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Cover images (top to bottom): An accelerometer based fall detector (courtesy of Garrett Brown); The 2007 M*Racing* Formula SAE racecar in Japan (courtesy of Gabriella Harrison and David Belo); DP Day, a large-scale volunteer effort organized by the Detroit Project, more information available at www.thedp.org (courtesy of Kamaljit Chahal); and *Cebus Capucinus*, Costa Rica (courtesy of Gretchen M. Olsen).

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Michigan Formula SAE Team

Gabriella Harrison[1] and Jason Moscetti[1]

[1]Department of Mechanical Engineering, University of Michigan, Ann Arbor, Michigan

Formula SAE (FSAE) is a student engineering competition in which students organize, manage, and fund a racing team whose primary goal is to design, build and race an open-wheeled racecar. The competition that started with a handful of American college teams in the 1980's, has now grown to over 300 teams from universities in North America, South America, Asia, Australia, and Europe. The race season begins at the end of May with Formula East in Southeast Michigan and finishes in December at Formula SAE Australasia.

MRacing is the Formula SAE team at The University of Michigan that works to build a new racecar each year. Development of the racecar follows a fairly routine, but packed timeline that spans just a year from basic research and design to the final result. From the day that the first FSAE race ends in Michigan at the end of May, we begin researching and testing for next year's racecar. Over the next three months during the summer, new designs are tested through computer simulation and experiment. In the fall, designs are packaged in CAD and a new racecar begins to take shape. During those months and into the New Year, countless hours are spent manufacturing each component, until the new MRacing Wolverine is carefully assembled for the first time. Between that moment and competition, the racecar undergoes exhaustive testing and tuning. When the car is unveiled in April, there is not a blemish to be seen.

The rules for this competition are designed to be flexible and allow the team to express their own engineering abilities and creativity. This allows MRacing team members to research, design, and manufacture over 90% of the racecar's components. Some of these research and development projects have included a redesign of our dampers, the use of E85, and vehicle traction control implementation.

Seeing the World: The 2007 MRacing Formula SAE racecar spent a week surrounded by the gorgeous Japanese mountains.

Damper Development

Damper performance plays a major factor in the overall handling characteristics of a racecar. Most FSAE vehicles use dampers that are severely compromised for their application. Typical damper solutions employed by FSAE teams are either undersized mountain bike dampers, or oversized racing dampers designed for automobiles much larger than FSAE cars.

Members of the team decided to solve this problem by designing dampers specifically for our vehicle to overcome these compromises and achieve a higher level of performance. The final design specifications are a mono-tube damper with a remote reservoir that can adjust compression and rebound damping externally and independently. They include a high flow piston and control of the damping characteristic is achieved using a deflecting stack of shims. This provides us enough control over the damping characteristics, while being significantly simpler in design than a piston that achieves its damping only by fluid flow through the piston. Compression damping is adjusted in the reservoir such that it only affects flow going in, while rebound is adjusted through a one way valve in the shaft. These dampers were originally designed for the 2006 racecar but proved to be so successful that a similar but improved design will be used again on the 2007 racecar.

E85 Research

Fuel selection is a very important part of insuring that the team has the best performing racecar possible. The majority of the FSAE racecars use 100-octane gasoline. This year, however, the MRacing team will make the switch to E85 (15 percent unleaded gas and 85 percent ethanol, which is made from corn and grain). Thanks to a generous donation of 110 galloons of E85 from Atlas Oil, the team is free to make the fuel switch and conduct all the necessary research before implementing any changes.

Because E85 is much different than typical racing fuel, the fuel system of a conventional car needs to be redesigned. Any materials within the fuel system need to be able to resist corrosion due to the E85. In addition to corrosion, rubber components are especially known to swell when surrounded by E85 for any length of time. This could cause different moving and sealing components to stick and not respond properly to the rest of the fuel system. This change, however, will be worth the time and effort as exhaust from an E85 system has a lower temperature and engine life will increase. This will increase overall vehicle performance and allow for other performance enhancing changes to be made.

Traction Control

Starting with the 2003 racecar, the team began to research and implement traction control to alleviate driver mistakes. The traction control system reduces torque output from the engine to minimize wheel spin and maximize traction. MRacing achieves this with their engine control unit.

Originally, the technology was only applied for launch control to make starts faster and more explosive. Over time the team learned more about the system and used their knowledge to develop traction control for "on-track" applications such as slick raceways, sharp curves and different environments. This year's team brought more complexities to the system to help give the team more of an advantage in all aspects of competition.

Traction Control technology has been important to the team's success as Formula SAE competes in all weather. This often means wet, rainy racetracks and more difficult handling.

It's all worth it

With the guidance of team alumni, direction of upper-classmen and the fresh ideas of new team members, these and other new research projects are applied to improve the racecar each year. The results are more than noticeable - the 2006 MRacing team finished third place overall at the Formula SAE East Competition, held each year in Southeast Michigan and was invited to compete at the Formula Japan competition this past September. There, the team won seven design awards in addition to a third place Formula SAE Japan and a FISITA World Cup finish.

Making New Friends: Sophia University's Formula SAE team hosted MRacing during the Formula Student Competition in Japan.

Pictures taken by Team Member David Belo.

For more information on MRacing visit www.engin.umich.edu/soc/sae/formula

Teaching Laparoscopic Surgery with Dr. William Roberts

Interview by Evann Eisenberg[1]
[1]Department of Psychology, University of Michigan, Ann Arbor, Michigan

Laparoscopy is a form of minimally invasive surgery in the pelvic or abdominal cavities. Over the past twenty years, laparoscopic procedures have become increasingly popular. The process involves inflating a patient's abdomen and making multiple 5-10mm incisions in which laparoscopic tools can be inserted. The entire procedure is performed on a monitor and the surgeon must be able to perform a 3-demensional procedure on a 2-demensional screen. Laparoscopy can reduce the need for pain medication and hospital and recovery time by up to 50% compared to open surgical procedures. Surgeons must develop laparoscopic skills so that the tools used act as an extension of their hands. They must be able to cut, remove, clamp, and suture equally as well as in an open procedure. Although many surgical specialties utilize laparoscopic surgery, urological procedures in particular have become increasingly minimally invasive in recent years. Teaching residents and medical students laparoscopic skills has become a new challenge.

One way of training these individuals is by using simulators. Here at the University of Michigan Hospital, the Clinical Simulation Center is one of the most advanced in the country. Students and physicians learn to perform a wide range of medical procedures without any risk to patients. For urology students, the primary equipment used is the LapSim, LapMentor, UroMentor, and Standalone Box Trainer. Each device trains the individual in basic surgical tasks in order to ensure a smoother transition from the classroom to the operating room. Although the equipment is readily available, many specialties have not yet integrated the use of simulators into the curriculum. The most logical reason for this fact is that there is no compelling research proving that simulators provide the best training methods for laparoscopic surgical procedures.

Dr. William Roberts, a urologist at the University of Michigan, is developing a urology curriculum for both residents and medical students that includes the use of laparoscopic simulators. Working with Dr. Pamela Andreatta, Director of the Surgical Simulation Center, Dr. Roberts is compiling data from various institutions and surgical specialties to develop a curriculum that can shorten the learning curve for students. His goal is to incorporate simulators into the curriculum for basic surgical tasks so that patients can be exposed to a minimal risk in the operating room. I sat down with Dr. Roberts to discuss the progress of his work:

Evann Eisenberg: What does the development of these simulators mean for future surgeons?
William Roberts: It represents an alternate way of acquiring skills that should ensure a basic level of proficiency before actually working with a human. I think that these are going to become commonplace everywhere.

EE: Do you think that there should be a mandatory allocated amount of time for residents to spend in the Clinical Simulation Center?
WR: Yes. I believe that time spent in the center should be integrated into every curriculum. I think this is so important. Right now, students go into the operating room and aren't able to do a lot. This may accelerate the speed at which the students are able to gain hands on experience. We just need to prove that it is a valid way of doing so.

EE: Why do you think that there are not many curriculums established for medical students/residents with regard to clinical simulation?
WR: There are a couple of reasons. First, simulators are expensive and not everyone can afford them. Second, this is a new paradigm for education. It takes time for acceptance and hasn't shown to be valid yet.

EE: What do you believe the face validity among the operating room experience and the simulators is? Also, if a new machine with superior face validity is developed do you believe that the hospital will invest in it?
WR: I think that they are adequate for some tasks but not quite ready for widespread use. They are not ready to be mandated. I absolutely believe that the hospital would invest in a new machine if a better one came out. The hospital believes that constant upgrades are necessary and they have invested a lot already to pursue the use of simulators.

EE: Why is it that there are so few bench training models available for use?
WR: I'm not sure exactly. People have come up with their own and that seems to be working. Also, I don't think that they are easy to market.

EE: Minimally invasive procedures have become incredibly popular lately yet many experienced surgeons are not as proficient in laparoscopy as they are in open procedures. Do you think that these doctors could benefit from practicing on the simulators? Also, do you think these simulators focus too heavily on minimally invasive surgery?
WR: To acquire laparoscopic skills, yes I think they could benefit. I do think that they focus a lot on minimally invasive procedures but the technology allows for this to be simulated more easily than open procedures.

Nearest Neighbor Distance in Relation to Behavior in White-Faced Capuchin Monkeys, *Cebus capucinus*

Gretchen M. Oleson[1] and Johannes Foufopoulos[2]

[1]Program in the Enviroment and Anthropology/Zoology, University of Michigan, Ann Arbor, Michigan

[2]School of Natural Resources and Enviroment, University of Michigan, Ann Arbor, Michigan

Abstract

Individuals in a group of white-faced capuchin monkeys, *Cebus capucinus*, were studied in a tropical rainforest of Costa Rica. Spatial preferences to the nearest white-faced capuchin neighbor in relation to different behavioral activities were the main focus of this study. Feeding, foraging, locomotion, and resting were the behaviors that were tested. The purpose of this study was to analyze the correlation between competitive behaviors as opposed to non-competitive behaviors and their effects on individual preferences in distance to a nearest neighbor. Also, we assessed patterns in terms of sex, age, and class differences. We concluded that there was a relationship between competitive behaviors and greater spatial distances as well as non-competitive behaviors and smaller spatial distances.

Background

Behavior is usually the result of decisions relating to survival, child rearing, mating, and the acquisition of food. If an organism's behavior is advantageous for its environment and will help the organism to increase its offspring, natural selection will select for this behavior and filter out less advantageous ones. Similarly, closeness to the nearest neighbor is determined by exposure to predators, access to food, and the potential for interaction with other group members.[1] Many studies on neighbor preferences in wild and captive primates have shown there is strong neighbor preference.[2] Spatial distance preferences are important for understanding which behaviors the proximity of neighbors have been evolutionarily beneficial. Studies in spatial relations also help to show how behaviors influenced by ecological pressures result in different spatial preferences.

A number of studies have exposed different motivations pertaining to proximity. Hamilton discussed the proximity of individuals in context of the group as a whole and how the position of each group member may affect its exposure to predators.[3] A study done on wild mountain gorillas (*Gorilla gorilla beringei*) revealed closer proximity between female gorillas with unweaned infants and silverbacks for greater protection against infanticide.[4] Another study of brown-faced capuchin monkeys (*Cebus apella*) found that females forage closer to the edge of the group than do males.[5] Females may reduce confrontation by deliberately avoiding the center of a group while foraging for resources that are in limited supply.[5] An additional study done on white-faced capuchins found that dominant individuals in the group preferred a center position.[6] In conclusion, multiple factors such as predator surveillance, offspring protection, competition, social status, and opportunity for interaction determine the preference for nearest neighbor distances in primates.

Certain characteristics documented for white-faced capuchins have provided different possibilities for understanding why particular spatial preferences are preferred over others during various activities. First, white-faced capuchin groups contain both multiple males and multiple females, and are comprised of six to thirty individuals.[7] Within such groups, the hierarchy includes an alpha male.[8] In addition, they are considered female-bonded with females forming long term bonds with one another. Also, both sexes form coalitions.[9] Female-female aggression, however, has been documented.[9] Another doumented characteristic of capuchins is that those who spend more time grooming will more frequently form coalitions than those who do not.[8]

Capuchins are omnivores that eat mostly fruit and insects. Females tend to exploit smaller embedded invertebrates while males are more likely to capture more mobile prey.[10] Fruit trees, spaced out with food in clumps, are monopolized by more dominant group members. Both sexes do quarrel over food. However, both sexes tend to avoid aggressive encounters.[8]

From factors including group size, associative patterns, and diet, it can be reasoned that there will be a correlation between certain behavioral activities and nearest neighbor distance preferences. The alternative hypothesis is that there is no relationship between behavioral activities and spatial preferences. Based on the hypothesis, several questions regarding spatial distance preference were asked. First, during activities where competition is greatest, such as foraging and feeding, will spatial distances be greatest in order to avoid competition and aggression and, therefore, decrease unnecessary energetic expenditures? Secondly, when competition for resources is not a direct component of the activity, will the spatial distance preference be closest so that the subject will have a higher potential for social and grooming interactions and, therefore, increase the possibility of forming coalitions?

Materials and Methods

Study Site: The study region was a tropical rainforest at La Suerte Biological Field Station. The field station is on a 750 acre ranch located in northeastern Costa Rica. As a result of logging, the tropical rainforest contains both secondary and primary forest. The subjects, *Cebus capucinus*, were mostly observed and followed by a set of trails. There are two species of primate that live in this area other than *Cebus capucinus* including *Alouatta palliate* (mantled howler monkey) and *Ateles geoffroyi* (spider monkey).

Study Subjects: At the study sight there were two main groups of white-faced capuchins, *Cebus capucinus*. Eighteen members including infants were estimated in each group. Both groups had been extensively observed by humans in the past and were habituated to human observers.

Sampling Techniques: The study took place for eight days from June 9 - June 16 2005. All data were taken during the rainy season. Eleven hours of data were collected during the study. Instantaneous focal sampling was used in continuous one minute intervals. In the focal animal sampling technique a subject was selected and focused on for a maximum of ten minutes before the focal animal was replaced. Spatial distance preference was measured by determining the distance of the focal animal to its nearest neighbor. The nearest neighbor was determined by scanning the entire area and concluding the nearest white-faced capuchin to that focal animal.

During each one-minute interval, age, sex, behavior, and nearest neighbor distance were recorded. The behaviors included were social, feeding, foraging, locomotion, and resting. However, due to the fact that most social behaviors require having a nearest neighbor distance of touching or close (grooming, biting, food sharing, etc.) it was decided that social behaviors would not be included in the final data analysis. Foraging and locomotion behaviors were differentiated by determining whether an animal was searching for food (i.e. slowly moving while scanning or manipulating substrate) as opposed to moving from one place to another as in locomotion.

The distances were categorized into five categories: 1. touching 2. close (0.1-2 meters) 3. far (2.1-10 meters) 4. very far (10.1-20 meters) 5. out of sight.

Focal animals were chosen at random with equal females and males included in this study. Infants that had not been weaned were not included in the analysis. Juveniles were not distinguished by sex. We strived to pick focal animals that did not change their behavior when a human observer was around. Also, we attempted to collect equal morning and afternoon samples.

Methods for analysis: Data were analyzed by taking the total amount of one-minute interval samples for each sex and age group and totaling the different nearest neighbor distances for each behavior. Patterns were assessed by analyzing a time budget table. The time budget table shows the percentage of time that each sex or age group spent in a given distance to its nearest neighbor during a certain behavior.

Data were also entered into an SPSS (14.0 for Windows) spreadsheet. The Pearson chi-square analysis was then applied to the data to check for a statistical relationship between distance and type of behavior (competitive or non-competitive).

Results

General results: All females, males, and juveniles had similar activity budgets. The most recorded behaviors for males, females, and juveniles were locomotion, foraging, and resting, respectively. Of the eleven hours of data, males and females were not visible 17% of the time and juveniles 22% of the time. All social behaviors were the least recorded behaviors for all the groups.

The chi-square analysis showed that the p-value for competitive opposed to non-competitive behaviors was equal to 0.381 with four degrees of freedom. This data proves that the relationship between distance and behavior is not significant using a 5% significance level and the null hypothesis (no relationship) cannot be rejected (Table 1).

Table 1. The observed and expected count assigned to all competitive (foraging and feeding) and non-competitive (resting and locomotion) behaviors for each group of distances to their nearest neighbor.

			Behavior		Total
			Competitive	Non-competitive	
Distance	Touching	Count	0	2	2
		Expected Count	0.7	1.3	2.0
	Close	Count	32	80	112
		Expected Count	38.1	73.9	112.0
	Far	Count	70	117	187
		Expected Count	63.6	123.4	187.0
	Very Far	Count	40	69	109
		Expected Count	37.1	71.9	109.0
	Out of Sight	Count	25	56	81
		Expected Count	27.5	53.5	81.0
Total		Count	167	324	491
		Expected Count	167.0	324.0	491.0

However, when locomotion and feeding behaviors were removed and only foraging and resting behaviors were compared with nearest neighbor distances, the chi-square test showed a statistically significant relationship (Figure 2). The p-value for this analysis was 0.005 with four degrees of freedom.

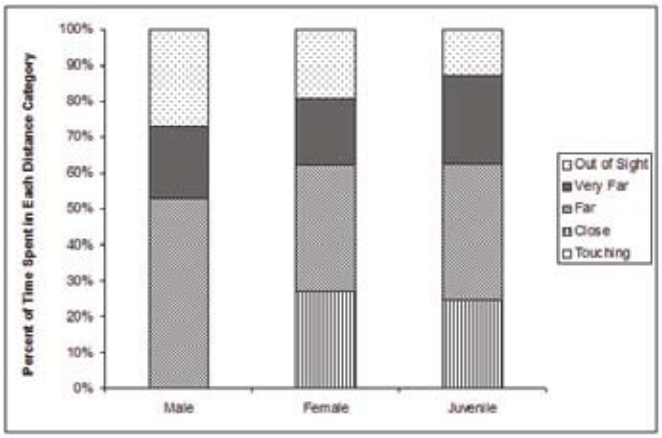
Table 2. The actual and expected count for the behaviors resting (non-competitive) and foraging (competitive) for each group of distances to their nearest neighbor.

			Behavior		Total
			Foraging	Resting	
Distance	Touching	Count	0	2	2
		Expected Count	0.9	1.1	2.0
	Close	Count	15	39	54
		Expected Count	24.4	29.6	54.0
	Far	Count	39	44	83
		Expected Count	37.5	45.5	83.0
	Very Far	Count	24	19	43
		Expected Count	19.4	23.6	43.0
	Out of Sight	Count	12	5	17
		Expected Count	7.7	9.3	17.0
Total		Count	90	109	199
		Expected Count	90.0	109.0	199.0

We chose to examine a relationship between foraging and resting while excluding locomotion and feeding for several reasons. Foraging compared to feeding should have a higher rate of competition because once the food source is attained by an individual, competition for it should decrease. We also chose to leave out locomotion and focus solely on resting while computing the second statistical relationship because some types of locomotion capuchins use may require greater distances solely for the range of motion and not for the competitive aspect of the behavior (i.e. leaping). Further dialogue of characteristics and the competitive aspects of these behaviors are discussed in greater detail later in this article.

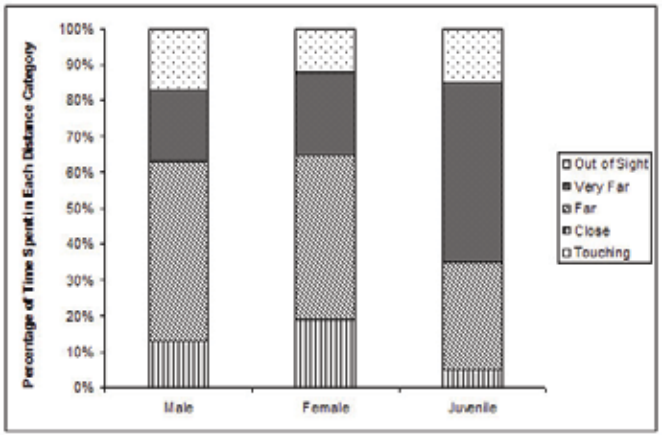
Feeding: Most of the feeding behaviors were recorded for all groups as "far" from the nearest neighbor. Females and juveniles had a significant amount of data where feeding occurred "close" to the nearest neighbor (35% for females and 38% for juveniles), while no data for males was recorded as anything closer than "far" to their nearest neighbor (Figure 1).

Figure 1. The percentage of time that adult male, adult female, and juvenile white faced capuchin monkeys spent in distances categorized as touching, close, far, very far, and out of sight to their nearest neighbor while in the behavior of feeding.



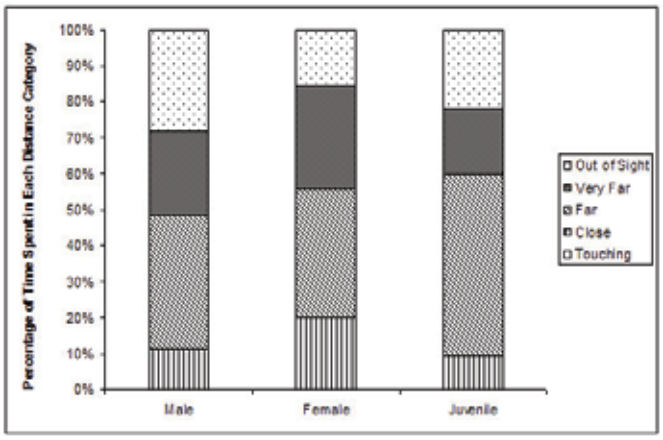
Foraging: Males and females had the same basic pattern of spatial distances to their nearest neighbor with "far" being the most common distance. Juveniles spent the most time being "very far" from their nearest neighbor (50% while foraging), doubling the amount of data points that the adult males and females were recorded in that category (Figure 2).

Figure 2. The percentage of time that adult male, adult female, and juvenile white faced capuchin monkeys spent in distances categorized as touching, close, far, very far, and out of sight to their nearest neighbor while in the behavior of foraging.



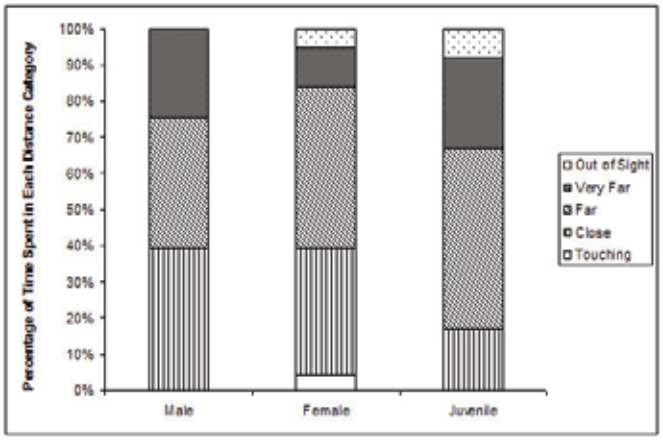
Locomotion: When in locomotion, all three groups tended to lean towards being "far" through "out of sight". The adult females were the only group that had more time spent being "close" to their nearest neighbor when in locomotion (versus being "out of sight" to the nearest capuchin) (Figure 3).

Figure 3. The percentage of time that adult male, adult female, and juvenile white faced capuchin monkeys spent in distances categorized as touching, close, far, very far, and out of sight to their nearest neighbor while in the behavior of locomotion.



Resting: Most of the data points for resting were at a distance of "far" or "close". Juveniles were the exception to the adults and spent greater amounts of time being "very far" (25%) versus being "close" (17%) to their nearest neighbor (Figure 6). The least amount of time was spent "touching" and being "out of sight" to their nearest neighbor for all the groups.

Figure 4. The percentage of time that adult male, adult female, and juvenile white faced capuchin monkeys spent in distances categorized as touching, close, far, very far, and out of sight to their nearest neighbor while in the behavior of resting.



Foraging and Feeding compared to Resting and Locomotion: When the capuchins were foraging or feeding they spent 43% of their time in large distances ("very far" or "out of sight" categories) while 15% of their activity budget while foraging and feeding was spent at close distances ("close" and "touching" categories). When the capuchins were in locomotion or resting, 34% of their time was spent at large distances ("very far" or "out of sight" categories) and 22% of their time was spent at close distances ("close" and "touching" categories).

Discussion

Most of the data concurred with the hypothesis that there is a relationship between different behavioral activities and certain preferences in nearest neighbor distances. It should be noted, however, that because there were only 11 hours of data collected, some of the results may be skewed to one conclusion over another. More observational time would need to be gathered to verify that the data were not skewed or biased due to, by chance, several outlying points.

Behaviors that involved competition (foraging and feeding) tended to occur at larger distances from conspecifics. This idea supports the concept that maintaining greater distances from other individuals to avoid conflict and competition may outweigh the advantages of being close for predator surveillance, learning, and social interaction during these behaviors. In accordance with this hypothesis, the female and juvenile capuchins when feeding spent more time being "close" to their nearest neighbor than during foraging. Foraging may require more competition because one individual is trying to find the food source before others. Once the food is acquired, the competition in finding it tapers and it is not as necessary to have as great of a distance between the nearest sources of competition. In the behavior of foraging, juveniles had more occurrences in the "very far" (10.1-20 meters) category than any of the other distances (50%). Similarly, while feeding, juveniles spent the most time in "very far" distances than either males or females. This may be a result of juveniles not being able to monopolize certain food sources like the more dominant, older group members and are forced to strike out on their own to obtain food.

Behaviors, including resting and locomotion, do not have a clear competitive component. It is surprising then, that both resting and locomotion occurred at larger (mostly at "far") rather than shorter distances ("touching"). It is not surprising, however, that although the distances occurred further apart than expected, most time was spent at "far" and some at "close" with less time spent at distances "very far" and even less at "out of sight". In these instances, it may be more advantageous to create availability for social interaction and utilize others for predator surveillance by having a closer proximity to other group members rather than creating greater space between group members to avoid competition and confrontation. This is achieved by being "far" and "close" (as it was during resting), but not "very far" or "out of sight". Perhaps, because the research site was a fragmented patch of rainforest, there was a lack of predators living in the area and the benefit of predator surveillance was less necessary. The lack of "close" distances recorded during locomotion is most likely the result of the type of locomotion white-faced capuchins use. White-faced capuchins, when on the move, use mainly three types of locomotion: quadrupedal walking, leaping, and climbing.[11] Although the type of locomotion was not used during this study, other researchers have demonstrated that capuchin monkeys employ mostly leaping (24.7%) and quadrupedal walking (52.2%).[11] Because locomotion like this requires a great deal of space, particularly when leaping, animals tend to space out during movement explaining the "far" neighbor distance recorded.

Conclusion

Using the chi-square analysis, there was not a significant relationship of competitive behaviors versus non-competitive behaviors and distance to the nearest conspecific. However, by looking at the time-budget tables and the chi-square analysis for only resting and foraging, the results of this study show some support for the hypothesis that there is a correlation between different behaviors and individual preferences for distances to the nearest neighbor. More specifically, activities that had a competitive component (feeding, foraging) tended to occur at larger distances. In contrast, non-competitive behaviors (resting, locomotion) tended to occur at somewhat smaller distances. White-faced capuchins, while in a group, must always be weighing the costs and benefits of proximity to a neighbor. This study shows that when competition drives a behavior, an individual in the group will tend to choose to some extent greater distances than normally expected to its neighbor, lessening the competition and potential for confrontation. Wherever competition is not a direct force, animals tend to prefer somewhat of a closer proximity. Nonetheless, this study also shows that the relationship of distance and type of behavior is not as dichotomistic as one would assume.

Acknowledgements

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Study on Student and NPO Administrator Experience in Volunteer Work

Dorothy Gotlib[1] and Phoebe Ellsworth[2,3]

[1]General Studies, University of Michigan, Ann Arbor, Michigan

[2]Law School, University of Michigan, Ann Arbor, Michigan

[3]Department of Psychology, University of Michigan, Ann Arbor, Michigan

Abstract

The aim of this study is to identify the attributes of student volunteers as well as to differentiate successful volunteer efforts from unsuccessful ones with the goal of increasing volunteer participation and satisfaction for both students and the organizations that use their help. Unique to other studies about community service learning, this work is an in-depth look into the student's role in the world of service-learning and volunteering. We also address the role of the non-profit administrator in the student's volunteer activities. Although this study is exploratory, through our research we anticipate to learn more about what student volunteers and non-profit administrations can contribute to enhance volunteer experiences.

Introduction

Volunteering is a major source of social good in the United States. According to one estimate, in 1995, 93 million adults in the United States participated in some form of volunteerism. That number contained 49% of the adult population in the United States at the time. Twenty-five percent of these individuals surveyed contributed five or more hours per week to volunteering.[1] In 2001, the estimated volunteer contribution in the United States was $239.2 billion. This estimate assumes that a total savings of $16.05 per hour is achieved from each volunteer.[1] This value is more than 50% of what the United States Department of Health and Human Services allocated for their expenditures ($435.45 billion dollars).

The aim of this study is to identify the attributes of student volunteers as well as to differentiate successful volunteer efforts from unsuccessful ones with the goal of increasing volunteer participation and satisfaction for both students and the organizations that use their help. In this study, non-profit administrators in the community were surveyed about their experience with volunteers and students at the University of Michigan about their personal volunteer experiences. Goals of the study are twofold: to help administrators of non-profit organizations better utilize student volunteers, and to help students seek and find more meaningful volunteer opportunities. In order to accomplish this, one needs to understand the functions, motivations, and goals of student volunteers. Why are some volunteer experiences satisfying to both the volunteer and the organization? Why is it that some are not? How can satisfaction be maximized for agencies and volunteers? Snyder identifies the following criteria for volunteerism[1]:

1. Behaviors performed must be voluntary or based on the actor's free will, without bonds of obligation.
2. The act of volunteering or seeking ways of providing services for other involves some amount of deliberation.
3. Volunteer services must be over an extended period of time.
4. The decision to volunteer is based entirely in the person's own goals and without expectation of material compensation.
5. Volunteering involves serving those who desire help.

Since many students either receive credit for volunteering or, volunteer as a requirement, some may not consider them to be volunteers. This may be why although their contribution to volunteerism is significant, there is little current research independently considering them as a population.

Do the 'rewards' they receive invalidate their candidacy for volunteer status? Does a helpful attitude get disregarded if not entirely altruistic? One should recognize that most people have selfish reasons for volunteering, if only to make friends. If this does not invalidate considering one as a volunteer, why should receiving credits? While students defy the traditional definition of volunteering, as will be discussed later in this paper, they still contribute significantly to non-profit organizations (NPOs) and social services. In addition, while students may receive grades or peer pressure as incentives to volunteer, they are still doing good for society and offering their time and energy to help others, regardless of other purposes it may serve for them.

One might claim that everything about volunteering logically shouldn't happen. Selfless investments in strangers do not make sense. So, why do they happen? This study desires to know more about what people get out of it and why they do it. What would inspire such unusual behavior? What about it makes one feel good? And, lastly, is it important to understand this in order to determine what the best experiences will be for students and NPOs?

Previous studies suggest that there are several reasons for which people volunteer: for a greater understanding of the world, for social benefits, for career advantages, to protect oneself from guilt associated with being more privileged, and for enhancement of good feelings derived from helping.[2] It is the case that people seem to volunteer for many different reasons

that are in no way limiting to their capabilities to serve their selected organization. More specifically, studies show that when considering the different psychological traits or motivations that individuals may have regarding their volunteer experiences, one can conclude that even diametrically opposed motivations can often lead to the same actions and the same net result.[3] Either way, the end goals are achieved and seem to encompass aiming towards the betterment of society and student enrichment.

The fact that there is such variation in why different people volunteer allows organizations the opportunity to recruit different kinds of volunteers.[1] Students who are either self-orientated (volunteering for potential personal benefit such as career skills) or other-oriented (concerned more with those they will be serving) will respond to different types of recruitment. For example, a more self serving individual may respond to an ad that reads, "build your resume; come and volunteer at our organization." While someone who is more "other-oriented" might respond to another-oriented advertisement which says, "come help others." This same study concludes that the initial motivations are not a good predictor of how reliable students will be or how long they will continue their volunteer service.

If we try to compare the sustainability of individuals with different reasons for volunteering, we must consider the self-serving aspects of each of the defined volunteering motives. We must also consider a study (mentioned earlier) which states that self or other orientation is not an accurate indicator of performance and perseverance.[3] Also, although some students are certainly more altruistic than others, there are always several motives involved when doing anything. How does one decide where the self-oriented individuals stop and the other-oriented volunteers begin on the spectrum of altruism? Does it even matter? In fact, it does. It turns out that those who openly recognize themselves as self-oriented may be more reliable volunteers.[1] Does this suggest that those who are working for themselves are more invested in the volunteer work? Since each person is receiving some sort of personal benefit for volunteering, rather than concluding that there is no correlation between those who are considered self or other oriented, one might conclude that people recognize whether they are motivated by benefits to themselves or to others.

Volunteers who have greater satisfaction in their work and also believe in its importance will stick to it even in hard times.[4] This information suggests that NPOs should remind their volunteers of the importance of their work while simultaneously making sure that their volunteers are aware of the benefits others receive from their efforts. This will hopefully lead to increased student satisfaction and keep volunteers working harder and longer to serve the organization and its goals. But, after the volunteer (in this case student) is recruited, what makes for a satisfying experience? How does one encourage volunteers to have a greater stake in the cause? How can volunteers and NPO administrators do their part to ensure positive volunteer experiences? For example, advertisements that cater to a larger number of the specific volunteers' motivations will recruit more volunteers.[1] However, as mentioned earlier, it is also the case that there are fundamentally different characteristics of a volunteer experience which can sustain an individual. Therefore, we can conclude that it is essential that a volunteer needs be satisfied in order to have the best experience which, in turn, enhances dedication and inspires longer commitment. This suggests that volunteers should do their part to educate themselves and NPO administrators should do their best to inform students of the opportunities available to them at their organizations before taking them on. Choosing a good NPO fit seems to be highly important and a strong indicator of quality and quantity of involvement.

While academic studies relating to community service have become increasingly prevalent in recent years, attention is focused on the phenomenon of the act of volunteering and rarely considers the administrator-volunteer relationship. In order to probe the volunteer to organization relationship further, attention must ultimately be paid to the often neglected interpersonal aspects of the NPO-volunteer relationship. In order to have a clear idea about this relationship, one must question the benefits to the NPOs, how can they be defined and quantified, and whether they justify using volunteers, specifically student volunteers? "Is free labor worth the insecurity and instability of using volunteers?" This is an overriding question that will be explored in this study.

Since this work is exploratory there are no specific hypotheses. One can, however, anticipate learning more about what student volunteers and the NPO administrations can contribute to enhance volunteer experiences. This study strives to improve the quality of student volunteer experiences at local NPOs which has the potential to improve local NPO functioning while providing more fulfilling educational and volunteer experiences for students.

Methods

Since the goals of this study are to understand both the student volunteer experience and the NPO administrator experience, both students and NPO administrators were surveyed. Three different groups of students were surveyed. Each student group was chosen either in efforts to select people who have an interest in volunteering or to represent the general student population at the University of Michigan.

The first group of students included students in pre-medicine studies. They were emailed from a list obtained from The Career Center at the University of Michigan. Another group of student participants came from those registered at the Ginsberg Center in a program called America Reads. The Ginsberg Center is a university unit at the University of Michigan that works with students and faculty members in efforts to combine community service and academic and civic learning. At the Ginsberg Center questionnaires were administered in person. Another group were University of Michigan students (n=100) who were randomly approached at the computer lab in Angell Hall.

The pre-medicine groups emailed consisted of University of Michigan graduates and students preparing to attend medical school. There were 580 who received the survey, 16 of whom returned it. At the Ginsberg center, a total of 10 students were administered the survey in person, all of whom submitted their surveys. After distributing 100 surveys to students at Angell

Hall an additional 91 students completed and returned the surveys (91%).

There were a total of 72 NPOs in the Ann Arbor area who were sent the survey which inquired about their experiences with student volunteers. Seven surveys were returned to sender because of faulty address information posted online. Of the 65 survey that reached their recipients, a total of 37, just over half, were returned.

The significance of the NPO administrators being surveyed is as follows. Since this study aims to learn about how to improve the quality of the volunteer experience from the perspective of both students and NPO, it was essential to learn from the administrators how they experience student volunteers. Do they enjoy having them around? Are they helpful? If not, why? This study attempts to figure out why some organizations use student volunteers and others don't. It also seeks to discover what the positive and negative aspects are for those who do use volunteers. The list of NPO administrators selected to be recruited for the survey was obtained from an Internet search of NPOs. The main sources of NPO addresses came from volunteermatch.org and other Google listings of individual organizations that came up under the search, "Non-profit organizations AND Ann Arbor Michigan." A survey was mailed to each of them with a consent form and cover letter at their offices.

The survey distributed to the students inquired about both their parents and their own claimed importance of volunteering. The survey also asked questions about the students' volunteer experiences, motivations to volunteer (if they did volunteer), and also requested some demographic information.

The survey sent to the NPO administrators included questions about their experiences with student volunteers. It inquired about their perceived advantages and disadvantages about working with student volunteers. The survey also requested specific examples of positive and negative experiences with student volunteers as well as information about the types of tasks assigned to student volunteer at their organizations.

Results

The NPO administrators were overwhelmingly enthusiastic about their experiences with their student volunteers. NPOs surveyed use students for an incredibly wide range of tasks including: cooking, filing, running errands, event coordination, crisis intervention, computer help, making copies, and cleaning.

The most common advantages mentioned with regard to working with student volunteers were the energy and idealism of the students, the flexibility of the students' schedules during the day time, and the large number of them available. Much fewer commented on the benefits of the free labor, advantages of utilizing their expertise, and value of having the opportunity to educate students about the NPO community for the future.

Common disadvantages mentioned by the NPO administrators were scheduling conflicts, interruptions during the holidays or semester breaks, quick turnaround times, and low reliability. These disadvantages oftentimes seemed to leave the NPO administrators with a feeling of discouragement when considering training student volunteers. One NPO administrator remarked, "The expectations of the students are too high for their commitment level."

Interestingly, an equal number of NPOs reported thinking that students were in it for resume building or job skills compared to having meaningful interactions with others or to give to others. While, as mentioned before, most to all NPOs reported being amazingly satisfied with their student volunteers, many also remarked that students too often expected to have fun when volunteering and expected more flexibility from the NPOs than they could offer. The NPOs reported were most interested in the students who consistently showed up and were on time. They also frequently expressed an interest in commitment from students. Although many NPO administrators recognized this attribute as a benefit in working with the student population, many NPO administrators claim that they want students to offer their input and expertise more often.

Some NPOs (19%) even reported wanting more volunteers. It was found that the need or want for more volunteers sometimes had an inverse relationship to the amount volunteer recruitment performed. For example, one administrator who said that their organization had too few student volunteers only mentioned two forms of recruitment exercised by their organization. In contrast, NPOs responding that they have just the right amount of volunteers frequently mention between 3 and 5 methods of recruitment. A common recruitment tool listed was the internet. Also, it was found that NPOs had better recruitment experiences when they directly coordinated with a professor or entity at the University.

When asked what their NPO has to offer student volunteers, NPO administrators offered a wide range of opinions: a new experience, selfless experience of community service work, and the opportunity to make a difference. Others mentioned good supervision, training programs, credits, or food. The few NPOs that claimed that they offer training and an organized program to participate in also seemed to report fewer disadvantages of working with the student population.

Amongst those surveyed, results show that there is a significant correlation between the frequency and claimed importance of students volunteering practices (P=.000). There also was a significant correlation between the claimed importance of volunteering to the students and their perceived importance of volunteering to their parents (P=.000).

Of those surveyed, female students returned more completed surveys than their male counterparts—representing 66% of those surveyed. In addition, when comparing the level of reported importance of volunteering between men and women students, our data did not show a statistical significance between their claimed importance regarding volunteering and their genders (P=.001). Out of all of those surveyed (n=117), all but 5 students had some volunteer experience.

Just over eighty percent of students reported that they preferred more structured activities over those which are less structured (selecting 6 or less on a scale of 1-10, 1 being the most structured

While it is interesting to note that almost a third of the student participants (32.5%) are either agnostic or have no religion, this study did not find that there is a significant correlation between religion and volunteer practices amongst students.

Table1: Frequency of Females Volunteering

Weekly/Monthly	Less than Monthly	Never
45%	55%	1%

Table 2: Frequency of Males Volunteering

Weekly/Monthly	Less than Monthly	Never
45%	45%	10%

Table 3: Student's Preferred Level of Structure for Activities that they Participate in

1-3 (more structured)	4-6 (neutral)	7-10 (less structured)
31.6%	48.7%	16.2%

Discussion

While many students claim to prefer structured activities, many NPO administrators do not have the time to offer this to volunteers. It seems crucial that the NPO administrators and students find a common ground in which students receive the structure they need and are provided with a forum where they can best utilize their expertise for the organization. If NPO administrators find a semi-structured system in which they establish some structure and set goals for students, students may respond with more consistency. This task will not be easy and entails more planning and premeditation on both the NPO administrators' and the students' part.

It seems that the least structured events are those which only instructions may be, "just walk around, observe, and find something to do," and an extremely structured event may be a list of routine tasks such as; cleaning or filing. As an alternative, a more moderately structured task would require an initial time investment of coming up with projects and learning about the students specialties, but, it seems there would be a great pay off in the end. For example, a highly structured task may be something as straight forward as putting together a mailing, cleaning, or filing. On the other hand, the least structured tasks are those which one has to come up with on their own, "just walk around and find something to do."

In order to maximize the benefits of working with student volunteers, we conclude that the NPO must make an initial investment in the volunteer. Learning about the volunteer's expertise or major is essential. If they are studying graphic design, maybe they want to work on the newsletter. A student majoring in psychology and marketing may want to help recruit new volunteers. Having an education major cleaning the bathrooms instead of helping with a curriculum, tutoring, or teaching would be a terrible loss to both parties involved. By taking time to learn about the volunteer and also teaching the volunteer about the organization, the pay off will be great.

After reading all of the disadvantages of working with student volunteers mentioned by the NPO administrators we had to ask, is the NPO to student volunteer relationship one that is worth establishing? One must consider that free labor valued at $16.05 per hour is difficult for an NPO to turn down.[1] Student energy and enthusiasm seems to be refreshing and relieving to NPO administrators, NPO staff, and even their clients.

The utilization of student expertise must be worth even more to the organization. The drawbacks, however, while difficult to quantify, cannot go unmentioned. Snyder concludes that volunteering is clearly beneficial, and volunteer organizations say that volunteers are helpful.[1] Nonetheless, there are costs associated with free labor. Many NPO administrators complained of cases where students displayed a sense of entitlement, lack of skills, feelings that they didn't take their work as volunteers seriously, etc.

One NPO administrator in this study complained that an irresponsible student once left a group of elderly people that he was supposed to be watching in a retirement community early and without notice. She was alarmed that this student was so irresponsible to risk leaving these people unattended and at risk of danger. In this instance, it is hard to speculate why the student was irresponsible but she appears not to have had the most selfless intentions. While it is fine to volunteer for reasons other than those which are exclusively self motivated and selfless, it is critical that a volunteer's actions do not precipitate harm. This, in addition to concerns of reliability of students, is a good example of why it is difficult to quantify the disadvantages of using student volunteers. While students are often very helpful, how often will there be inappropriate behavior with a student volunteer as compared to a non-student volunteer or an employee? This requires further research.

While oftentimes offering opportunity to the student, utilizing student volunteers may or may not be a cost effective practice for the organization. While it is not completely clear from the beginning whether or not a volunteer experience will be productive, there are certain precautions one can take to ensure the best chances of a productive experience. A recent study done in the school system parallels the example of the NPO to student relationship.[5] In this study, Greenberg found that the more coordination, social, emotional, and academic efforts contributed to a school based program, the more those involved benefited. They found that short term efforts consistently yielded short term results and vice-versa. In this case, putting more in seems to entail NPOs investing more to not only attract more student volunteers, but also working to make sure that the students are the right fit for their organization. This process involves constant maintenance of the NPO relationship with the students. Students need to be reminded of the good they are doing so they will stay engaged and utilize their expertise.

There is a common contradiction throughout many of these surveys. The NPO administrators simultaneously claim students are helpful to them but then mention all sorts of disadvantages that one would think would be incredibly disruptive to the work. Why then is using student volunteers so satisfying for so many organizations? Unlike Snyder's claims that financial savings are a major reason for NPOs to utilize volunteers, this study showed that only 2 of 33 of NPO administrators claimed that saving money was an advantage in working with student volunteers. We suppose it is possible that they accepted it as a given or forgot to mention it. For our purposes, whether or not there is a significant monetary value to utilizing student volunteers is impossible to determine from this survey's data. It is clear that the NPO administrators equate students with energy and idealism, traits that seem to be quite valuable to the

NPOs.

It may be that case that the number of students recruited for this study was too small of a sample. Although it was important in some ways to find students who were involved in volunteering or interested in community service work, it may be the case that their practices and input do not represent students as a whole.

Whether this is a primary motivation or not, the pre-medicine students are all going into a field that focuses on helping people. The fact that there was such a small return on the emails that went out to this group may be exemplary of the lack of interest. It may also be exemplary of the large workload in their disciplines or of how unsuccessful email research can be. But, our sample from this group of students is so small that any conclusions other than speculations about the low survey return rate cannot be made.

Although feedback from people who had at least somewhat of an interest in the research were desirable, the America Reads students provided feedback that is exclusively from students who are actively volunteering and participating in the field. This is good because it provides more information about the student's experience in volunteering but, offers less of an opportunity to understand anything about all students and their experience (often required or requested by graduate programs) with volunteering.

The random group of students approached at Angell Hall may not have a deep interest in volunteering but, although many did express involvement in their surveys, presented a truer representation of the typical student on campus.

More research will be needed on cost and turnover at NPOs to assess whether the monetary and other values NPOs receive from volunteers is actually worth it considering the associated disadvantages. Such research should also address the potential for future volunteerism from students who have volunteered at some time during their education and other impacts of increased awareness of the NPOs cause. Could student involvement lead to more donations and other community involvement for the NPO that may be directly or indirectly related to the student's involvement but nonetheless advantageous to the organization?

Aside from the potential benefits awarded to the NPOs in this relationship, other research confirms that students gain many benefits from participating in a volunteer experience.[1] Studies claim that involvement in volunteer experiences increases participants' confidence, self-esteem and overall mental well being. In addition, research associated with this study finds that student volunteers often claim to achieve a better sense of self as a result of their volunteer efforts. We need to understand this correlation better. "How do we know that this is not related to other changes in their lives? Can it be that they were in a better place psychologically and that is why they volunteered?" More research is required to determine whether or not this is the case.

While this study found no correlation between religion and volunteerism, another recent study indicated that there is a positive correlation between actively being religious and increased volunteering.[6] Furrow's study suggested the exact opposite of our results. This possible relationship of agnostics or non-religious individuals being more active in the NPO community should be further explored.

Another issue that could be addressed in future studies is the concern that the NPOs surveyed did not necessarily match the students who volunteered. In the future, one might try to arrange to survey the students at the organizations that are being surveyed.

In conclusion, while there are many theories about what causes people to volunteer and what sustains them in their volunteer positions, it is not entirely clear why such an improbable activity occurs so frequently. In a recent survey, 75% of adults said that volunteering was important but only 30% volunteer once a month or more. Although it is easy to see how volunteering is important, it seems to be difficult for people to initiate and participate.[1] This study shows that all participating students felt that volunteering was at least moderately important and most thought it to be very important. However, in this instance, 46.2% of the surveyed population reported that they volunteered once or more each month. It may be the case that the student population who responded to the survey is biased towards volunteering or have more incentive to volunteer because of its academic importance.

The fact is that smaller NPOs need help to be able to offer their clients better services. One must conclude that if students take the time to find volunteer experiences where there is a good fit, they will find a constructive avenue to fulfill their objectives, engage them, and feel enabled to utilize their expertise. NPOs, in return, need to be willing to invest in training volunteers so they will have happy, productive volunteer experiences. It is important that actual activity and not just ideas are interesting. NPOs need to stay fixed on student flexibility and unavailability at the same time. This researcher believes that NPOs willing to invest more time and energy into training students will reap increased benefits from the relationship.

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The survey used in this study is available for download from www.umich.edu/~umforum, or by contacting Dorothy, gotdorth@umich.edu.

Diatom Diversity and Community Structure Along a Thermal Gradient in the Maple River of Northern Michigan

Andrea Maguire,[1] Yoshimi Yamakawa,[2] Stephanie Mixson,[3] Rex Lowe,[4] and Patrick Kociolek[5]

[1]Department of Biology and Program in the Environment, University of Michigan, Ann Arbor, Michigan

[2]Departments of Cellular and Molecular Biology and Anthropology, University of Michigan, Ann Arbor, Michigan

[3]Department of Biology, Wake Forest Universtiy, Winston-Salem, North Carolina

[4]Department of Biological Sciences, Bowling Green State University, Bowling Green, Ohio

[5]University of Michigan Biological Station, University of Michigan, Ann Arbor, Michigan

Abstract

The effects of temperature on diatom diversity and community structure were investigated along a naturally occurring thermal gradient (9-19 °C) in the Maple River, Pellston, Michigan, USA, by allowing diatoms to accumulate on artificial substrates placed at 2-m intervals along a 14 m transect between 07 and 22 July 2006. Diatom species composition was examined and total species richness, relative abundance, and the Shannon-Weiner species diversity index were calculated. A Z-test showed a significant difference in mean species richness between sites 0 and 8 m, 8 and 14 m, and 0 and 14 m. Shannon-Wiener diversity indices calculated for 0 m, 8 m, and 14 m showed no increase in species diversity along the gradient. Other factors such as water chemistry, light intensity, pH, or water velocity most likely influenced species diversity and composition. As temperature increased, species richness also increased but species diversity did not.

Introduction

Diatoms are unicellular algae that have adapted to a wide range of environments. These autotrophic organisms are highly specialized, and many taxa have specific environmental ranges that they can tolerate, such as availability of nutrients including nitrogen, phosphate and ammonia, as well as organic material.[1] Studies have shown that other factors affecting diatom communities include water velocity, pH, amount of light, substrate type, and temperature.[2] Diatom communities change species composition and abundance because of variables within a microhabitat.[3] Since each species has different tolerances and preferences, diatoms are good indicators of environmental conditions.[3]

Diatoms are present and thrive across many environments ranging from cold arctic waters to hot thermal springs. This specialization among diatom taxa is also evident over small-scale thermal gradients. One study has shown a significant increase in diatom species diversity and number over a gradient of 10°C.[4] The effect of temperature on algal growth has been discussed by multiple authors, but these studies primarily focus on diatom response to climatic changes over a large span of time.[5,6] Previous studies concerning thermal effects have focused on aquatic communities along gradients caused by hot springs or industrial runoff.[7] It is less clear how diatoms respond to thermal gradients created as cold waters enter a temperate stream. This experiment was implemented to assess the degree of sensitivity diatom communities have to small-scale changes in temperature.

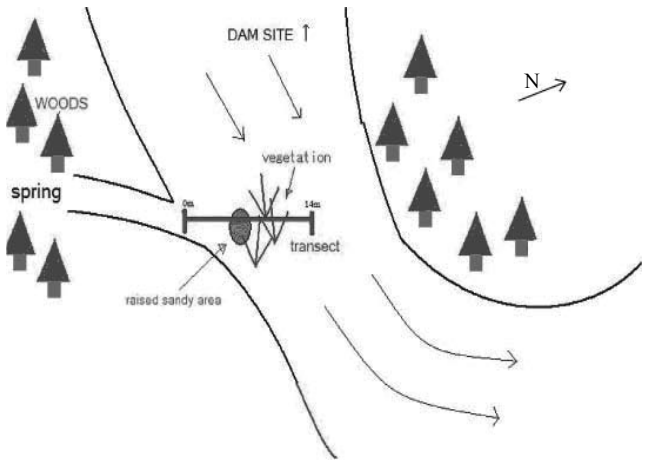
The aim of this study was to investigate benthic diatom communities along a naturally occurring thermal gradient, formed by a cold spring-fed stream flowing into the warmer Maple River. Specifically, diatom diversity and community structure were examined along this thermal gradient. It was hypothesized that diversity in the diatom community would increase with temperature and that the composition would change across the gradient.

Methods

On July 7, 2006, a 14 m transect was laid out along a naturally occurring thermal gradient (9 °C-19 °C) from a cold spring-fed stream that enters the southeast segment of the Maple River south of the Maple River Dam (lat 45.25°N, long 84.45°W; Fig. 1). This transect was divided into 2-m intervals creating a total of eight sites. At every site, three wooden dowels, each 5 mm in diameter, were firmly placed into the sediment 3 cm from one another to act as artificial substrates for colonization. The sites varied in water depth from approximately 10-50 cm. Each dowel was immersed in different amounts of water, but all of the dowels were in at least 10 cm of water.

The substrates were left in the water for a period of 15 days to allow for sufficient establishment of diatom communities. Water temperature was taken every three days at various times during the day to account for potential diurnal fluctuations in

Figure 1: Transect in Maple River south of Maple River Dam, Emmet Co., Michigan,starts where a cold, spring-fed stream enters the river (left). Location of sand bar and vegetation are marked.



the thermal gradient. General observations were made concerning the aquatic flora surrounding each site as well as stream topography. Water chemistry data (dissolved nitrate, phosphate, calcium, and ammonia levels) were analyzed at the University of Michigan Biological Station Water Chemistry Lab the week of July 17, 2006. Water flow was measured by timing a blade of grass from the beginning of the transect to the end on July 19. Light intensity was measured with a photometer on July 19 and on July 25, and broad-range pH was measured using Whatman pH indicator paper (range 4.5-10; 0.5 unit increments).

On July 22, 2006 the dowels were harvested individually by placing a plastic whirl pack around the dowel to ensure that loosely attached periphyton was not lost. To prepare the diatom slides, potassium dichromate was added to 10 ml of material that came off of the dowels, in order to remove the organic material. After decanting, cover slips were prepared and mounted using Naphrax®.[8] Two cover slips of diatoms were prepared from every dowel except for the 14 m site, from which four cover slips per dowel were prepared due to the small amount of diatom community growth. Using a Spencer light microscope, one slide from each dowel was examined under 1000x magnification under oil immersion and the first 500 valves encountered were identified to the lowest taxonomic level (four slides from the 14 m site were needed to count a total of 500 valves). Due to time constraints, three replicate counts were only made at the 0, 8, and 14 meter sites representing the beginning, middle, and end of the transect. One count from each of the remaining six sites was made and no average calculated. Diatoms were identified to species level using Krammer and Lange-Bertalot (1986-1991), Hansmann (1973), and Patrick and Reimer (1966).[8-13]

Total species richness, relative abundance, and the Shannon-Weiner species diversity index,[14] were calculated in Microsoft Excel for Windows for the 0, 8, and 14 m sites (from the coldest to warmest site) because these had three replicates counted at each site and averages could be calculated. A Z-test was used to determine statistical significance between the mean species richness at the 0, 8, and 14 m sites.

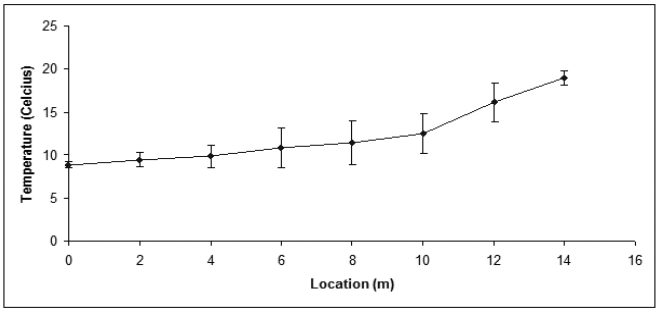
The level of diversity in a community can be measured in different ways. Species richness is the simplest way to measure diversity. It is a count of the number of different species found in a particular sample--a sample with higher species richness has greater diversity. We can also calculate the relative abundance of each species in a sample--relative abundance refers to the percentage abundance of a particular species by comparing the number of individuals of each species to the total number of individuals in a sample. This gives information about which species are most abundant in a sample. Other diversity measures simultaneously take into account species richness and relative abundance. If two samples have the same number of species, one may be considered more diverse than the other if its species all have similar relative abundances. For example, take two samples that both have a population of 100 individuals of five different species. Sample A has 20 individuals of each species, and sample B has 96 individuals of one species and just one individual of the other four species. Sample A would be more considered to have more evenness, and therefore Sample A is more diverse than Sample B, whose evenness is lower. We use the Shannon-Weiner species diversity index to estimate this level of diversity, because it takes into account both species richness and evenness. The Shannon-Weiner index produces a single diversity score whereby a sample's Shannon-Weiner value will be higher with a larger number of species that are distributed with greater evenness. The higher the index value, the greater the diversity. The index is used to compare overall diversity among different communities that have been sampled.[14]

Results

Physical and Chemical Characteristics

Average temperature increased along the transect (Fig. 2). A definite thermal gradient occurred with the coldest temperature at 0 m (8.86 ºC) and the warmest at 14 m (19 ºC). Temperatures at 6, 8, 10, and 12 m had a larger standard deviation compared to the other sites (10.86 ºC± 2.34 ºC; 11.43 ºC ± 2.64 ºC; 12.50 ºC ± 2.36 ºC; 16.14 ºC ± 2.27 ºC, respectively). The average of the 2 m site was 9.42 ºC and for 4 m was 9.86 ºC. According to water chemistry data, there was an overall decrease in nitrate and phosphate levels along the thermal gradient. Calcium carbonate levels remained nearly constant and ammonia levels spiked in the middle of the gradient (Fig. 3). The broad range pH taken at each site was almost neutral except at the 8 and 10 m sites where it was slightly acidic (Fig. 4). The mean light intensity was calculated and the data showed a slightly lower light intensity at the beginning of the transect (from 0-4 m) as compared to the end (Fig. 5). A faster velocity was observed at the beginning of the transect but became stagnant at the 6-8 m interval. The transect was disrupted by a sand bar where the water was most shallow. Once past the sand bar, the current increased due to the influx from the Maple River, albeit in a different direction. Water depth varied along the transect with the shallowest being at the opening of the stream and the deepest where the stream enters the Maple River. The depth varied from 10 to 50 cm. There was also varying amounts of vegetation with more occurring on and around the sand bar.

Figure 2: Mean temperature (°C, n=5) along transect in Maple River (± standard deviation).



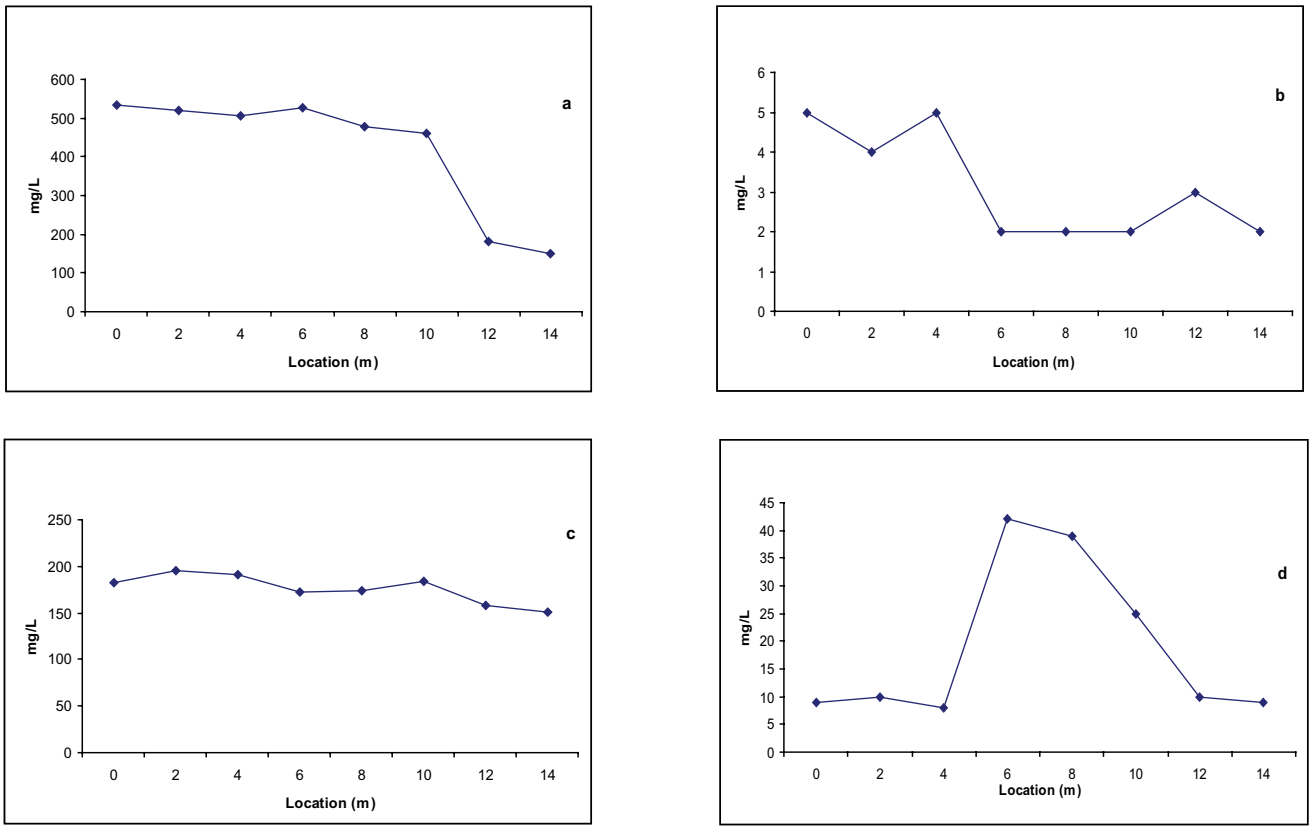
Species Composition

The five dominant species at 0 m were Martyana ansata (17.9%), Fragilaria pinnata (15.8%), Melosira varians (13.4%), Diatoma hiemale var. mesodon (10.6%), and Meridion circulare (7.91%). At 8 m, those dominating were Fragilaria construens f. venter (22.3%), Fragilaria pinnata (12.6%), Achnanthidium minutissimum (12.1%), Martyana ansata (10.8%), and Fragilaria vaucheriae (7.01%). At 14 m, the dominant species were

Achnanthidium minutissimum (9.57%), Cocconeis pediculus (9.06%), Martyana ansata (8.41%), Gomphonema intricatum (6.31%), and Gomphonema parvulum (5.93%) (Fig. 6). For each of the dominant species from 0, 8, and 14 m, the change in relative abundance was graphed over the entire gradient (Fig. 6).

the mean temperatures at these sites. However, there were no individuals of this species in the surrounding sites. One study showed that the rarer a species, the more likely it is to have a clumped distribution.[15] The environmental conditions at 8 m, including factors other than temperature, such as habitat complexity and nutrients, could have been precisely what F. construens f. venter needed, and thus encouraged its growth.

Figure 3: Dissolved nutrient levels along gradient a) Nitrate b) Phosphate c) Calcium carbonate d) Ammonia.



Species Diversity

Species richness increased with increasing temperature. A Z-test showed a significant difference in mean species richness between sites 0 and 8 m, 8 and 14 m, and 0 and 14 m ($p = 0.007$, $Z = 1.64$; $p = 0.001$, $Z = 1.64$; $p < 0.0001$, $Z = 1.64$, respectively). The Shannon-Wiener diversity indices calculated for 0, 8, and 14 m showed a higher species index value at 0 and 14 m and lower at the 8 m site. The index was 2.61 at 0 m, 1.97 at 8 m, and 3.12 at 14 m (Fig. 7).

Discussion

Species diversity is characterized by species richness and evenness, the influence of both factors overall diversity is determined using the Shannon-Weiner index. Since the Shannon-Weiner index did not follow the same trend as the species richness at 8 m, this suggests that the diatom communities among sampling locations were uneven. Fragilaria construens f. venter was the dominant species at 8 m and present only at 6 and 8 m, causing a drop in species evenness and the diversity index compared to the 0 and 14 m sites. The optimal temperature range for F. construens f. venter could be from 10.9 °C to 11.4 °C,

These other factors could have all had an effect on which species colonized each location, as well as how diverse the community became. For example, the influx from the Maple River allowed for a greater variety of immigrants to potentially colonize the artificial substrates. The presence of the sand bar and increased vegetation is likely to also have had an impact on the concentration of nutrients, pH, and habitat availability, due to water recharge and plant metabolism.

Figure 4: Broad range pH along gradient

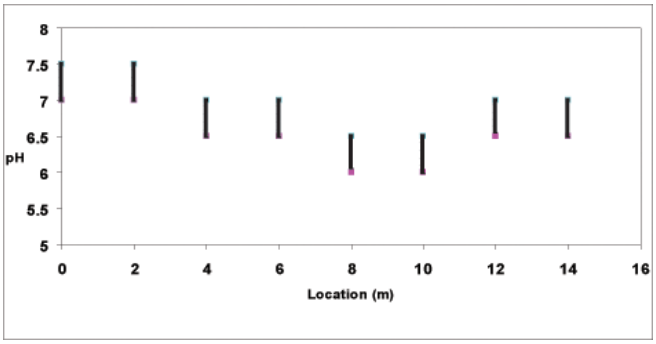
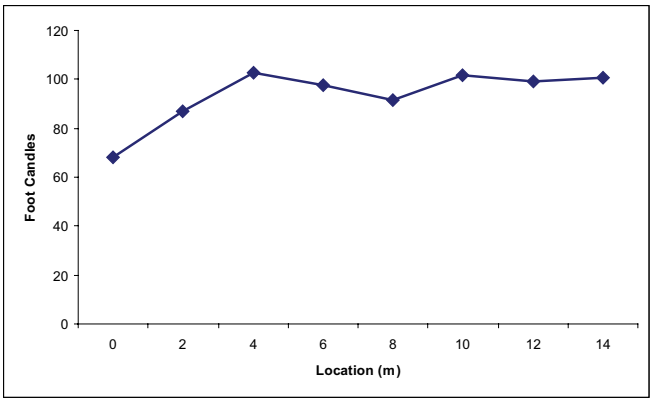


Figure 5: Light intensity by location.

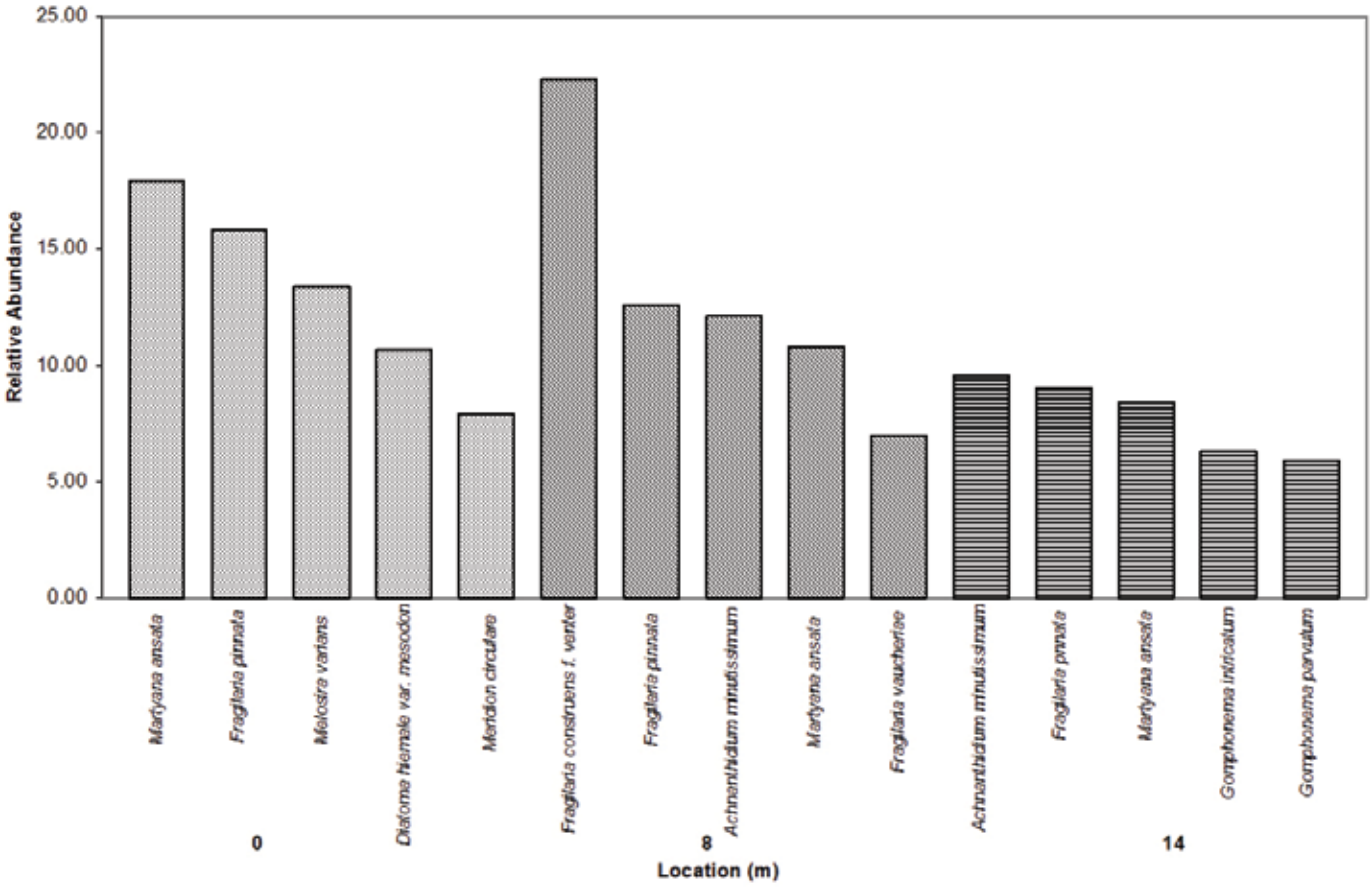


Regarding the water chemistry, calcium carbonate did not change significantly over the gradient, so it was unlikely to influence differences in community structure. Dissolved nitrate and phosphate levels both decreased over the gradient and ammonia levels spiked around the 6 to 8 m interval. These nutrients could have had an effect on the diatom communities, especially nitrogen and phosphate, which can both be limiting to the growth of diatom communities.

Another factor that could have an effect on the diatom communities was the amount of light available at each location. There was a lower light intensity at the beginning of the transect, which was also the coldest area. Temperature and light intensity are closely related with one often being a direct result of the other; if more light is available, then more energy can be absorbed, thus increasing temperature. Gomphonema parvulum, Synedra ulna, and Fragilaria vaucheriae have been known to proliferate with more light.16 In this experiment, G. parvulum and S. ulna follow this trend, but F. vaucheriae, which was more dominant at the 0 m site, does not. This could be due to any of the variables mentioned earlier, or perhaps this species prefers colder water. At 0 m there was more shade due to tree coverage, which could have made the water temperature colder. Cocconeis pediculus may have responded to temperature as well, showing a dominance later in the transect. According to Lowe et al. (1986), Meridion circulare has been shown to associate with colder temperatures.[16] The data showed that M. circulare was most abundant at the 0 m site and Melosira varians showed this same trend. This could be because both of these species prefer colder water.

Moreover, the curved structure of Cocconeis pediculus allows it to strongly attach to substrates in faster moving water. There is a slight trend in the data showing this genus to be more prominent at the 0 and 14 m sites, where the velocity was greater than the 8 m site. Lowe et al. (1986) supported the idea that Achnanthidium minutissimum prefers high-velocity water.[16] Yet in the current study, A. minutissimum was dominant in the 14 m site, which had a slower velocity than the opening of the stream. One possible explanation is that A. minutissimum may have been absent from the pool of available immigrants around the colder end, whereas merging with the Maple River allowed the warmer end to contact many more species.

Figure 6: Relative abundance of the five most dominant species at 0, 8, and 14 m.

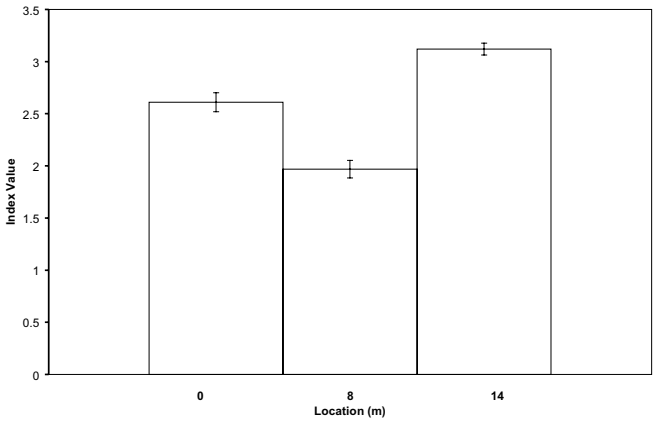


Along with the possible influx of species from the Maple River, the current may have also brought other organisms that could have affected the diatom communities present. Grazers prefer diatoms because they are very nutritious and grazers may influence the composition and diversity of a diatom community.[17] If grazing can keep diatom populations small enough that individual species are not competing for limiting resources, then a larger variety of species can exist in the same area due to less interspecific competition.[18]

The choice of substrates in this experiment was an important factor. Since the dowels were not part of the natural environment, it was not expected that they would yield an exact representation of the natural diatom communities present across the thermal gradient. Nevertheless, it has been shown that representative communities will form on artificial substrates.[19]

This experiment tested the effect of temperature, a single variable, on diatom communities in their natural environment. There were many other parameters besides temperature that varied along the gradient, making it difficult to attribute specific change in the community to temperature alone. Despite the difficulty in testing a single variable, it was important to consider how the variables affected the diatom community structure, and more importantly, to examine what effect they have on diversity. Although the diatom communities at different points along the thermal gradient shifted in species composition, it was hard to identify the direct cause of these shifts.

Figure 7: Shannon Diversity index (± standard deviation) calculated for 0, 8 and 14 m.



A controlled experiment could be designed to minimize other variables and focus directly on temperature, but this approach could potentially produce diatom communities that are not representative of the Maple River.

Temperature was an interesting factor to look at because even though the thermal gradient was only 10°C, there was a significant change in diatom community structure over a short distance. Changes in structure of an ecosystem start at the microhabitat level and a slight change in a single environmental factor like temperature could restructure an entire diatom community. Investigating the nature of these small scale ecosystem changes may offer insights into the dynamics of human-environment interactions at a local scale.

Acknowledgements

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The Effect of Xenophobia on Voter Support for Parties of the Extreme Right in Western Europe: A Macro-Level Analysis

Abdulrahman M. El-Sayed[1]
[1]Department of Political Science, University of Michigan, Ann Arbor, Michigan

Abstract

This project assesses how xenophobia within a population translates to support for parties of the extreme right in Western Europe. Extreme right parties have experienced a dramatic rise in support at the polls with both the prominence of post-material values in voter decision-making and the party dealignment. They represent Western Europe at its most volatile: the extreme right echoes salient concerns about a stagnating economy and increasing multiculturalism. The party family staunchly opposes immigrants and minorities, blaming them for much of Europe's domestic strife. Extreme right rhetoric is wrought with xenophobic sentiment. How does the key attitudinal variable of xenophobia affect voter support for parties of the extreme right on the macro-level? Using data from Eurobarometer 53, a survey posing questions regarding Western European citizens' attitudes, and controlling for other variables postulated in the literature to be affecters to support for the extreme right, we quantitatively assess the relationship between xenophobia and vote share for parties of the extreme right in Western European democracies. Although not as powerful an affecter as immigration, xenophobia is demonstrated to be an important causal determinant to voter support for parties of the extreme right.

Why Model Voter Support for Parties of the Extreme Right?

The world is getting smaller. The forces of globalization have increased the scale and scope of communication, commerce and cultural outreach. Modern day advances allow farmers in France to sell their gourmet cheeses to cosmopolitan Chinese; a car manufactured in Idaho by a Japanese automaker is shipped overnight to its buyer in Germany. Such feats in commerce and subsequent meshing of cultures could only have been imagined by businessman and international connoisseurs in the past.

In Europe, the growth of the European Union has allowed free movement of goods, capital, and people between the borders of the continent. More importantly, globalization has facilitated the flow of international immigrants across Europe's collective border. Such freedom of mobility represents the greatest hopes of some, and the worst fears of others. Immigrants from West and North Africa and Asia continue to emigrate northward by the boatload to Europe in search of better political and economic lives for themselves and their posterity. European countries, immobilized by stagnant economies, an aging population, and a relatively volatile political climate, have responded with mixed emotions to their new, darker-skinned and culturally-conspicuous neighbors. In all, Europe has reluctantly accepted its newcomers. However, immigrant birth-rates far outweigh those of the indigenous, and first-generation European-born children of immigrants are caught between their traditional cultures and those of Europe; cultural friction increasingly characterizes the situation. Riots by culturally-estranged and economically-handcuffed French-born Arab youth in the fall of 2005 serve as a blood-curdling reminder of what could be in store for Europe in the future.

Most interesting is the effect that immigration has had on European politics. Parliamentary systems in Europe allow researchers to quantitatively study the effects that this looming culture clash has had on European voting tendencies. Europe has in no doubt been affected; the recent popularity of parties representing the extreme right has polarized many across the continent. In the last two decades alone, many such parties have tripled their vote shares.[1]

These parties represent European politics at its most volatile. Led by the Front National in France, they advocate an anti-system, populist brand of politics and voice a rather salient discontentment with the political status quo in Europe. More importantly, however, these parties voice a staunch resistance to immigration and multiculturalism. Many of the parties of the extreme right flaunt outright xenophobia and cultural extremism.[1]

Europe's strongest parties of the extreme right are the aforementioned Front National in France, the National Alliance and the Northern League in Italy, the Flemish block in Belgium, and Austria's Freedom Party which has even broken into government coalitions in the past.[1] Although many of these parties have not had sufficient electoral success to warrant them considerable policy sway, many have had important affects on national political campaigns due in large part to their ability to set the topic of discussion and force other parties to recognize their most salient and controversial issues and establish positions on them.[2]

As in any democratic system, the rise of the extreme right in Europe can be fundamentally attributed to party popularity at the polls; these parties have mobilized to their present state because they attract voters. Therefore, understanding the factors behind voter support for parties of the extreme right in Europe is crucial to understanding this party family and its future. Deeper understanding will allow for more in depth analysis of the cultural friction behind much of Europe's domestic unrest, as well as shed light on the potential strength and scope of such cultural turmoil in the future. Perhaps more importantly, un-

derstanding voter support for the extreme right might allow researchers to anticipate extreme right policy preferences as such parties grab power within the framework of Europe's democracies. In this manner, understanding voter support for the extreme right will allow for better overall characterization of the party family itself in the context of an evolving Europe.

What is the Relationship Between Xenophobia and Support for the Extreme Right?

This project seeks to understand voter support for parties of the extreme right on the unit of the European population. We will explore the connection between voter attitudes and support for parties of the extreme right. Voter attitudes are factors other than political and economic outlook that likewise shape voter trends and issue-positions. Where past research has focused on the effects of ideological (left/right) proximity and immigration, as well as the effects of protest voting on support for parties of the extreme right, we consider the effects of the fundamental attitudinal variable xenophobia in the macro-level.[3] In the scope of this project, xenophobia is defined as discomfort with people of other races and/or religions. Because many parties of the extreme right preach anti-immigration and anti-multiculturalism to an extent that is often outright xenophobic, xenophobic sentiments are doubtlessly an attitude that might shape voter support for these parties.

What is the effect of xenophobic tendencies in a population on support for parties of the extreme right? This is the fundamental question posed and answered here. The ramifications of such a question are many. By understanding the salience of xenophobia in voter decision-making, one can then consider the social circumstances affecting voter attitudes, understand the way these attitudes manifest themselves in the political schema, and forecast the future of parties of the extreme right in the context of a volatile Europe.

Literature Reviewed

Parties of the extreme right have been a popular subject of study among political scientists, psychologists, and sociologists alike because they do not lend themselves to the mould of the classical political party. They are especially interesting when considering voter behavior. Researchers have considered methodological issues such as tabulating support for the extreme right, and independently assessing the salience of institutional, economic, and attitudinal factors influencing extreme right support. Still others have used comparative means to assess the factors that contribute to individual extreme right party success and failure.

Golder provides a groundbreaking model for support of the extreme right.[4] He considers various causative variables to an individual party's relative success at the polls. His work is based on three main hypotheses. The Materialist hypothesis argues that unemployment increases support for parties of the extreme right only when immigration is high. The Institutional hypothesis argues that more permissive electoral systems function to increase the vote share of the extreme right. Finally, the Ideational hypothesis argues that high immigration increases support for the extreme right regardless of other factors. His data affirms both the Institutional and the Ideational hypotheses finding both variables of electoral permissiveness as well as immigration to be significant positive affecters to vote share. Golder establishes a framework for understanding the economic and political factors that benefit parties of the extreme right in the context of European democracies.[4] More importantly to this project, he provides a valuable set of controls that must be considered when attempting to quantitatively gauge support for parties of the extreme right using other external variables, such as xenophobia.

Norris also analyzes the rise of the radical right.[5] She argues that voter support for this party family is a product of a complex synthesis of voter attitudes, party processes, and political structures. She downplays the importance of immigration rates and economic stability. On a macro-level, Norris argues against the value of attitudinal variables in predicting support for extreme right parties.

> Radical right parties can gain ground in societies where attitudes toward ethnic minorities remain relatively liberal and tolerant, such as Norway, as well as faring poorly elsewhere in countries where the public proves more hostile toward outsiders...[5] (p. 167)

However, the analyst does support the value of attitudinal variables in predicting support for the extreme right on the level of individual voters. Mainly, she argues that cultural protectionism, or the desire on the part of the individual to mitigate the effects of external cultural influences on his society, is the fundamental attitudinal cause for support for parties of the extreme right.[5] In the context of Golder's work, Norris rejects the Materialist and Ideational hypotheses and accepts the Institutional hypothesis on the macro-level.

Van der Brug *et al.* argue that voter support for parties of the extreme right is based mainly in ideological (left/right) proximity, anti-immigrant stance, and relative party strength; they illustrate that such votes are not protest votes as is largely assumed.[3] Their study of the 1994 European elections in seven electoral systems shows that voter support for parties of the extreme-right is no less based on rational choice than is support for mainstream parties. The researchers provide evidence that support bases of parties of the extreme right can be discussed in the same vain as those of other, more mainstream parties.[3]

The work of Van der Brug *et al.* is important because it implicitly argues that the political and economic outlook in a particular country has a large impact on voter support for parties of the extreme right. If voters vote based on rational judgment of policy preferences, then it is likely that their opinions on policies change with the political and economic situation in their particular country. This might indicate that the recent increase in support for parties of the extreme right at the polls is more a product of Europe's increasing political volatility and deepening economic stagnation rather than variables concerned with voter attitudes toward people of different races and/or religions. This framework directly contradicts Norris's analysis, which downplays economic and political variables in the macro-level, while supporting Golder's Materialist hypothesis.

Fetzer's work on voter support bases for anti-immigrant and/or nativist parties focuses on voter economic self-interest and cultural marginality as explanations for support for these parties.[6] He argues that sociological and psychological models for voter behavior do not mesh sensibly with anti-immigration party policy preferences and methodology. Using survey data and multivariate analyses focusing on France, Germany and the United States, he assesses the strength of economic self-interest and cultural marginality as affecters to voter support for anti-immigrant parties. His findings indicate that although economic self-interest is at best a "luke-warm" predictor to voter support for the extreme right, cultural marginality is a strong predictor; the more culturally marginalized a voter feels, the less likely s/he is to vote for an anti-immigration/nativist party.[6]

Cultural marginality can be understood as an inverse of Norris's variable of cultural protectionism: majority cultures, those that are not culturally marginal, show cultural protectionism. In this sense, because Fetzer argues that cultural marginality is an inverse predictor to an individual voter's propensity to vote for the extreme right, and because Norris argues that cultural protectionism directly influences an individual's vote toward the extreme right, Norris and Fetzer implicitly agree on an important micro-level attitudinal cause to voter support for parties of the extreme right.

Fetzer's work also discusses the Allport-Pettigrew Contact hypothesis, which stipulates that contact can improve the overall relationship between natives and immigrants when this contact is meaningful and cooperative. However, when contact is casual, it tends to increase xenophobia on the part of the native, further isolating immigrants. He applies this theory to both Germany and France and discusses both cases.[7]

Schain discusses the tactics of the Front National in achieving surprising success in the 1997 parliamentary elections in France.[2] He attributes their success to three fundamental capacities. First, the party was able to unite voters on previously opposite sides of the political spectrum; it mobilized the working class by capitalizing on fears that immigrants had, and would continue to stifle the French unskilled labor market. At the same time the party maintained its more traditional right wing ultra-conservative support. He also discusses the Front National's masterful use of French labor unions in establishing "party machine" style campaigns. Finally, he hails the party's ability to control the campaign agenda by forcing other parties to consider controversial issues such as immigration, the present state of French politics, and French suburban conditions and articulate stances on them. In this manner, he implicitly warns that the Front National has established a model by which other parties of the extreme right might seize power across Europe.[2]

Schain's breakdown of the Front National's success fundamentally agrees with Fetzer's understanding of support bases for parties of the extreme right. Fetzer argues that economic self-interest and cultural marginality are both significant affecters to an individual's decision to support the extreme right. It is clear that working class support for the Front National stems directly from economic self-interest; while the party's traditional right wing ultra-conservative support base represents the least culturally marginalized in France. Those who are more culturally marginalized are proportionally less likely to vote for parties of the extreme right. Therefore, it follows that those that are least marginalized are most likely to vote for the extreme right. In this manner, the Front National garners strength from both the economic self-interest of the working class, and by tapping their constituency's least marginalized voters.[6,2]

De Witte also models support bases for the extreme right; he takes a multi-disciplinary approach to contrasting strong support for the Vlaams Blok, a Belgian party of the extreme right, and weak support for the corresponding party in the Netherlands.[9] He analyzes the political systems of each country, the comparative attitudes of each country's citizens, and the agonistic effect both factors have on one another; he calls these three factors supply, demand and mobilization respectively. He argues that

> ...[s]upply, demand, and mobilization are the three basic elements of any theory of participation, regardless of whether it concerns voting for a party associated with a movement or taking part in a demonstration.[9]

He stipulates that in both countries, support for the extreme right is mainly based in the "demand", or negative attitude toward immigrants and to a lesser extent feelings of political dissatisfaction. He concludes that greater proportional support for the Vlaams Blok in Belgium is principally due to more intense negative attitudes towards immigrants and therefore, attitudinal factors are the most important affecters to support for the extreme right.[9]

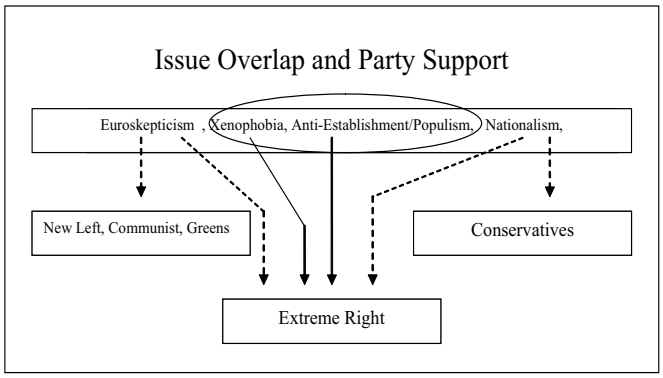
Although researchers have modeled voter support for the extreme right, and many have considered attitudinal variables in their arguments, the present work fails to analyze the effects of outright, expressed xenophobia on support for the extreme right in a quantitative, macro-level fashion. By considering xenophobia and its impact on voter support across Europe, we will shed light on much of the previous work considered here. In particular, we will refine the connections between attitudes, political realities and voter support for the extreme right, and will further define the concept of "attitude" in the scope of extreme right support.

Theory: Xenophobia Causes Support for the Extreme Right

Our analysis hinges on the relative importance of economic and/or political variables as opposed to attitudinal variables in the minds of voters on polling day. Although economic and/or political variables may be important, we hypothesize that attitudinal variables carry greater weight in the minds of voters; voters support parties of the extreme right mainly because these parties express outright opinions that are in line with voter attitudes.

The onset of post-material values in Europe has led to a steady dealignment in party identification across the continent. Because this dealignment has diminished the prominence of the political party in voter decisions, it has allowed smaller, more ideologically acute parties, such as parties of the extreme right, to gain in overall vote share.[10] The dealignment has increased

Figure 1: The first line accounts for predispositions that could contribute to voter support for the extreme right. The circled dispositions are those that do not contribute to voter support for other parties and therefore are most salient in voter support for the extreme right.



the importance of party viewpoints on singular issues: voters today vote on independent issues more than ever before.[10] Today's voters are most likely to vote for the party that articulates their viewpoints on the issues most important to them. It follows that as party viewpoints on singular issues have increased in importance, attitudinal factors affecting voter viewpoints on such issues have become superbly important because voters select parties that share their viewpoints on key issues. Therefore, attitudinal factors have become more important than individual political and/or economic variables since post-material sentiments have pushed dealignment.[10]

Another important outcome of the dealignment is the ability of smaller parties to manipulate the electorate. As Dalton states, "the lack of longstanding partisan loyalties may also make electorates more vulnerable to manipulation and demagogic appeals." [10] (p. 193) Schain's discussion of the Front National in France exemplifies the ability of smaller parties to manipulate the electorate; parties of the extreme right pressure their more mainstream counterparts by forcing them to articulate their stances on issues of immigration and multiculturalism thereby making these factors more salient in voter decision-making processes.

Identifying the particular attitudinal factors that cause voter support for parties of the extreme right is another implicit objective of our analysis. We hypothesize that xenophobia is the most important attitude delineating support of the extreme right. To rationalize this hypothesis, one must consider the stances of the party family itself. Parties of the extreme right can be characterized as anti-immigrant, anti-multiculturalism, Euroskeptic, populist or anti-establishment and extremely nationalistic. Which predispositions on the part of a voter coinciding with these party stances most influence that voter to support an extreme right party? To consider whether a disposition of xenophobia, Euroskepticism, anti-establishmentism/populism or nationalism is most salient in voter choice, one must question where the policy stances of parties of the extreme right overlap with those of other, more mainstream party families. Logically, where party stances overlap, a voter is likely to have several parties to choose from, and is therefore less likely to vote for a party of the extreme right based solely that singular policy stance. It is those stances with fewest overlaps that must then correspond with attitudes that have the greatest effect on extreme right vote share.

Nationalism and Euroskepticism are both characteristics shared with other party families; nationalism is an ideal to which the conservative party family holds, while Euroskepticism is held by parties of the new left, communist parties, and, to an extent, the green party family. By default, then, the most salient predispositions of voters for the extreme right are xenophobia and anti-establishment/ populism because no other European party families adhere to these stances.

Although being anti-establishment/ populist is an important predisposition, it does not represent an attitude. Such a disposition is largely a product of the political and/or economic climate in a given country and therefore variable based on a

Table 1: Extreme Right Vote Share and Xenophobia by Country. Shows vote share of the Extreme Right, proportions of respondents answering "disturbed" by people of other races (question 47) and religions (question 48) as tabulated on "Eurobarometer 53", and Average Xenophobic Index by country analyzed.
* Average xenophobic Index varies between 0 and 2; 0 indicates no xenophobia, 2 indicates complete xenophobia.

Country	Voteshare(%)	Proportion Disturbed by Other Nationalities	Proportion Disturbed by Other Religions	Average Xenophobic Index*
Belgium	13.7	0.27	0.26	0.5
Denmark	12.9	0.23	0.32	0.5
Germany	0.6	0.17	0.18	0.3
Greece	1.1	0.23	0.20	0.4
Italy	16.3	0.14	0.12	0.3
Netherlands	0	0.05	0.06	0.1
Spain	11.1	0.20	0.17	0.4
France	11.4	0.10	0.10	0.2
Portugal	0	0.12	0.10	0.2
United Kingdom	0	0.16	0.13	0.3
Sweden	1.4	0.12	0.17	0.3
Austria	13.7	0.14	0.12	0.3
Aggregate	6.9	0.20	0.20	0.3
St. Deviation	6.5	0.10	0.20	0.1

Table 2: Vote Share and Control Variables by Country. Vote share of the Extreme Right, immigration (percentage of foreign citizens), percent unemployed, an interaction term between immigration and percent unemployed, log of the average district magnitude and seats allocated at the upper tier by country.

Country	Voteshare(%)	Immigration	Unemployment* Immigration	Log(Avg. District Magnitude)	Upper Tier Seats	Unemployment Rate
Belgium	13.7	8.7	79.17	0.88	0	9.1
Denmark	12.9	4.7	24.44	0.9	40	5.2
Germany	0.6	9.8	92.12	0	328	9.4
Greece	1.1	0	0	0.72	68	11.2
Italy	16.3	2	23.4	0	155	11.7
Netherlands	0	2	28.4	0.83	0	14.2
Spain	11.1	6.3	77.49	0	0	12.3
France	11.4	4.3	17.2	2.18	0	4
Portugal	0	0	0	1.05	0	4.5
United Kingdom	0	3.6	25.2	0	0	7
Sweden	1.4	6	49.8	1.03	39	8.3
Austria	13.7	9.2	34.96	1.31	28	18
Aggregate	6.9	4.7	37.7	0.7	54.8	9.6
St. Deviations	6.5	3.2	29.3	0.6	93.1	4.2

country's economic and/or political status quo. Therefore, xenophobia remains as the fundamental attitude delineating support for the extreme right (Figure 1).

In formulating our hypothesis we also consider De Witte's supply and demand model of support for parties of the extreme right. Comparing strong support for the Vlaams Blok in Belgium and relatively weak support for the extreme right in the Netherlands, he argues that the quintessential factor behind support for parties of the extreme right is demand.

> The demand-side of participation covers the grievances, the perceptions of deprivation and injustice, the group identification and ideologies that spur people on to take part in the activities of an organized movement.[9] (p. 2)

He therefore argues that negative attitudes toward immigrants and not institutional variables of party strength and potential for success are what drive individual voters to parties of the extreme right in Belgium and the Netherlands. He concludes that a proportionally more intense sentiment of distrust and disdain for immigrants is the causal variable accounting for increased support for the Vlaams Blok over its counterpart in the Netherlands. De Witte illustrates that the attitudinal variable of xenophobia on the part of the unitary voter is fundamentally important to predicting vote share for the extreme right. Because xenophobia is here shown to be the most important micro-level affecter of vote share for the extreme right, it follows that this variable should prove most important in macro-level analyses as well.

Because we conclude that xenophobia is the attitude most salient in extreme right voter identity, and that attitudinal factors are most important in predicting voter choice, we hypothesize that as xenophobic sentiments within a population increase, support for parties of the extreme right within that population also increase. This implies that European countries in which greater percentages of the population are xenophobic should garner greater electoral support for parties of the extreme right, and countries in which lower percentages of the population are xenophobic should garner lower electoral support for such parties. Our theory has several important implications when considering the recent rise in support for parties of the extreme right.

Data

We use linear regressions to analyze the relationship between xenophobic attitudes in European populations and support for the extreme right. Such a model is optimal because it allows for a uniformed analysis and is most suitable for hypothesis testing.[4] Our analysis includes 12 Western European countries: Austria, Belgium, Denmark, France, Germany, Greece, Italy, the Netherlands, Portugal, Spain, Sweden, and the United Kingdom (Table 1).

Information on xenophobic attitudes was obtained from "Eurobarometer 53", a multi-question survey administered to 12,127 respondents in the spring of 2000, which asks questions to measure respondents' attitudes toward people of other nationalities, races and religions.[11] For the purposes of our analysis we created a xenophobic index for each respondent from the questions below:[11]

46. And do you find the presence of people of other nationalities disturbing?
47. And do you find the presence of people of another race disturbing?
48. And do you find the presence of people of another religion disturbing?

Table 3: Regression Coefficients of Variables Analyzed in Micro-Level Analysis. The dependant variable is the vote share of the extreme right. Model 1 shows regression with Xenophobic index only. Model 2 shows regression with all variables. B coefficients are not standardized. Standard deviation listed in parentheses. N = 12,127 * indicates P = 0.034 ** indicates P = 0.000

Variable	Model 1	Model 2
Xenophobic Index	0.648** (0.086)	0.526** (0.081)
Immigration	*********	1.175** (0.049)
Unemployment* Immigration	*********	-0.067** (0.006)
Log(Avg. District Magnitude)	*********	0.256* (0.121)
Upper Tier Seats	*********	-0.0012** (0.001)
Unemployment Rate	*********	0.255** (0.027)
CONSTANT	6.320** (0.063)	1.581** (0.289)
R2	0.005	0.12

Question 46 was omitted because it showed a negative correlation with the other two questions and because being disturbed by the presence of other nationalities in one's own country is not necessarily a function of xenophobia, but nationalism. Therefore, inclusion of question 46 might have skewed our index meant only to gauge xenophobia. Using the other two questions, answers of "disturbing" were converted to one and answers of "not disturbing" were converted to zero. Respondents answering "don't know" for either question were omitted. To formulate the xenophobic index, the values recorded for both questions 47 and 48 for each respondent were added. Vote shares for parties of the extreme right in each country were obtained from national election results closest to the administration date of "Eurobarometer 53" (Table 2).[11]

To assure that our data was unbiased, it was necessary to establish controls. Golder's work described above provides an efficient basis for controlling our data with economic and/or political variables.[4] We therefore include variables that account for all three of Golder's hypotheses in our analysis: we include an immigration variable (percent foreign citizens in each country) to address the Ideational hypothesis; two variables of electoral permissiveness to address the Instrumental hypothesis (the log of the average district magnitude of each country and the number of seats allocated at the upper tier for each country); and an interaction variable between unemployment (EUROSTAT standardized unemployment rate) and immigration to address the Materialist hypothesis. Unemployment data was included in the regression to assure that no statistical errors were encountered in using the interaction variable. The data used for control variables was obtained from Golder.

Because Golder's controls each address economic and/or political factors, xenophobia can reasonably be deduced as the most salient attitudinal factor contributing to vote share for the extreme right. Regressing the xenophobic index next to Golder's variables will not only identify whether or not xenophobic trends in voter support for parties of the extreme right are important, it will also allow for a quantitative assessment of the relative importance of attitudinal factors vis-à-vis economic and political factors in voter support for extreme right parties.

Results

Micro-level Linear regression analysis shows xenophobia as a significant affecter to support for the extreme right in the Western European democracies we analyzed (p = 0.000). The data also supports immigration and unemployment (p = 0.000) as well as the log of the average district magnitude (p = 0.034) as affecters to support for the extreme right. Finally, the interaction term between immigration and unemployment, as well as the number of seats allocated at the upper tier both showed negative, yet significant coefficients (Table 3).

Aggregate-level Pearson correlation coefficients show that all variables significantly correlate with the vote share of parties of the extreme right. Immigration is strongest correlated with vote share (0.261). The number of seats allocated at the upper tier and unemployment both show negative significant correlations with vote share (Table 4).

Discussion and Implications on Future Research

The attitudinal variable xenophobia is in fact an affecter to voter support for the extreme right: as the tendency of xenophobia within a European population increases, voter support for the extreme right in that population also increases, and as the tendency of xenophobia decreases, voter support decreases. In this manner, there is a causal relationship between xenophobia in a population and voter support for parties of the extreme right.

Although xenophobia is an affecter to vote share for parties of the extreme right, it is not the strongest affecter, as we originally hypothesized. The immigration control variable shows a higher beta coefficient in our analysis, and is therefore more important in determining support for the extreme right. This affirms Golder's Ideational hypothesis, which maintains that as the proportion of immigrants living within a given population increases, support for parties of the extreme right increases regardless of other factors.

Interestingly, our data is inconclusive concerning Golder's Institutional hypothesis, which is found by the analyst to be significant. The hypothesis stipulates that more permissive electoral systems favor parties of the extreme right. We analyze both average district magnitude and the number of parliamentary seats allocated at the upper tier as variables of permissiveness. The affect of the log of the average district magnitude on vote share of the extreme right is significant and positive while upper tier seats shows a significant negative affect; although both measures of permissiveness are significant, one is a positive affecter and the other a negative affecter. The discrepancy likely occurs because Golder's analysis accommodates several years worth of data, whereas our analysis uses only one data point per variable per country in years closest to the year 2000 in which the "Eurobarometer 53" survey was administered.[4,11]

Immigration, the variable found to be the strongest affecter to extreme right vote share, is most often considered a political rather than an attitudinal variable because it describes a current

condition of the population in question. In the classic conception of the variable, it acts through economic means by stressing the low-skilled job market, and therefore pushing low-skilled labor to vote for extreme right parties.[2] The fact that immigration is a stronger affecter to extreme right vote share than xenophobia would seem to disprove the proposed theory that attitudinal variables are most important in determining voter support for parties of the extreme right. However, although a political variable, immigration affects vote share in this context by means of an attitudinal pathway, as explained by the Allport-Pettigrew hypothesis.[8]

As discussed, the Allport-Pettigrew Contact hypothesis stipulates that contact can improve relationships between "in group" and "out group" when such contact is made in the context of sharing in a particular effort, friendship, or other such cooperative circumstances. However, when contact is casual, it tends to increase xenophobia in natives and further isolate immigrants.

In general, Western European "out group" immigrants are relegated to specific boroughs of the largest cities, having little to no cooperative or friendly contact with "in group" natives; European natives perceive the presence of immigrants, but due to societal barriers, do not interact with these immigrants in a constructive manner. Therefore, primarily casual contact leads to increased distrust and disdain for immigrants by natives. It follows logically that immigration increases the effect of the contact phenomenon. This attitudinal influence of immigration likely accounts for its large affect on support for parties of the extreme right.

If immigration was to modulate extreme right vote share due to economic effects rather than through our proposed pathway, then the effect of immigration on vote share should multiply in poor economic times. Golder's Materialist hypothesis addresses the question of immigration and its correlation with economic self-interest in voter motivations. This hypothesis, which models immigration as a modifier to the effects of unemployment on voter support for parties of the extreme right is rejected by both Golder's analysis and our own. Therefore, data indicate that immigration acting through economic self-interest is at best a poor affecter to voter support for parties of the extreme right and that immigration should be considered an attitudinal variable modulating support for parties of the extreme right in Europe.

Multivariate trend analysis is an important avenue for future research. While dealignment, increased immigration, and support for the extreme right have all corresponded, the mechanisms connecting them are only hypothetical. Researchers must continue to consider the institutional and attitudinal fall-out of the dealignment, as well as analyze the connection between immigration and support for parties of the extreme right. It is likely that the answer to the perplexing rise in voter support for the extreme right lies in such analysis. In identifying the role that each of these trends plays in propping the others, analysts of Europe can gain a greater understanding of the social and political forces at work.

Another important consideration for future research is the mechanism by which xenophobia leads to increased support for parties of the extreme right. Although we assume the relation

Table 4: Aggregate-Level Pearson Correlations with Vote Share by Variable. Pearson correlation coefficients with vote share by variable. **indicates P = .000

Variable	Correlation Coefficient
Xenophobic Index	0.069**
Immigration	0.261**
Unemployment* Immigration	0.139**
Log(Avg. District Magnitude)	0.123**
Upper Tier Seats	-0.096**
Unemployment Rate	-0.001**
Average	0.066
St. Deviation	0.141

ship to be direct, there may in fact be a mediating variable between xenophobia and party support. Future analysts should focus on the affect of xenophobia on other factors that might themselves lead to voter support for the extreme right. Such factors could act as intermediating variables between xenophobia and voter support.

Understanding the factors that compel voters to support parties with such intense standpoints on so many issues has extremely broad implications on the future of Europe's political climate. By analyzing the affects of xenophobia on voter support for such parties, we have effectively identified its relative importance as a partial determinant to voter support for parties of the extreme right. However, our work only clarifies one portion of a very murky enigma that will likely require the cooperation of multiple social scientific perspectives to completely understand.

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