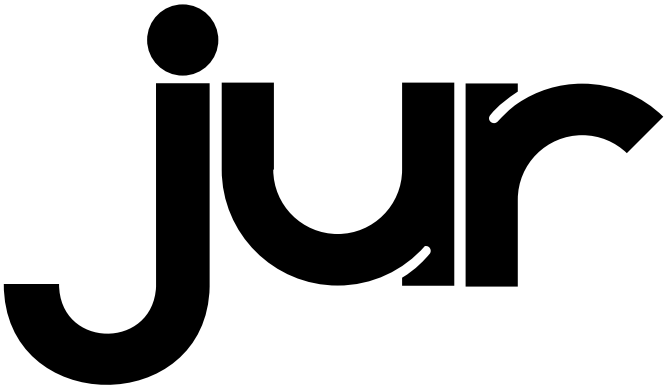
Journal of Undergraduate Research



University of Rochester

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The *Journal of Undergraduate Research* (*jur*) is dedicated to providing the student body with intellectual perspectives from various academic disciplines. *jur* serves as a forum for the presentation of original research, thereby encouraging the pursuit of significant scholarly endeavors.

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From the Editor

Sir William Osler once said that "The hardest conviction to get into the mind of a beginner is that the education upon which he is engaged is not a college course, not a medical course, but a life course, for which the work of a few years under teachers is but preparation." The unique character of Rochester's research-oriented curriculum provides an exceptional opportunity to experience the fact that we are not just here to learn. We learn in service of a greater good, improving our own lives and the lives of others through new information and discoveries. Research is the tool we use to open up and ultimately change the world that surrounds us. As you plan your own Rochester Curriculum, consider carefully how utilizing the research possibilities here can aid you in education and establishing your own life course.

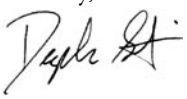
Some are starting their last year at the University and already have a few years of research experience. Before your departure, take advantage of the university atmosphere. Take a moment to appreciate your colleagues' research. More importantly, give them the opportunity to appreciate your research. Take your work to the next level; produce a paper you share not only with your professor, but with the entire academic community here at Rochester and beyond. Use *jur* as a stepping stone into the publishing world. Our humble journal has grown into a professional periodical received by over 100 universities in the US. From submission to publication and distribution, editing to layout and graphics, *jur* provides a publishing experience similar to that of larger journals.

This issue has been expanded significantly. You can garner the wisdom of seasoned researchers in the "Letters to the Editor" section, which is now based on a single question distributed to the university community. We have brought forth a new section, the Featured Researcher, which helps remind us that research comes in all forms and from all fields, and need not be restricted to a lab.

We have showcased research from a wide variety of fields: physics, film, political science, neuroscience, religion and English. In keeping with our commitment to facilitating undergraduate research, we have created *jurf* – the Journal of Undergraduate Research Forum, which can be found at http://www.jur-forum.com. Not only will students from universities around the nation learn how to start their own research journal, but students here at the University of Rochester can post research-related questions which will be answered by a staff member or professor. We hope this new venture will help undergraduates in finding research opportunities and spur the development of undergraduate research journals.

We thank the Rochester community for their continued support and invite submissions of original research, reviews and letters. Please visit our website for further information at http://jur.rochester.edu or email jur@mail.rochester.edu with any questions or comments.

Sincerely,



Deepak Sobti, '04
Editor–In–Chief

Letters to the Editor

What problems have you faced in your research and how have you overcome them?

Learning about the Field

Thinking back on my first research project, I recall being overwhelmed with the amount of material I needed to learn at the outset. Since I didn't know anything about the field I was researching, I tried to learn everything about it before I started tackling the problem. That was a big mistake – subsequent research experiences revealed that complete knowledge is too lofty a goal and that I could spend an entire lifetime trying to attain it without making any progress on the research problem at hand. By observing my professors, however, I came to realize that successful researchers have coping mechanisms to deal with incomplete knowledge. Here are some that have served me well:

1. *prioritize – what do you need to know the most in order to make progress?*
2. *read everything made available to you and seek out more, but don't use reading as an excuse not to make progress*
3. *multitask – when stuck on a difficult problem or issue, is there something else that you can pursue that would help you make progress?*
4. *simultaneously attack the problem from different angles*
5. *pester people who might have the info you need (but be sure to respect their time)*
6. *initial solutions are rarely perfect – propose working models so that you can continue to make progress*

Now-a-days, I continue to encounter obstacles in my research. Despite these obstacles, I do my best to find a way to make progress, and that, in my opinion, is key to being a successful researcher. Sincerely,

—Gautam Altekar '04
Computer Science Major

Research is Learning How to Think Critically

Looking back at the past four years and talking with my friends at other universities, I have found conducting research at the University of Rochester to be very "undergraduate friendly." The biology department offers many chances to gain research experience through the independent research course (BIO 395), the GEBS summer scholars program, and the de Kiewiet summer research fellowships. Once in a research lab, I found obtaining results challenging and time consuming. In my junior year I began doing research as part of the BIO 395 course and worked through my senior year with the intention of doing a senior thesis. However, at the end of my senior year, I was unable to gather enough positive results to compose a coherent thesis. The biology faculty that I spoke with were extremely understanding when I explained my situation. Although it can be quite intimidating to begin working in a lab (as it was for me), it is crucial to realize that faculty do not expect ground-breaking results at the undergraduate level. Rather, it is beginning to learn critical thinking skills and acquiring some hands-on experience that is important in doing research as an undergraduate, and the UR faculty provide ample opportunities to become involved.

—Maximilian Wei-Lin Popp '04
Molecular Genetics (B.S.) and Chemistry (B.A.) Majors

Finding a Research Topic

Many students look forward to conducting original research in order to better prepare themselves for graduate work, to improve their academic resume, or to delve further into a topic in which they have great interest. Unfortunately, like money, interesting testable hypotheses do not grow on trees, and without a topic, your aspirations of breaking new ground in academia are stopped dead in their tracks.

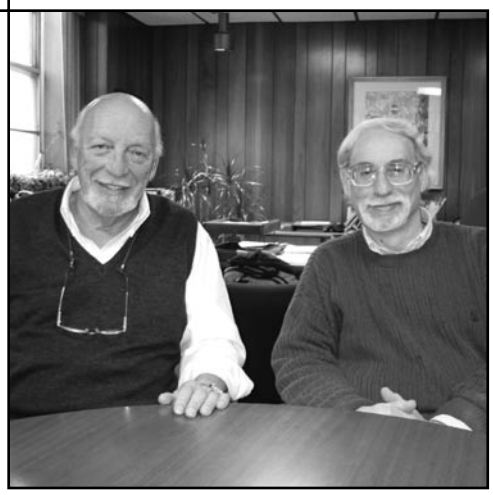
So in order to prepare yourself to conduct research, you should gain a deep understanding of one area in a discipline that interests you. By becoming familiar with theories and contemporary research, you provide yourself with a solid framework through which to evaluate your topic. For example, my thesis is focused on representation by African Americans, so I took classes on voting rights, congressional elections, and theories of representation. This grounding is also important because new research is conducted to build on the current understanding of a topic or to inquire into related areas that have not yet been explored.

Once you have a good background, it is time to design a research question that your project will set out to answer. This question should be both interesting and doable. The crafting of your topic is without a doubt the most important step in the process because if you select a question that does not interest you, research will quickly turn from something that is supposed to be an enlightening intellectual experience into an unbearable chore. In addition, because each of us is operating with limited time and financial resources it is critical that your research topic be sufficiently limited in scope. You cannot expect to be able to dedicate forty hours a week to your research, have time for your other classes, and still have some time to enjoy yourself. In that same vein, it may not be fiscally viable to choose a topic that requires you, for example, to travel the world collecting DNA samples of indigenous inhabitants of the world's rainforest. While your department may be able to offer limited financial resources, you should strive to keep costs to a minimum. In addition to these more obvious pitfalls, you may also run into the problem of necessary data not being available or the required analytical methods being too complex. Sometimes these problems prove to be surmountable; sometimes they do not. In either case, they are something that needs to be considered.

Faculty in your department will be invaluable in helping you develop your topic: make appointments with professors who perform their own research in an area that interests you. They may have ideas for projects that they have not had the time to study yet, and even if they don't, they will definitely be able to help you think about hypotheses that would be ideal for your research.

Despite the hurdles, I am glad I decided to write a senior thesis. It has allowed me to apply what I have learned at the U of R in ways that regular classes would not have. Anyone can make independent research a rewarding undertaking, if they take the time to fully explore their options and select a doable topic that particularly interests them.

— Mark Dundon '04
Political Science and Economics Major



The Biopsychosocial Model: Interdisciplinarity in Science and Medicine

jur interviews Drs. Ader and Brown

Dr. Robert Ader, a basic science researcher who is considered the father of psychoneuroimmunology (PNI), and Dr. Theodore Brown, an esteemed scholar of the history of medicine, discuss what role interdisciplinarity plays in medical research with respect to the biopsychosocial model.

jur: What is the biopsychosocial model?

Brown: The biopsychosocial model was first articulated under that label by Dr. George Engel in a now-classic paper published in the April 1977 issue of *Science*. Essentially, the model puts the usual biomedical understanding of physiological, clinical and pharmacological phenomena together with the psychosocial dimension in one comprehensive, multi-layered model. In that form, with that language and with that vocabulary it was quite a novelty and began a life of its own. Using that paper essentially as its origin, people started to refer to the biopsychosocial model and have since built a 25 year history mostly in clinical literature.

My interest as a historian is to look for antecedents of the biopsychosocial model. I can trace those origins back to the very beginning of the western medical tradition and have found comprehensive evidence that people are trying to integrate psychological and biomedical dimensions right through the classical writers in the western tradition, right through the middle ages, through the modern period, and so on.

My interest as a historian is to ask what Dr. Engel perceived to be the novelty of his formulation in 1977, assuming that the biopsychosocial model was this long-standing tradition with special twists and turns in the twentieth century, and that Dr. Engel was both exposed to and part of that tradition. And also, what were the historical forces that stimulated him to come up with this new formulation of a concept that actually has such deep roots in history? My simple answer is that he thought the earlier biopsychosocial approaches, though not so labeled, were being threatened and challenged in the 1960s and 1970s, and in the face of that challenge he felt the need to restate and reformulate the biopsychosocial model in powerful terms to give it new life and the prospect for additional influence in the future of medicine. The emphasis there is that it is very much a clinical orientation rather than a scientific orientation.

Ader: Yes, I was going to add the clinical if you hadn't because that's where George Engel was coming from. The history you talk about was more theoretical or conceptual than it was practical. There were a few cases in which it was practical – things you might call alternative medicine today. But I think it was not so much to correct what existed before; his ideas were stimulated by his clinical experiences. What is interesting is that you can also find this in the writings of people who were not behavioral scientists. One of my favorite people to quote is Rene Dubos, a microbiologist; if you read some of his passages, he clearly rejects the biomedical model and its limitations from an experimental point of view. It is totally restrictive and has no bearing on the way things really work in the real world.

jur: How has the biopsychosocial model been received by the medical and scientific communities in both the past and the present?

Ader: The vast majority of people adhere to reductionistic strategies, so there is more lip service to than actual implementation of the biopsychosocial model. The reasons for that are both theoretical and practical. Theoretical reasons include, for example, that you are taught that the scientific method includes certain strategies requiring you to eliminate all variables except the one you are interested in to get valid results. This reasoning is why studies are done *in vitro* – you've gotten rid of everything except exactly the variable you're interested in. The problem with this approach, though, is that it's not the way the real world works and those *in vitro* studies don't necessarily

generalize to the *in vivo* situation. That's one reason why I think it has been easy to fall back on reductionistic strategies: it was training. Also, to be more direct, that's where your bread is baked in the biomedical sciences – the practicalities of promotion and advancement depend upon publications and almost necessitates a model that will produce a great deal of data, but you don't necessarily question the ultimate value of that data.

Brown: What Dr. Ader said about lip service is very important. I think that a department chair or a dean of a medical school will often speak in biopsychosocial terms because it's like motherhood – it's the right thing to say. But at the same time, that very person as dean or chair might support primarily *in vitro* research without looking into the other variables. Just as no one would be against diversity as an idea, it is very hard to imagine one being against the biopsychosocial model. To add another dimension to this, often the biopsychosocial language and philosophy is a rallying cry for some clinicians who feel they are being overshadowed by research-dominated priorities. At least at this institution, the people who would generally be the most vigorous proponents of the biopsychosocial approach are those who are defending their clinical sensitivity and the need to train students in the techniques that will help elaborate the model, such as good interviewing techniques to create a conversational connection with patients, rather than simply using laboratory diagnostic testing and the like. That split between the clinicians and the hard biomedical bench scientists was given a fundamental challenge with the development of the area in which Dr. Ader is a great pioneer: the psychoneuroimmunological approach. In my view as a historian, psychoneuroimmunology came as a great shock because there, in the midst of the biomedical approach were unmistakably rigorous investigations and undeniably powerful evidence that seemed to question some of the foundations of the biomedical approach from a research point of view rather than a clinical one, and from hard data rather than from rhetorical pronouncements.

jur: Dr. Ader, would you mind describing your research?

Ader: Broadly speaking, I research the interactions between the brain and the immune system. I use the word "interactions" specifically because there is information flowing in both directions. It was long assumed that the immune system was autonomous, so when we came along and questioned these cherished assumptions, we expected the kind of responses we received. My research is primarily concerned with the nature of relationships between the nervous and immune systems at a number of different levels. We are now doing clinical research, but mostly it has been an animal research laboratory. The field started primarily as one that was concerned with the effects of behavior on the immune system; now there is an equivalent amount of work dealing with the effects of the immune system on behavior. The pathways are basically the same; some originating from the nervous system, while some of them originating from the immune system. That is the basic notion of psychoneuroimmunology.

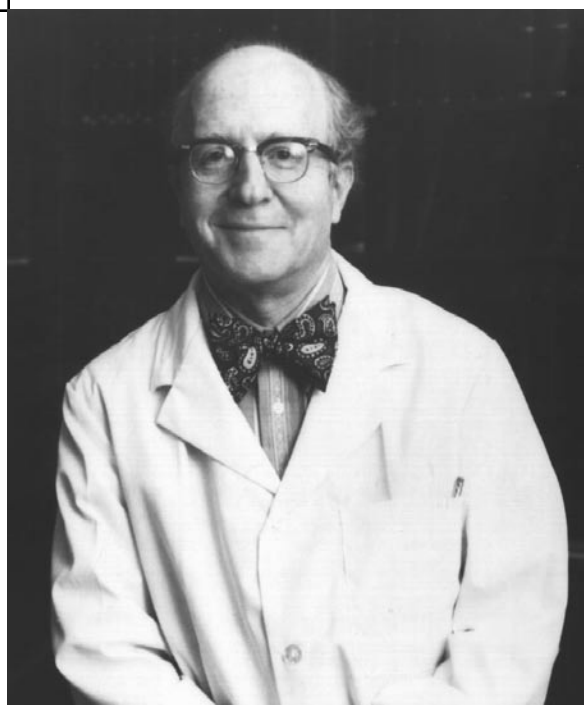
jur: What do you see as the advantages of using an interdisciplinary approach in basic science research?

Ader: From my point of view, the first advantage is that it is a closer approximation of how the real world works. In my opinion, it doesn't really make a lot of sense to study responses that don't even occur in intact, behaving organisms. Let me give you a concrete example. There has been a lot of press recently about a study purported to be the first one to rigorously test the effects of optimism on cancer survival. Well, it wasn't very rigorous and certainly wasn't the first. However, the critical problem is that they made a big point of something that is clearly not demonstrated. Here is a disease, a certain type of cancer, from which only ten percent of people survive, no matter what you do. Now, you try to determine if optimism is going to have an effect on a disease from which only ten percent survive. So optimism has no more or less an effect than chemotherapy or anything else. But now the whole notion that some psychosocial factor may influence cancer is being thrown out the window. I'll agree that optimism may be good, but you need to think about the simplicity of the model that was set up: A) it was "cancer" – it didn't make any difference what kind of cancer; and B) there was no consideration of qualitative or quantitative differences among individuals.

You are exposed to germs all the time, but as Dubos said, you are not subjected to pathogens via a route or in a dose that will unconditionally elicit disease. You are subjected to doses that are sub-clinical in a sense, so the question is: why do some people get sick while others do not? If you want to test if optimism or humor has any influence on disease, you don't test it in a model where everyone is going to die anyway; you test it in a model where it could go either way. You only find out whether or not it has an influence when you have the latitude to see the influence.

Brown: One of the things that you can see in a broad historical prospective is that much of biomedical research over the years has been like looking for your keys in a dark alley only near the lamp post because that's where the light is. It's not necessarily where the realities that need to be explored are, or where the complexities that come close to the clinical situation may be, but it is convenient for a model. People perceive it as though they are actually finding something, but in fact they have already oversimplified their parameters. Another very general observation would be that some areas of medicine commonly regarded as rigorous and well-established have, in recent years, been shown to be less than rigorously founded. If evidence-based medicine is a new thing in various clinical and surgical disciplines, then that suggests that there wasn't that rigorous and well-established evidence in the management of stroke and many other fields until people suddenly realized we don't really have the rigorous basis for examination.

Some of what clinicians encountered over the centuries were what I call glimpses of the psychoneuroimmunological relationships. They may not have had a theoretical understanding, they certainly didn't have a good scientific



Dr. George Engel, whose 1977 paper in *Science* revitalized the biopsychosocial model.

understanding, but just by being open to the clinical experience, they could see certain connections between the emotional and physical states at the margins of infectious disease or other disease processes. They got a glimpse of something that has been passed down as the lore of medicine that is now in many cases finding its scientific validation. Those glimpses came not so much from theory in all cases, but from good bedside observation and an openness to take in the phenomena even if people did not understand what the phenomena were really about.

jur: How does the interdisciplinary research in the basic sciences like psychoneuroimmunology complement the biopsychosocial model which is normally applied to the clinical environment?

Ader: I don't know that it complements it, it's the other side of the coin so to speak; its part of the model. Interdisciplinary research is not done to support a model derived from clinical observation. It attempts to relate things that are going on at several levels of organization – from the cultural to the molecular. Those levels change depending on what you are doing. In a world that accepts the biomedical model, it provides evidence in support of the biopsychosocial model.

I thought it was fascinating that, when we showed that we could condition changes in the immune system thus demonstrating a functional relationship between the brain and the immune system, that was not enough to satisfy people that there was a connection. If you demonstrated that there was a neural connection between the two, even though you don't know what it's there for, that was enough to do it. So people accept different kinds of evidence with different degrees of support or belief, because a lot of this is about belief systems.

You have to play according to the rules that are laid down by the biomedical community, and you don't make changes like this from the outside; you only make changes like this from the inside. I am critical of the reductionistic approach, but I'm not implying that these people don't understand or that they're not bright or anything like that. If you provide the kind of data they understand, they will come along. But you have to provide that kind of data because those are the rules of the game. If that means you have to be more righteous than the righteous, then so be it. Those are the rules of the game and you can't just take your ball and go home.

jur: In light of that, where do you see the whole field going, in terms of interdisciplinarity? Do you see the biomedical and the biopsychosocial models fusing, or do you see them drifting apart?

Ader: I think I'm sort of in a pinch. I'm certainly in a pinch with psychoneuroimmunology. It comes along, everyone gets excited about it and you have people from different disciplines getting involved. Then as soon as they get a piece of it, they again fall into their old way of doing things and extract that little piece of it from the work whole. The notion is that someday we'll put it together. Well, that someday rarely ever comes for most things. In the long run, I believe the biopsychosocial model will win out simply because it will be shown to be a better predictor of health and illness. It will win out because it will lead to new and different approaches to treatments.

Brown: I wouldn't be so optimistic. I think that there are these ongoing tensions now, but if there is some new magic bullet that comes from either microbiology or genetics it will flood the field for a very long time, and some of these very sophisticated approaches will at least temporarily be lost. There will be people who will still pursue them, but they won't have the popularity and visibility, they will sort of be drowned and put into the shadows by the bright new light. That's actually a recurrent phenomenon that I see in medical history. When you have a new discovery, whether it be Pasteur in the 19th Century or recent discoveries of penicillin, there's such a desire for them and they play so well, they're so sexy, and they're so easy to market, both figuratively and literally, that they just overwhelm the rest of the field. And I would like to believe that we've now reached a new plateau of sophistication, but I'm not convinced that we really advance in this continuing dynamic and alternation.

jur: Is there any way that undergraduates can get involved in any aspect of this research?

Brown: I was just going to say that there's lots of historical work; there are all sorts of untried areas that would be rewarding to investigate. I've had some students over the years who have enjoyed doing this and would welcome more, if I could put a little plug in there.

jur: In terms of interdisciplinarity, what valuable lessons can students take away from the biopsychosocial model, whether or not their interest is in science?

Ader: I think what happens to undergraduate students and beginning medical students is that the biopsychosocial model simply reinforces the beliefs they had when

they came here. They already have this interdisciplinary mind-set; I think it was part of the reason they decided to be physicians. So then you have to ask the next logical question: "What happens that changes student attitudes?"

Brown: There are seductions along the road that deflect them.

Ader: Very practical ones.

Brown: Very practical ones. If they want to make it in this particular lab, then they're going to do what that lab is doing, and they may lose sight of the broader connections that they may still really be interested in, but that's not how they can develop the next stage of their career. Get the funding, get the support, get the mentorship they need.

jur: So, being somewhat idealistic or keeping a broad ideal are both qualities that will ultimately help them with a holistic career?

Brown: One hopes, one hopes. But there will be lots of pitfalls along the way.

Further Reading List:

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Engel (1987) *Physician-scientists and scientific physicians: resolving the humanism-science dichotomy*. American Journal of Medicine 82(1): 107-11.

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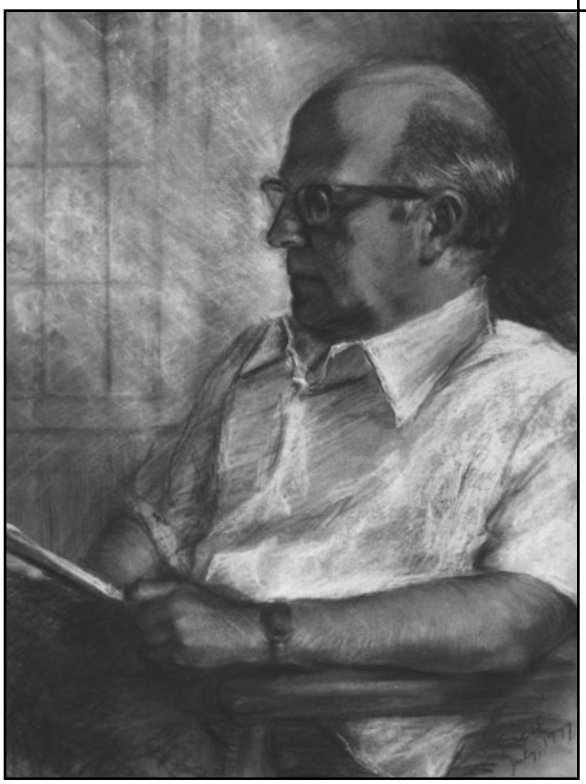


A sketch of Dr. George Engel.

Tracing Fluids in a Subduction Zone:
1291 and Halogens in Geothermal Waters from New Zealand

Featured Researcher: Audrey Stewart

This Featured Researcher article focuses on Audrey Stewart, class of 2004, who did her research abroad in New Zealand. Portions of the article are abbreviated excerpts from her senior thesis, which is available in its entirety at http://jur.rochester.edu.

What is doing research abroad all about?

Doing research abroad is about many different things. From a scientific perspective, doing research in multiple countries allows scientists, like the Professors that I have worked with, to investigate specific questions about the earth as they apply across the globe. When we take such a global view, we can correlate natural processes that happen in different places and gain a "big picture" perspective on how the natural world functions. From my perspective as a student, another important component of doing research abroad is becoming acutely familiar with a different culture and environment. I discovered how to effectively interact with a new culture and not only experienced but carefully studied, analyzed and drew conclusions from a new environment. And, of course, a nice perk of this type of research abroad includes the opportunity to travel for free, with the expenses paid for by a research grant.

How does your project relate to your major?

As an Environmental Science and History double major, the geology field work I did with the Earth and Environmental Sciences department evolved into a senior thesis project. Many environmental scientists are curious about the ways that humans impact the natural world, but we cannot fully understand how society affects the environment without first understanding how the earth functions on its own. My research project gives us more information about how elements cycle on the earth's surface, which has multiple implications relating to my major and also to broader academic questions. For example, if we understand more about how elements cycle in nature on a global scale, which is an important part of the project I worked on, we can continue to document how human actions alter those natural cycles and what the affects are. Take global warming and greenhouse gases as an example; they have attracted a lot of attention recently. Although the project I am working on does not measure greenhouse gases directly, many gases, such as methane, are emitted at our sampling sites. If we find out where the geologic material comes from at those sites, something my project investigates, we can potentially learn more about where the associated greenhouse gases come from, too. That information might eventually help geochemists to quantify the flux of gases emitted along subduction zones. This would help to further establish the relationships between natural and anthropogenic greenhouse gas emissions on a global scale, with implications for the future of earth's climate and, as a result, social or economic policy. I don't mean to be confusing – I'm not doing climate change research, myself – I'm just trying to show how a small project is connected to larger questions. Limiting ourselves to "majors" and "departments" allows us to specialize, but often causes us to forget how interconnected the different academic subject areas really are.

What or who inspired you to do this project?

My avid love of the outdoors was a major inspiration for doing research abroad. In hopes that I could both gain experience with geology and go on great hikes in beautiful remote areas of the world, I asked several professors in the Earth and Environmental Sciences Department if they needed field assistants for summer research trips. As luck would have it, some did! The field experience involved some serious back-country travel, which was great. Getting to the sampling sites gave me unique views and experiences of the country I never would have otherwise seen. (For example, I got to see mountain-top sheep fields and bubbling mud pits, and meet many sheep farmers.) I was also motivated by several of the professors in the department who have fabulous stories and pictures from their own field-work experiences. My thesis advisor, Professor Udo Fehn, especially encouraged me to become more involved in the research project as a good way to gain

first-hand knowledge of the scientific process. In that way, what started as exciting fieldwork evolved into a senior thesis project.

How can students do research abroad?

Become geology majors! Really. In the past year or two, geology undergraduates at UR have done research in Ireland, Bolivia, New Zealand, the Arctic, and on an ocean-bound cruse ship, and there is a possible trip to Japan coming up. In my case, I traveled to New Zealand for two weeks to collect samples as part of Professor Fehn's multi-year project studying subduction zones in New Zealand and Japan. The research expenses were covered by the Professor's research grant, funded by the National Science Foundation. But, if geology doesn't excite you, fear not; this approach isn't the only way to travel abroad, and it is not always free for undergraduates. Students interested in doing research abroad should realize that there are many available options and that, depending on your academic interests, students can research abroad through various institutions. For example, SIT (the School for International Training) offers field-based study abroad programs during the school year and summer, with emphasis on field research and independent study projects. If you are a student interested in doing research abroad, good first steps include talking to professors in the appropriate departments and counselors in the study abroad office. Our professors are doing some incredibly interesting things, and just might have grant money available for undergraduate research assistants. If not, they can at least point you in the right direction, and the study abroad office can help you identify programs that are already organized to allow students to do research abroad. It is a very rewarding experience, and I encourage anyone who is interested to investigate the opportunities right away!

Figures 1 and 2:
Sample collection locations.

Research Overview

My research project documents halogen concentrations and iodine isotope ratios from geothermal fluid samples along the forearc region of New Zealand's North Island in order to determine the origins of those fluids. The forearc is the region of a subduction zone between an active volcanic arc and the trench, where one tectonic plate is sinking under another. Determining the origins of geothermal fluids helps to increase scientific understanding of element transport between oceans, the crust and the upper mantle. Previous investigations of subduction zones indicate that some subducted crystal material returns to the surface through fluids in the main volcanic arc (i.e. volcanoes). A limited number of samples from previous studies suggest that fluids along the forearc contain material from the continental marine rocks of the overlying slab, rather than remobilized material from the subducting slab. By providing a more extensive investigation of the East Coast, my project shows that fluids here are most likely derived from old marine sediments in the continental crust, that are released due to folding and faulting of the continental crust along the subduction zone.

Field Methods

We collected 18 1-L fluid samples, and gas samples where possible, from seeps and springs along the East Coast of New Zealand's North Island over a two-week period in July 2003. The chloride concentrations in the fluids were measured with ion chromatography and the bromine and iodine concentrations in the fluids were measured using Inductively Coupled Plasma Mass Spectrometry at the University of Rochester. We extracted the iodine from portions of our samples, using methods established by Professor Fehn. Iodine extractions were then sent to the PRIME Lab at Purdue University, where iodine isotope ratios were determined using a method known as Accelerated Mass Spectrometry. Gas samples were not analyzed as part of this study but will be incorporated in future studies by the lab group.

Discussion and Conclusion

The halogen concentrations and iodine ratios determined for the East Coast support studies by Fehn and Snyder (2003) and show that iodine in the forearc originates from a different source than iodine in the

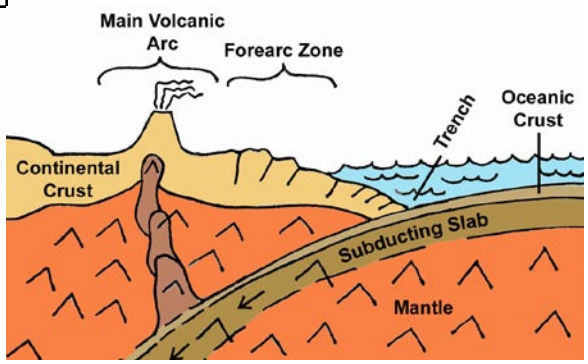


Figure 3: Cross section of a subduction zone.

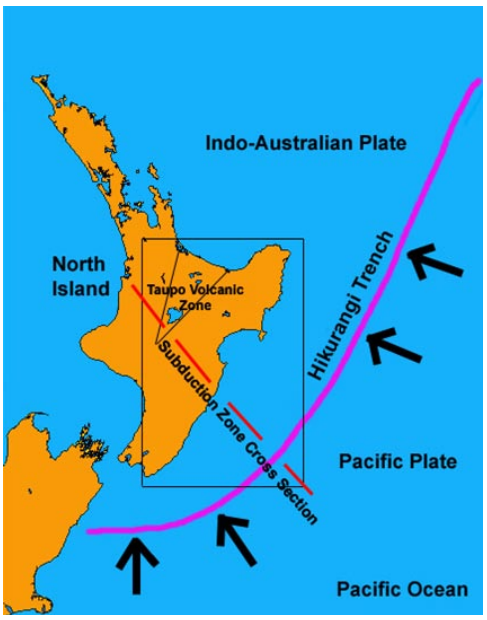


Figure 4: Tectonic sectioning of North Island.

main arc. Calculations from the end-member ratio of the iodine isotope indicate that the minimum age of the fluid is 60 million years, corresponding with earlier age determinations of 70 million years based on a limited number of samples. Both of these clearly differ from ages for the subducting slab, which exceed 110 million years. Iodine concentrations are heavily enriched on the East Coast, close to 100mM (one to two orders of magnitude higher than concentrations in the main volcanic zone), and oil, other liquid hydrocarbons and gas are observed to be closely associated with most seeps. These findings suggest that the likely source of fluids is organic-rich Tertiary and Cretaceous sedimentary marine formations present in the continental crust along the forearc zone. The age calculation is a minimum, and while it does not conclusively rule out the potential for remobilized elements from the subducting slab, other evidence points to a continental source. This strengthens the findings of Fehn and Snyder (2003). The three sample sites that indicate most similar iodine and halogen behavior are Waipuka, Pouhokia 1, and Waihireri. While Waipuka and Pouhokia are relatively close in geographic location, Waihireri is over 100 km to the north. Roto-o-tahi and Whangara both exhibit potential mixing with older groundwater; given their proximity to the coast the fluids at those seeps may also experience mixing with seawater. It is interesting to note that no trends regarding sample location or type are immediately evident; for example, proximity to coast, hot vs. cold seeps, mud lake vs. individual cones. The lack of distinct trends along the coast indicates that processes leading to the release of geothermal fluids are relatively constant across the length of the forearc.

Numerous factors indicate that geothermal fluids in the forearc zone are derived from continental organic material. The presence of gas and liquid hydrocarbons, the high concentrations of iodine, and the iodine age signal all point towards a continental source.

These findings have several applications. First, the research confirms that remobilized iodine from the subducting slab is present in the main volcanic zone but not in the forearc. This suggests that all iodine recycling from the subducted slab happens at the main volcanic zone, which is useful when calculating certain element budgets in the crust and upper mantle.

In addition, knowing that fluids in the forearc zone have a continental source helps us to understand geologic processes associated with subduction in the forearc zone. Particularly, it suggests that the release of geothermal fluids in a forearc leads to recycling of elements from continental sedimentary rocks of older, marine origin.

The study in this paper is just one component of a larger project, and investigations of several areas which deserve further research are already underway. Analysis of gas samples from New Zealand's forearc are currently being carried out by Robert Poreda at the University of Rochester Rare Gas Facility. More research of halogens, iodine and gases from other forearc regions, such as the study of Japan planned by Professor Udo Fehn at the University of Rochester, will help to determine whether the processes detected at New Zealand are typical of all subduction zones or unique to New Zealand.

New Zealand: A Microcosm for Studying Subduction Processes

New Zealand is located along the Hikurangi Trench, the plate boundary at which the Pacific Plate is subducting under the Indo-Australian Plate. The island's geology is directly affected by the subduction process occurring at the trench. The North Island spans multiple geologic regions over a relatively short distance and is the first location where iodine and halogens have been measured in both a volcanic arc and its forearc. The main volcanic arc, called Taupo Volcanic Zone, is located ~280 km west of trench. Geothermal power plants operate in this region. The region has been studied extensively in previous works. The forearc region along the East Coast is unusually broad and contains a thick accretionary wedge. Geology primarily composed of marine sedimentary rocks of Tertiary age (1.6-65 million years) overlying Cretaceous basement layer (65-144 million years). Accessible seeps and springs along the forearc are ideal for sampling; previous iodine work there is limited to several sampling sites. At trench, the subducting slab is approximately 98 million years old, subducting rate is 3-6 centimeters per year.

Transnational Cinematic Production and the Emergence of John Malkovich as a Transnational Actor

Chadwick Schnee, 2005

Advised by Randall Halle, Ph.D.

Department of Modern Languages and Cultures

"The Yanks have colonized our subconscious."
-Kings of the Road, Wim Wenders

With the ever-increasing ease of travel and communication, questions of national identity and iconography have come to the forefront of scholarly debate, especially in that of "German" films of the last two decades.[1] Through the reduction of state-sponsored programming and the increased desire for profitability in world markets, state-sponsored films have broadened their definition of what makes a film inherently "German." In his essay "German Film *Aufgehoben*: Ensembles of Transnational Filmmaking," University of Rochester professor Randall Halle examines the identification of *House of Spirits* (1993) as a German film:

> *The director of the film, however, is Bille August, a Dane, and its narrative derives from the novel by Chilean author Isabel Allende. Furthermore, the film features an international cast with Meryl Streep, Glenn Close, Winona Ryder (American), Antonio Banderas (Spanish/American), Vanessa Redgrave and Jeremy Irons (British), and Maria Conchita Alonso (Spanish). Significant in fulfilling FFA [German Federal Film Board] requirements for funding was the presence of eminent German actor Armin Mueller-Stahl among the cast albeit in a supporting role… The presence of Mueller-Stahl and the site of the premier were enough to qualify the film for FFA funding.*[2]

Despite the fact that the majority of the cast members were not German, the FFA still dubbed *House of Spirits* a "German" film, providing it with funding.

The use of an international cast in transnational productions is nothing unique to Germany, however, as the film *Captain Corelli's Mandolin* (2000) demonstrates. The French company Le Studio Canal+, the American company Miramax Films, as well as the British company Working Title Films produced the film, which was shot in Greece by a British director. The film also features Spanish actress Penélope Cruz, American actor Nicolas Cage, and British actor Christian Bale. These ensembles were for the large part lambasted by critics because of their international cast:

> *This is one of those films where the cast seems to go through their paces without really inhabiting their roles and where everybody has a different accent: Spanish for Cruz, Brit for Hurt and Bale and cheesy Italian organ grinder for Cage, not to mention the babel generated by an international stew of supporting players.*[3]

In the same review, critic Robert Butler mentions the Oscar-winning film *Dangerous Liaisons* (1988) as an example how a good actor (John Malkovich) should be malleable enough to play any part.

Dangerous Liaisons is a film nationally produced by an American company that retells a French play written in the 19th century that was later made into a movie in 1959 by French director Roger Vadim. It should be no surprise that Warner Bros. was able to bring popular and expensive Hollywood stars to the film, such as Glenn Close, Michelle Pfeiffer, Keanu Reeves and Uma Thurman. Transnational films brought together by international production companies, however, have much more limited budgets than that of Hollywood, and often have to rely on lesser known actors who may be more cost effective than bigger Hollywood names.

In the midst of transnational filmmaking, Peter Falk, David Hasselhoff and Udo Kier have all emerged as transnational actors through their unique ability to generate ambiguous identification across international borders. In the majority of their roles, these actors have been able to simultaneously encourage and deter identification with the characters they play. The American Falk, internationally recognized for his role as Lieutenant Columbo, has starred in transnational films such as *In weiter Ferne, so nah!* (1993), which is a film by German Wim Wenders that featured various German, Swedish and American actors while being distributed by various other nationalities. Before launching into his singing career in 1995, German cultural icon David Hasselhoff starred in the sci-fi film *Starcrash* (1979), which was directed by Italian Luigi Cozzi and featured Canadians, Americans and Britons. German Kier, for example, has starred in transnational

films such as Andy Warhol's *Dracula* (1974), which was produced by Italian Compagnia Cinematografica Champion and French Yanne et Rassam and features an ensemble of German, Italian and American actors. Through their abilities to blur their national identities and generate ambiguous identification, these actors have emerged as transnational actors.

In the context of transnational cinema the Chicago-born Malkovich plays an interesting role. Acting in over forty-nine films and made-for-TV movies since 1981, Malkovich is an international sensation whose celebrity is only slightly rivaled by Falk and Kier. As of April 2003, more than thirty-two of Malkovich's films could be considered transnational films — films that involved the collaboration of more than two different nationalities.[4] Malkovich has emerged as a transnational actor, a status highlighted by both his filmography and his personal life. After graduating a star high school football player, Malkovich joined Gary Sinise's theater troupe, named the Steppenwolf Theatre Company, in 1976.[5] Seven years later, Malkovich won an Obie award for the Steppenwolf production of "True West." In 1984, Malkovich appeared alongside Dustin Hoffman in a revival of "Death of a Salesman," later winning an Emmy when it was turned into a made-for-TV movie directed by German Volker Schlöndorff. In his début film *Places in the Heart* (1984), Malkovich played a blind lodger, earning himself an Academy Award nomination. "Though he has tried his hand at comedy (*Making Mr. Right* 1987), Malkovich excels at limning aloof, amoral, generally unsympathetic characters such as the black marketeer in *Empire of the Sun* (1987), the Vicomte de Valmont in *Dangerous Liaisons* (1988), the bored intellectual in *The Sheltering Sky* (1990), and the desperate, materialistic yuppie in *The Object of Beauty* 1991)," film critic Leonard Maltin wrote, while mentioning Malkovich's nomination for his second Oscar in 1993 for his role as a psychotic would-be assassin in the film *In the Line of Fire*.[6] Malkovich himself admitted to his frequently dark roles while traveling to his farmhouse in Southern France in the Bravo Profile filmed shortly after finishing production on *Shadow of the Vampire* (2000), quoting a famous Hitchcock adage — "A film is only as good as its villain."[7]

In 1999, Malkovich played a role that had fascinated a worldwide audience for decades — himself. *Being John Malkovich* (1999) is one of his most successful films to date, grossing over $22 million in the U.S. alone.[8] Malkovich received praise both domestically and abroad for his work revolving around a person's irrational obsession with becoming Malkovich by travelling through a hidden tunnel on the seventh-and-a-half floor. While bizarre, the film touches upon the worldwide fetish with Malkovich, stemming from Malkovich's ability to keep audiences identifying with him while remaining distant. This seemingly paradoxical relationship viewers have with Malkovich is the reason for his international appeal. In the films *Der Unhold* (1996) and *Shadow of the Vampire* international audiences continually experience moments of ambiguous identification with the characters Malkovich plays.

In his essay "Star and auteur: films with Bergman" in *Hitchcock's Films Revisited*, Robin Wood outlines six factors in the construction of identification, which work universally. For Wood, identification with the male gaze is a key factor in identification, although it should be noted that the term "male gaze," as Wood uses it, presumes an assumption of "maleness" by all viewers, regardless of gender and sexual identity. Wood also believes that the audience identifies with the victim, as it does with any character to the extent in which moviegoers are encouraged to do so. The sharing of consciousness, like the use of point of view shots from a character, also encourages the audience to identify with a character. The use of cinematic devices such as editing, shot angles and lighting, among other examples, make the viewer identify with certain characters. His last point is that the viewer identifies with the star of the film as well.[9]

Shadow of the Vampire

As it is with many of Malkovich's films, the audience only identifies with him to a limited extent in *Shadow of the Vampire*. American Nicolas Cage's Saturn Films, two Luxemburg companies, and British BBC Films and Long Shot Films produced the film, while Briton Eddie Izzard, German Kier and American Willem Dafoe starred in it. The plot also has its transnational leanings as it bases its premise on the fact that actor Max Schreck in F.W. Murnau's classic *Nosferatu* (1922) actually is the part he plays — a vampire. From this, the characters of Murnau (Malkovich) and "Count Orlock" (Dafoe) have various battles over control of the film and its production, telling a story of obsession, loyalty and power.

Throughout the film, there are shots that mimic those of *Nosferatu*. These shots use the iris, are black and white, and feature Murnau giving directorial voiceovers to the actors in the frame. These shots can be called point of view shots, as Murnau stands by the camera and, along with the sound of the camera winding, provides the audio while remaining offscreen. After the titles, the film opens with an extreme close up of Murnau's eye that begins out of focus and racks focus. After a shot of the camera lens, the frame irises in to a medium shot of Greta Schroader dangling a ball of string in front of a cat sitting in a windowbox while Murnau talks offscreen. The next shot is a close up of Murnau, who meows while wearing black goggles over his eyes. After a few similar shots in which Murnau tries to set the mood for the actress, there is a low angle full shot that shows Murnau and the rest of his crew wearing white lab coats and black goggles, watching the scene while the bright lights used in film production shine toward the camera (see Shot-by-Shot Description).

In this opening sequence, the viewer is unsure of how to feel about Murnau. While the audience shares consciousness with Murnau in the point of view shots, the viewer also gains identification with Murnau because Malkovich, as the main character of the film, plays him. The

close-up of Murnau encourages the audience to identify with him, but the slight low angle and the goggles over his eyes distance moviegoers. Additionally, the sterile, white lab coats and Murnau's voiceover discourage identification with him, as they portray Murnau as an uncaring manipulator. Malkovich's actions, as well as the setting around him, place the character in the gray area of ambiguous identification.

When Murnau confronts Orlock after the vampire preys upon Wolf the cameraman, another instance of ambiguous identification occurs. While the audience identifies with Murnau because of Malkovich's star power, it is questionable with whom the audience connects with more — the vampire or the director. In the scene, Murnau berates Orlock for killing Wolf. As Murnau directly addresses the camera in fast-moving shots and thrusts his finger toward the camera, the audience feels that he victimizes the vampire. In the scene, however, Orlock makes demands of his own, such as not sailing and suggesting other people he could eat. Because Murnau attempts to satisfy his demands, viewers see Murnau is at least practical if nothing else. Additionally, all of Orlock's shots are static while Murnau's are erratic and quick moving, making the audience interpret Murnau as the perpetrator of the actions. The audience, however, does gain some identification with Murnau as a result of repeated point of view shots in the scene. Because Orlock is a vampire, however, moviegoers continue to seek identification with Malkovich more than Orlock, placing him in a nebulous area of identification (see Shot-by-Shot Description).

In the final scene of the film, the audience loses a great deal of identification with Murnau as he focuses completely on his film instead of his cast and crew. After Greta, while laying on the bed wearing a white nightgown in a medium shot, notices that Orlock does not have a reflection, Murnau, wearing a white lab coat, sits down on the bed next to Greta in a 3/4 shot and forcibly administers drugs to her. Murnau then begins filming again, while Orlock, wearing black, leans down and places his arm over Greta, resting his head by her neck. In a medium shot, Murnau watches the action, while wearing black goggles over his eyes (see Shot-by-Shot Description).

Murnau's actions, as well as his attire, distance the audience from the character. The audience, however, identifies more with Murnau because of Orlock's overpowering bloodlust. As a result of Orlock's straightforwardness, the audience may feel that Murnau's action is not as bad as Orlock's bloodlust, causing the audience to identify with the director more. Additionally, Murnau, through his calmer and more rational attitude in this scene, embraces these human qualities, making the viewer identify with him in stark contrast to Orlock's visceral desires.

As it is in the rest of the film, the audience fails to fully identify with Murnau in these three scenes. While viewers identify with Murnau due to his juxtaposition against a vampire and the casting, the dialogue and various aspects of mise-en-scène and camera movement all prevent the audience from completely identifying with Murnau. This is, however, the reason why Malkovich can be dubbed a transnational actor: he is able to play a character that generates ambiguous identification.

Der Unhold

The audience largely remains distanced from Malkovich in *Der Unhold*, directed by German Volker Schlöndorff. The film represents a different sort of transnational filmmaking, as there was no direct influence by Hollywood from American production companies. Instead German companies Studio Babelsberg, Universum Film A.G., and Westdeutscher Rundfunk worked together with French companies Le Studio Canal+, France 2 Cinéma, Renn Productions and British company Recorded Picture Company in making the movie. In the film, Abel (Malkovich) has a strange preoccupation with children and allows fate to guide his life in Germany during WWII after he is captured as a French prisoner of war.

When Abel "discovers" the sexually abused girl in the beginning of the film in France, for example, the audience fails to completely identify with him, setting up the mixed reactions to him that follow throughout the entire film. The scene begins with Abel walking towards the camera in a fast-paced medium close-up from a low angle, which is then followed by a tight low angle close-up of Abel ducking and looking down to enter the room. The girl, who is wearing a uniform with a bright, untarnished white collar, is then shown in a high angle full shot, with her weeping and curled into a ball among a dark background. Abel then crouches down into a medium shot and asks what is wrong, and the police then respond to the girl's wailing in a deep focused full shot. Abel is shown again in a medium shot, crouching by the girl, explaining that the person who did this must still be close by. The police then grab Abel, dragging him away into the shadows in a full shot, as the girl continues to sob, "He hurt me." Abel is then shown outside being dragged into a waiting police car in a shot that moves from a full shot to a medium close-up (see Shot-by-Shot Description).

The audience reacts with mixed feelings during this scene, as viewers do not fully identify with Abel. In this instance, the audience does not

Malkovich as Abel in *Der Unhold.*

see any negative action that Abel may or may not have taken; Abel's "concerned" actions preserve the viewer's identification with him. In this scene, however, the audience identifies with the girl to a certain extent, as she is the obvious victim, which is highlighted by the fact that she is shown from a series of high angle shots. The audience fails to be encouraged to identify with the darkly dressed Abel, both because viewers are uncertain about his possible sexual molestation and because he emerges from dark shadows. Some viewers may sympathize with his "concerned" actions, but ultimately the filmgoers are uncertain of his actions. The close shots of Abel, as well as what could be termed point-of-view shots of the girl, however, encourage the audience to identify with Abel. From Wood's theory of identification, one presumes that because Malkovich is the most prominent actor in the film, spectators identify with the character he plays to a greater extent. Due to Abel's questionable actions and sympathy with the victim, the audience maintains its mixed feelings for Abel, as it does for the remainder of the film.

In another scene in the film, the audience initially identifies with Abel, but, at the end of the scene, becomes distanced from the character. In the first shot, a close up of Abel entering the cabin from the darkness outside, the tight frame and Abel's action of squinting as his eyes adjust to the light encourages the audience to identify with him. Moviegoers also gain identification with Abel through the use of the point of view shots and repeated tight close-ups during the scene. Viewers and Abel also share a sense of consciousness as they discover the fate of the birds at the same time. The repeated shot/reverse shots between Abel and what he is looking at also encourage identification. While the audience also identifies with Abel because Malkovich plays him, viewers lose some identification with him when he attacks the captain. Instead of playing the victim, which would further audience identification with Abel, he initiates an attack from which other prisoners of war have to drag him away. In the end the audience feels distanced from Abel due to his reaction (see Shot-by-Shot-Description).

After Abel begins caring for the Hitler youth, he begins roaming the countryside, looking for other children to join the movement. In a full shot, for instance, Abel, wearing a black cape with a black skullcap, moves toward the camera, towed by his fierce black dogs who are on leashes in front of him. In the scene, children run away from Abel with expressions of fear on their faces. In a close up shot, viewers see the legs of a child running left as the camera tracks with the movement. Immediately afterwards, a similar close up is shown, except the black legs of a horse run to the left this time, chasing after the child. In this scene, there is very little identification with Abel, as he victimizes the children through pursuing them. Abel's all-black attire and the color of the animals around him also cast Abel as the predator in this scene, as does Abel's movement toward the camera.

Malkovich once again generates ambiguous identification with the audience in the film Der Unhold. Throughout the entire film, Malkovich wears dark clothing and emerges from darkness in many scenes, portraying himself as a villain of the film. While he helps support the Nazi movement and may have sexually abused a girl, Abel does some admirable things as well, such as attempting to save the children's lives when the Russians approach and rescuing a fallen Jewish boy from certain death. The use of point of view shots and lighting also help encourage identification with Abel. The audience is uncertain of how to feel about Abel.

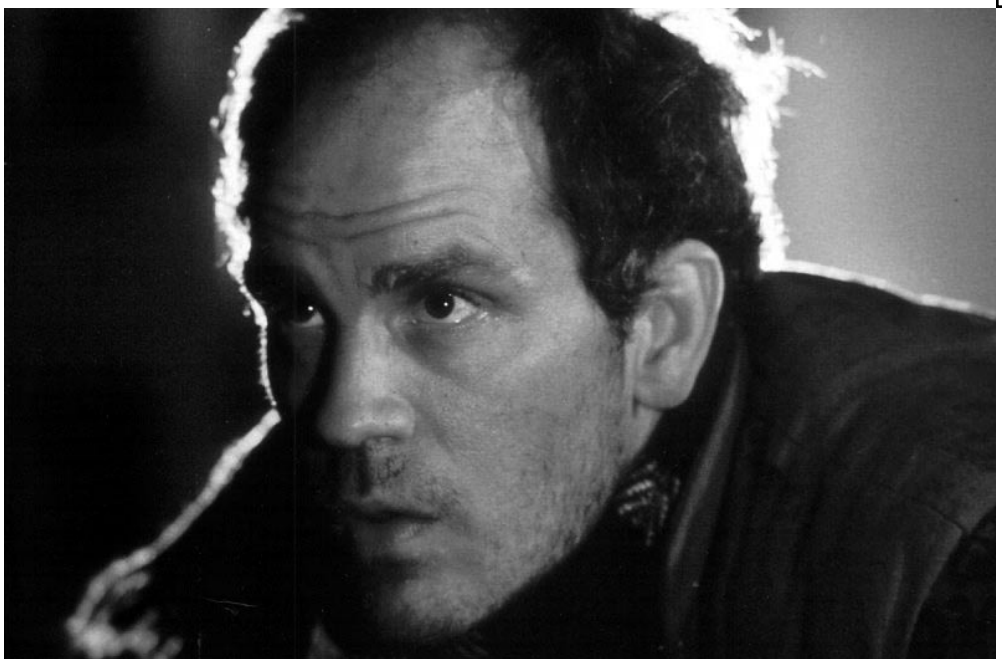
In the new era of cinematic globalization, Malkovich has become one of the most successful transnational actors to date, with box office grosses and worldwide fascination far beyond that of others. In both *Shadow of the Vampire* and *Der Unhold*, audiences fail to fully identify with Malkovich. This, however, is exactly what makes him a successful transnational actor — his ability to simultaneously encourage and discourage identification with the characters he plays. Generated through the hybridization of classical Hollywood and European Arthouse film styles, ambiguous identification has led to a form of filmmaking seeking broad transnational appeal, often at the expense of the film itself.

Abridged Shot-by-Shot Description of *Shadow of the Vampire.* The full version can be found at jur.rochester.edu.

First Scene
1. (ECU) Out of focus shot, straight on angle. Rack focus to in focus shot of green eye. –*cut*
2. (ECU) High angle of camera lens. The camera moves up and left, rotating around it. -*cut*
3. (3/4 shot) Iris out. Black and white. High angle. Greta dangles ball of string in front of kitten. Murnau does a voiceover. -*cut*
4. (CU) Slight low angle. Murnau looks toward camera, talking. -*cut*
5. (3/4 shot) as 3. Murnau continues to talk. -*cut*
6. (CU) as 4. -*dissolve*
7. (MCU) Low angle. Eddie Izzard ties his tie -*dissolve*
8. (CU) as 4. -*cut*
9. (Full) Low angle. Murnau stands next to the camera, as the rest of the crew looks toward the camera. -*cut*
10. (CU) as 4. -*cut*
11. (3/4 shot) as 3. Iris in, shot turns to color. Camera moves up. -*cut*
12. (Full) as 9. Murnau looks right, towards Wolf. -*cut*
13. (CU) Straight on angle. Wolf looks toward the camera, leaning on his. -*cut*

Second scene
1. (MCU) Slight high angle. Camera tracks right with Murnau's movement. Murnau approaches the camera to a CU while yelling at Orlock. -*cut*
2. (MCU) Slight low angle. Point of view shot. Orlock stands in the center of the frame. -*cut*
3. (MCU) Slight high angle. Murnau moves toward the camera. Camera follows movement, tilting up, then down and pans left. -*cut*
4. (MCU) as 2, but Orlock stands on the left side. -*cut*
5. (MCU) Slight high angle. Murnau paces left and right, and camera pans to the movement. -*cut*
6. (MCU) as 4. -*cut*
7. (MCU) as 5. Murnau turns toward the camera. -*cut*

8. (MCU) as 4. Orlock laughs. *-cut*
9. (CU) Straight on angle. Murnau yells toward the camera and points his finger at it. His finger is out of focus. *–cut*
10. (M) Straight on angle. Orlock looks down and left as watery light reflects off his face. *-cut*
11. (MCU) as 7. *-cut*
12. (MCU) as 4, but Orlock looks right, then turns left, recoiling. *-cut*
13. (CU) as 9, except his finger is in focus while his face is not. *-cut*
14. (MCU) as 12 ended. *-cut*
15. (CU) Slight low angle. Profile of Murnau looking left in the right side of the frame while Orlock stands in the background, out of focus. *-cut*
16. (MCU) as 4. Orlock discusses ship. *-cut*
17. (CU) as 15. Murnau looks at Orlock, then focus changes to Orlock. *-cut*
18. (MCU) High angle. Murnau, looking shocked, questions Orlock. Golden watery light reflects on his face. Camera pans left. *–cut*
19. (MCU) as 16. *-cut*
20. (MCU) as 18 ended. Murnau shouts. *-cut*
21. (M) Slight low angle. Murnau, facing away, shouts at Orlock. Orlock looks down. *-cut*
22. (MCU) as 16, looking down. *-cut*
23. (CU) as 9. *-cut*
24. (MCU) as 16. *-cut*
25. (MCU) Slight low angle. Murnau yells, points his finger. *-cut*
26. (MCU) as 16. *-cut*
27. (MCU) as 25. Murnau moves toward camera. *-cut*
28. (MCU) as 16. *–cut*
29. (CU) Straight on angle. Murnau continues to talk, camera pans left with movement. *-cut*
30. (MCU) as 16. *–cut*
31. (CU) as 29 ended. *-cut*
32. (MCU) as 16. *-cut*
33. (MCU) Slight high angle Murnau continues to shout. *-cut*
34. (MCU) as 16. *-cut*
35. (CU) as 29, camera pans left and tilts up as Murnau approaches the camera. *-cut*
36. (Full) Slight low angle. Orlock in left side shudders. Murnau faces away on the right side. *-cut*
37. (MCU) as 16, Orlock hisses at Murnau, recoils a bit. *–cut*
38. (MCU) as 33. *-cut*
39. (MCU) as 37 ended. *-cut*
40. (MCU) Slight high angle. Murnau paces left, then right. Camera pans



Malkovich as Basie in *Empire of the Sun*

movement. *-cut*
41. (Full) as 36. Murnau paces across frame. *-cut*
42. (MCU) as 16. *-cut*
43. (Full) as 36. Murnau faces right in a profile shot. *-cut*
44. (MCU) as 16. *-cut*
45. (CU) Straight on angle. Slightly closer than a CU with Murnau's face on the left side. *-cut*
46. (MCU) as 16, Orlock facing left. *-cut*
47. (MCU) Slight high angle. Murnau turns away, moving offscreen right. *–cut*
48. (MCU) as 46. Orlock reaches down, then camera pans right with his movement to a CU. *-cut*
49. (ECU) High angle, point of view shot. Orlock holds the locket of Greta in his hands. *-cut*
50. (MCU) as 48 ended. Long take as Orlock holds up the locket and discusses love. *-cut*
51. (Full) Orlock turns away and moves down in his cave *–fade*

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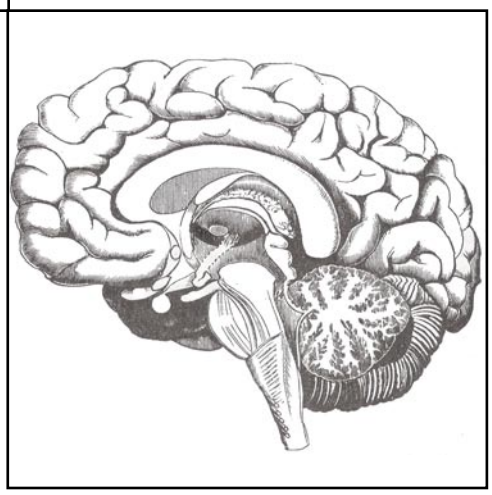
Chadwick Schnee is a senior who is majoring in Film Studies and English Literature. This article is the culmination of Professor Randall Halle's course on New German Cinema, which was offered in the spring of 2003. In the future, Schnee plans on furthering his understanding of identification and film theory.



Neuronal Mechanisms of Actively Steering Optic Flow:

Global versus Local Motion

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Optic flow provides a moving observer with information about heading and the 3-dimensional layout of the environment. Passive viewing of optic flow by a passenger is a very different experience than active steering of optic flow by a driver, although the same optic flow fields are seen. The driver would seem to be more engaged in visual motion processing in order to actively steer the heading direction, as compared to the passenger. In addition, optic flow might be analyzed by perceiving the global pattern of motion or by responding to a local patch of motion in the pattern. Medial superior temporal (MST) neurons show optic flow selective responses with tuning for the simulated heading of observer self-movement.[1] We have now compared MST neuronal responses to optic flow during global and local motion processing of passive viewing and active steering of the simulated heading direction of optic flow.

The data suggest that MST neuronal responses to optic flow are influenced by tasks that require real-time visual analysis. Passive and active observers both process optic flow, but their responses to those stimuli differ. Top-down mechanisms may enhance MST responses when the subject uses global motion and actively suppress responses when using local motion strategies. These motion strategies may be particularly relevant when local and global motion are incongruent, such as tracking the path of a deer as it crosses one's path.

The results indicate that most MST neurons respond differently to optic flow during passive and active conditions when the monkey uses global motion. The most robust effects are the enhancement of MST responses in the active steering condition and the suppression of MST response in the passive viewing condition. In addition, we speculate that the use of a local motion strategy to process optic flow tends to suppress MST, while a global motion strategy enhances MST response. This response suppression (local) and enhancement (global) is not limited to the preferred stimulus direction and is evident under both passive and active steering conditions.

Optic Flow Perception

In 1950, J.J. Gibson coined the term "optic flow" to refer to the patterned visual motion by a moving observer.[2] Gibson studied how observers estimate their position and orientation in space, suggesting that optic flow provides the observer with information about his movement and the 3-dimensional layout of his environment to guide self-movement. In his schematic illustration of optic flow (Figure 1), he depicted the optic flow seen by a pilot trying to land a plane on a landing strip. As the plane moves forward, stationary objects are seen to move radially with increasing speeds towards the peripheral visual field. The center of this expanding radial pattern is called the focus of expansion (FOE) and indicates the observer's heading direction.

Figure 2 shows the overhead view of the observer's movement (left panels) and the retinal pattern of optic flow (right panels). If the observer moves forward while looking straight ahead (A, left), a radial pattern of optic flow (arrows) is projected onto the retina and the FOE indicates the direction of the observer's movement (A, right). When the observer moves right-forward (B, left), the observer sees a radial pattern in which the focus of expansion is displaced to the right of gaze, indicating a rightward heading direction.[3]

Studies have shown that in order to guide ordinary locomotive activities like skiing or running, one must estimate heading within 1-3 degrees.[4] Other findings have indicated that observers judge their heading with great accuracy; thresholds are at least as low as 0.5 degrees when viewing optic flow.[5,6] The length of exposure to the optic flow seems to be important also, as performance improves with increased viewing times of optic flow.[7]

Smooth pursuit eye movements made in order to track objects during self-movement add to the optic flow image, resulting in an FOE that is shifted towards the direction of eye movement. Therefore, during pursuit, heading estimation from optic flow is more complicated.[8] Psychophysical studies have indicated that humans can

still estimate their direction of heading from the resulting retinal motion, although this heading estimation during pursuit improves with the addition of multiple depth planes in optic flow.[9-11]

Recent studies have shed light on the neural mechanisms of optic flow perception. In particular, studies have shown that when an observer is presented with a random dot display, his sensitivity to the direction of motion enhances as the area of the display increases. This psychophysical result provides further evidence for spatial integration and summation of optic flow over large regions of space within the visual system. In addition, the sensitivity to the motion of optic flow seems to be sharply tuned for speed, which is consistent with the physiology of MST neurons.[12] Duffy and Wurtz have proposed that this sharp tuning for speed allows for the integration across multiple depth planes during combined self-movement and pursuit.[12]

Optic Flow Neurophysiology

MST is categorized into two distinct regions: lateral (MSTl) and dorsal (MSTd).[13,14] In general, MSTl neurons have smaller receptive fields than MSTd cells. Some MTSl neurons are suited for discriminating a moving object from the background because they exhibit center-surround disparity selectivity. MSTd neurons have very large receptive fields; many neurons respond to stimuli within a full quadrant or a complete hemi field.[13,15-17]

Saito et al. used anesthetized and paralyzed monkeys to study the visual response properties of neurons in the cortical area surrounding the middle temporal area (MT) in the superior temporal sulcus (STS).[14] Their findings indicate a functionally distinct region where three classes of directionally-selective cells with large receptive fields cluster: MSTd. One class of cells responded to a straight movement of patterns in the fronto-parallel plane with directional selectivity (51.4%), the second class of cells selectively responded to an expanding or contracting size-change of patterns (15.7%), and the third class of cells responded only to a rotation of patterns in one direction (13.7%). They suggested that these cells integrate motion information extracted by MT cells.

Duffy and Wurtz suggested that the selective responses of many MSTd neurons to the rotational and translational components of optic flow deemed them important in contributing to the analysis of optic flow fields.[18] When they investigated whether neurons that respond to radial and circular motion respond differently when the center of motion was shifted to different regions of the visual field,[1] they found that about 90% of the neurons studied responded differently when the center of motion was shifted away from the center of the field. In addition to showing selective responses to simulated heading direction in optic flow, these MSTd neurons also displayed sensitivity to speed gradients.[12] In addition, Bradley et al. demonstrated that MSTd neurons have different FOE preferences for optic flow presented during fixation and pursuit.[19] Overall, MSTd neurons are assumed to respond to movement of the observer, which is important in navigation and spatial orientation.[20]

Lesion studies help confirm MT and MST's role in motion perception. Chemical lesions made to area MT in conjunction with psychophysical tasks were used to assess sensitivity to motion. Results indicated that the lesions into MT caused striking elevations in motion thresholds, suggesting that neural activity in MT contributes selectively to the perception of motion.[21] Bilateral lesions of areas MT/MST of varying intensity caused a temporary disruption, followed by at least partial recovery, of most motion thresholds. Permanent effects of the lesions on visual sensitivity were graded with lesion extent. In general, these results demonstrated that MT/MST areas make an important contribution to the performance of various motion perception tasks including the discrimination of differences in direction and speed, and the perception of global motion in the presence of directional noise.[22]

Salzman et al. tested the effects of cortical microstimulation on perceptual judgements of motion direction on rhesus monkeys.[23] They determined that microstimulation biases the monkey's behavior in a direction that is predicted by the neuron near the stimulating electrode. This demonstrates a functional link between the activity of direction-selective neurons and perceptual judgements of motion direction.[23] Celebrini and Newsome electrically stimulated clusters of directionally selective neurons in MST in Rhesus monkeys during a direction discrimination task and found that microstimulation biased the monkeys' choices toward the direction of motion encoded by MST neurons at the stimulation site.[24] Since receptive fields in MST are typically much larger than those in MT, Celebrini and Newsome determined that stimulation of a single site in MST can influence judgements over a much larger portion of the visual field than equivalent stimulation in MT.[24]

Britten and van Wezel tested the hypothesis that MST is involved in the analysis of self-motion by electrically microstimulating MST while monkeys performed a visual heading discrimination task.[25] They found that

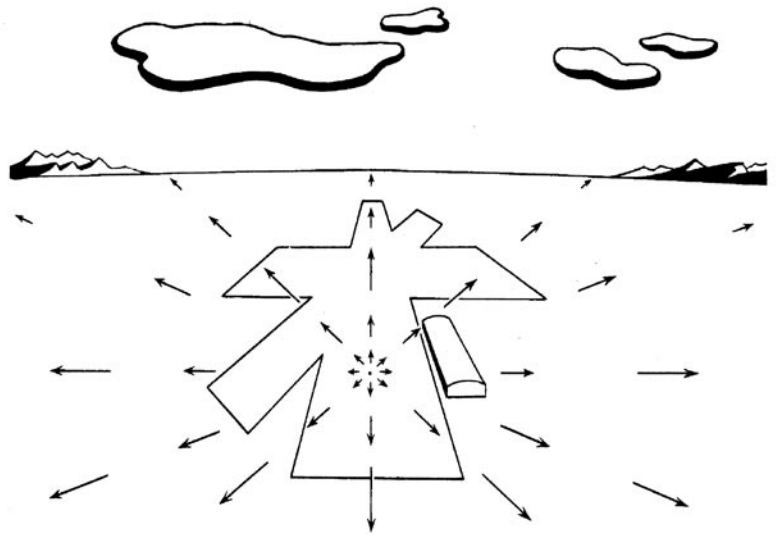

Figure 1: Gibson's Depiction of Optic Flow: This schematic illustration depicts images of objects and their motion patterns seen by a pilot during runway approach. As the plane approaches, objects appear to radiate outwards from the heading direction, called the focus of expansion (FOE). The radial speeds of the objects increase as they move from the FOE, depending on the distance to the observer. The location of the FOE could be used to navigate a successful landing.

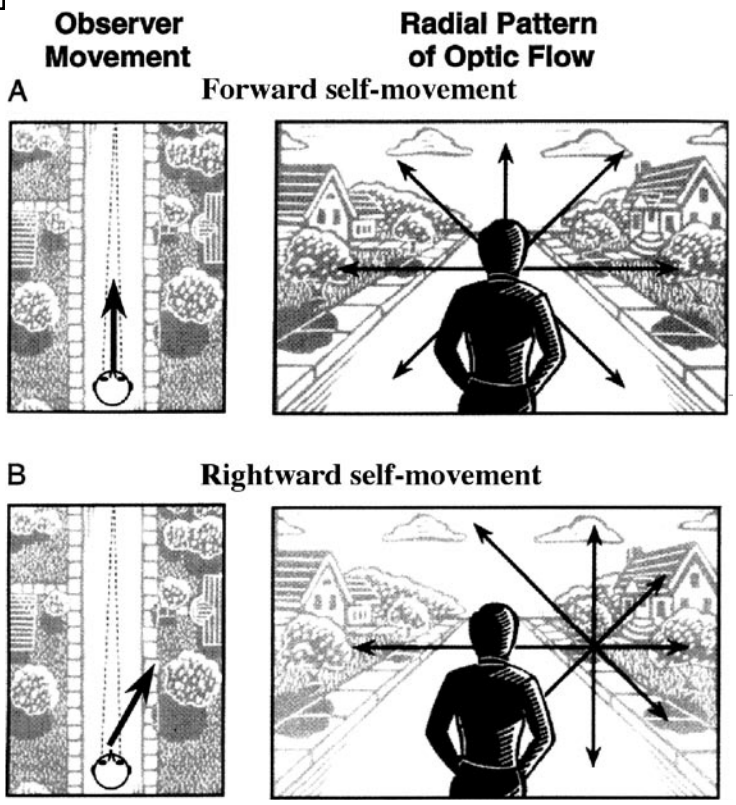

Figure 2: Overhead view of the observer's movement (left panels) and the optic flow (right panels). If the observer moves forward while looking straight ahead (A, left), a radial pattern of optic flow (arrows) is projected onto the retina and the FOE indicates the direction of the observer's movement (A, right). When the observer moves right-forward (B, left), the observer sees a radial pattern in which the focus of expansion is displaced to the right of gaze, indicating a rightward heading direction. (Adapted from Duffy et al., 2003)

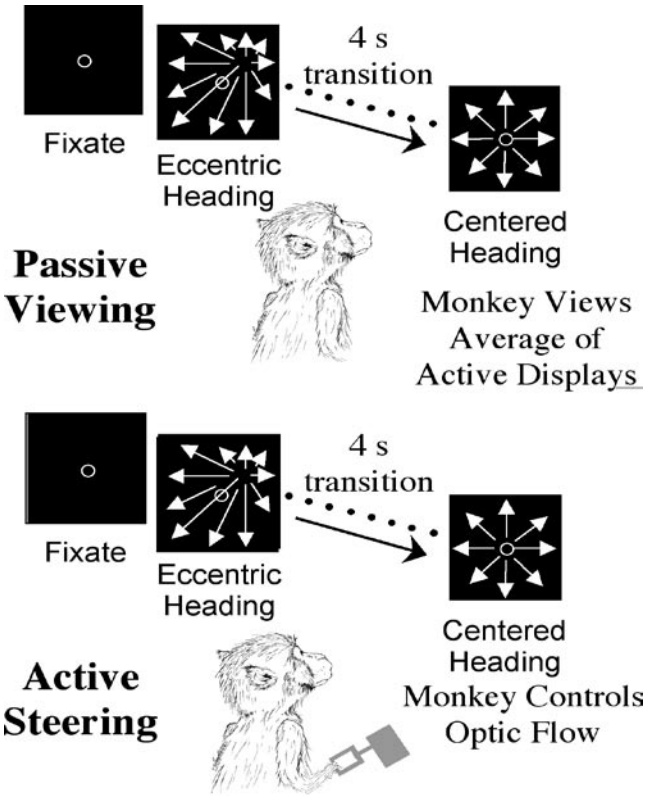

Figure 3: The monkey maintained centered fixation while the heading in optic flow changed from one of 8 eccentric directions to the straight-ahead centered heading.

Passive Viewing: The monkey did not touch the joystick while the heading in optic flow transitioned toward the center.

Active Steering: The monkey used the joystick to actively steer the heading to the centered heading direction.

in a majority of the experiments, microstimulation induced a significant bias in the monkey's decision. This result suggests that MST signals representing heading are used by the monkey in forming heading judgments.[25]

More recently, Eskandar and Assad examined neuronal signals in the monkey area MST during visually guided hand movements and tested whether the direction selectivity depended on the direction of the stimulus spot or the direction of the hand movement.[26] They trained animals to use a joystick to guide a spot to a target and found that many neurons responded in a direction-selective manner in this guidance task. One of the tasks involved recording the movement of the spot while the monkey actively steered it, and then playing back that movement in a passive trial during fixation. Their results indicated that MST neurons were active and directional in both joystick-movement mode and playback mode and were not affected by the direction of hand movement.

Overview of Thesis

The present study attempts to address MST neuronal responses to optic flow viewed passively or during the active steering of the stimulated heading direction. We hypothesize that MST neuronal responses will be inhibited during passive trials and enhanced during active trials. During the active trial, we assume that MST neurons are actively engaged in the global motion perception and steering of the simulated heading direction, while in the passive trial, MST neurons are not as responsive to the heading direction.

In experiment 1, we analyzed MST neuronal responses from passive movement of heading in optic flow from one of eight eccentric directions to the straight-ahead centered heading, while the monkey maintained centered fixation. We compared this to MST neuronal responses during active steering, in which the monkey used a joystick to actively steer the heading to the centered heading direction, while also maintaining fixation.

Experiment 2 was identical to Experiment 1, except that a total of sixteen optic flow stimuli were used, eight outward and eight inward radial patterns requiring the monkey to use global motion processing of the entire scene rather than local processing at the center of the screen. Again, we compared MST neuronal responses during active steering and passive fixation.

Experiment 1: Local Motion

Dot motion in the optic flow presented in Experiment 1 simulated the observer's movement with respect to a remote fronto-parallel surface as an outward radial pattern emanating from a focus of expansion (FOE). Eight optic flow stimuli were used that contained FOEs displaced 20° from the center, and distributed at 45° intervals around 360°. During active steering trials, the monkey's task was to use the joystick to actively steer the heading of the optic flow to the centered heading direction (Figure 3). During passive trials, the displaced FOE moved in a straight line to the center. These passive optic flow stimuli were averages of active displays. Active and passive trials consisted of eight conditions that were randomly interleaved within altering blocks of either active or passive trials. Four to six trials for each condition were successfully completed for each recording session.

Most MST neurons responded differently to optic flow during passive and active conditions. The most robust effects were the suppression of activity in the active steering condition. In some directionally selective neurons, this effect was seen in the absence of a change in directionality of the neuron, suggesting a general increase in response for the preferred heading during active steering compared to passive viewing.

In other neurons, active steering influenced the strength of directional responses by changes in response amplitudes, despite the overall decrease in activity during active trials. This suggests that the increased responses in the passive condition cause neurons to lose their directional sensitivity as a generally high firing rate is observed for all heading directions.

In the population sample of MST neurons, preferred heading and heading selectivity did not seem to change with passive viewing or active steering. However, many MST neurons showed an increased strength of directional responses and peak responses during passive viewing, as compared to active steering. These findings led us to consider whether the monkey might be using local motion cues to steer the FOE. This speculation is consistent with our findings, but it is not obvious why this should suppress MST neuronal activity as local motion processing might proceed very well without suppressing MST.

Experiment 2: Global Motion

Optic flow stimuli and behavioral tasks in Experiment 2 were the same as that of Experiment 1 except that eight inward radial optic flow patterns were added to the stimulus set (Figure 4). These simulated the movement of the observer away from a remote fronto-parallel surface with dot motion inward toward the focus of contraction (FOC).Passive playback was identical to previous active trial for each optic flow pattern. Active and passive trials were block-wise interleaved and four to six trials of each condition were successfully completed for each recording session.

We proposed the local motion hypothesis about the monkey's perceptual strategy in Experiment 1. This is based on the view that optic flow might be analyzed either by perceiving the global pattern of motion or by responding to a local patch of motion in the pattern. We speculate that MST might be suppressed during active steering if the monkey is using a local motion strategy, rather than processing the global pattern of optic flow.

Training with in/out optic flow promoted the monkey's use of the global pattern rather than the use of ambiguous local motion cues during active steering. Contrary to results obtained from Experiment 1, some MST neurons showed a robust enhancement of neuronal activity in the active steering condition in Experiment 2. In addition, response enhancement (global) and suppression (local) was not limited to the preferred heading direction. These results supported our hypothesis that MST neuronal activity would increase during active steering of a simulated optic flow heading, as compared to passive viewing of the optic flow.

MST, Navigation, and Spatial Orientation

Passive and active observers both process optic flow, but their responses to those stimuli often differ. Given the change of responses in MST neurons during simulated optic flow heading in passive viewing and active steering conditions, we find that MST neuronal responses to optic flow are influenced by tasks that require real-time visual analysis.

In particular, active steering by global motion enhances MST's optic flow responses. We suggest that top-down mechanisms may enhance MST responses when the subject uses global motion and actively suppress responses when using local motion strategies. We believe that a local motion strategy may be better served by MT's smaller, more central, direction selective receptive fields. These differences in motion strategies may be particularly relevant when the local and global motion are incongruent. This may be important when tracking the motion of an object as it crosses one's path.

MSTd's Role in Papez's Circuit for Navigation and Orientation

Movement through the environment is accompanied by a diverse array of sensory cues about observer direction and speed. MSTd neurons combine visual and vestibular cues about self-movement with oculomotor signals about pursuit eye movements to create a wide variety of response properties. The population response in MSTd estimates the direction of observer self-movement with greater accuracy in light than in darkness and without significant detrimental effects of concurrent pursuit eye movements.

As previous studies have shown, MSTd neurons are involved in determining self-movement direction. However, they also show selectivity for particular paths. In addition, some MSTd neurons show place specific responses both during translational

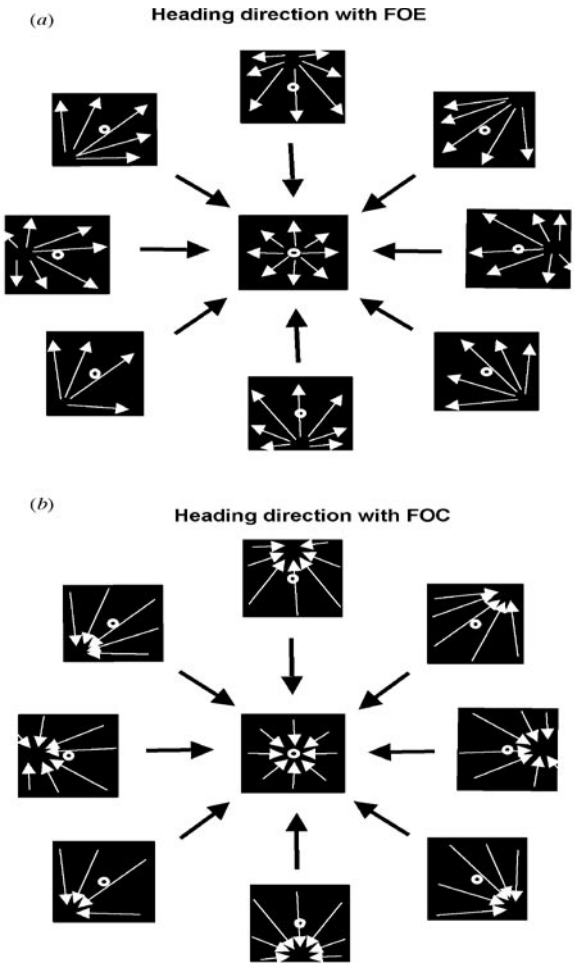

Figure 4: Optic flow stimuli with heading direction indicated by FOE (a) and FOC (b): (a) Optic flow simulates the observer's movement with respect to a remote fronto-parallel surface as an outward radial pattern emanating from a focus of expansion (FOE), or (b) as an inward radial pattern emanating from a focus of contraction (FOC). Experiment 1 used only FOEs originating from one of eight eccentric directions, which the monkey passively viewed or actively steered to the centered heading while experiment 2 used both FOEs and FOCs in the same task.

movement and when the animal is held at a stationary position in the room.[27] Thus, MSTd neurons are capable of integrating sensory and oculomotor information to represent self-movement, guide locomotion, and contribute to spatial orientation. Recently, Duffy et al. suggested that the posterior parietal cortex may engaged in a navigational circuit with reciprocal interactions with hippocampal, thalamic, and other cortical centers that create a cortical-subcortical system that is parallel to Papez's emotional circuit but is devoted to information processing for navigation and spatial orientation.[28]

They propose that Papez's circuit for navigation might be thought of as beginning in dorsal extrastriate visual cortical areas that combine visual, vestibular, and other signals relevant to self-movement perception and to spatial orientation.[29-31] These parieto-temporal areas are reciprocally connected with parahippocampal cortices[32-38] that then connect reciprocally with the hippocampus.[39-43] The place neuron responses in the hippocampus might be the result of spatial activity in the hippocampus.[44-46]

Parahippocampal and subicular areas project to the anterior and lateral dorsal thalamus via the fornix and the mammillo-thalamic tract.[47] These connections may contribute head direction sensitivity. Reciprocal projections from the anterior and lateral dorsal thalami to posterior cingulate and retrosplenial cortical areas[48-50] engage these cortical areas in spatial processing.[51] These projections then connect reciprocally to posterior parietal cortical areas, completing the cortico-subcortical circuit.[48,50,53,54] Thus, Duffy et al. proposes a "bidirectional information flow supporting navigation and spatial orientation."[3]

Thus, the involvement of cortical and subcortical systems allows for the integration of memory and motivation to influence MST neuronal responses. In particular, MSTd's engagement in reciprocal interactions with hippocampal, thalamic, and other cortical centers creates a system that is parallel to Papez's emotional circuit for information processing. With the influence of memory and motivation from this cortical-subcortical system, MSTd neurons integrate sensory and oculomotor information for navigation and spatial orientation.

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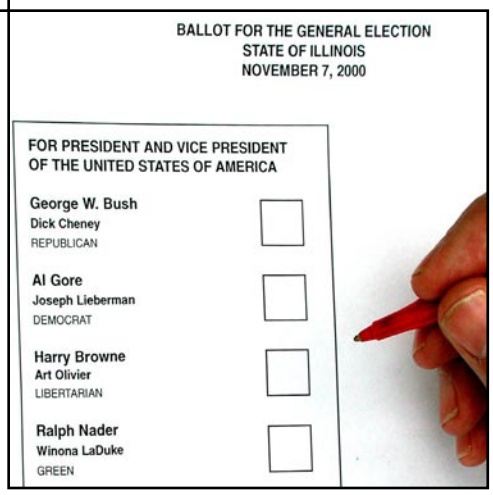

Election Commissioners and the Law:

Commissioners' Responses to Questions about Identification Requirements

Miriam Grill-Abramowitz, 2004

Advised by Richard Niemi, Ph.D.

Department of Political Science

Miriam Grill-Abramowitz wrote her Political Science Seniors Honors Thesis on the problems college students encounter with voting. This article is an excerpted chapter from her thesis, focusing on problems with identification requirements as they pertain to college students that have arisen from the 2002 Help America Vote Act.

In 2002, Congress passed the Help America Vote Act (HAVA) requiring potential voters to provide identification when they register to vote; if a potential voter registers by mail, poll workers are instructed to ask that individual for identification on Election Day. HAVA could pose problems for college students because many students have out-of-state addresses on their licenses. The question, then, is whether or not students can vote as members of their college communities, even if they do not have state-issued identification that includes their college addresses. The law is unclear on this point; as a result, many commissioners do not fully understand the identification requirements. Additionally, commissioners within the same state offered contradictory information about identification requirements prior to the implementation of HAVA. My interviews demonstrate that the commissioners must be educated about this confusing body of law in order to ensure that they are able to provide students with accurate information about identification requirements.

Implications and Interpretations of HAVA

Title III (Sec. 303) of HAVA states, in part:

> (5) Verification of voter registration information.—
>
> (A) Requiring provision of certain information by applicants.—
>
> (i) In general.—… notwithstanding any other provision of law, an application for voter registration for an election for Federal office may not be accepted or processed by a State unless the application includes—
>
> (I) in the case of an applicant who has been issued a current and valid driver's license, the applicant's driver's license number; or
>
> (II) in the case of any other applicant…the last 4 digits of the applicant's social security number.

As the above excerpt from HAVA indicates, an individual must present either a driver's license or the last four digits of his or her social security number in order to register to vote. However, the law does not specifically indicate that the driver's license must be from the same state in which the person is applying to register to vote. Also, it is unclear whether or not an individual is allowed to provide his or her social security number instead of his or her driver's license number, especially if the license is issued by another state.

Alternatively, if a person registers by mail, he or she will be asked for one of a variety of forms of identification at the polling place (Sec. 303):

> (2) Requirements.—
>
> (A) In general.—An individual meets the requirements of this paragraph if the individual—
>
> (i) in the case of an individual who votes in person—
>
> (I) presents to the appropriate State or local election official a current and valid photo identification; or
>
> (II) presents to the appropriate State or local election official a copy of a current bill, bank statement, government check, paycheck, or other government document that shows the name and address of the voter.

The law then explains that if an individual both registers and votes by mail, he or she will have to submit with the ballot a photocopy of any of the forms of identification listed above. Finally, if an individual registers to vote through the mail, and with the registration includes "a copy of a current and valid photo identification; or a copy of a current utility bill, bank statement, government check,

paycheck, or government document that shows the name and address of the voter," he or she will not have to provide identification at the polls (HAVA, Title III, 2002).

According to HAVA, an individual registering to vote in person should present a driver's license or a social security number. However, an individual registering through the mail can include one of several forms of identification, either with the mail-in registration form or at the polling place on Election Day. This means that if college students try to register in person, they may be denied the ability to do so if their driver's licenses are from out-of-state. If they register through the mail and present an alternative form of identification, either with the registration application or at the polls, then they will most likely be allowed to vote. This alternative form of identification, which according to HAVA must be "current and valid," may even be a student identification card, which is something that every student has.

This is one of many possible interpretations of the law and, whether or not it is correct, commissioners from within the same state are still offering contradictory interpretations of identification requirements even after the implementation of HAVA. The clear implication is that identification requirements are confusing and this is undoubtedly an obstacle for students who wish to vote as members of their college communities.

Commissioners' Interpretation of the Law

One person I interviewed was Thomas Ferrarese, the Democratic Election Commissioner of Monroe County, New York. When I asked Commissioner Ferrarese about HAVA, he told me that people voting in New York will have to show photo identification at the polls after HAVA comes into effect. According to Ferrarese, after January 1st 2004, I would still be allowed to vote in local and state elections if I were to register in New York with an out-of-state license, but I would be turned away from the polls at federal elections. I would be left with three choices, according to Ferrarese: (a) vote locally in local and state elections; (b) vote as a member of my home community via absentee ballot in local, state, or federal elections; or (c) obtain a New York State driver's license or some other state-issued ID and vote locally in all elections. However, Ferrarese acknowledged that he was not certain that his interpretation was correct; he conceded that the "future is cloudy," and that there could be other interpretations of the law.

Other such interpretations came from the commissioners from Genesee County, New York. They all said that HAVA will not interfere with college students' ability to vote as members of their college communities, indicating that the future of HAVA is "still up in the air." When I asked them about what identification HAVA requires in order to register to vote, they informed me that various forms of identification are acceptable – for example, a utility bill is sufficient evidence of residency. Clearly, the Genesee commissioners' interpretation of HAVA's identification requirements was much more lenient than that of Ferrarese. The Genesee commissioners also said that while an individual who registers to vote in person will be asked for identification, it will be a different scenario for groups. If a group brings in a bundle of voter registration forms, people will be able to register without any identification, meaning that a group such as the League of Women Voters, or College Democrats could hold voter registration drives on college campuses without requiring students to provide identification. The commissioners continued to explain that most poll workers probably will not ask for identification from people voting in groups, even though they legally can. Richard Siebert, one of the two commissioners from Genesee County, said that he "highly doubts" that poll workers will begin to ask for identification as a result of HAVA's implementation. Neither Commissioner Siebert nor Commissioner Dawn Cassidy, the other Genessee County commissioner, believe that HAVA will reduce anyone's ability to vote. However, this clearly contrasts with Commissioner Ferrarese's interpretation of HAVA, despite the fact that Ferrarese, Siebert, and Cassidy are all commissioners within New York State.

The commissioners from Livingston County, New York agree with the Genesee commissioners that HAVA will not affect college students' ability to vote. Moreover, these commissioners cited aspects of the law that would continue to make it possible for college students from out-of-state to vote in local elections. In the view of the Livingston commissioners, a social security number is sufficient identification to both register to vote and vote at the polls. Furthermore, according to the Livingston commissioners, if one registers by mail and does not provide any identification, the election board will automatically contact the Registry of Motor Vehicles and ask them to provide verification of residency for the voter in question. If the person is not a registered driver, he or she will be asked for ID at the polls. Again, however, the Livingston commissioners state that a social security number is sufficient, even though this is not made explicit in the law. But, if a person provides identification or a social security number when registering, he or she will not be asked for identification at the polls at all.

The commissioners from Monroe, Genesee, and Livingston counties all provided different explanations about the impact of HAVA on college students' abilities to vote as members of their college communities. The question that remains to be answered is whether the ambiguity surrounding HAVA is sufficient to deter students from attempting to vote locally.

Interpretations of Election Law Prior to HAVA

The election commissioners I spoke with from Minnesota also conveyed the fact that there is not yet one standard interpretation of identification requirements, even before the implementation of HAVA. Jeffrey Cox, city clerk from Duluth, gave me a list of acceptable forms of identification that college students can use at the polls, including a driver's license, a state identification card showing an address, or a current fee statement showing an address in Duluth accompanied by any photo identification. I then asked him if an individual could bring a fee statement that shows an address in Duluth along

with a driver's license from another state. He replied, "The State usually requires a Minnesota ID." The word "usually" implies that poll workers may have the ability to decide whether or not to accept any specific form of identification; consequently, a college student's ability to vote in his or her college town may be decided on a case-by-case basis.

Gerald Amiot, the Polk County, Minnesota auditor and treasurer, contradicted Mr. Cox about identification requirements prior to HAVA. According to Mr. Amiot, nothing in Minnesota law says that state-issued identification is necessary in order to be able to vote. Mr. Amiot said that when students arrive at the polls, they simply need to show photo identification and the poll workers will then look for the student's name on the dorm lists provided by the university. This serves as sufficient proof of residency, making it very easy for a student who lives on campus to meet the identification requirements at the polls. Even if universities in Duluth, where Mr. Cox works, do not provide lists of students who live on campus to the election officials, they could begin to do so. Then, students in Duluth, like students in Polk County, could provide any form of photo identification, from any state. Judy Scherr from Rochester, Minnesota stated that a student identification card along with an out-of-state driver's license is sufficient identification. It appears, then, that students who attend college in Minnesota can vote locally, despite identification requirements. However, the fact that Mr. Cox believes that state-issued identification is necessary means that many students may not receive this information clearly.

The official I spoke with at the New Hampshire State House similarly conveyed that the issue of identification is confusing, both before and after the implementation of HAVA. She said that while you can register to vote with a dorm address, you have to prove residency when you register. In the case of a college student with an out-of-state driver's license, she said that certain pieces of mail or a student identification card are acceptable, but only if they contain the student's address, which many student identification cards do not include. When I asked her about HAVA, she said that the law will not affect the ways in which college students could prove their residency. Leo Bernier, city clerk of Manchester, New Hampshire, gave a list of other ways in which a student could prove his or her residency. He said that the student could provide a driver's license, utility bill, or a rent receipt. While many students who live off campus pay rent and utility bills, these bills may not actually be in their names; students often live in groups and bills only come to one person. Fortunately, students probably have paychecks or bank statements that include their names and addresses, and the law does allow these as acceptable pieces of proof of an individual's residency. Clearly, commissioners tend to provide incomplete information about identification requirements, or information that contradicts statements from other registrars even within the same state. This is a reflection of the fact that identification requirements, as they pertain to college students, are confusing.

Joseph Hanlon from the Boston Office of Voter Registration explained how students will continue to be able to vote locally, despite the fact that their driver's licenses may be from out of state. He said that according to Massachusetts law, an individual does not need to show identification in order to register to vote – this will, of course, no longer be true after the implementation of HAVA, unless a person registers by mail, in which case that person will be asked for identification at the polls. He further explained that poll workers ask to see identification from approximately one out of every fifteen or twenty people who come to the polls to vote, and if a poll worker had a problem with accepting a driver's license from out of state, the person would still vote and the poll worker could then challenge the vote. At that point, the voter would ask his or her university to confirm residency, and if confirmed, the vote would be counted.

As is quite clear by this point, commissioners gave me a wide variety of responses about how college students could prove their residency, both before and after the implementation of HAVA. It is quite possible, then, that if college students ask about what forms of identification are acceptable, they will receive different answers from different commissioners, even within the same state. Due to confusion about HAVA's implications, commissioners may even tell college students that they are not permitted to vote in federal elections as members of their college communities. This reflects Commissioner's Ferrarese's interpretation of the law, and it is unlikely that he is the only commissioner in the country who interpreted the law as such. Clearly, work needs to be done to educate the commissioners so they have a clear understanding of the law and how it affects college students. The law has the potential to deter college students from trying to vote in their college communities due to the fact that students might assume that their driver's licenses from out of state are unacceptable, and they also might assume that they have no acceptable alternative forms of identification. While we already know that commissioners are unlikely to engage in information drives on college campuses, they should at least be able to provide clear information to the students who call their offices with questions.

Miriam Grill-Abramowitz graduated from the University of Rochester in May 2004, with degrees in political science and history. This article is an excerpt from her political science honors thesis, which identified obstacles to voting for college students. She is moving to New York City to teach special education, and ultimately wants to pursue a career in public policy.

State	Registration Deadline (relative to election day)	Corresponding Date for 2004
Alabama	11 days prior	22-Oct
Alaska	30 days prior	4-Oct
Arizona	29 days prior	5-Oct
Arkansas	30 days prior	4-Oct
California	15 days prior	19-Oct
Colorado	29 days prior	5-Oct
Connecticut	14 days prior	20-Oct
Delaware	20 days prior	14-Oct
D.C.	30 days prior	4-Oct
Florida	29 days prior	5-Oct
Georgia	5th Monday prior	4-Oct
Hawaii	30 days prior	4-Oct
Idaho	25 days prior	8-Oct
Illinois	28 days prior	6-Oct
Indiana	29 days prior	5-Oct
Iowa	11 days prior	22-Oct
Kansas	15 days prior	19-Oct
Kentucky	29 days prior	5-Oct
Louisiana	30 days prior	4-Oct
Maine	10 business days prior, or day of if in-person	19-Oct
Maryland	21 days prior	13-Oct
Massachusetts	30 days prior	4-Oct
Michigan	30 days prior	4-Oct
Minnesota	21 days prior, or day of if in-person	13-Oct
Mississippi	30 days prior	4-Oct
Missouri	28 days prior	6-Oct
Montana	30 days prior	4-Oct
Nebraska	3rd Friday prior	15-Oct
Nevada	5th Saturday prior	1-Oct
New Hampshire	10 days prior	22-Oct
New Jersey	29 days prior	5-Oct
New Mexico	28 days prior	6-Oct
New York	25 days prior	8-Oct
North Carolina	25 days prior	8-Oct
North Dakota	Does not have voter registration	
Ohio	30 days prior	4-Oct
Oklahoma	25 days prior	8-Oct
Oregon	21 days prior	13-Oct
Pennsylvania	30 days prior	4-Oct
Rhode Island	30 days prior	4-Oct
South Carolina	30 days prior	4-Oct
South Dakota	15 days prior	19-Oct
Tennessee	30 days prior	4-Oct
Texas	30 days prior	4-Oct
Utah	20 days prior	14-Oct
Vermont	2nd Saturday prior	22-Oct
Virginia	29 days prior	5-Oct
Washington	30 days prior, or 15 days prior if in-person	4-Oct
West Virginia	20 days prior	14-Oct
Wisconsin	13 days prior, or day of if in-person	21-Oct
Wyoming	30 days prior	4-Oct

State-specific voter registration information including 2004 registration dates. The chart was compiled by the *jur* staff. See www.fec.gov or individual state websites for more information.

Developing and Understanding Mantra:

A Movement from Veda to Tantra

Stephen Brown, 2004

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This paper examines the use of mantra in two separate but parallel traditions: śaivism and śāktism. "Śaivism" refers to traditions that follow the Hindu god Siva, while "Śaivism" refers to traditions that worship Sakti (lit. power), the goddess consort of the Lord Siva. Both of these systems reside within a meta-category known as Hindu tantrism. Hindu Tantrism itself is a refinement of and a response to the ideas advanced by upaniṣadic and yogic philosophy. The upaniṣadic philosophy is historically paralleled to Buddhism in what is known as India's axial age from 600 to 100 B.C.E. Yogic (lit. to yoke or control) philosophy is a tradition which takes the intellectual advances of the upaniṣads and layers upon them a series of physical and meditative practices.

Śaivite scholar Paul Muller-Ortega once said "The mantra is not an arbitrary set of syllables, and no amount of secondary meaning built onto a set of arbitrary syllables will make it a mantra. The mantra is a powerful vehicle you hop on and ride straight into enlightenment." This statement is rooted in a discussion of the opposing views of southern śākta tantrism and the "Kashmiri" śaiva tantrism on the issue of what a mantra is and how it functions. Muller is arguing that the southern śākta tradition of using mantras with no "intrinsic" meaning and literally "layering" meaning upon arbitrary syllables as a form of mantric practice is distant and perhaps even inexplicable from the "Kashmiri" Śaivite perspective. Rather, the Śaivite mantra is thought to be literally a manifestation of śiva consciousness that functions as a vehicle to ascend into the heart of śiva. This is the very thesis I will test: What exactly is the nature of the śaiva mantra theory and practice? Does śaiva philosophy directly suggest the mantra is a tool itself empowered, or does it actually believe it is the understanding of the mantra that functions to create freedom consciousness? As a matter of clarification, this is not an attempt to understand the "sonic" nature of reality, described by Andre Padoux as "vāc", with its multiple layers of realism. Rather, this is meant to be a detailed study of Mantra and an investigation of mantra as a specific sort of tool for expanding consciousness.

Developing and Understanding Mantra: A movement from Veda to Tantra

Padoux quotes the *Principals of Tantra:* "From the mother's womb to the funeral pyre, a Hindu literally lives and dies in a Mantra." This quote is likely, as Padoux says, a "pompous" one. It strikes me as being filled with the religio-centrist and religio-jingoistic attitude common to all early and much modern scholarship on eastern religion. This statement can easily be interpreted in at least two ways: first, as an insulting commentary on the "simpleton" Hindu, content to say the functional equivalent of "open sesame" at each moment of their lives in a false belief that they control their world; second, and I think perhaps more instructively, this statement reveals the tendency of the Indian mind to rely on an efficacious praxis which appears to the outsider to be an inane set of meaningless utterances, known in the tradition as mantra.

Veda Mantra

The Veda are initially a set of stories and "myths" written as hymns to be sung. As Vedism ages and the language of the Veda becomes too culturally distant to be meaningful to those hearing it, there develops a highly philosophical system of sonic significance attached to the verses that make up the Veda. It seems clear in reading the content of the Veda that they are in fact telling a story, and not one necessarily designed to function "mantrically" on an obvious level. Whether or not the development of mantraśāstra [science of mantra] is contemporaneous with the reduction of knowledge of Vedic language is a highly debated point. There is undoubtedly a "sonically" affective sound in the recitation of the Veda; what is less clear however, is whether this is a function of the Veda acting as poetry or Veda acting as mantra. The Veda comes to be spoken of as the sonic mirror of the cosmic

structure of the universe. The recitation of the Veda at a certain moment seemingly shifts from a series of hymns sung to praise and pacify a set of marauding war-gods to a set of mantras sung to ritually advance the creation and maintenance of the universe. Vedic mantra evolves from an explication of and story about what Eliade calls *in ill tempore* (in the beginning time) to an enaction and bringing about of that *in illo tempore*. This is mantra at its infantile stage, slowly defining and building itself from a set of pre-existing but not necessarily related building blocks.

Upaniṣad/bhakti/yoga

Subsequent to the Veda, Mantras take on two basic forms. There is the familiar "om / dative nominal / word of praise" or some combination thereof, i.e. "Om Namah śivāya". Also quite common is the considerably less formulaic descriptive mantra which usually combines a list of attributes of the deity supplicated and a proclamation of devotion or a request of some sort of boon. These represent a second stage in mantric development. These mantras are specifically designed to be intoned [audibly and inaudibly] and are intrinsically empowered; this stands in contradistinction to the Veda which is empowered by a connection to the "justified and ancient." It is in this period [known as 'classical' Hinduism] that mantras assume their modern form. It is during the upaniṣadic and yogic revolution that mantra is first used as a meditational tool. Mantra comes to be described as *individually* soteriological through its use as a meditational tool. The mantras of yoga develop into tantric mantra, which takes these forms as well as a quintessentially tantric third: the bija mantra.

Tantra

The bija (lit. seed) mantra is a series of syllables which have no apparent meaning to the uninitiated. The difference between śākta and śaiva uses of these bija mantras may not be quite as broad as our introduction implied. Both traditions use these apparently incoherent strings of syllables as meditational and ritual tools. The bijas themselves are so difficult to understand that the greater discussion lies in how they are used and talked about in these two traditions respectively. The śāktas, as stated earlier, have a tradition of layering a series of meanings onto each of the particular syllables of their many mantras, the foremost of which in the śrīvidya, a tradition prevalent in South India, is the kādi śrīvidya: "क ए ई ल ह्रीं ह स क ह ल ह्रीं स क ल ह्रीं." An example of this is the syllable "hrīṁ": it is said to represent the earth and its goddess bhūvaneśvarī; hrīṁ also represents a portion of the gāyatrī: dhiyo yo naḥ pracodayāt. It is also understood as breaking down into four individual characters each of which represents a state of consciousness.[1]

Are we to here suggest that the śaivas do not elaborate on the meaning of their seed mantras? No, in fact, they often associate the syllables with many of the same deities and elements as their śākta counterparts and have a tradition of nuancing mantras greatly. What then is the difference? The difference is in the application and discussion of mantric meaning. For the śākta, it is in fact, the meaning layered upon the syllables that is the key to the practice of the mantra. The practice of reciting the mantra is literally placing the mantra on the body (nyāsa) and then placing each of the attendant deities and concepts on those places of the individual syllables with each repetition of the mantra "ka e I la…etc." In the śaiva philosophy, these mantras are described and given extensive subtle meaning. The key to grasping the śākta/śaiva separation lies in two words: practice and philosophy. In the *practice* of the śrīvidya the attendant meaning and understanding of the mantra takes precedence as the actual vehicle of accomplishment, much like the negative dialectic in Nagarjuna's Buddhist path, one must become a "philosopher king" to achieve enlightenment. In śaivism the discussion of the symbolism of mantra is relegated to *philosophy* and systematically isolated from the practice. In fact, in the śaiva tradition, it is the actual mantra and its inherent power that is the vehicle, not a highly intellectualized endeavor to build the theological worldview onto a set of syllables seen in the śrīvidya.

Mantra in the General

How can the preceding discussion be tied back into a greater understanding of mantra? It can be used to inform our discussion of how mantra develops from songs sung to empowered mantras used for liberation. Padoux makes the claim that mantric development from story-telling songs to incoherent syllabic combinations can be seen as a historical evolution towards the innermost or silent (tūṣṇīm) mantra because of the proclivity of yogic and tantric traditions to vaunt the silent and innermost recitation of mantras as the highest form of recitation.[2] However, the silent and higher forms of mantra are not a "late" development. In fact the concept of multi-valent mantric practice is quite well defined by the late upaniṣadic or early yogic period. Not only are the ideas developed but the traditional preference for the silent is well established.[3] I cannot presume Padoux's intention for that particular claim, but I think it pushes hard into the traditional tendency of sympathetic scholars to say "x is a movement towards the increasingly subtle." In fact, I think quite the opposite is the case. The evolution of less and less grammatically coherent mantras does not indicate a move towards silence and an increase in subtlety, but I posit rather that it suggests a movement towards a more advanced concept of the function of mantra and an increase in the "realism" and gross function of mantra. In the Vedic period the mantra moves the universe invisibly and the ritual in which it is used provides the sacrificer with a set of [often] intangible results. The yogic and tantric revolutions bring about a set of mantras that violently[1] and immediately go about transforming the mind, body, and subtle layers of the reciter's being. To quote Douglas Brooks on the matter: "Hindus resort to the unseen only under duress." The movement of mantras can be seen as mirroring this greater traditional movement towards concretizing experience and results in a replicable and reliable way.

Grasping at the structural and theoretical straws of mantra

Important in improving our understanding of mantra, is delineating where each of these mantras get their respective authority. The Veda derives its authority by proceeding from the mouth of god. It is referred to as the śruti, the heard. These Vedas were transmitted by the lord to the Maharsis who transmitted it to the Brahmins, who transmit it back to god in their chanting. So here, the authority of these "mantras" is placed not only long ago and far away, but its use is limited to the Brahminical caste. This mantra is cast into an inevitable cycle of sonic circularity. That is to say, the mantra in the Vedic sense is not a vehicle, it is not a tool, it is not itself *efficient*; rather, it is a set of intonations uttered by a set of officiants, the first of which is god, the latest of which are his [caste preferred] descendants. Here then, the mantra can be seen as an exclusive religious privilege, used to restrict access to religious power socially.

The mantra of upaniṣadic and later Hinduism derives its authority by proceeding from *efficacy* in application. The mantra may be said to come from some god i.e. "this very mantra was given to swami x by the lord x himself." The tantric mantra gains meaning by, as Muller-Ortega puts it "…[tending] automatically to move to its own source."[4] Here not only does the mantra come *from* śiva, it is in fact the substance *of* śiva, and thus closes in increasingly smaller concentric circles on itself [and increasingly larger concentric circles to encompass itself]. Additionally, these mantras are themselves efficient and are not caste and birth restricted. The mantra here can be given to the initiated, or the uninitiated by way of hearing, or may spontaneously arise in the mind of an individual this is known as a svabhava [self-becoming] mantra.

Padoux claims that the illocutionary power of mantra is not inherent but rather socially bound. He says "mantras, the uses of which are strictly codified, have, mutatis mutandis, no other efficacy than that ascribed to them by the Hindu, Jain, or Buddhist traditions to which they belong and within the ritual prescribed by these traditions."[2a] This claim is somewhat unsalutory, however. Mantra is certainly in many cases ritually linked and specific to a moment in a ritual; however, mantra is not an exclusively ritual tool. Mantras can be used as interruptive protectorates, meditative tools, greetings and hundreds of other purposes. The practice of mantra best known in the west is the recitation of mantras [jāpa] as a self-sufficient practice. Mantra repetition, while clearly a practice, cannot necessarily be cast into the set of actions known as "ritual." This all goes towards replying to Padoux's argument that mantra is culturally bound. The theory of mantra, especially when considering the possibility of the svabhava mantra, suggests that the mantra must have some self-possessed efficacy and intention beyond the things thought and said about it.

On the issue of appropriating mantra Padoux says:

> *We should never forget…(1) Mantras are efficient forms of speech within a particular tradition, where speech is conceived of within a particular mythico-relgious framework. If we pluck them from this cultural milieu, which is their nourishing soil, is "the luminous bud of mantra," as A. Avalon used to say, likely to survive" One may well doubt it. (2) We must remember that mantras, even in their higher, supposedly redemptive forms, are always part of a precise and compulsory ritual context, outside of which they are useless and powerless. A mantra may be a liberating word but only in accordance to precise and binding rules.*[2b]

Padoux here attempts to reduce mantra into something less self-efficacious than in fact it is. I don't want to take up a discussion of whether or not the west can reasonably appropriate mantra, but I do have issue with his basic claims here. Mantras are not only valid in a particular mythico-religious framework. The west is the perfect example of this fact. There are two mantras that are very well known in the west, both of them referred to as mahāmantras "oṁ namaḥ śivāya" and "hare rāma hare rāma rāma rāma hare hare hare kṛṣṇa hare kṛṣṇa kṛṣṇa kṛṣṇa hare hare." The first of these is a śaiva mantra that is given to each and ever person who goes to a Siddha Yoga program, in programs lead by Shivananda instructors, and in the teachings given nightly throughout the globe by a variety of modern gurus. The second, a vaiṣṇava mantra, is used by dozens of groups, but is best known as the popularly intoned initiator mantra of ISKCON a.k.a. the "Hare Krishnas." In the Siddha Yoga case this mantra is given freely and with little more prescription than to use it as an implement of concentration or as a metrical controller for the breath in meditation. While the tradition has a series of advanced rituals based on the use of this mantra, is the initiation of a general mass into the mantra somehow inane because it is not attached to a strict set of ritual prescriptions? One would be forced by the simplest logic to say no. The tradition believes the mantra to have a life of its own. They understand the mantra to be capable of entering the mind and heart and voice of the initiate[3] and forcing it into a higher plane of consciousness and automatically beginning to open the doors of perception of the higher self.

The mantra is not a culturally bound set of words any more than love is limited to a specific instance of experiencing it. Padoux's fault here is not being wrong, but rather being incomplete. It would be absurd to claim that mantra does not arise from culture, and that there is not a set of prescriptions about how mantras are to be utilized. However it would be equally absurd to claim [as Padoux does] that these are the only the functional characteristics of mantra. Mantra is a complex, multi-valent, linguistic and sonic tool to open consciousness to the experience of the heart of the universe, the individual self.

The śaiva Mantra

मध्यजिह्वे स्फारितास्ये मध्ये निक्षिप्य चेतनाम्।
होच्चारम् मनसा कुर्वंस् ततः शान्ते प्रलीयते॥

If one maintains the mouth widely open, keeping the inverted tongue at

the center and fixing the mind in the middle of the open mouth, and voices vowel-less ha mentally, he will be dissolved in peace.

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Is the śaiva mantra qualitatively different from other forms of mantra?

It is with some difficulty that we move into the second portion of our study, the śaiva aspect of mantra. We will focus exclusively on śaiva bija mantras. There are clearly a large set of mantras employed by the śaiva tradition which are not seed (bija) mantras, not the least of which is the well known "oṁ namaḥ śivāya" mantra. However bija mantras, being the most esoteric and important mantras in śaivism [to say nothing of a dearth of philosophy which is accessible on linguistically bound mantras], will effectively provide us with a basis for discussion of śaiva mantra.

Here we will address the question: what is the śaiva perspective on mantra, and how does mantra function in the śaiva system? Undoubtedly a good number of our previously expressed ideas about the freedom and self reliance of the mantra are rather mitigated and qualified by the strict ritual structure of śaivism. However, both Alper and Padoux stake a claim in their respective articles in the volume *Mantra* which is ultimately reductive. They want to claim that mantra can *only* be understood as limited, and can *only* be used in rule-bound environments, however the philosophical perspective of the Tantra simply does not support this thesis. The Tantra is rife with a set of comfortably unresolved controversies on any number of subjects, not the least of which is mantra. The Tantra wants to have it both ways. They want mantra to be an exclusively insider and ritual tool for specific application and implementation; yet, at the same moment, they want that same mantra to have the possibility of spontaneously entering the heart of an individual. This very fact is encoded into the tantric world-view. The Tantra claims the world to be the substance, the perception of the substance, and the enaction of the perception and substance of that universe. As a result, the omni-presence of consciousness and its manifest forms of śiva and śakti leaves all limitation subject to change, and all experience of limitation subject to expansion. In his explication of the bija mantra sauḥ, Abhinava seems to suggest that the very practice of mantra can be free and natural in a sense, even though he is casting it in a specific ritual dimension. He says:

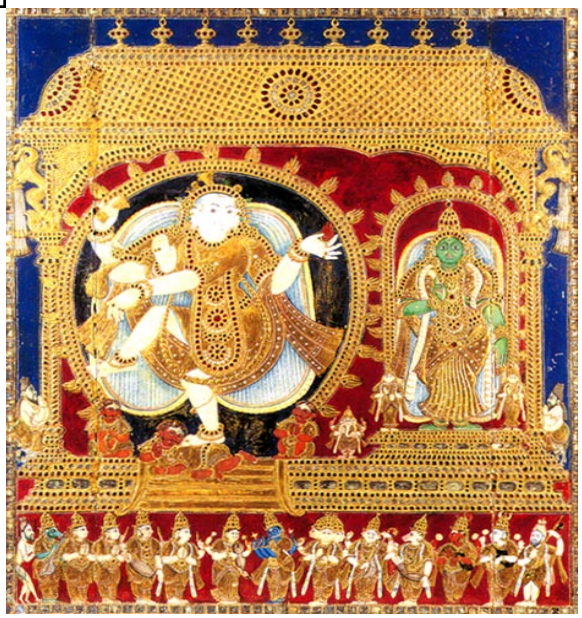
… The nature of these three phonemes is that the are composed of three states of repose, respectively, in the knowable object (s), in the process of knowing (au) and in the knowing subject (ḥ). The Depending upon which state of repose one selects, the pronunciation extends as far as that phoneme alone. A threefold pronunciation therefore occurs.

Commentary on the paratrimsikalaghuvrrti vs21-24p17.

While the ritual contemplation of this mantra is an obvious dimension of what Abhinava is teaching, I think another level can be seen as well. This passage describes the mantra as expressing three levels of reality and reality-perception. These three levels of knowing and being are understood as coinciding and interexpressing. This is based on the interdependence of the three expressions "I will," "I know" and "I act," each of which co-arise in the proclamation of another. That is to say, one cannot make the statement "I know" without also invoking both "I will" and "I act." Even the knowing is itself an act, the act is dependant on knowing, the knowing itself arises from the will to know, which is itself an act. The interconnectedness suggests a well woven web with no clear entrance and exit points. This sauḥ mantra is not only a mantra designed to bring about enlightenment, it is in fact an expression of the nature of the universe. The S is the contracted form of Sad, referring to knowable objects, or the manifest world. This S is linked to the sheath of mayā, which is the potential of manifestation. The Au represents the process of coming to know the nature of an object, the systematic reproval such that one comes to know the true nature of that object, which is without aspect other than being. The ḥ represents the perspective, or rather the assumption of the perspective of Bhairava. This visarga, or emanation, ejaculation, pulsation, of Bhairava, is the playing with and manipulation of the S and Au as an experiencable state.

Shiva as the Supreme Lord with Parvati the Supreme Goddess and Manifest Shakti.

Seeing this mantra thusly, as an expression of the natural state of the universe, we can also open doors on how it is, in fact, naturally empowered. The idea here is that not only can one open doors of perception with the mantra, but that doors of perception continuously open and close as a function of the nature of reality, and as such the nature of reality mirrors the mantra in the same way that the mantra mirrors reality. This is also mirrored in the nature of the individual. This state is expressed in kṣemarāja's pratyabhijñāhṛdayam sutras 3



Shiva Natraja: A Medieval Temple Painting.

and 4:

> तन्नानानुरूप ग्राह्य ग्राहक भेदात् ३
> चिति सम्कोचात्मा चेतनो ऽपि संकुचित विश्वमयः ४
>
> *The universe is manifold because of the differentiation of reciprocally adapted objects and subject.*
>
> *The individual experient, in whom citi or consciousness is contracted has the universe as his body in a contracted form.*
>
> *PBH 3-4*[5]

As a result of this coincidence of fact, nature thus acts as a mantra in one's experience of the world, constantly pulsating with the emmissional power of śiva. This then causes the exact result expressed in the function of the mantra, consciousness feeds back on itself. The consciousness of the world pushes itself into the individual's experience causing an infinite expansion of consciousness. As kṣemarāja says in PBH vs. 15:

> बललाभे विश्वमात्मसात्करोति १५
>
> *When he acquires the inherent power of universal consciousness, the yogin assimilates the universe into himself.*
>
> *PBH 15*[5]

The initiation described by this experience is in fact that highest form of initiation. This is recognized by the śaivas as the highest state of initiation, the so called samsiddhika "spontaneously perfected" state where one is initiated by the śakti present in the heart as the true nature of the individual. Here the nature of the universe as manifest śakti interacts with the inner-knower such that the understanding and experience of the world as the emmissional (visarga) power of śiva is spontaneously recognized. This spontaneous recognition is expressed as an expansion of the inner core, or the heart of the yogin. The final state of experience resulting from the expansion of that heart is described by kṣemarāja and expresses the connection between mantra and nature and individual in the final verse of the PBH:

> तदा प्रकाशानन्द सार महामन्त्र वीर्यात्मक पूर्णाहन्ता वेशात्सदा सर्व सर्ग संहार कारि निज संविद्देवता चक्रेश्वरता प्राप्तिर्भवतीति शिवम्।२०।॥
>
> *Then, as a result of entering into the perfect I-consciousness or self, which is, in essence, consciousness and bliss, and is of the nature of power of the great mantra; there accrues the attainment of lordship over the wheel of the deities of consciousness which brings about all emanation and reabsorbtion of the universe. All this is the nature of çiva*
>
> *PBH 20*[5]

So then perhaps this example of Abhinava's description of a particular mantra suggests the potential understanding of the mantra as innate and natural. Here we see that both dimensions of the mantra are at least recognizable in this passage, in that it is both ritually bound and it is unbound as it is the expression of pure śiva consciousness bursting forth.

Śaivism and the science of mantra

Mantra must be seen as fitting into the greater structure of śaiva perspectives on language. Śaiva philosophy holds the experiential world and our convention of language used to describe it as being of the same substance. The entire world is seen as emanating forth from Śiva. The visarga described in the mantra sauḥ as pulsating and vibrating and emitting initially takes the form of light. As the pulsation (sphuratta) of this light slows it moves from a photic emanation to a sonic emanation, a sounding forth of the cosmic or supreme word (parā vāk). This sounds at the moment of creation and extends through and beyond the present moment. The supreme word is said to descend successively through four stages: parā, paśyantī, madhyamā, and vaikharī. A brief discussion of each will be illuminating to our understanding of mantra.

Parä

This is the state of undifferentiated śiva which descends into manifestation and yet remains unchanged and undifferentiated. This state is both that in which all other states manifest and that which becomes differentiated to create the manifold universe. Parā vāk is the very substance of the highest reality, and is luminous and pure consciousness. The nature of this parā vāk is that of an infinitely pulsating sound which creates by its very nature a variety of sounds. These sounds are then associated with language which are strained through the multitude of human consciousness to form conventional meaning in the form of phonemes which develop into language. As such, not only is the world of the substance of this undifferentiated, pulsating tone, all knowledge and understandings which use language are inevitably linked with this the highest possible plane. As such, all convention is given by Abhinava a transcendental correctness and realness. This level of parā is the very potential from which all sounds and manifest objects move, it is the ontological root of expression. So, it is precisely as Padoux says "parāvāc, from the standpoint of language as well as of manifestation, should not be regarded as an initial state of speech but as the basis of paśyantī, Madhyamā, and Vaikharī, which alone are actual stages."[6a]

Paçyanté

This stage is literally the 3rd person plural form of the root paś meaning "to see." It implies the first manifest stage of the transcendent form of speech. Paśyantī expresses the tendency of consciousness to "see" objects. It signifies the first level of

what could be called conventional duality. In this stage the mind tends away from itself, but there is not in fact an object for it to attach to, nor is there actually a differentiation in the unmitigated sounding forth of the parāvāc in the form of syllables and the like. This stage however, is both the key to freedom and the key to being bound in the tantric perspective. Paśyantī could perhaps best be described as 'curiosity.' This curiosity has both conventional and transcendental vectors. As a conventional vector, paśyantī can be seen as the motion towards a set of differentiated objects outside of one's self. On the Transcendental, this very same level of curiosity can be seen as the desire and vehicle that moves towards the undifferentiated experience of consciousness. It would also be instructive to view this level as human will (iccha) supporting action and knowledge. As such, paśyantī is the level of human cognition and shows light upon the manifold experience of the differentiated world and on the luminous form of the single pointed vision of the goddess.

Madhyamä

This stage is best described and translated as the middle. This stage represents a move away from differentiation. Here phonemes emerge and form words. The formation of words allows for the first time for the development of cognitive conceptualization and experience. It is here that one actually experiences their differentiation proposed in the level of Paśyantī as a set of concrete cognitive objects. However, these objects are not actually real as they do not have physical substance. Here exists the experience of real objects. Because the conventional experience of cognition is actually an experience of objects refracted and projected on the screen of personal perception, the day-to-day experience of human life takes place at this stage of middling. Harnessing the middle is harnessing the buddhi, manas and ahamkara to pursue an ascention of cognition into the supreme word. So we can see here that this level tends both towards transcendence and away from it at the same moment.

Vaikharé

This stage is referred to by Padoux as "the non-supreme energy."[6b] This is the level of physical and concrete manifestation. Here the delusionary power of speech causes the bringing about of a world bound and caught in the snare of absolute physicality. This physically manifest world is, for all of its delusional substantive form, actually only the contracted form of the supreme word.

And again, Mantra

So we can see, even in this very basic discussion of speech, a number of tendencies that mirror the visarga or emmissional and spanda or vibrational aspect of the supreme consciousness. The pulsation of consciousness is seen as constantly expanding and contracting on a photic, sonic, and gross level.Mantra, as specifically chosen bits of speech, best represent this tendency of the very texture of reality (and unreality) to open and close upon itself. By using mantra, one can harness the tendency of sonic reality to force his own awareness towards the experience of an undifferentiated consciousness.

Conclusions, implications, and ideas.

Our argument finds itself all too comfortably eschewing rules and ritual context. The ritual and rule complication is irrefutable and central to the tradition. The Tantra proposes a highly ritualistic universe and espouses a path which is highly ritually bound. I have found here an excellent point of entry into another study: what exactly is the ritual dimension of Tantra? Padoux and Alper both speak *ad nauseum* about this decidedly ritual bound understanding of mantra but never actually explicate that dimension. Does this suggest an all too common manifestation of the insider/outsider problem? The explication of an initiation based tradition by non-initiates seems to leave something to be desired. The texts of śaivism are intentionally ambiguous and encoded with a series of complex schemes available only to insiders. The secrecy of the sauḥ mantra is deftly exposed by Muller in *Triadic Heart*, and appears to open up through a complex lens of ritual prescriptions that are not entirely obvious. Perhaps this suggests an inaccessibility of these ritual prescriptions to the modern world, in the disappearance of an initiated elite to show the ritual prescriptions. As a final suggestion, perhaps it is the case that the ritual dimension is intentionally obscured not to make it secret, but to confuse those who believe there is in fact a secret to the mantra, that is to say, to weed out the deluded. Shall I find a world where the mantra is in fact self-sufficient? Only time will tell.

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English Ails:

The Interaction of Nature and Chivalry in English Arthurian Literature

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Advised by Richard W. Kaeuper, Ph.D.

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In speaking of the culture of medieval Europe, the term "Dark Ages" is often used to the distress of medieval scholars. It implies a period of ignorance, intolerance, and violence. While certainly a misnomer which would not be readily accepted by the inhabitants of that period, ideas of darkness and isolation were nevertheless very important to the medieval mindset. In a dark world, pockets of civilization were surrounded by a fierce natural world that is difficult to comprehend today. Forests were larger and deeper, and the unknown dwelled within. Protection from the unknown came through the creation of community and social structure. More abstractly, the infinite variety of creation present in nature was overwhelming: through historical study, the medievalist sees individuals that attempted to order this infinite variety for human comprehension. In these attempts, symbolism is of the highest importance in grasping what the world means. Honorius of Autun, a theologian from the first half of the twelfth century remarked, "Every creature is a shadow of truth and life."[1] The reference to 'shadows of truth' is indicative of a long tradition of Christian and Platonic thought which dominated medieval theology for much of the Middle Ages. It deserves mention here so that the general reader will understand the dominant force of this form of Christian thought, which permeated a multitude of sources, both literary and instructional, from the period. In the sources we will examine, nature was a direct manifestation of God's will. However, this process of ordering did not calm anxieties about the dangers of the natural world. To paraphrase Honorius, nature was a screen through which man can arrive at two ends: although nature could provide insight into the work of God, so too could it lead the searcher astray into worldly preoccupation.

This attempt to know nature properly was by no means limited to theologians. Contemporaneous with this development of spiritual thought, the secular man of means would often turn to humane studies or courtly behaviour. This preoccupation with nature finds itself clearly expressed in the chivalric romances; in these, a searcher quite literally leaves the safety of civilisation and enters into the world of nature. For the more secular literature, nature was a dangerous place wherein adventure and possible gain is found, be it maiden, castle, or, most importantly, glory and honour, an interpretation which seems removed from the theological discussion above. When faced with these two differing readings, it is crucial that the modern reader not see them to be widely divergent. It was not that the secular and the spiritual were seeing two different worlds, but simply that the viewer's eyes saw from different vantages. From the theological point of view, there are two possibilities when entering the natural world. Some could achieve a higher spirituality, whereas for others the entrance was risky, and one could lose oneself in the natural world. We can, moreover, find the same in chivalric romance, but only by looking deeper, past the battles for honour by one's peers and into the spiritual quest that also takes place.

Thus, we are to understand that the clergy is able to read nature appropriately. We are also to understand that it is the knighthood that faces the greatest danger in its forays into the forests. Like the clergy, the knighthood can eventually find its way. It is this path, however stumbling, that Gawain walks in Sir Gawain and the Green Knight. Like Adam, the knighthood could become lost in worldly preoccupation, and remain in danger of destruction. It is this horrific possibility that is reflected in the title character of the bloody Alliterative Morte Arthure. Finally, and most tellingly in a tale by a knight, Sir Thomas Malory, whose Moste Piteous Tale of the Morte Arthur Saunz Guerdon reveals a third possibility to the wandering knighthood—that a knight, in this case Lancelot, who becomes too preoccupied with the world, if he possesses enough prowess, can actually subvert the spiritual rule of the universe and force nature to act in accordance with his chivalry. We will examine each of the possibilities in turn, accompanied by a close reading of each text.

i.

Sir Gawain and the Green Knight, an alliterative Middle English verse romance, tells the tale of a fateful Christmas Feast of Arthur's peers. There is the sudden and mysterious appearance on horseback of a green man, dressed in green, toting a very large axe. He mocks the bravery of Arthur's court and issues a challenge to trade blows with the axe. Arthur or his proxy gets to hit him once with the axe on the neck; should he survive, he gets to strike back a year later, at his Green Chapel. Plainly, it is Gawain who accepts.

The story begins: "Siþen þe sege and þe assaut watz sesed at Troye…Fro riche Romulus to Rome ricchis hym swyþe…And fer ouer þe French flod Felix Brutus / On mony bonkkes ful brode Bretayn he settez…[Since the siege and the assault was ceased at Troy…Noble Romulus hurried in haste to Rome…and from over the French Sea Felix Brutus / On many broad hills established Britain…]"[2a] Thus the Gawain poet opens his late fourteenth century text with a direct reference to the contemporary popular tales of ancient Rome and Troy, tying his tale to the long history of chivalry. For our purposes, it is also advantageous to note that the two cities also fit neatly into more spiritual medieval thought as constructs of men isolated from God, doomed to fall. The presentation of the Christmas feast follows, presenting a series of worldly pleasures. "With rych reuel orygt and rechles merþes. Þer tournayed tulkes by tymez ful mony, [with rich revel aright and carefree mirths. There tourneyed men many times]" "court caroles to make, [making court carols]" and a feast that is "ilyche ful fiften dayes. [equally full for fifteen days]"[2b]

Were the simple pleasures of that high feast not enough to represent a worldly and artificial society, we are also treated to perhaps the first example of product placement in a popular medium; Guinevere sits on "þe dere des, dubbed al aboute, / Smal sendal bisides, a selure hir ouer / Of tryed tolouse, and tars tapites innoghe. [the precious dais, fully adorned / fine silk all about. A canopy over her / made of famous Toulouse cloth, and Tartar tapestries plenty.]"[2c] Even after the challenge of the Green Knight, we are told that Gawain is "dubbed in a dublet of a dere tars [dressed in a doublet of precious Tartar cloth,]" in addition to lavish descriptions of his clothing and raiment.[2d] The pleasures of the court thus not only appeal to all of the senses, but make direct reference to specific locations within the world of man. Before he leaves the court, Gawain is in the epitome of courtly, and therefore worldly, preoccupation. In Arthur's court, everything, even the presentation of adventures, is centered on immediate gratification and theatrical presentation. Upon the exit of the Green Knight, Arthur can only remark on the entertainment of the moment to his queen:

'Dere dame, to-day demay yow neuer;
Wel bycommes such craft vpon Cristmasse,
Laykyng of enterludez, to laȝe and to syng,
Among þise kynde caroles of knygtez and ladyez.
Neuer þe lece to my mete I may me wel dres,
For I haf sen a selly, I may not forsake.'
He glent vpon Sir Gawen, and gaynly he sayde,
'Now, sir, heng vp þyn ax, þat hatz innogh hewen.'

['Dear Dame, today be not dismayed;
Such dramatics is pleasing on Christmas,
Entertainment of interludes, to laugh and to sing,
Among these brotherly carols of knights and ladies.
Nevertheless to my meal may I now hurry myself,
Since I have seen such a sight, I cannot deny.'
He glanced at Sir Gawain and aptly said,
Now , Sir, hang up thine axe, with which you
have hewn enough.'][2e]

Drawing back to our argument, Arthur's court has lost its way. One of his knights, however, has had thrust upon him a chance to find his own.

Gawain's journey to the Green Chapel is a physical reflection of his spiritual journey. Considering again notion of quest described above, Gawain enters into nature in an attempt to find the right path. At this point in the tale, his success is hardly assured. This tension is reflected in the description of his heraldic symbol, "a syngne þat Salamon set sumquyle… a figure þat haldez fyue poyntez [a sign that Solomon established sometime past…a figure that had five points]"[2f] This sign has a number of symbolic attributes. The five points reflect Gawain's faultlessness "in his fyue wyttez, [in his five senses]" just as it represents "þe fyue woundez / Þat Cryst kagt on þe croys. [the five wounds / that Christ caught on the Cross]"[2g] Gawain's crest represents not only the devices through which he can fail or succeed, but also gives a hint to the right path; Gawain is now the knight-errant in a decision-making process. Will he choose spiritual or worldly rewards?

Gawain travels on a continuum. It is only fitting that the way station on his journey is a place that represents both the artificial and the natural, the castle of Hautdesert, and that Gawain is again at court during the Christmas celebrations. This court is of extreme importance in the analysis of Gawain's journey; Hautdesert functions on two levels. It is both the locus of final temptations before Gawain completes his end of the pact, and the bridge between civilisation and nature. Like Camelot, the castle is richly decorated:

A brygt boure, þer beddyng watz noble,
Of cortynes of clene sylk wyth cler golde hemmez,
And couertorez ful curious with comlych panez
Of bryȝt blaunner aboue, enbrawded bisydez,
Rudelez rennande on ropez, red golde ryngez,
Tapitez tygt to þe woge of tuly and tars,
And vnder fete, on þe flet, of folgande sute.

[A bright bower, with fine bedding,
With curtains of clean silk with beautiful golden hems,
And coverlets skilfully fashioned with fine fur panels
Made of fine ermine above, embroidered also,
Curtains running on ropes with red gold rings,
Tapestries tight on the wall from Toulouse and Tartary.][2h]

Situated in the deep forest, Hautdesert is an island of civilisation, and Gawain is once again lured to a place of worldly and artificial comfort. However, to Gawain's credit, it is not as much material desires, but a challenge

The journeys of knights-errant through the wilderness were fraught with danger, that often took the form of other wandering knights. When knights meet in the wilderness, they usually end up jousting.

to his prowess in such a world that draws him into sinful behaviour. Gawain's courteous behaviour is questioned, and he finds himself unable, even at the cost of behaving discourteously, to allow this. To further this tension, Gawain agrees to a pact with his host: the host goes out hunting during the day whilst Gawain remains in; at dinnertime, the two gentlemen will trade whatever trophies they won. Gawain is now bound twofold to his host: the gift of herbourgage (that is, to provide accommodation, to accept and protect the guest) begun when his host accepted him into his court and provided him with shelter and protection, demands obedience as does the new promise of traded gains. In this game, the medieval audience recalls the bonds that tie man to God: God, like the host, provides sustenance. So too does God, through the symbolism of the universe, promise spiritual reward through the natural world to those that repay Him by living rightly.

In the third part of the poem, Gawain faces his temptation. The transitions from the scenes of the hunt and the scenes in the bedroom not only mirror each other, but continue to express the liminal area that Gawain now inhabits. As the baron hunts, Gawain is hunted by the baroness, who declares that a man whose honour and "hendelayk [are] hendely praysed, [courtesy are courteously praised]" should now prove his skills in the romantic arts.[2i] In the first two interludes, Gawain manages to escape with a kiss, which he dutifully gives to the host in return for the beast of the hunt. Although Gawain does his best to resist, the court of worldly pleasures finally overcomes him with the promise of salvation. However, it is not the salvation of the soul, which is the true quest that Gawain takes, but salvation of the body; through the garter of the baroness, her final gift to him, Gawain is ensured that the axe blow will not harm him. It is in hopes of this protection that he fails on his third trial, unable to give to the baron what he received. Rather, he leaves Hautdesert with his secret shame. Despite this failure, the quest is not yet lost; the audience would appreciate the infinite love of God, who will allow the fallen man any number of chances for redemption. Like Adam, our knight is a man cast out and lost; like mankind, he is granted another chance for grace. Gawain, in the long nights leading to this moment has had time to reflect on his past actions. We see at this point that Gawain has indeed begun to move from a world of artifice, in which failure results in shame before peers, to a world of true vision, in which it leads to guilt before God. Gawain's final severance from this courtly world occurs when his guide to the Green Chapel makes him an offer:

> 'Forþy, goude Sir Gawayn, let þe gome one,
> And gotz away sum oþer gate, vpon Goddez halue!
> Cayrez bi sum oþer kyth, þer Kryst mot yow spede,
> And I schal hy3 me hom agayn, and hete yow fyrre
> Þat I schal swere bi God and alle his gode halgez,
> As help me God and þe halydam, and oþez innoghe,
> Þat I schal lelly yow layne, and lance neuer tale
> Þat euer ge fondet to fle for freke þat I wyst.'
>
> ['Therefore, good Sir Gawain, let the man alone,
> And go away by some other road, for God's sake!
> Ride to some other land, may Christ speed you,
> And I shall hurry me home again, and I promise you, further,
> That I shall swear by God and all his good saints,
> As God helps me and the holy relics, and plenty of oaths,
> That I shall loyally conceal you, and never let out the tale
> That you ever hurried to flee from that man I know.'][2j]

Here we find Gawain protected from shame, yet he refuses the offer: "Bot helde þou hit neuer so holde, and I here passed / Founded for ferde for to fle, in fourme þat þou tellez, / I were a knygt kowarde, I myggt not be excused. [But no matter how loyally you held that I fled here / Hurried for fear to flee, like you said, / I would be a coward knight, and would not be forgiven.]"[2k] Gawain has thus interiorised his shame, and realises that it is not the

appearance, but the reality of a situation that defines its nature. Only he would know of his cowardice, but this does not fit with his concept of knightly virtue. Of course, we can also question his motivations; after all, underneath his armour, he still wears the girdle given to him by the baroness. Upon making his decision, his guide leaves him, and he goes forward into the forest alone.

His encounter with the Green Knight, then, needs little more than brief outline. Gawain must now face a final test, administered at axe-edge by Bertilak, the Green Knight. The swings of the axe mirror the tests in the court, but function in reverse. On the first two, Gawain panics and flinches from the blade, but at the third, Gawain no longer fails, and upon receiving it (little more than a nick), admits his cowardice and deception. The tone takes on a highly religious form. Bertilak declares that Gawain is "confessed so clene, [cleanly confessed]" having borne "þe penaunce apert of þe poynt of [his] egge [the open penance of the point of his ax-edge]".[2m]

As is seen, however, the efforts of a single knight do not necessarily benefit the entire court. In a dark finale, the poet presents the blind court of Camelot, which finds in Gawain's quest only a cause for celebration, not personal reflection. To emphasise this point, the poet ends with the description of Troy: although Gawain may have found his way, the court is still lost.

ii.

Moving from pessimism to pessimism, we can turn to a contemporary work that despairs at chivalry ever finding the right path. The Alliterative Morte Arthure will present a court that is similar in extravagance to the court of the Gawain poet, but is very clearly warlike and bloodthirsty. In the AMA, the quest for glory supersedes even the desire for pleasure, and the results are grisly. It tells the story of King Arthur's court upon receiving a demand for tribute by the Roman emperor. Arthur, convinced that he should be subject to no ruler, chooses instead to go to war, kill the emperor, and take the imperial crown.

The poet opens with a semi-ironic dedication: "In Nomine Patris et Filii et Spiritua Sancti. Amen pur Charite. Amen. [In the name of the Father and the Son and the Holy Sprit. Amen for Charity. Amen." The virtue of charity was placed in the medieval hierarchy above all others; a charitable man's love of God obliged him to place all other men before oneself. This virtue, however, plainly receives little attention through the rest of the poem. Unlike Sir Gawain and the Green Knight, which began with a reference to Troy, Rome, and Britain; the AMA is far more direct: Arthur, confronted by emissaries of the Emperor Lucius, decides to claim the empire for himself. The dressing for war is dwelt on in obsessive fashion, as the various knights gather their forces and they prepare to leave Britain. In this action, we see a failure on the part of Arthur. Driven by a desire for glory, Arthur chooses to abandon his kingdom, leaving it in the hands of a regent, his son Mordred. Arthur is driven by avarice and vainglory, the vices opposing charity. This point is made quite clear by Mordred, who recognizes his own inability to rule:

> "I beseek you, sir, as my sib lord,
> That ye will for charitee chese you another,
> For if you put me in this plitt, your pople is deceived.
>
> [I beseech you, Sir, as my kindred lord,
> That for charity you will choose another,
> For if you put me in this plight, your people will
> suffer.]"[3a]

Arthur will not hear of the request, however, and responds with an unjust threat of power and retribution: "forsake not this office; / That thou ne work my will, thou wot what it menes. [forsake not this office; / If you do not do my will, you know what will happen.]"[3b]

Unlike Gawain, Arthur not only enters nature but combats it blindly. It is this, more than anything else, which ensures his failure. The first confrontation with nature that Arthur faces is the battle with the giant of Mont St-Michel, a foul beast that holds the surrounding area in fear, a kidnapper, a rapist, and a murderer, who ghoulishly wears a coat of the beards of kings whom he has killed. Arthur enters into direct combat and wins. The giant represents the pitfalls of a threatening nature that can trap those that rush blindly. The giant may (and should) be defeated, but in doing so, the wise knight will be led closer to grace. That Arthur fails in this entirely is made clear; upon defeating the giant, he declares, "Have I the kirtle and the club, I covet nought elles. [I'll have the girdle and the club, I want nothing else]"[3c] In one sense Arthur clearly lies, because he commands his shipmen to take "All the much tresure that traitour had wonnen, [all the treasure that the traitor had won]" in another, his remark indicates that Arthur wishes to become the giant, lost in the boundary-world of nature.[3d] Although he still recognises the giant as evil, Arthur is also clearly drawn to his strength.

After taking Rome, Arthur displays fully this blood-thirsty change. Although he has accomplished his potentially worthy goal, he is now driven by vengeance, and travels about the whole of the continent, destroying cities, until finally he reaches the level of wickedness equal to the giant's:

> Walles he welt down, wounded knightes,
> Towres he turnes, and tourmentes the pople,
> Wrought widowes full wlonk wrotherayle singen…
> And all he wastes with war there he away rides…
>
> [He cast down walls, wounded knights,
> Toppled towers, and tormented the people,
> Made widows woefully keen…
> And after wasting everything with war he rides away…][3e]

The bloodshed continues, finally reaching Arthur's own allies. Whilst away on his rampage, Mordred has gone into rebellion, seized Guinevere, and prepared to fight against Arthur to keep the British throne for himself. The knights of the Round Table die in battle against Mordred, and even after witnessing the savagery and unnecessary deaths, Arthur the Giant-King is unable to see where he turned astray, blaming to the end the treachery of Mordred.

As must be remembered, the journey into nature is a journey dependent on sight: in nature, one saw the word of God. Arthur, unfortunately, is clearly blind, and he thus rages and fights, but never sees the signs of God. The poet of the AMA holds that chivalry is too far divergent from pious behaviour to ever reconcile with it. Although the story still shows the journey, as in Sir Gawain and the Green Knight, it shows the very large traps that snare the knighthood because of their unending thirst for glory and riches. For this poet, like the Rome that Arthur wishes to conquer, chivalry is cursed to remain always the city of fallen men.

iii.

Finally, in order to see what may happen should a knight be so powerful in the world that he chooses to lose himself, not in nature, but in the material world, we can turn to the opinion of a knight, Sir Thomas Malory, also an author who compiled (and altered) a tremendous volume of Arthurian stories. Although Malory was working from French sources, it is not too much to presume that in translation, Malory would either not understand and thus include, or omit, those sentiments which were contrary to his own. In the situation that we will look at, it is likely that Malory understood what the text was saying, if not the previous authors' attitudes towards it. This is the theme of Lancelot's prowess and its ability to subvert the will of God in the world. Though the concept of trial by combat (that is, the determining of guilt or innocence by a duel between the parties involved or their proxies) was on the wane, it is clear in the whole of Malory's works that combat was still considered a worthy way to settle a legal dispute. It was presumed by the medieval man that God would grant victory to him whose cause was just. In the selection we will examine, the Morte Arthur, the adulterous affair between Lancelot and Guinevere is revealed to Arthur by Mordred. Lancelot breaks from the court to do battle against the Round Table in defence of Guinevere's honour.

At the very outset, the king himself brings up the possibility that Lancelot might surpass the will of God:

> Sir Launcelot is an hardy knight, and ye all know that he ys the beste knyghte amonge us all, and but if he be takyn with the dede he woll fight with hym that bryngith up the noyse, and I know no knight that ys able to mach hym.
>
> [Sir Lancelot is a powerful knight, and you all know well that he is the best knight among us all, and unless he is taken in the act he will fight with his accusers, and I know no knight that is able to match him.][4a]

Arthur clearly believes that unless if there is visible proof that Lancelot is guilty, his strength in battle will outdo any that challenge him. At this point, Malory introduces the idea slowly. Arthur has not said that Lancelot can win a trial by combat, only that Lancelot will battle any who make an accusation, and that it will prove to be a difficult battle. The first direct reference to a judicial trial is made by Lancelot himself. After he is "takyn with the dede," he rescues Guinevere from the stake (in the process slaying the unarmed brothers of Gawain) and retreats to his castle, Joyous Guard. Under siege, he declares himself his wish to prove himself in combat:

> I shall…prove hit upon ony knight that bereyth the lyff…that my lady, quene Gwenyver, ys as trew a lady unto youre person as ys ony lady lyvynge unto her lorde, and that woll I makey good with my hondis.
>
> [I shall…prove it through combat with any knight that lives…that my lady, Queen Guenevere, is as true a lady as any lady living for her lord, and that oath I shall make good with my hands.][4b]

Since we know that Lancelot cannot rely on truth, the audience must presume that he expects to win regardless of right—he holds faith in his "hondis," not God.

Thus, Lancelot's prowess eclipses the natural and divine orders. From his battles with Gawain, although they are not strictly a trial by combat, one would presume that the victim of fratricide would be able to make right over an adulterer, if nature was in order. It is difficult to overestimate the fear that lurks in this subtext. If a truly powerful knight can undermine the will of God, where does that leave the weak? A knight such as this could conquer unfairly and rule unjustly, and remain unpunished. Fears such as this

were likely great in a post-Plague, post-Hundred Years' War, post-failed Crusades world. To the audience, this possibility must have seemed all too real. Another fear expressed is that in addition to challenging the will of God, an overly powerful knight might succeed in challenging the secular order. When Lancelot retreats from Camelot, he takes many of his kinsmen with him. With him also go men that admire his skill. In a discussion with Arthur, Gawain makes the point explicitly, that "muche peple drawyth unto hym, as I here say. [many people are drawn to his cause, I say here]"[4c] According to Gawain, prowess has now eclipsed rank and regal authority—Arthur's rule (which, lest we forget, was divinely sanctioned), now falls because of a rebellious and powerful knight.

In Malory, we see a less spiritual and more secular address on the interplay between nature and chivalry. There is no journey to grace, but we still see a threat that worldly glory can supplant the grace and will of God.

iv.

Fourteenth and fifteenth century England was by no means of one mind on the relationship between worldly and spiritual glory. In discussing these three pieces, however, we are able to confirm the framework with which we began. In the medieval mind, nature is both treacherous and promising, grace is both evident and difficult to attain, and civilisation is both safe and false. The journey into nature is one made by a man who is locked in civilisation and seeks a greater fulfillment. Unfortunately, the journey is by no means easy, and we have identified three possible traps for the knight-errant. The first is that he might be too easily lured back to civilisation. The second is that the knight might become lost in nature, and remain both outside of grace and outside of civilised behaviour. The third is that the knight might realise the power that he has and abandon all together the quest he wanted to undertake, remaining as a dangerous lord within the world of man.

These texts are written to address this audience of knighthood, and in each, we see avocations and admonitions to this audience. It is too imprecise to state that the only purpose of these texts was didactic. Each is an important contribution to the corpus of medieval English literature because of the depth of its meaning, its variety of interpretation, and, of course, entertainment. Nevertheless, at the same time that we try to find what the texts tell us, we cannot forgot what these texts were trying to tell their original readers. The fourteenth century was one of great wars and greater death. It is clear that people of all classes would be led to considering what was waiting for them after their death; the adherents to chivalry were by no means immune to this concern.

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   c. Pg. 687.

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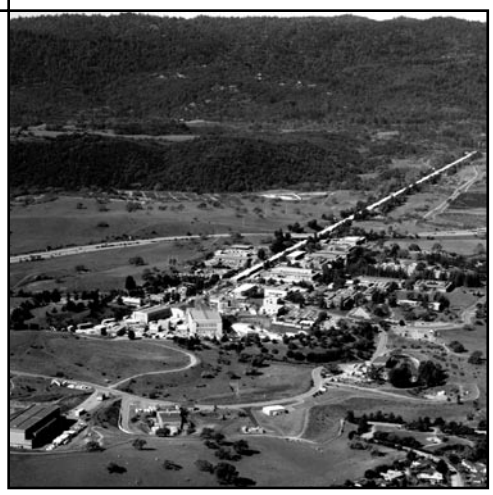

If niobium thin film cavities could be shown to have properties similar to bulk niobium cavities, the cost of constructing facilities like the Stanford Linear Accelerator (SLAC) pictured above could be dramatically reduced.

Characterization of Niobium Films and a Bulk Niobium Sample with RRR, SIMS and a SQUID Magnetometer

Jason A. Thompson, 2004
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Scientists have discovered that everything in our Universe is comprised of a small number of basic building blocks called elementary particles. Some of these particles are stable and form normal matter, while others are unstable and live for only fractions of a second before decaying. For a few instants after the Big Bang, all of these particles existed together. The extremely high energies that can be achieved in Superconducting Radio Frequency (SRF) particle accelerators have allowed physicists to recreate the environment present at the origin of the Universe. Turning back the clock to the Big Bang provides the theoretical framework to understand the formation of stars, earth, oceans, trees, and most importantly, ourselves!

Currently, all high-gradient accelerators utilize large voltages per meter to speed up particles and have cavities made of ultra-pure bulk niobium (Nb). Niobium is used in cavities because it becomes a superconductor at the highest temperature of any element, thus making it the most inexpensive to cool. The extremely high magnetic fields obtained from superconducting Nb are used to accelerate particles to close to the speed of light and smash them together. Physicists use detectors to monitor these high-energy collisions and can identify particle components or discover new ones, revealing the nature of the sub-atomic interactions between them. The cost of producing accelerator cavities has a major impact on the decision of whether or not to build a new facility. Although bulk cavities can obtain higher energies than thin-films cavities, they are much more expensive, at an approximate cost of fifty million dollars per kilometer (km). Huge sums of money could be saved in a thirty to fifty km long accelerator if thin-films were proven to have qualities comparable to bulk Nb. Accordingly, my research for this summer involved experimentally analyzing Nb thin-films and a bulk Nb sample in an effort to find evidence about the performance of thin-films in a high-gradient accelerator.

Our samples included a bulk Nb sample with a Residual Resistivity Ratio (RRR) of 282 from the Deutsches Elektronen-Synchrotron (DESY) TeV-Energy Superconducting Linear Accelerator (TESLA) group in Germany. The value of RRR is an indication of the purity and the low-temperature thermal resistivity of the Nb. In general, a more pure sample would have a higher value of RRR and would perform better in an SRF cavity. We were also supplied a Nb film on a copper substrate produced at the European Organization for Nuclear Research (CERN) in Switzerland. Our other samples were epitaxial Nb films on single crystal sapphire substrates produced at Cornell by DC magnetron sputtering. Sputtering is the process by which gas ions from plasma are accelerated toward a target of the element (Nb in our case) desired for the film. Material is then detached, or sputtered, from the target and deposited on the substrate.

Our experiment included finding the critical fields of magnetization versus applied magnetic field in the bulk Nb and thin-films. We used a Quantum Design Material Property Measurement System (MPMS) Superconducting Quantum Interference Device (SQUID) magnetometer. Critical fields of magnetization are a good indication of what kind of energies a specimen in an accelerator cavity could withstand. After placing our sample in the instrument, we cooled it down to a superconducting temperature, either 1.90 or 4.20 K, and then applied an external magnetic field. At this time, our sample excluded the external field by producing currents that flow on the surface of a superconductor, called Meissner Currents. These surface currents produce their own magnetic field, which oppose the external change in field (Faraday's Law) and prevent flux from entering the niobium. When the SQUID moved our sample up and down through its coils, the magnetometer was able to detect and measure the area void of field. By continually increasing the external field, we could find the first critical magnetic field, H_{C1}, at which point the Meissner Currents were maximized

and flux started to enter the sample. With the addition of even more field, the sample eventually became completely saturated with flux and ceased being a superconductor. This upper critical field is called H_{C2}. H_{C1} and H_{C2} are shown in Figure 1.

H_{C1} is more directly related to cavity performance than H_{C2}. It is believed that any flux entry into the superconducting cavity wall will lead to excessive heat dissipation resulting in thermal breakdown, thus setting the effective maximum attainable accelerating gradient of the cavity. Therefore, by knowing the magnetic field (Oe) value of H_{C1}, we can find the proportional value for the maximum accelerating gradient in MeV/m: the higher H_{C1}, the larger the gradient, and consequently the higher achievable energy in the accelerator. Please refer to Figure 4 for all our measured values. The value of H_{C1} for pure Nb is published, but the value for the DESY sample was measured on site. Such close agreement indicates that our techniques are correct. Our relatively high value of H_{C1} for Film 30 could be from a surface barrier effect, which causes the lines of magnetic flux to pile up and prevents them from entering the film. Although highly unlikely, discovering how to alter a thin-film in such a way as to increase the lower critical field, $H_{C1,}$ would be a significant step in allowing Nb thin-films to replace expensive bulk Nb in future accelerators.

We used Secondary Ion Mass Spectrometry (SIMS) to obtain the element versus depth profiles for our films. The SIMS process involved an ion microprobe shooting a beam of positive cesium ions into our film, essentially boring a hole. Secondary anions from the hole were monitored and recorded. By analyzing the data from SIMS, we were able to obtain vital information about the ratios of oxygen to niobium and carbon to niobium in our films. In addition, SIMS enabled us to determine the level of impurity on the surface and at the film-substrate boundary. A SIMS plot for the CERN film is shown in Figure 2.

The amount of oxygen and carbon in our films dramatically affected the observed value of RRR, which ranges from 2080 for pure single crystals to 11 for polycrystalline specimens. For example, a significant amount of oxygen and carbon were introduced into Film 29 by annealing in a furnace with a poor vacuum. This resulted in a RRR value of 4. Film 30, on the other hand, with very little oxygen and purity close to the DESY sample, had a RRR of 65. In general, any film made with a RRR value greater than 60 could be considered "good."

We used the Desert Cryogenics Full Wafer Probe Station to find RRR and the critical temperature, T_C, of our films. T_C is the temperature at which a material transitions to a superconductor. A lock-in amplifier sent a current through our film while we measured the voltage. Gold contacts were sputtered at the corners of the films prior to the measurement. For example, to find T_C we simply watched for the voltage reading to drop to zero. At this point the resistance must also be zero, since V = IR, and the specimen starts superconducting. Our temperature scan for Film 30 is shown in Figure 3. The fact that this film shifts from normal to superconducting in less than 0.2 K indicates its quality.

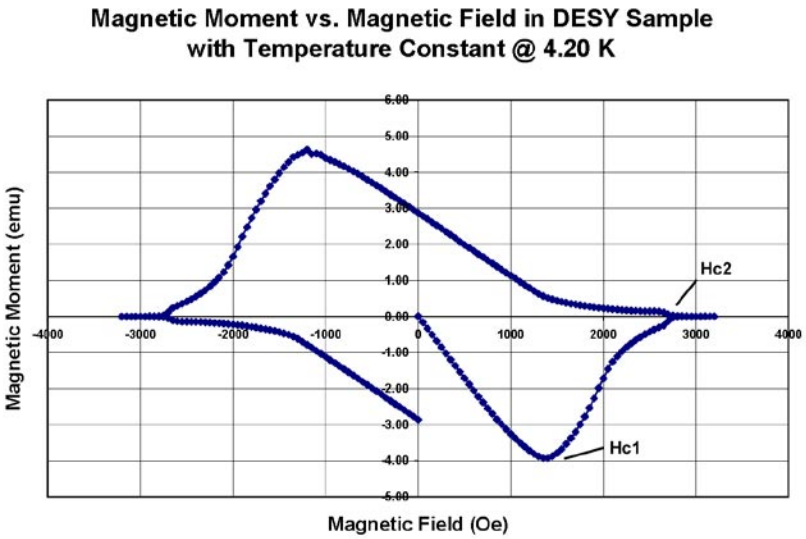

Figure 1.

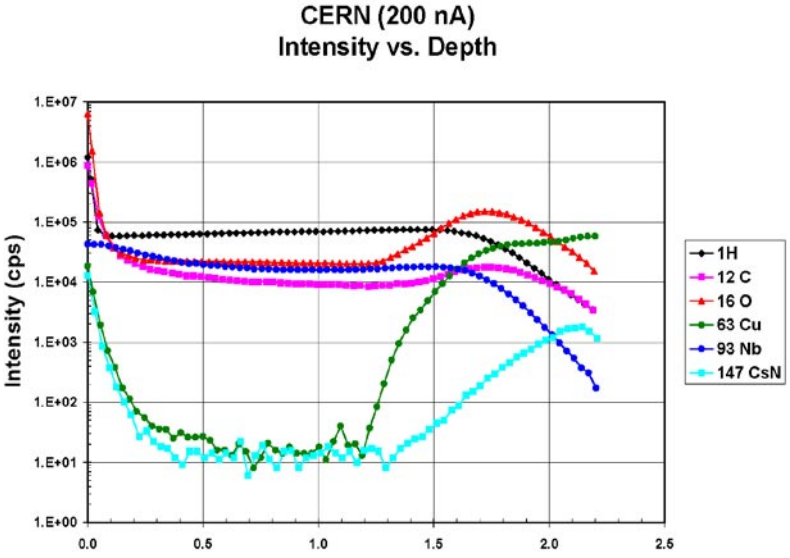

Figure 2.

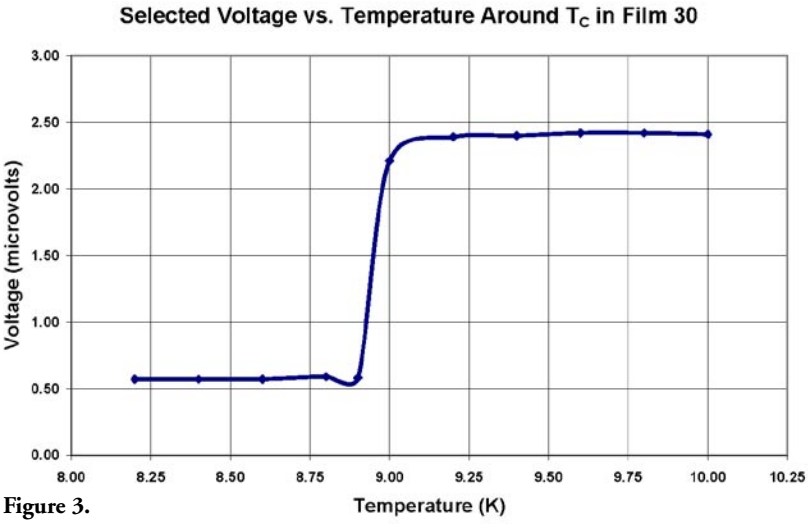

Figure 3.

Sample	Ultra Pure Nb	DESY	CERN	Film 19	Film 29	Film 30
Area (cm^2)	-	0.309	0.224	0.336	0.36	0.513
Thickness (cm)						
RRR	-	0.114	1.50×10^{-4} (nom.)*	-	1.22×10^{-4}	3.29×10^{-4}
SIMS	-	0.114	3.357×10^{-5}	1.75×10^{-4}	9.50×10^{-5}	2.35×10^{-4}
Volume (cm^3)	-	0.0353	3.357×10^{-5}	5.887×10^{-5}	3.910×10^{-5}	1.688×10^{-4}
-dm/dH (emu/Oe)						
1.90 K	-	3.388×10^{-3}	3.194×10^{-5}	1.118×10^{-5}	-	1.569×10^{-5}
4.20 K	-	3.405×10^{-3}	3.093×10^{-5}	1.474×10^{-5}	-	-
{-4 /V} x {dm/dH}	-					
1.90 K	-	1.206	1.257	2.386	-	1.168
4.20 K	-	1.212	1.158	3.1476	-	-
RRR	1600±400	282†	11.5±0.1*	-	4.10	65.3
T_C (K)	9.26	9.26	9.50±0.02*	9.10±0.10	8.40±0.08	9.20±0.05
H_{C1} @ 1.90 K (Oe)	1,676	1653±70	1471±60	1454±80	-	1946±50
H_C @ 1.90 K (Oe)	1,909	1621±300	1926±200	2146±260	-	-
H_{C2} @ 1.90 K (Oe)	3,677	3940±100	10615±230**	8805±120	10740±500	7170±100

* These values are published values from CERN- C. Benvenuti et al, Physica C 351 (2001) 429-437.

** This value is scaled to 1.90 K from the published value at 0 K, our measurement at 1.90 K is 9700 ± 800 Oe.

Ψ All values in this column are published in D. K. Finnemore et al, Phys. Rev. 149 (1966) 231-243.

† Measured at DESY.

Figure 4. Cornell Center for Materials Research (CCMR) Data Collected on Nibium, summer 2003.

Our conclusions included that sputtered niobium films do not have the same superconducting properties as bulk niobium of similar purity. Please see the Figure 4 for our data. Although some superconducting properties, such as H_{C1} and T_C, are similar, others are not. We believe the higher density of dislocations (defects) in our films is a prime suspect for creating the higher H_{C2} values seen in the table. We hypothesize that high temperature annealing is necessary to make films with the same properties as the bulk niobium. This summer's research supports our belief that films can be made to perform under high-gradient conditions. Considering the huge amount of money that would be saved with film cavities, continued research in niobium films is worthwhile.

In acknowledgement, we would like to thank the National Science Foundation and Cornell Center for Material Research for making this summer's work possible. We would also like thank Jonathan Shu, Maura Weathers, John Sinnott, and Ron Kemp for all their assistance. I especially appreciate the hard work of Linda Brainard and Melissa Hines in coordinating this REU program.

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Jason Thompson is currently a senior pursuing a B.S. in Mechanical Engineering. He plans to attend graduate school for the same discipline. Jason is chair of the University of Rochester American Society of Mechanical Engineers (ASME) student section, and likes following the New York Yankees and weight training in his spare time.

The Progression of "Stress" in Ladies Home Journal

Joy Newman, 2006

Advised by: Professor Theodore M. Brown, Ph.D.

Department of History

In today's twenty-first century society it is difficult to read a woman's magazine without coming upon at least one article related to stress. Current women's magazines are filled with articles on how stress affects one's love life, hair, skin, children, and overall well-being and happiness. However, stress is not a new concept. Doctors have been studying the mind-body relationship for over 2,000 years, but they used different vocabulary to describe it. Stress, particularly in females, was often referred to as "hysteria" or "nervousness." These terms imply that stress was traditionally seen as a female problem that resulted from emotional weakness and lack of self-control. These traditional beliefs about the nature of stress were not called into question until the mid 20th century, and it was not until the late 1970's that stress was openly discussed in the classic women's magazine, Ladies Home Journal. It is interesting to observe how the term "stress" was introduced to the female public of the mid 20th century, as well as what that introduction says about the nature of stress in today's modern society.

Like most magazines, Ladies Home Journal (LHJ) is a mixture of regular columns and guest features. One of the regular columns in the 1950's was written by a woman named Dorothy Thompson. Traditionally printed in the beginning of the magazine, Thompson's articles were written for the female intellect and focused on current international politics, domestic turmoil, interesting social phenomena, and medical discoveries. It is not surprising that the first references to stress printed in 1950's LHJ magazines were found in Thompson's column. The first of these articles, printed in April of 1955, was entitled "Are We Scaring Ourselves to Death?" This particular article focused on an apparent increase in public education and community awareness of serious diseases, as well as on medical studies being conducted in the hopes of changing such statistics. However, what is most fascinating about this article is not what it says about mental disease as a public affliction, but rather how it discusses the nature of mental illness. For example, in the first paragraph Thompson writes, "As for mental disease, we are all, it would seem, suffering from 'neuroses' and an appalling proportion of our population from insanity."[1a] However, just a few pages later Thompson describes "mental and emotional stresses" in the context of introducing the growing field of psychosomatic medicine.[1b] Thompson's article exemplifies the slow transformation from stress being viewed as a weakness to stress being viewed as a disease. She introduces her article with the terminology of the time, which was, in the eyes of her middle class white female readers, "neuroses," and then slowly introduces the concept of "stress" as an actual disease resulting from the physical effects of the mind-body relationship. However, Thompson ends her article by referring to "strain" as opposed to "stress."[1c] It appears that although the concept of emotional stresses was something that the public would be familiar with, or at least understand, the term "stress" itself did not yet exist in the everyday vocabulary of the 1955 female public.

Just two years later Thompson once again focused her monthly column on stress, this time under the term "anxiety." What is interesting about the word anxiety is that, unlike neuroses, anxiety began as a synonym for stress but soon developed its own definition with a slightly different meaning. For example, Thompson's July 1957 article was entitled "The Banishment of Anxiety." In this article Thompson used the term "anxiety" to refer to all kinds of emotional stresses and fears. However, in her April 1960 column entitled "May I Tell You About My Heart Attack?" she referred to both "stress" and "anxiety" as separate but related concepts: "You are more likely to suffer [a heart attack] if your reaction to conditions of stress is anxiety than if it is anger." This 1960 article is also the first time that the term "stress" appeared on its own in a Ladies Home Journal article. However, the majority of the article still traditionally referred to "tension" or "emotional stresses," demonstrating how the term "stress" still had not yet truly emerged as an independent concept.[2a,2b]

Thompson's articles presented the concept of stress as a disease. However, Thompson's intellectual articles represent only one way in which the concept of stress

was introduced to the average American female reader. For example, medication ads were often an early forum for the introduction of the concept of stress. Given the confines of this research, the earliest found ad related to stress dates back to February of 1953, in which Anacin was promoted to "Relieve Pain of Headache Neuralgia Neuritis." In September 1955 the Anacin terminology changed to "tense nervous headaches,"[3] and by March 1959 Anacin was advertising its ability to counteract "tension headaches," a term which is still used today.[4] Seven years later Anacin's ad not only advertised its effectiveness in relieving headache pain, but also in backaches caused by "weak, tense muscles, emotional stress and strain."[5] Like "tension headaches," Anacin took advantage of a new disease as a means of advertising its product.

Anacin was unusual in that, most likely for economic reasons, it actually referred to "stress" in its mid-century advertising campaigns. However, many other products referred to the effects of stress by using traditional terminology. For example, an October 1960 advertisement for BAN deodorant referred to the "highly offensive perspiration caused by nervous tension,"[6] and an April 1966 ad for a sleeping tablet called Sominex advertised to help female sleeplessness that often arose from "a woman's natural sensitivity and anxiety and simple 'nerves' and tensions."[7] The Sominex ad is interesting because it used both traditional and slightly more modern terminology, but did so in a manner that still insinuated female weakness. In fact, Sominex actually claimed that it was a "medical fact" that women had innate nervousness. It is ironic that in the midst of the feminist movement a product would advertise as being able to counter the effects of female weakness. For obvious reasons, most other products began to steer away from referring to female neuroses even if they weren't yet confident in the particular term "stress." For example, a March 1965 ad for Phillips' Milk of Magnesia asked its readers, "Does Tension Upset Your System?"[8] In July 1966 an Excedrin ad quoted a woman discussing her "headaches from tension or exhaustion," and in December of 1966 Midol advertised its ability to help comfort the tension that comes with monthly menstruation.[9] Ads from products like Phillips' Milk of Magnesia and Excedrin help illustrate the beginning stages of the slow transformation from referring to female "neuroses", which implies female weakness and lack of self-control, to referring to general "tension" which implies that outside factors affect a women's mental and physical well-being. This change in perception of the nature of stress helps to exemplify the increasing success of the gender equality movement, as well as the overall change in society's view of women at the time.

By the late 1960's the concept of stress was becoming well-known to the American public. Products felt comfortable advertising their ability to counteract the effects of "tension" and "anxiety," and actual articles and columns began to appear that specifically focused on issues of mental and emotional well-being. One of the first of these articles was printed in April 1967 and was entitled "Finally a Sure Cure for Housewife Fatigue."[10] This lengthy article, written by medical professional Walter E. O'Donnell, M.D., discussed a young housewife who was suffering from "psychogenic fatigue," otherwise known as "nervous exhaustion" or "the tired housewife syndrome."[10] O'Donnell discussed how this housewife almost always felt as though she was in a "state of great anxiety, almost panic."[10] While on the surface this article seems to be explaining the daunting job of being a housewife and how factors beyond her control may lead to fatigue and anxiety, when really examined this article seems more reflective of the traditional view that stress results from female disorganization and inability to control one's own life. Most of O'Donnell's suggestions for how to counteract "the tired housewife syndrome" involve having such women get up in the morning, shower and put themselves together, and then make a written schedule for the day that they commit themselves to follow. O'Donnell seems to be suggesting, and rightly so, that "stress" can be derived from a lack of things to do as well as from an overburdened schedule. It would be interesting to note if Dr. O'Donnell would suggest these same stress treatments to women who worked outside the home, and therefore presumably would already be familiar with the importance of routine.

In many ways O'Donnell's article is like Excedrin ads of the mid 1960's. Although O'Donnell's article did not specifically use the term "stress," he discussed what we would today refer to as "stress" through more traditional terminology such as "fatigue," "anxiety," and "panic." However, by 1969 the term "stress" was beginning to replace such traditional terminology in both articles and ads. For example, in January 1969 LHJ published an article entitled "What 'The Pill' Does to Husbands," written by Robert W. Kistner, M.D.[11a] Kistner's article discussed how a man's sperm count was lowered by "fatigue, tension, and worry – all ingredients of a stressful situation."[11b] Furthermore, Kistner's article exclaimed that "combining the problems of stress with excessive smoking, overindulgence in alcohol and the use of certain drugs such as amphetamines, the American male is lucky if he can become aroused at all."[11b] However, while Kistner writes a very pointed article on the effects of stress on fertility, he interestingly enough compares some of the male's "stress" symptoms to that of a woman suffering from "acute anxiety or hysteria." It is interesting that Kistner, a medical professional, would write an article for a women's magazine that explained "stress" as a viable physical affliction for men, but still referred to women as suffering from "hysteria." Kistner's incongruence in terminology reaffirms the fact that although "stress" was beginning to replace traditional terminology, that the transformation was not yet complete.

In the 1950's LHJ had published a 200+ page magazine every month. However by the mid 1960's the magazines became progressively thinner. The intellectual articles of the 50's written by women like Margaret Hickey and Dorothy Thompson became hard to find, and were instead replaced with a smattering of articles on fashion, cooking, dieting, and home-crafts. Monthly editions would feature a specific food such as "mayonnaise," and devote pages to recipes that could be made with that product. As televisions became more common, women no

longer relied on magazines like LHJ to provide them with lengthy stories to pass the time and the number of fictional stories published each month slowly dwindled. By the end of the 1960's, in effect, LHJ became a fad magazine, where women could go to find out about the latest trends but not much else. The articles by Drs. Kistner and O'Donnell signify a new era for LHJ.

The dawn of the 1970's saw new monthly columns written by medical professionals, such as "Medicine Today," written by Phyllis Wright, M.D. and David Zimmerman, which focused on medical discoveries affecting one's physical health. Another new column, "Dr Rubin," written by Theodore I. Rubin, M.D., focused on one's mental and emotional health. Throughout most of the 1970's these medical columns discussed "stress" and its effects on a person's overall well-being, but still shied away from the actual term. For example, one of the first "Medicine Today" articles featured a section on airline stewardesses and how they often suffered from "emotional crises and breakdowns" due to "anxiety, gloom or depression."[12] A section of May 1971's "Medicine Today" discussed how more and more young women were experiencing "emotional difficulties" and "anxiousness,"[13] and the July 1972 "Dr. Rubin" article explained most people have suffered from a least one period of "emotional distress" and that many people pay an "emotional price for hidden anger."[14] Ironically, the July 1972 "Dr. Rubin" article also stated that many men and women are "anxious about their own psychological well-being."[14] While from one perspective it seems humorous that people were stressed about being stressed, on the other hand that conundrum signifies that concepts of emotional health and stress were truly becoming part of Americans' way of thinking about their overall well-being.

As these two sister columns continued throughout the early 1970's they continually discussed the mind-body relationship and physical symptoms of one's emotional health. For example, a December 1972 "Dr. Rubin" article discussed how anxiety had led to night-eating and therefore chronic obesity, and the December 1973 "Your Questions Answered" (the new title for the traditional "Dr Rubin" column) stated that "anxious, tense people actually do have a problem with how they smell because anxiety brings on excessive perspiration and an ammonia-like odor."[15] Early 1970's columns like "Dr. Rubin" and "Medicine Today" show how the public was not only becoming aware of stress as a specific "disease," but also as a trigger and explanation for other physical problems. The discussion of stress as an underlying factor in many common health problems signifies that the public was fairly comfortable with the concept of stress as a disease and was now ready to learn and explore how personal stress was affecting their lives overall, and most importantly, what they could do to prevent it.

In addition to these columns which broadly discussed mental and emotional health concerns, the 1970's saw a rise in the number of actual articles written on stress and related topics. Similar to later columns, many of these articles not only specifically discussed "stress," but did so in the context of its effects on other medical problems. One of the first such articles on stress and its physical effects was published in September 1970 and entitled "Don't Let Tension Destroy Your Looks."[16] This article focused on how living with high tension is the "arch enemy" of beauty, and how "nervously tense people seem to have more hair problems than their fair share."[16] More importantly, the article explained how warm baths with light steam and scented water would banish "stress," and quite possibly old "stress marks" as well.[16] This article was only the beginning of LHJ educating its readership on the effects of "stress" on one's personal appearance. In October 1972 Dr. Rubin confirmed a reader's suspicions that "skin conditions have emotional origin"[17] and the August 1973 "Medicine Today" discussed how "stress and strain" affect the strength of hair.[18]

Although stress was discussed in more superfluous contexts such as hair strength and skin conditions, most of the early 1970's articles on

stress focused on heart disease, a concept that the public had been slowly exposed to for almost two decades. In January 1972 Christiaan Barnard, M.D., one of the most respected heart surgeons at the time, wrote an article for LHJ entitled "What Women Should Know About Heart Attacks."[19a] Unlike previous articles in which the effects of stress were merely mentioned in passing, Barnard dedicated an entire section of his article to "Stress and Your Heart", where he discussed how the stress of modern living had a detrimental effect on the function of one's heart, thereby increasing one's chances of suffering from a heart attack.[19b] In April 1973 Lynda Johnson Robb, the daughter of the recently deceased President Lyndon B. Johnson, wrote an article entitled "How to Prevent Heart Attacks" in which she encouraged people to be wary of built up tension and stress.[20a] Robb encouraged people to make time for rest, and shy away from temporary tension-relieving activities such as smoking in favor of true life-style changes.[20b]

By the late 1970's stress and its effects were well-known to the American public. Although it had taken over two decades, the term "stress" had definitively replaced traditional terminology such as "hysteria" and "nervousness." In October 1978 LHJ published a

feature article entitled "Children Under Stress: How Our Schools Fail" written by Mary Susan Miller. Not only did Miller specifically discuss the nature of both positive and negative stress as discussed in Hans Selye's book *Stress Without Distress*, she explained how all children, on some level, are suffering from classroom stress and the high expectations of their role models.[21a] Miller stated that "perhaps the single most stressful element in our education system is competitiveness."[21b] Miller explained that while some competition is inevitable, the goal of the classroom should be to help children experience positive stress as they learn to reach their own highest potential. Most importantly, Miller concluded her article by stating that "schools alone don't create stress in children, nor are they solely responsible for solving the problem."[21c] Miller then proceeded to provide parents with a list of "stress signals," as well as ways to counteract and prevent stress in their children's lives.[21c]

In December 1978, just two months after Miller's article was published, a reader wrote into LHJ. "How terrible to think that children are just as subject to stress and depression as grownups are," Cynthia Graham of San Francisco wrote. She continued by saying that "the article was a shocker, but perhaps if we become better aware of our children's tensions and anger, we can work to give them the carefree childhood that they are entitled to." Graham's comments demonstrate the culmination of "stress" becoming part of the American female vocabulary. Although women sometimes found new developments on stress hard to believe, they understood articles like the one published in March 1979 entitled "How to Get a Good Night's Sleep" in which Joann Ellison Rodgers explained how modern stresses affects one's ability to rest, and Dr. Helen A. De Rosis's August 1979 article on stress as an underlying cause of marital problems. By the late 1970's LHJ readers knew what stress was, both as a concept and as a disease, and were now ready to learn how to prevent stress from taking over their once happy lives.

People are often wary of new medical discoveries, especially when they relate to their own lives. Although people had always been familiar with the concepts of "hysteria" and "nervousness," these terms were mainly used to describe female weakness and females' inability to control their own lives. "Stress" changed that image because it did not imply innate female weakness, but rather helped to justify and explain how outside factors play a role in the mental and physical health of all Americans. The 1970's was a decade of feminism and increased opportunities for women. In many ways, "stress" as a disease that affected men and women alike became just another component of that gender equality.

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1. Thompson, Dorothy. "Are We Scaring Ourselves to Death?" Ladies Home Journal Apr. 1955.
   a. Pg. 11
   b. Pg. 18
   c. Pg. 21

2. Thompson, Dorothy. "May I Tell You About My Heart Attack?" Ladies Home Journal Apr. 1960.
   a. Pg. 12
   b. Pg. 17

3. Anacin Headache Reliever. Advertisement. Ladies Home Journal Sep. 1955: 42.

4. Anacin Headache Reliever. Advertisement. Ladies Home Journal Mar. 1959: 37.

5. Anacin Headache Reliever. Advertisement. Ladies Home Journal Mar. 1966: 177.

6. BAN Deoderant. Advertisement. Ladies Home Journal Oct. 1960: 1.

7. Sominex Sleeping Tablet. Advertisement. Ladies Home Journal Apr. 1966: 72.

8. Phillips' Milk of Magnesia. Advertisement. Ladies Home Journal Mar. 1965: 52.

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   b. Pg. 50.

20. Robb, Lynda Johnson. "How to Prevent Heart Attacks." Ladies Home Journal Apr. 1973.
   a. Pg. 125.
   b. Pg. 24.

21. Miller, Mary Susan. "Children Under Stress: How Our Schools Fail." Ladies Home Journal Oct. 1978.
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   b. Pg. 112.
   c. Pg. 224.

Joy Newman is a member of the University of Rochester's Class of 2006. She is majoring in History with minors in Health and Society and Judaic Studies. Deeply committed to health promotion and education, Joy is a New York State Emergency Medical Technician and a seasoned American Red Cross instructor. This particular article on stress, written under the guidance of Professor Theodore Brown, Ph.D. as part of the History Department's HOUR program, reflects that committment to community health. She plans to pursue a career in health education and administration.

Members of the Class of 2004 who received distinction in research

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Jessica Erin Gale
Ellen Meredith Ray

Biological Sciences: Biochemistry
Ian M. Harwood

Biological Sciences: Microbiology
Natasha Meriem Girgis

Biological Sciences: Neuroscience
Zarina Sultana Ali
Daniel Thomas Lioy

Brain And Cognitive Sciences
Jonathan Bewley Prince

Earth and Environmental Sciences: Geological Sciences
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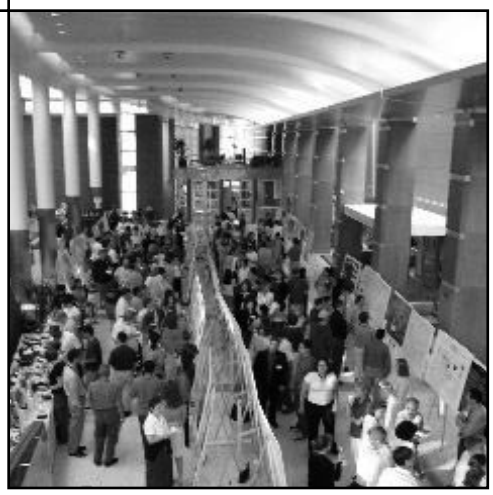
These names were provided by the Registrar's office. Departments not listed acknowledge outstanding scholarship through other methods. High and Highest Honors are awarded on a department-by-department basis.



Undergraduate Research Programs at the University of Rochester

A selection of programs with comments by recent participants.

For complete program listings please visit our website at jur.rochester.edu.

Graduate Education in the Biomedical Sciences

The GEBS (Graduate Education in the Biomedical Sciences) Summer Scholars Program provides summer undergraduate research opportunities to students interested in summer research experiences in biological research. The program is especially aimed at providing research opportunities in all aspects of biological and biomedical research to undergraduates who may be considering applying to graduate (PhD) or combined degree (MD/PhD) programs, under-represented groups in the biomedical sciences, and undergraduates with a potential interest in attending University of Rochester graduate programs.

GEBS provides a summer stipend and free housing so that participants can have an intensive immersion in laboratory-based scientific research. The program is further enriched through shared research seminars, social activities, presentations on graduate school and careers, and a final mini-symposium and poster session. All trainees work under the direct supervision of a participating faculty member for 10 weeks during the summer and present the results of their research at the formal poster session. For more information, see the GEBS program website, or contact Dr. Stephen Dewhurst at Stephen_Dewhurst@ URMC.rochester.edu

Peter Sidor:

"The GEBS program provided my first opportunity at actual laboratory research. GEBS combines working on an independent project with lectures, discussions, and various other academic activities to give you an introduction into both research and a simulation of actual graduate programs.

I worked in the lab of Dr. Mingtao Zeng, helping with the construction of replication-defective adenoviral vectors for the development of an improved anthrax vaccine. I am currently undecided about future plans, but the GEBS program provided me with a solid research foundation which I am sure will be useful in whatever future direction I take.

This program is great for anyone considering any sort of future in research. I would highly recommend it to anyone who is considering graduate studies."

Varun Chowdhry:

"Under the GEBS program I studied post-trascriptional tRNA modification under Dr. Eric Phizicky in the department of biochemistry and biophysics. In addition to working on our own research project, we were provided with the opportunity to attend various seminars on the research of different investigators. This gave us the opportunity to learn about other forms of research.

I eventually want to go into research, and this gave me an excellent background in how biochemistry research is performed. The opportunity also helped me in various courses which I took this past year. I got the opportunity to work closely with graduate students, post-docs, and techs. I also made friends with other students in the program.

Through GEBS, not only did I learn a lot about the practical aspects of biochemical research, I developed critical thinking skills which helped me with future science courses. I would recommend the program to anyone who is considering a career in the biomedical sciences."

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Erin Bressler
"Urokinase (uPA) Induced Smooth Muscle Cell Migration Involves Protein Kinase C Activation"
Advisor: Mark Davies

Erin Conway
"Durability of HSV-1 Amplicon Vector Directed Protein Expression *in vivo*"
Advisor: Steve Dewhurst

Amy Hein
"Characterization of CaMKII Expressing Neurons in the Avian Basal Ganglia"
Advisors: Ernest and Kathy Nordeen

Lidza Kalifa
"The mitochondrial genome maintenance protein Mgm101p"
Advisor: Elaine Sia

Aaron Merriam
"Purification and Characterization of Bovine Immunodeficiency Virus Reverse Transcriptase"
Advisor: Baek Kim

Woo-Sin Park
"RNA interference against the C. elegans male sensory neuron genes, cwp-4 and cwp-5"
Advisor: Doug Portman

Pranav Shah
"*In vitro* CD4+ primed precursor-like (Thpp-like) Balb/c lymphocytes produce IL-2 but not IL-4 or IFNg, and have increased expression of CD73"
Advisor: Tim Mosmann

The HOUR Program

The HOUR Program (History Opportunities for Undergraduate Research) offers students a chance to collaborate with History Department faculty members on their scholarly work. The program enables participants to implement skills and knowledge acquired in history courses, while providing a close look at what professional historians do. Students may undertake HOUR projects for independent study credit or for pay. For more information and an application, see the History Department website, or contact Prof. Joan Shelley Rubin at joru@mail.rochester.edu.

Caitlin Meives:

"Working with Professor Wolcott through the HOUR program has been a useful learning experience. As a history major who plans on pursuing history at the graduate level and as a career, I've gained valuable experience that will come in handy in future research projects and papers. In particular, I'm more aware of the myriad of research resources available through the library and I've become familiar with an important tool in historical research – microfilm. Also, perusing old newspapers has been fascinating."

Byron Raco:

"The best aspect of the program is the connection between the primary source research that I have been doing and the class taught by Prof. Jarvis in the same topic area. Prof. Jarvis has always found time to sit down and talk with me whenever I have had a question. I would certainly say that I have had a fun time working with the HOUR program. When I signed up, my main goal was receiving experience in a more hands-on, practical approach to studying history and this is exactly what I have gotten. For anyone interested in enriching their college experience I would urge them to try it out."

Jason Gogniat:

"Working in the HOUR program with Prof. Rubin has given me the opportunity to make some extra money doing something enjoyable. Going through microfiche has been a lot more amusing than I thought. There have been many times I have burst out chuckling or smiling while reading about people's past ideas, thoughts, or worries. This is also my first white-collar-type job and my first working experience where I feel like my contribution in working actually mattered. I have also gained some sense of what history research entails and how historians conduct their research."

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Advisor: Michael Jarvis

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Advisor: Joan Shelley Rubin

Corinne Carpenter
"Poetry in Practice: Autobiographies"
Advisor: Joan Shelley Rubin

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Advisor: Victoria Wolcott

Jason Gogniat
"Poetry in Practice: Women's Clubs"
Advisor: Joan Shelley Rubin

Rebecca Kowaloff
"Bermuda: The First Generation"
Advisor: Michael Jarvis

Caitlin Meives
"Integrated Amusements"
Advisor: Victoria Wolcott

Jesse Melman
"The Holy Warrior"
Advisor: Richard Kaeuper

Joy Newman
"The Concept of Stress"
Advisor: Theodore Brown

Katrina Nowak
"The Holy Warrior"
Advisor: Richard Kaeuper

Byron Raco
"Bermuda Sailors"
Advisor: Michael Jarvis

Rebecca Roberts
"Crime and Punishment"
Advisor: Michael Jarvis

Peter Schirtzinger
"The Holy Warrior"
Advisor: Richard Kaeuper

Jessica Stoll
"The Holy Warrior"
Advisor: Richard Kaeuper

Matthew Strabone
"The Holy Warrior"
Advisor: Richard Kaeuper

Benjamin Tejblum
"The Holy Warrior"
Advisor: Richard Kaeuper

Matthew Vnuk
"The Concept of Stress"
Advisor: Theodore Brown

Daniel Wolf
"Bermuda: The First Generation"
Advisor: Michael Jarvis

Picture References

All images of Dr. Engel from the interview are credited to the Edward G. Miner Library at the University of Rochester

Shiva as King of Dance (Nataraja) – Tamil Nadu 12th Century Bronze
The Asia Society Galleries – Mr and Mrs John D Rockefeller 3rd collection (see #3) p. 49

Shiva's Family – Uttar Pradesh, 10th century, sandstone p.22
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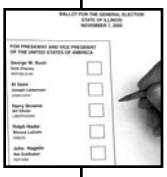

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