviction. Fighting for the glory of the Serbian nation seems to have had more to do with being in the wrong place at the wrong time than with a passionate attachment to Serbian-ness.

#### Notes

1. Branimir Anzulović, *Heavenly Serbia: From Myth to Genocide* (New York: New York University Press, 1999).
2. Michael Anthony Sells, *The Bridge Betrayed: Religion and Genocide in Bosnia* (Berkeley: University of California Press, 1998); Stephen Schwarz, *Kosovo: Background to a War* (London: Anthem Press, 2001); Tim Judah, *The Serbs: History, Myth and the Destruction of Yugoslavia* (New Haven: Yale University Press, 2000); *ibid*, *Kosovo: War and Revenge* (New Haven: Yale University Press, 2000).
3. For just one example, see Aviel Roshwald, *Ethnic Nationalism & the Fall of Empires: Central Europe, Russia & the Middle East, 1914-1923* (London: New York: Routledge 2001), 3-4, though the distinction is pervasive.
4. Moralno-politička podobnost was a prerequisite not only for those associated with the Union of Communists of Yugoslavia (SKJ), but for everyone from janitors to university professors. A rigorous filtering process left all those deemed "morally-politically inept" largely outside the public arena at best and imprisoned for counter-revolutionary activity at worst.
5. Svetozar Stojanović, *The Fall of Yugoslavia: Why Communism Failed* (New York: Prometheus Books, 1997), 105.
6. Lenard J. Cohen, *Broken Bonds: The Disintegration of Yugoslavia* (Boulder: Westview Press, 1993), 183. Emphasis in original.
7. See the Yugoslav Censuses from 1971, 1981 and 1991, available at the Belgrade Center for Political Studies and Public Opinion Research (Centar za političkoška istraživanja i javno mnjenje).

8. Stojanović, 106.
9. Cohen, 185.
10. Aleksa Dijas, *Najteže Pitanje* (Belgrade, Serbia: Artist, 2005), 36.
11. Marko Milošević, "Čepanje Poternice" in *Vreme*, January 27, 1996, p.11.
12. Bora Radović, *Jugoslovenski ratovi 1991-1999 i neke od njihovih društvenih posledica* (Belgrade, Serbia: International Aid Network, 2000), 42.
13. Ozren Žunec, "Rat u Hrvatskoj 1991-1995: I dio: Uzroci rata i operacije do Sarajevskog primirja" in *Polemos*, Volume I, Issue 1 (January – June, 1998), 163; Misha Glenny, *The Fall of Yugoslavia* (London: New York: Penguin, 1993), 141.
14. Cited in Radoslav Stojanović, *ICJ Testimony*, CR 2006/15 (translation), Friday, March 10, 2006.
15. Dijas, 142.
16. Žunec, 140.
17. *ibid*, 151.
18. Stipe Sikavica, "The Army's Collapse," in *Burn This House: The Making and Unmaking of Yugoslavia*, edited by Jasminka Udovički and James Ridgeway (Durham, NC: Duke University Press, 2000), 141.
19. *ibid*.
20. Sikavica, 142.
21. Dan Voich and Lee P. Stepina, *Cross-Cultural Analysis of Values and Political Economy Issues* (Westport, CT: Greenwood Publishing Group, 1997), 161-185.



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## St. Theresa of Avila: The Holy Whore

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In a small, Carmelite nunnery in 16th century Spain, a nun named Teresa shocked the Roman Catholic world with her divine visions and raptures. The church—at a point of precarious transition—turned its attention to a woman who proclaimed sexuality a key component of spirituality, celebrated fleshly love, and described her own raptures as orgasmic. With the power of literacy and a stunning talent for writing, Teresa dared offer the Christian world a reconciliation of a social contention apparent in both religious and secular spheres: the contradiction between earthly and spiritual love, fallen bodies and immortal souls. In a world where women were denied secular and religious power, Teresa audaciously suggested that her explanations included a kind of redemption and elevation of her sex.

How was it that this dangerous woman was not branded a lunatic and burned as a whore? How could the church allow her to proclaim and publish such ideas? How was Teresa—whose works at one point were burned by the Inquisition—beatified only thirty two years after her death? The answers—as this essay examines—lie in Teresa’s incredible genius, subtle knowledge of her dangers, and dedication to her revolutionary ideals.

*But, O alas ! so long, so far,  
Our bodies why do we forbear?  
They are ours, though not we ; are we  
Th’ intelligences, they the spheres. . .  
Love’s mysteries in souls do grow  
But yet the body is his book.”*

—John Donne

Bernini’s famous statue *The Ecstasy of St. Theresa* (1652) shows a beautiful woman in the throes of what is unmistakably, shockingly, and somehow gorgeously—an orgasm. In a world in which sexuality was associated with carnal, earthly “original sin,” where the primary biblical models of virtuous womanhood were asexual or celibate, and where female power was only occasionally able to escape its binds in both secular and religious realms, such a blatant celebration of intertwined female sexuality and spirituality seems an almost appalling anomaly. How, exactly 70 years after her death, was a self-proclaimed *mujercilla*, or “little woman,” able to leave such a legacy—summarized and visualized in this statue—that unified the contradictions between spiritual and sexual experiences, earthly and divine love, and that glorified a particular type of female power fundamentally vested in female sexuality? In short, how had St. Theresa been beautified as a saint rather than burned as a whore?

One of the great ironies of Theresa’s legacy is the language used by admiring male authorities to describe her life and legacy. She was heralded as a “virile woman,” “a manly soul,” and one 82

who “endured all conflicts with manly courage.”<sup>11</sup> While such avowals make sense in a misogynistic world, they fail to recognize one of Theresa’s strongest, most brilliant, and revolutionary philosophies: that her powers and miracles derived from the very womanhood the authorities were denying. The most brilliant aspect of this shocking assertion is that Theresa comfortably couched it in the rhetoric of existing social norms and stereotypes of women. Precisely by being weak, humble, obedient, nurturing, and subservient to male will, Theresa explains that women exemplify the truest of Christian virtues. Blessed with these characteristics, they are thus proven to be most suited for Christian love and most willing to receive God’s grace.

Such an assertion of female theological potential was a revolutionary idea that dangerously overturned Pauline doctrine, which throughout the Middle Ages had been a guideline for churches and a rationalization for the suppression of female clerical authority.<sup>2</sup> According to this doctrine, women, being more apt to be falsely led, should be denied positions of power in the church.<sup>3</sup> In contradicting this idea, Theresa took her implications a major step further: besides being emotionally and spiritually suited for Christian love and obedience to God’s will, she believed that women were also *physically* designed to be the receptacles for God’s grace. Such an assertion is not directly stated in Theresa’s writings, but is evident in both her insistent use of erotic language to describe her

raptures (in terms of a definite feminine physical response to a masculine God), and in her constant self-portrayal as the “Bride of Christ.” What is perhaps most fascinating about such an idea is that it brazenly reconciled certain contradictions inherent in both religious doctrine and in contemporary literature and poetry: the apparent divide between sexual and spiritual love, and earthly and divine desires. In a world in which the religious and secular worlds were virtually super-imposed, and where their respective ideologies therefore intertwined, such doctrinal and literary discourses were directly related. I will therefore examine exactly *how* Theresa’s life and writings reconciled these divides, thus proving her “a holy whore.”

The conflict within religious ideology stemmed from the Catholic insistence on a separation of sexual and spiritual love. There was an apparently irreconcilable void between the idea of sex as original sin, and the divine commandment to “be fruitful and multiply.” While condemning the effects of base animal passions on the soul, early Renaissance sources also admitted that only an “ardent appetite and lust” prevented “the bitter decay in short time of mankind.”<sup>4</sup> Thus according to strict Catholic doctrine, sex was either a terrible evil in which one allowed one’s carnal, hedonistic, earthly desires to hold sway over one’s higher spiritual yearnings, or a necessary element of procreation that was nonetheless acceptable only in marriage. Priests, nuns, and monks, in order to focus all their religious energies and to ensure the purest forms of Christian love, had to eschew all sexual liaisons and remain virtuously celibate. Chastity and virginity were touted as two of the most essential female virtues. Catholic women were caught between an idea of Eve as the lascivious, evil temptress on the one hand, and the essentially asexual feminine ideals of the Virgin Mary and the reformed prostitute Mary Magdalene on the other. Where, in such a spectrum, was there a model that allowed for female spirituality and sexuality? It was this void that, through careful language that used both connotations of marriage and quotations from the Bible itself, Theresa attempted to fill.

How could a divine experience be partly realized through the physical senses if the body was just a debased, clay

prison for an impeccable soul? How could sexuality, which caused the fall of man at the dawn of time, be implicated in his redemption? Could carnal desires really be mirrored in their spiritual counterparts? Theresa’s work, often cited as an integral watershed in mystic, feminist, and theological discourse, must also be seen as a fascinating answer to these questions. She reconciled femininity with Christianity by implicating its particular role in relation to a *masculinized* God, thus allowing it certain privileges and powers actually denied—or at least more challenging—to men. By identifying women as God’s chosen brides, she provided a socially acceptable legitimization for her two most controversial themes: the idea of women’s chosen, natural, and unique relation to God, and her own tendency to use erotic language and sexual connotations when describing her ecstasies. She reconciled the Christian fear of sex by identifying it as the most natural, good, and perfect state of union possible on earth, which—as God-ordained and designed “in His own image”—therefore echoed its spiritual counterpart: *unio mystica*.

The idea of a *unio mystica* with the Godhead was a practice and goal of centuries of mystics from a host of religions. In the 10<sup>th</sup> century, the Muslim-mystic Al-Hallaj was put to death for insisting that he and God “were one,” as was the German theologian Meister Eckart in 1329.<sup>5</sup> In the Middle Ages, with an increase in female participation in the church (particularly under Cardinals Ximenez and Cisneros) and various periods of what historian Allison Weber terms “an explosion of female piety,” a host of female mystics emerged.<sup>6</sup> St. Theresa herself, aware of the expanding numbers of female saints and of contemporary mystics and miracle-workers such as St. Maria de Santo Domingo and St. Catherine of Genoa, went so far as to avow that “The Lord grants these favors to many more women than men, as I have heard from the saintly friar Peter of Alcantara, and have also observed for myself. . . women made much more progress on this path than men [for]. . . excellent reasons. . . all in women’s favor.”<sup>7</sup> Theresa writes that “there is no reason to repeat” such reasons in her work (which we suspect may induce the wrath of certain male authorities), but an analysis of her autobiography, as well as other famous writings such as *The Interior*

*Castle* and *Meditations on the Song of Songs*, provide an insight into the personal evidence that induced such a claim.

The quintessential reason for women’s particular mystic abilities is ideological: they were able to settle themselves in the socially acceptable role of “Bride” to Christ—a designation that made all forms of humility, obedience, love, and even union perfectly legitimate and natural. Furthermore, they could envision themselves as naturally suited to receive God’s raptures by casting their mystic experiences in the terms of a heterosexual “union” that’s spiritual ecstasies mirrored sexual fulfillment. In other words, they could complement the notion of their particular *emotional* receptivity with the *physical* role of being the “receptacles” of God’s grace. Whilst males could and obviously did comfortably settle themselves in the role of servant or friend to God, they had no similar social construct that would allow for this particular kind of deferential love and union. In fact, such a ideological trend was empirically evidenced in a number of psychological studies conducted in the 1970s on a group of Carmelite nuns and monks. When describing their experiences of *unio mystica*, the nuns, consistent with their identity as the “Brides of Christ,” used a language implicating all the effects of sexual union during marriage: relation to a *masculine* God-image, erotic descriptions of aroused bodily awareness, and moments of intense, piercingly sweet “ecstasy.” The monks, on the other hand, did not express their rapture in terms of a physiological response—a restraint believed by psychologists to stem from a fear of homosexual implications.<sup>8</sup> Furthermore, the studies showed a greater frequency of experiences of *unio mystica* in females—evidence that provides fascinating implications for 20<sup>th</sup> century historians and intellectuals such as Simon de Beauvoir and Luce Irigaray who both argue that “mysticism is the sole place within the history of the West where women have achieved full and autonomous subjectivity.”<sup>9</sup> Of course, both intellectuals intensely studied St. Theresa of Avila as the quintessential prototype of such an expression of female power.

Like the Carmelite nuns of the 70s, Theresa’s language focuses on the idea of herself as God’s chosen bride both in her obedient duties to him and in the

spiritual ecstasies he rewards her with in the allegorical “bridal chamber” where the union of souls takes place. “You’ve often heard that God espouses souls spiritually,” she wrote in *The Interior Castle*, “and even though the comparison may be a course one I cannot find another that would better explain what I mean than the sacrament of marriage.”<sup>10</sup> In her autobiography, Theresa’s descriptions of her evolving relationship with God follow definite trends of courting, betrothal, marriage, and consummation. In one report of a vision, Theresa wrote that Christ appeared before her and gave her his right hand—as in the sacrament of marriage—saying “Behold this nail, which is a sign that from this day you will be My spouse.”<sup>11</sup> Theresa’s return vow, “Here is my life; here is my honor; here is my will” is voiced in her *Life* and again reflects the bridal duties to bequeath to her husband her life (in the ultimatum “‘till death do us part”), her honor (her virginity and loyalty) and her will (in the promise to trust and obey him).<sup>12</sup>

Within the legitimate, cemented framework of such vows and the ultimate assurance of God’s perpetual love and protection, Theresa’s language expands to implicate the same kinds of sexual desire and eroticism involved in earthly marriages. In attempting to explain such a relationship, Theresa explicitly compares it to the most perfect of *mortal* loves: “If two people, in this life, love one another. . . they seem to understand one another without signs, merely by the exchange of a glance; and this must be the case too in the experience I have been speaking of [prayer and raptures]. For without seeing one another, we look at one another face to face, as two lovers do. It is as the Bridegroom says to the Bride in the *Song of Songs*.”<sup>13</sup> Such a biblical reference is essential to the clarification of Theresa’s experiences as holy and not promiscuous, as gifts bestowed on one whom God has chosen as a partner rather than delusions perpetuated by the Devil. Indeed, she contextualizes almost all of her amorous descriptions and references to bridal love within the most astonishingly erotic and controversial parts of the Bible: the *Song of Songs*. It is here, in the beautiful, poetic descriptions of the truest kinds of love and sexuality between a bride and groom, that Theresa frames her own type of spiritual union. By using terms from the Bible itself, her erotic experiences assume a religious

significance and connote divine ordination and pleasure.

“Let Him kiss me with a Kiss of His mouth. . . Thy breasts are better than wine for they give off fragrance of sweet odours.” These are arguably *the* most sexual excerpts from the *Song of Songs*, which, interestingly enough, Theresa specifically chose to base her meditations upon. Inspired by this imagery, Theresa explains the way in which it resonates with her own experiences: “When this most wealthy Spouse desires to enrich and comfort the Bride still more,” she writes in her *Meditations on the Song of Songs*, “He draws her so closely to Him that she is like one who swoons from excess of pleasure. . . drawn near to that sacred side and to those Divine breasts. . . Awakening from that sleep and heavenly inebriations, she is like one amazed and stupefied.”<sup>14</sup> This is essentially spiritual foreplay, which Theresa herself explains awakens such burning desires that one is apt to be driven insane. Indeed, it is an integral part of the process of spiritual union, which can only take place when this intense, lustful craving for God’s love and grace is awakened.

“There grew so great a love of God within me that. . . I found myself dying of the desire to see God,” Theresa writes in astonishment. “This combination of joy and sorrow bewildered me. . . I remember that verse of David, *As the Heart panteth after the water brooks*.”<sup>15</sup> Again referencing the wine the groom in *Song of Songs* gives to his bride—a tradition, incidentally, that preceded intercourse so as to calm and seduce the young virgin—Theresa explains that “Once the faculties. . . have begun to grow drunk on the taste of this wine, they are very ready to give themselves up again in order to enjoy some more.”<sup>16</sup> Many mystics professed to such intense feelings of desire for the Divine: in the prologue to his *Life of Marie of Oignies* (1176-1213), James of Vitre wrote of women who “would faint from desire, and they were only rarely able to rise from their beds over the course of many years. There is no other cause. . . than He, desire for whom liquefies their souls. . . the King was in their chamber.”<sup>17</sup> What is fascinating is that such a female propensity for illnesses associated with a buildup of sexual appetite was actually *medically* documented as a condition known as *furor uterinus*. First identified by Hippocrates, it was explained by the Renaissance Italian

physician Girolamo Mercuriale as an “immoderate burning in the genital area of the female. . . brining about an erection of the clitoris. Because of this burning sensation women were thought to be driven insane.”<sup>18</sup> According to mystics like Theresa and Saint Beatrice (1200-1268), in whom “the very fervor of her holy longing and love blazed up as a fire. . . making her perceptively hot in wondrous ways. . . [and was] so excessive that she sometimes thought she would lose her mind,” such a condition was simply further evidence of women’s heightened receptivity, the ardor of their spirituality, and the powerful effects the Divinity could physically bestow upon their weak mortal forms.<sup>19</sup>

If Theresa could identify lust and *furor uterinus* as symptoms of the purest form of spiritual love mirroring earthly—and therefore sexual—love, she was obviously prepared to present the actual climax of orgasm in the same terms. Ironically—at least in terms of Catholic doctrine—Theresa presents orgasm not as the binding of the soul to its bodily sensations and earthly form, but as the *release* of the soul to the highest forms of spiritual elevation. In contradicting terms, Theresa writes that “this is not a physical, but a spiritual pain, though the body has some share in it—even a considerable share.”<sup>20</sup> Such a contradiction obviously arises from the fact that while she believes the reaction to be taking place within her *soul*, a physical reaction is implicated because of the inextricable, mortal connection between body and soul. The description in her *Life* of her most intense “spiritual orgasm” is in perfect correlation with the statue created by Bernini some 70 years after her death, and is worth a careful analysis to assess the exact type of feminist message (for I believe this is what it was, though premature and perhaps unconscious) she was promoting.

Theresa begins her description by explaining that beside her “appeared an angel in bodily form. . . he was not tall but short, and very beautiful. . . in his hands I saw a great golden spear, and at the iron tip there appeared to be a point of fire.” This delineation of particular *masculine* characteristic is proof of her ideological association of the Godhead with masculinity, and even the spear takes on the appearance and function of a phallus. “This [spear] he plunged into my

heart several times so that it penetrated to my entrails. When he pulled it out, I felt that he took them with it, and left me so utterly consumed by the great love of God. The pain was so severe that it made me utter several moans. The sweetness caused by this intense pain is so extreme that one cannot possibly wish it to cease, nor is ones soul then content with anything but God.”<sup>21</sup> Such confessions of “plunging,” stabbing pains, “moans,” and “sweetness” that “one cannot possibly wish to cease” are very obvious and unapologetic references to a type of spiritual union that almost exactly mirrors its sexual counterpart on earth. Yet if the *Song of Songs* celebrates such true love and sexuality, and if God Himself proclaims the need to “be fruitful and multiply,” and if He Himself offers His Hand in marriage to His chosen brides and satiates their spiritual desires with divine favors, why should Theresa fear using such language? What is astounding is not only that Theresa so fearlessly and blatantly used such connotations, but that, by virtue of her careful tiptoeing around church authorities and misogynistic constraints, her orgasms were taken as miracles and her erotic writings disseminated throughout the Christian world.

One amusing paradox that becomes apparent in this kind of analysis of Theresa’s contributions is the fact that it was a *religious* work that reconciled a divide in the nature and definition of true Christian love. After all, this was the theme that had plagued writers and intellectuals throughout the era, inspiring all sorts of tragic, despairing poems and stories. As previously explained, this was an era when religious and secular spheres overlapped and religious doctrine infused almost ever aspect of daily life, thought, and practice; literary themes thus ran parallel to religious ideology. Popular works from Marguerite de Navarre’s *Heptameron*, Sir Philip Sidney’s *Astrophil and Stella*, and John Donne’s poems struggled with an apparent contradiction between the purity and beauty of spiritual love, and the tarnishing, base, carnal evil of sexual desire—the same divide inherent in Catholic doctrine. To such writers, the body and soul are irreconcilable, as one is a low, flawed mortal and the other an incarnation of the Divine. In such a philosophy, spiritual experiences cannot possibly be realized in physical terms. Thus the heroes and

heroines of many stories and poems battle with their consciences and each other to completely separate their feelings of pure love—the product of their soul—and their lust for sexual satiation—the product of bodies steeped in original sin.

The longest story in Marguerite de Navarre’s *Heptameron* concerns the lengthy, agonizing love affair between a beautiful princess, Florida, and her devoted warrior/servant, Amador. It is the quintessential tale of courtly love, the era’s most popular literary, musical, and poetic theme that concerned itself with the divide between sexual and spiritual love. Florida, desperately in love with Amador and yet determined to maintain her highest virtue—her chastity—subjects him to the torture of devoting himself to being her adoring slave throughout her marriage to another man. Initially overjoyed to revel in the purely “spiritual” love that consists of amorous looks, love sonnets, and deep sighs in his cold bed at night, Amador eventually succumbs to the insatiable, carnal desires of his body. The story revolves around the push and pull of Florida’s pleas for their love to remain entirely pure, which precludes consummation, and for Amador’s crazed attempts to realize his desires in earthly fulfillment. The story ends—rather pathetically to a modern reader—in unrealized, sterile love and a tragic end to painful lives.

Sir Philip Sidney’s famous poem *Astrophil and Stella* echoes this theme so perfectly that it could have been written by Amador himself. In one stanza, he moans that he simply cannot comprehend why his “desire” and “pure love,” each of which “doth blow the fire of my heart,” must be divorced.

“Desire, though thou my old companion  
art  
And oft so clings to my pure love, that I  
One from the other scarcely can descry,  
While each doth blow the fire of my heart,  
Now from thy fellowship I needs must  
part.”

Rather than argue with whatever doctrinal or societal imperative is forcing him to separate his emotions, he reconciles himself to the apparent necessity of making “Virtue’s gold” now “head my Cupid’s dart.” In the last line, however, the

reader hears an echo of doubt arising from the perplexed conviction of an anomaly: “Thou Desire, because thou wouldst have all/ Now banished art, but yet alas how shall?”<sup>22</sup> Theresa, perhaps, would interrupt the poet’s aggrieved soliloquy by reminding him that such desire is a natural human reaction, that it proves the intensity of one’s love and commitment and that it therefore should not be divorced from the idea of the love itself.

In number of instances, Theresa’s work frankly disparages the highfalutin despairs and prudish squeamishness of contemporary literary intellectuals and religious authorities alike. “You may think that in these *Canticles* there are some things which might have been said in a different way,” she writes mockingly—for who would dare to think this about the *Bible*? “We are so stupid that I should not be surprised if you did: I have heard some people say that they actually tried not to listen to them. O God, what miserable creatures we are!”<sup>23</sup> Such language, she insists in her *Meditations on the Song of Songs*, is “the language spoken by the Holy Spirit,” as God’s “deliberately chosen style.”<sup>24</sup> It is His “chosen style” precisely because He is aware that it is only in these terms that every human being—from the most common, ignorant peasant or woman to the most learned theologian—can understand divinity. Just as every experience is constrained to the human body, so every description, no matter its spiritual nature, is bound within the confines of human language. Rather than “lower” the nature of the experience, such boundaries simply make it universally comprehensible and attainable. Bernini himself understood this: his statue can therefore be viewed either as pornography to those who believe earth and heaven to be tragically divorced, or as an ideal form of Christian gospel: the communication of a religious message in universal human terms.

John Donne’s Poem “Exstasie” applies Theresa’s religiously contextualized ideals to the realm of love between two mortals, explaining that the body is the “booke” for “Love’s mysteries” that “in soules doe grow.”

“For soul into the soul may flow,  
Though it to body first repair.  
As our blood labours to beget  
Spirits, as like soules as it can,

Because such fingers need to knit  
That subtle knot, which makes us man:  
So must pure lovers soules descend  
T’affections, and to faculties,  
Which sense may reach and apprehend,  
Else a great Prince in prison lies.  
To our bodies turne wee then, that so  
Weake men on love reveal’d may looke.”<sup>25</sup>

Theresa’s work rejoices in “that subtle knot,” or the union of body and spirit that God vests in humans. Indeed, if renounced, it leaves “a great Prince in prison,”—in other words, the soul in sterile confinement. Like Donne, she delights in the way her “sense may reach and apprehend” that which her “pure soule” imbues.

Within such a sensory context, Theresa not only describes her own physical responses, but applies various sensory characteristics to God himself. In this way she can, as Donne writes, “on love reveal’d may looke.” She writes that God, in the many visions he granted her, had impressed an image of his physical beauty on her: “I longed to see the color of His eyes, or His statue,” she explains wistfully, “Once I had seen the Lord’s great beauty, I could find no one who seemed handsome to me in comparison, and no one to occupy my thoughts.”<sup>26</sup> To both her readers and herself, she has truly identified her love for God not simply as that of a father or teacher, but of a lover and husband. She understands that such an idea is difficult for most Christians, who after all identify most readily with the trauma of courtly love and the writings of Marguerite de Navarre and Sir Philip Sidney. In her *Meditations on the Song of Songs*, she recalls a time she went to a church service in which the priest expounded upon “those loving delights with which the bride communed with God.” She reports that there was “so much laughter, and what he said was so poorly taken, that I was shocked.” Yet she also explains that she understands the reason for this, “that we practice so poorly the love of God, for it doesn’t seem possible for a soul to commune in such a way with God.”<sup>27</sup> She herself therefore takes on the responsibility of showing people that it is entirely natural, and profoundly *good*, when, as she explains when recounting one of her raptures, “the soul’s joy is so keen that it makes itself felt in the body.”<sup>28</sup> Furthermore, the fact that such a feeling is so often felt in *women* perhaps even more than men, is simply

divine proof of their unique and powerful role in relation to the Godhead.

While her own lessons impart a message celebrating the body and sensuality as a medium for experiencing the divine, she still limits it within the legitimate confines of *marriage*. Only as a Bride can she reap the rewards of divine love. Such a clarification does not detract from the power of the message itself, nor in its implications for feminine power and even a mode of sexual freedom. Rather, it illustrates the way in which Theresa persistently unified her “revolutionary” theories with traditional Christian doctrine. She was, after all, a true, devoted Catholic nun, and we must believe that she honestly struggled to reconcile her ideals and experiences within a particular theological framework. We must also remember that she was required to tread extremely carefully, lest she be targeted by angry, misogynistic authorities and the Inquisition.

In her work *The Book of Foundations*, Theresa explained that “We are living in a world in which we have to think of people’s opinions of us if our words are to have any effect.”<sup>29</sup> Intent on proclaiming her message yet preferably remaining safe from the stake, Theresa was extremely careful to tread carefully around anything that might label her a witch, a heretic, or a “*mujercilla ignorante y soberbia*,” (“an ignorant and proud little woman,”) which was the scornful depiction of one of her more unfortunate female contemporaries.<sup>30</sup> Instead, her works consistently identify herself as a simple, ignorant, humble *mujercilla*, one who was careful to give scriptural evidence for every revolutionary avowal and who constantly sought and echoed the advice of “learned men.” So it was that Theresa maneuvered through a religious gauntlet and remained unscathed.

In at least partly reconciling a paranoia and contradiction that plagued the Christian empire—though of course not irrevocably and indefinitely—Theresa also took a huge step in the history of feminism. While I do not pretend that she was remotely aware of feminist theory, which would not come into structured existence for centuries, I do consider the triumph of her life and works as a watershed in the evolution of the ideology that would lay the groundwork for its birth. In carefully trodden steps backed extensively by

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scriptural and doctrinal sources, Theresa’s ideas evolve and expand to implicate a particularly *feminine* power: From the idea of a natural, divinely-designed union of body and spirit she derives the comparison of marital consummation between a bride and groom. From the association of women with Brides of Christ she implicates a phenomenal potential intrinsic in the female constitution. From such a unique relationship with God she provides women with the religious, authoritative, and *sexual* power and freedom to rule heaven and earth. “A soul is indeed blessed when the Lord brings it to an understanding of the truth,” she rejoices. “What a state this would be for kings!”<sup>31</sup> It seems beautifully ironic that, in a world so misogynistic that she was subjected to a number of inquiries and her writings were almost burned, Theresa still values her womanhood and status as the “Bride of Christ” over the highest male power on earth.

Women are therefore blessed because it is *they* who can most clearly identify with the awesome implications of a marriage between earthly and spiritual roles and experiences. With such an understanding of their unique calling, they have the power to become queens of heaven. After numbers of spiritual orgasms and heated proclamations of intense desire and unquenchable love, Theresa reaches such a state of perfect, stable, totally unified love and marriage with God that she writes “the Lord often says to me, as a sign of His great love, ‘Now you are Mine and I am yours.’”<sup>32</sup> In one rapture, she explains that he “placed a crown on my head, and thanked me.”<sup>33</sup> Her own devotion and obedience has paid off in perfect reciprocation, for God informs her that she has reached such a height in his eyes that He will obey her in turn, for He knows she will always act in accordance with His will: “You need have no doubt that I will even more readily do what you have asked Me . . . I promise you.”<sup>34</sup>

Theresa’s lessons, in sum, unify Heaven and Earth. They place spiritual experiences in the bodily realm, they put God in Man’s image, and they fit a social construct—that of marriage—to a divine relationship. The indirect message that reverberates in the evolution of feminist ideology—which, itself, tiptoes around authorities and progresses in infinitesimal steps throughout history—is that female power is *also* interchangeable between

Heaven and Earth. Female roles as Christ’s crowned queens in heaven translate into their duties as piously awaiting brides on earth. They therefore have the capability and the *duty* to lead Christian souls to the path of salvation, no matter what centuries of church tradition and certain doctrinal assumptions exist. “Lord of my soul,” Theresa writes, “You did not hate women when You walked in the world, rather You favored them always with much pity and found in them as much love and more faith than men.”<sup>35</sup> Possessing “*more faith*” than men, an emotional structure mirroring Christian virtue, a physical design allowing the most natural spiritual/bodily union, and a socially-and-divinely-ordained role that allows an almost *joint power* with God, women are poised to achieve the highest positions on Earth as it is in Heaven. In a Renaissance world perpetually struggling to unite the two realms, women could seamlessly negotiate what was only the *illusion* of a divide.

#### Notes

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