

The Pioneer Research Journal

*An International Collection of Undergraduate-
Level Research*

Volume 1

2014

Pioneer
academics

The Pioneer Research Journal

*An International Collection of Undergraduate-Level
Research*

Contents

Contributing Readers.....	i
Foreword.....	v
Age of tobacco use initiation, concomitant tobacco use and nicotine dependence.....	1
Author: Ziyue Wu Pioneer Seminar: Development of Drug Use, Abuse and Dependence	
Anxiety Disorders Untangled.....	15
Author: Gabrielle Davis Pioneer Seminar: Neurobiological Basis of Cognition, Emotions and Decision Making	
Constructing Multiple Identities.....	45
Author: Mengyao Yuan Pioneer Seminar: Introduction to African American Literature	
Cryptography, the RSA method, large primes, and finding non-trivial square roots of $1 \pmod{p(p+a)}$	61
Author: Fatima Haidari Pioneer Seminar: Number Theory, Cryptography, and Secret Codes	
Insider/Outsider: Jewish Perception of Space and Place in Early Modern Europe.....	69
Author: Ziqi Qiu Pioneer Seminar: Jewish Life in Medieval and Early Modern Europe	
Introduction and Applications of Sperner's Lemma.....	89
Author: Haoyu Sheng Pioneer Seminar: Introduction to Combinatorics and Graph Theory	

On Anne Elliott’s Rebellion: New Women and New Marriage in <i>Persuasion</i>	107
Author: Feng Ye	
Pioneer Seminar: Overview of Jane Austen’s Works	
On the Relationship Between Biology and Ethics.	131
Author: Angela Liu	
Pioneer Seminar: Science, Technology and Society	
An Overview of the Brazilian Economy.	145
Author: Luccas Borges	
Pioneer Seminar: An Overview of the U.S. Macro-Economy	
Paralanguage of English-Speaking Teachers with Chinese Students vs. with English-Speaking Colleagues.	169
Author: Miaoxin Wang	
Pioneer Seminar: Nonverbal Communication	
Riding the Elephant in Our Mind: A Research Into the Relationship Between Happiness and Forming Habituated Activities.	207
Author: Xinxiang Liu	
Pioneer Seminar: The Pursuit of Happiness	
The State of the Nigerian Economy: The Natural Resource Curse.	221
Author: Zurum Oreneke	
Pioneer Seminar: An Overview of the U.S. Macro-Economy	

Age of tobacco use initiation, concomitant tobacco use and nicotine dependence

Ziyue Wu

Author background: Ziyue grew up in China and currently attends The Affiliated High School of South China Normal University in Guangzhou. Her Pioneer seminar program was titled "Development of Drug Use, Abuse and Dependence."

Abstract

The major purpose of the study was to (a) understand whether different types of tobacco use are associated with different levels of risk for nicotine dependence; (b) discover whether age of initiation of tobacco use is associated with level of risk for nicotine dependence; and (c) find out whether age of initiation is associated with concomitant tobacco use. The sample was taken from the first wave of the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC). Logistic regression was used to examine the association between different kinds of tobacco use and nicotine dependence. Cigarettes, snuffs and chewing tobacco were positively associated with nicotine dependence, while cigars and pipe smoking failed to independently predict nicotine dependence. Earlier onset of tobacco use was found to be associated with higher risk for nicotine dependence and a larger number of methods of tobacco use. The study shows that since early age of initiation may elevate a tobacco user's probability of becoming nicotine dependent and becoming a concomitant tobacco user, more attention is needed on childhood and adolescent tobacco use. The study also shows considerable variability in risk for nicotine dependence due to types of tobacco used.

Introduction

The growing use of tobacco products has strong negative effects on public health conditions such as cardiovascular disease, cancer and lung disease (MacKenzie, Bartecchi, & Schrier, 1994). As the leading cause of preventable death in the U.S., tobacco use has been linked to the death of approximately 5 million people annually (Jha, Chaloupka, Moore, Gajalakshmi, Gupta, Peck, Asma & Zatonski, 2006). Given the addictive nature of nicotine, many tobacco users are likely to become chronic smokers and to have difficulty in achieving successful cessation. Most research on tobacco use has focused on cigarette smoking. Ethnicity and gender have been found to be associated with cigarette smoking behavior, with males and those reporting Hispanic ethnicity having higher probabilities of smoking. (Hu et al., 2006). Further, psychiatric disorders have been shown to contribute to the transition from daily smoking to nicotine dependence (Dierker & Donny, 2007; Breslau et al., 1998).

Despite the large number of studies examining cigarette smoking and nicotine dependence, the risk for dependence based on other types of tobacco use has received far less research attention. Different types of tobacco use (cigarette, cigar, pipe smoking, snuff, tobacco chewing) may predict nicotine dependence differently. Moreover, little is known about the effects of concomitant tobacco use on risk for nicotine dependence.

Previous studies have shown that age of initiation of tobacco use is associated with amount of tobacco use, difficulty in cessation (Chen & Millar, 1998; Khuder et al., 1999) and frequency of use (Taioli & Wynder, 1991). However, the age of initiation may also be correlated directly with nicotine dependence and the number of forms of tobacco use. It remains

uncertain whether individuals with earlier onsets of tobacco use have greater risk of becoming nicotine dependent and using tobacco concomitantly.

By examining the data from The National Epidemiologic Survey on Alcohol and Related Conditions (NESARC), we can (a) understand whether different ways of consuming tobacco can lead to different levels of sensitivity to nicotine dependence; (b) discover whether age of initiation of tobacco use contributes to different levels of sensitivity to nicotine dependence; (c) find out whether age of initiation is associated with concomitant tobacco use.

Method

Sample

The sample was taken from the first wave of the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC). NESARC, conducted by the National Institute on Alcohol Abuse and Alcoholism (NIAAA), has an unprecedentedly large sample size (n=43,093) to achieve stable estimates of even rare conditions. It represents the civilian, non-institutionalized adult population of the United States, including residents of the District of Columbia, Alaska, and Hawaii. People that lived in households, military personnel that lived off base, and people that lived in group quarters -- boarding or rooming houses, non-transient hotels and motels, shelters, facilities for housing workers, college quarters, and group homes -- were interviewed on a computer-assisted personal basis after consenting to participate. NESARC is an unprecedented source on the natural history and comorbidity of AUDs and associated disabilities, and it sets the standard for survey methodology, statistical analysis, and psychiatric epidemiology (Grant et al, 2006) NESARC is a large, random and

representative survey conducted nation-wide in the US, which is suitable for the current study.

Measures

Use of tobacco products was measured by asking respondents whether they had used cigarettes/cigars/pipes/snuff/chewing tobacco in the previous twelve months. Frequency of current tobacco use was measured with the question “How often did you use cigarettes/cigars/pipes/snuffs/chewing tobacco in the past twelve months?” Quantity was measured with the question “What was the usual quantity when you used them?” Usage quantities per month of each kind of tobacco were estimated by multiplying the midpoint of the range of each reported frequency per month by the usual quantity per time that the respondent used tobacco.

Age-related measures selected as third variables and control variables included age, age at the onset of certain kinds of smoking behavior (“How old were you when you first used cigarettes/cigars/pipes/snuff/chewing tobacco?”), age at the onset of daily use (“How old were you when you started using them daily?”), age at the onset of tobacco using behavior (“How old were you when you used tobacco for the first time?”) and age at the onset of everyday tobacco use (“How old were you when starting to use tobacco daily?”). A variable reflecting the number of kinds of tobacco used was created to separate concomitant tobacco users from single method users. For concomitant tobacco users, variables were created to show which kinds of tobacco respondents used at the time of the interview and which kinds of tobacco they used when they started using tobacco. A variable reflecting the number of years since the respondents started using tobacco was also created by subtracting the age at the onset of tobacco use from age at the time of the

interview. A categorical variable was created to describe combinations of tobacco use: single way smoking, single way smokeless tobacco, concomitant use of smoking, concomitant use of smokeless tobacco, or concomitant use of smoking and smokeless tobacco.

The nicotine dependence-related variable was “Nicotine dependence in past twelve months.”

Data Analyses

The original analyses were conducted using the author’s SAS program. Logistic regression was estimated to determine whether different forms of tobacco use predicted nicotine dependence independently. A second set of logistic regression analyses was conducted within each type of tobacco-using behavior, with controls for amount used, age, ethnicity and gender. A Pearson Correlation Test was conducted to examine the association between age of initiating tobacco use and the current number of different types of tobacco used.

Results

Different tobacco uses and nicotine dependence

More than one fourth (25.8%, n=11,118) of the respondents reported some form of tobacco use in the previous 12 months. Among those who used tobacco in the previous 12 months, 89.2% (n=9,913) smoked cigarettes, 10.1% (n=1,119) smoked cigars, 1.9% (n=215) used pipes, 6.5% (n=720) used snuff and 4.5% (N=502) chewed tobacco.

Further, the number of average cigarettes smoked per month was 186.3 (SD=332.32), whereas the numbers of monthly uses of cigars, pipe smoking, snuff and chewing tobacco were 2.1 (SD=27.61), 2.8 (SD=28.70), 4.1

(SD=38.38) and 1.9 (SD=24.71), respectively.

Logistic regression was used to examine the association between different kinds of tobacco use and nicotine dependence, controlling for age of tobacco initiation, years using tobacco, ethnicity and gender. Cigarettes (O.R. 1.001, CI 1.001-1.001), snuffs (O.R. 1.001, CI 1.001-1.002) and chewing tobacco (O.R. 1.001, CI 1.000-1.002) were positively associated with nicotine dependence, while cigars and pipe smoking failed to independently predict nicotine dependence.

Further analyses were conducted to discover the reasons that led to such an outcome. Two facts emerged. First, among all cigar smokers (n=1,119) and pipe smokers (n=215), 62.0% (n=694) of cigar smokers and 74.9% (n=161) of pipe smokers were concomitant tobacco users. Second, 80.1% (n= 896) of cigar users smoked less than or equal to 14 cigars per month. 60.9% (n=131) of pipe smokers smoked pipes 18 times or less.

Age of onset, tobacco usage amount, and nicotine dependence

The average age of onset of tobacco use was 16.5 (SD=5.21) years old and the average number of years using tobacco was 32.1 (SD=17.37). Of 18,943 subjects who reported ever using tobacco, 77.6% (n=14,693) started before adulthood.

Logistic regression was used to estimate the association between age of initiation and nicotine dependence. Covariates included years using tobacco, ethnicity, gender and the amount of tobacco use. Age of onset of tobacco use was found to be negatively related to nicotine dependence, with earlier onset associated with higher risks for nicotine dependence.

Moreover, multiple regression was used to estimate the correlation between age of initiation and current amount of tobacco use, with variables

for years using tobacco, ethnicity and gender controlled. For the most popular type of tobacco use, cigarette smoking, a strong positive relationship was shown between age of onset of cigarette smoking and amount of current smoking. That is, earlier onset was associated with a higher current amount of cigarette smoking. The number of cigarettes consumed was found to be positively associated with the likelihood of experiencing nicotine dependence.

Concomitant tobacco users and single way users

Among the 11,118 respondents who reported tobacco use in the past 12 months, 10.3% (n=1,149) were concomitant users. Among 1,144 concomitant tobacco users (total 1,149) with available data, 54.6% (n=624) had started smoking cigarettes as the first way of using tobacco. In total, 71.3% (n=816) of respondents started using tobacco in smoking form(s) (cigarettes, cigars, pipes or combined smoking). Only 20.7% (n=237) of respondents started using tobacco in smokeless form(s) (snuff, tobacco chewing or combined smokeless tobacco). The rest, 8.39% (n=96) of respondents, first used tobacco in both smoking and smokeless ways. Also, among 1,034 daily concomitant tobacco users, 70.5% (n=729) started smoking cigarettes first.

The outcome of the Pearson correlation test for the age of tobacco use initiation and the current number of forms used showed a small, significant negative correlation ($r = -0.11$, $p < 0.0001$). Earlier onset tobacco use was associated with a larger number of ways of using tobacco.

Moreover, tobacco users were separated into different categories: single way smoking, single way smokeless tobacco, concomitant use of smoking, concomitant use of smokeless tobacco, or concomitant use of smoking and

smokeless tobacco. Chi-square tests were conducted to examine each of two different categories and nicotine dependence. Single way smokeless tobacco users were found to have lower probabilities of becoming nicotine dependent (26.97%) than single way smokers (45.34%), concomitant smokers (44.61%) and concomitant users of smoking and smokeless tobacco (49.62%), except for the concomitant users of smokeless tobacco (35.94%). Also, the group of concomitant users of smokeless tobacco was also found to have lower probabilities of nicotine dependence (35.94%) than co-users of smoking and smokeless tobacco (49.62%).

The ANOVA (Analysis of Variance) of the combined amount of tobacco products used per month was conducted to test whether smokeless tobacco users had smaller amounts of tobacco use. The results showed that the average amount of tobacco use among single way smokeless tobacco users was 98.0 usage events for tobacco, which was significantly lower than those of single way smokers, concomitant smokers and concomitant users of smoking and smokeless tobacco, which were 408.2, 460.8 and 584.4, respectively.

Discussion

The present study sought to examine whether age of onset of tobacco use was associated with nicotine dependence and numbers of kinds of tobacco used. The study also aimed to examine whether different kinds of tobacco use had different correlations with nicotine dependence. Tobacco use and nicotine dependence was also examined among concomitant users. Four major findings appeared. First, different methods of tobacco use were differently associated with nicotine dependence. Whereas cigars and pipe smoking failed to independently predict nicotine dependence, the other three

kinds of tobacco, cigarettes, snuff and chewing tobacco, were independently positively related to nicotine dependence. Second, age of onset of tobacco use was associated with nicotine dependence. An earlier initiation of tobacco use enhanced the probability of developing nicotine dependence. Third, age of onset of tobacco use was correlated with number of kinds of tobacco use. An earlier onset also elevated the probability of becoming concomitant users. Lastly, most of the co-users of tobacco started with smoking cigarettes.

The finding of variability in association with nicotine dependence in different kinds of tobacco may be explained by discrete habits and intentions of tobacco use. Of the five kinds of tobacco, cigars and pipe smoking failed to independently predict nicotine dependence. There might be two reasons. First, most of the cigar smokers and pipe smokers were concomitant smokers. Second, most cigar smokers and pipe smokers did not consume large amounts of cigar products. In fact, 80.1% (n= 896) of cigar users smoked 14 or fewer cigars per month. 61.0% (n=131) of pipe smokers smoked pipes 18 times or fewer. Such small doses may not show enough association with nicotine dependence. To summarize, , cigar users and pipe users probably consumed these products for pleasure rather than to satisfy the desire for nicotine.

The correlation between age of tobacco use initiation and nicotine dependence showed that early initiation increased the probability of nicotine dependence. In the case of cigarette smoking, early initiation also elevated the current use amount. This outcome is consistent with previous literature that stated early age of onset was associated with heavy smoking in later life (Chen & Millar, 1998). Although early age of onset has been evaluated in terms of its potential to increase tobacco use amount, difficulty in tobacco

cessation (Chen & Millar, 1998; Khuder et al., 1999) and tobacco use frequency (Taioli & Wynder, 1991), the result of the present study strongly implies that age of onset may also have direct association with the possibility of becoming nicotine dependent.

Moreover, the relationship between age of tobacco initiation and current kinds of tobacco use indicates that early onset also promoted the probability of becoming a current poly-tobacco user. Previous researchers discovered that gender, ethnicity, education and income were related to concomitant tobacco use (Bombard, Pederson, Nelson & Malarcher, 2007). However, the present study has shown evidence for the association between age of tobacco use onset and concomitant tobacco users.

Further, the present study showed that a significantly large proportion of concomitant users started using tobacco by smoking cigarettes, and then initiated other kinds of tobacco use. The direction of shifting among different tobacco products has been studied by others, and several different results have emerged. While some suggest that smokeless tobacco products may act as gateway substances to cigarette smoking (Hatsukami, Nelson & Jensen, 1991; Haddock et al., 2001), others propose that cigarette smoking initiates smokeless tobacco use (Riley et al., 1996). There are some researchers that claim that neither of them initiates the other (Wetter et al., 2002). The outcome of the present study suggests that cigarette smoking is likely to precede smokeless tobacco use.

In the pair comparisons of different combinations of tobacco use, the group that used only one kind of smokeless tobacco showed a significantly lower probability of becoming nicotine dependent than groups of single way smokers, concomitant smokers and co-users of smoking and smokeless tobacco. The only group that was not significantly different in sensitivity to

nicotine dependence from the group of single way smokeless tobacco users was the concomitant smokeless tobacco users. One reasonable explanation for such phenomena is that smokeless tobacco may be less addictive than smoking (Henningfield, Fant & Tomar, 1997). Another explanation is that smokeless tobacco users might use a smaller amount of tobacco products per month.

Strengths and limitations

There are several limitations in the present study.

First, only frequency of use and usual use quantity were available for estimating the amount of tobacco products used per month. There was no variable that directly reflected the actual amount of use. Moreover, there was no precise measure for nicotine exposure, which made it impossible to separate the respondents into groups by this measure or to compare the addictive nature of different tobacco products within the groups. Also, since the survey was not aimed at concomitant tobacco use, it lacked questions specified for tobacco co-users. Therefore, this limitation impeded the intention to further analyze the gradual changes in ways of tobacco use by concomitant tobacco users.

Additionally, the sample NESARC had some inherent limitation. In its original design, NESARC oversampled Blacks and Hispanics at the design phase of the survey and oversampled young adults ages 18–24 at the household level. The NESARC sample was then weighted in the account of its designed characteristics (Grant et al., 2006). Also, although the sample size in the NESARC was relatively large, it still could not provide a sample large enough in some special circumstances. For example, after subsetting to respondents who had only smoked pipes, there were fewer than a hundred

people left. Therefore, some tests aimed at rare types of tobacco use could not be successfully conducted.

Despite the study limitations, the present study provides implications to guide future research. First, as early age of initiation has been found to elevate a tobacco user's probability of becoming nicotine dependent and becoming a concomitant tobacco user, the study suggests that more attention is needed on childhood tobacco use and adolescent tobacco use. Moreover, while nicotine intake has been shown to be highly associated with the development of nicotine dependence, the study shows considerable variability in risk for nicotine dependence due to types of tobacco used. Future research should investigate whether different tobacco products lead to different probabilities in developing nicotine dependence with the same level of nicotine intake.

References

- Breslau, N., Peterson, E. L., Schultz, L. R., Chilcoat, H. D., & Andreski, P. (1998). Major depression and stages of smoking: a longitudinal investigation. *Archives of general Psychiatry*, *55*(2), 161-166.
- Chen, J., & Millar, W. J. (1998). Age of smoking initiation: implications for quitting. *HEALTH REPORTS-STATISTICS CANADA*, *9*, 39-48.
- Dierker, L., & Donny, E. (2008). The role of psychiatric disorders in the relationship between cigarette smoking and DSM-IV nicotine dependence among young adults. *Nicotine & Tobacco Research*, *10*(3), 439-446.
- Grant, B. F., & Dawson, D. A. (2006). Introduction to the national epidemiologic survey on alcohol and related conditions. *Alcohol Health & Research World*, *29*(2), 74.
- Haddock, C. K., Weg, M. V., DeBon, M., Klesges, R. C., Talcott, G. W.,

- Lando, H., & Peterson, A. (2001). Evidence that smokeless tobacco use is a gateway for smoking initiation in young adult males. *Preventive medicine*, 32(3), 262-267.
- Hatsukami, D., Nelson, R., & Jensen, J. (1991). Smokeless tobacco: Current status and future directions. *British Journal of Addiction*, 86(5), 559-563.
- Hatsukami, D. K., Lemmonds, C., & Tomar, S. L. (2004). Smokeless tobacco use: harm reduction or induction approach?. *Preventive medicine*, 38(3), 309-317.
- Henningfield, J. E., Fant, R. V., & Tomar, S. L. (1997). Smokeless tobacco: an addicting drug. *Advances in dental research*, 11(3), 330-335.
- Hu, M. C., Davies, M., & Kandel, D. B. (2006). Epidemiology and correlates of daily smoking and nicotine dependence among young adults in the United States. *American Journal of Public Health*, 96(2), 299-308.
- Jha, P., Chaloupka, F. J., Moore, J., Gajalakshmi, V., Gupta, P. C., Peck, R., ... & Zatonski, W. (2006). Tobacco addiction.
- Khuder, S. A., Dayal, H. H., & Mutgi, A. B. (1999). Age at smoking onset and its effect on smoking cessation. *Addictive behaviors*, 24(5), 673-677.
- MacKenzie, T. D., Bartecchi, C. E., & Schrier, R. W. (1994). The human costs of tobacco use. *New England Journal of Medicine*, 330(14), 975-980.
- Riley, W. T., Kaugars, G. E., Grisius, T. M., Page, D. G., Burns, J. C., & Svirsky, J. A. (1996). Adult smokeless tobacco use and age of onset. *Addictive behaviors*, 21(1), 135-138.
- Taioli, E., & Wynder, E. L. (1991). Effect of the age at which smoking

begins on frequency of smoking in adulthood. *N Engl J Med*, 325(13), 968-969.

Wetter, D. W., McClure, J. B., de Moor, C., Cofta-Gunn, L., Cummings, S., Cinciripini, P. M., & Gritz, E. R. (2002). Concomitant use of cigarettes and smokeless tobacco: prevalence, correlates, and predictors of tobacco cessation. *Preventive medicine*, 34(6), 638-648.



Anxiety Disorders Untangled

Gabrielle Davis

Author background: Gabrielle grew up in the United States and currently attends Asheville School in North Carolina. Her Pioneer seminar program was titled “Neurobiological Basis of Cognition, Emotions and Decision Making.”

Abstract

Anxiety disorders including fear, phobias and post-traumatic stress disorder (PTSD) create a significant social and financial burden to society. Representing the most common type of psychiatric illness in the United States today, almost 30% of the population will experience some form of anxiety-related symptoms in their lifetime. Treating the disorders becomes not only costly in terms of medicines and behavioral therapy but also diminishes time away from daily responsibilities such as work, family and education due to challenges of treatment. The fear network in our brain is somewhat tangled. Many factors and approaches to therapy have been researched in both animals and humans, but it is not well understood which combination of therapy will be best for which disorders. Future research should be directed at looking at individual factors such as genetics and brain circuitry to untangle and better tailor successful treatments for the different types of anxiety disorders.

Introduction

Many people suffer from anxiety disorders, creating a significant social and financial global burden. The most common types of anxiety disorders include General Anxiety Disorders (GAD), phobias and fears, and post-traumatic stress disorder (PTSD). These disorders are the most common type

of psychiatric illness in the United States today with almost 30% of the population experiencing some form of anxiety-related symptoms in their lifetime.¹ Fear is "characterized by anxiety and agitation due to expectation and impending danger. It can be acquired and expressed in a variety of ways".¹ General Anxiety Disorder is characterized by the excessive worrying about a situation. People who have GAD have trouble calming their worries about everyday problems. This type of disorder is estimated to occur in 5.7% of the adult population in the United States and has an average age of onset of 31 years.² Specific phobias include a fear of a particular situation or object like a fear of flying or spiders. Its prevalence is about 12.5% and can occur as early as 7 years of age.² Post-traumatic Stress Disorder occurs in about 6.8% of the population with an age of onset of about 23 years and typically begins after a terrifying or frightening event like a violent experience/assault or by natural, human-caused circumstances such as war.² People who have PTSD have a hard time removing painful thoughts from their mind and often have trouble functioning on a daily basis. Although anxiety and fear are separable constructs, it is thought that they share many similarities especially when it comes to brain network findings.

Fear conditioning is based on the classical model of conditioning (mainly from Pavlov's experiments). It basically states that when a neural conditioned stimulus is combined with an aversive or bad unconditioned stimulus like pain, for example, there is a cluster of conditioned behavioral effects like that of a fear response.^{1,3} In fear conditioning studies, a conditioned stimulus is able to elicit a fear-conditioned response. These studies form the basis of almost all animal and human research today using neuroimaging and neuropsychology to evaluate the brain findings and

lesions. The fear network in both animals and humans is a complex and somewhat convoluted circuitry that likely has many opportunities for intervention based upon individual differences, especially when looking at the different types of anxiety.⁴ One such approach has to do with investigating fear extinction or reversal by understanding how the brain manifests the gradual weakening in the amplitude of the conditioned response, i.e., fear or anxiety, that results in the behavior decreasing or disappearing.^{5,6}

One of the most common behavioral treatments for anxiety disorders is an exposure-based approach with repeated exposure to the feared situation or agent, i.e. general anxiety, fear of spiders or post-traumatic stress disorder, and operates based upon a fear extinction model.

Exposure-based Therapy (EBT) means that a person is repeatedly exposed, first typically starting with pictures. Then the feared situation will be physically encountered, but often with the support of the therapist. The hope is that this repeated confrontation will reduce or eliminate the fear and subsequent anxiety. Re-writing negative memories into neutral or positive traces is one form of EBT. Questions arise if this alone is the best form of therapy and whether it effectively modifies behavior in some or most people. Also, do we have solid research that it works in both acute and chronic cases? Cognitive Based Therapy (CBT) is also a type of therapy utilized when treating people who have experienced traumatic events or who suffer from anxiety disorders to help them overcome the negative psychological effects of the behavior. It is generally used once a person indicates that they are ready.

Other therapies include pharmaceutical agents which are often first line treatments. These encompass many classes of drugs such as SSRIs which

are Selective Serotonin Reuptake Inhibitors, tricyclics, Monoamine Oxidase Inhibitors (MAOIs), and high-potency benzodiazepines and even beta blockers.¹ Research looks at ways to examine other treatments discussing pharmacology and chemistry/physiology mechanisms to alter the pathways in the brain to reduce the faulty fear network. Recently, Whittle⁷ describes compounds to help overcome extinction learning deficits, promote long-term fear inhibition and ultimately support relapse prevention. Sandkuhler⁸ discusses a method of erasing memory traces of pain and fear through looking at glial cells, receptors and pathways. Examining the neuroendocrine and neurotransmitter pathways also helps direct specific therapeutic interventions and will be described in more detail.⁹

Although an initial combination of therapies (drugs and behavioral therapy) might be the best approach to helping people both acutely and in the long term wean off meds later on, it seems that a better approach might be looking at individual factors including genetics, neurologic assessment (fMRI) and chemical pathways to see what that combination should be and when best to use it. This would open up several new doors of clinical research specifically for PTSD and other types of anxiety.

Most research papers about fear and anxiety modulation in the literature involve both animal and human-based experiments, but virtually all discuss the translation from animal models to humans. For example, it has been shown that the activated neural circuits in rodents in response to fear are the same as those in mammals.^{4,10} Human emotions are very highly varied in their expression and differ from one person to the next. The main structures in the brain affected are the amygdala, which is the part of the brain that aids in the processing of memory, decision making and emotional reaction, an almond-shaped structure in the medial temporal lobe, and the prefrontal

cortex (PFC). The main structures in the brain affected are the prefrontal cortex (PFC) and the amygdala, an almond-shaped structure in the medial temporal lobe that aids in the processing of memory, decision making and emotional reaction. In humans with Generalized Anxiety Disorders, there is repeated evidence of alterations in the amygdala circuits involved in emotion processing, i.e., impaired discrimination between threat and safety.³ A problem exists in the network connections between the amygdala and the ventromedial PFC which is where risk and fear are assessed. The fear network in our brains appears to encompass the amygdala, insula and anterior cingulate cortex for the development and maintenance of anxiety disorders— faulty connectivity between these structures occurs in anxiety disorders. Recently developed neuroimaging techniques (fMRI) can help us untangle exactly what happens in the brain, particularly in regard to individual differences like in genes, neurotransmission and neurological pathways.⁴

Hypothesis: Fear and anxiety network connections are best modulated long term with a select and tailored combination of exposure and cognitive-based therapy along with pharmacologic intervention.

The form of treatment approach described in the hypothesis applies to patients with all types of anxiety, especially PTSD. This paper will discuss the relevant research regarding structural and neural pathways of anxiety disorders, fear conditioning, extinction and behavior therapies as well as the role of genetics and pharmacology in support of my hypothesis.

I. Structural and Neural Pathways

Anatomy

Concerned with instinct and mood, the limbic system of our bodies is a complex array of nerves and networks in the brain involving several areas near the edge of the cortex. It controls our basic emotions -- fear, pleasure, and anger -- and drives hunger, sex, dominance, and care of offspring. (Wikipedia) The fear and anxiety network within the limbic system of the brain is made up of the amygdala, the insula and the anterior cingulate cortex. Located in the medial temporal lobe, the almond-shaped amygdala is a group of nuclei known to be involved in several fear and emotion related processes. (Figure 1) The amygdala plays an important role in fear and aggression and also in emotions and memory in general. Its central nucleus (CeA) connects and communicates with cortical regions, especially the limbic cortex and the hippocampus, thalamus and hypothalamus along the hypothalamic-pituitary-adrenal (HPA) axis, which is described in a diagram later.

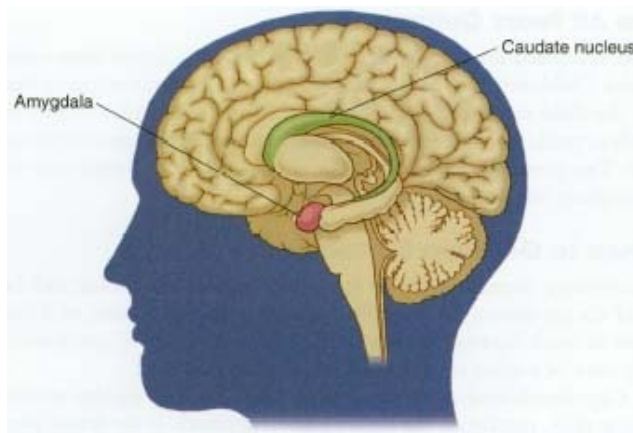


Figure 1 Anatomy showing location of amygdala

from <https://psych-brain-trust.wikispaces.com/Amygdala> (Last accessed 10/15/2014)

As mentioned previously, when one is frightened, depressed or presented with a conditioned stimulus, the areas that are most active in the brain are the insula and the anterior cingulate. Known for emotion processing, the insula is a central structure deep within the cerebral cortex and is responsible for more subjective feelings. The anterior cingulate cortex (ACC) plays an important role in fear learning in terms of mediating and modulating fear responses.¹¹ These structural findings have been able to be observed directly as a result of the development of more recent neuroimaging techniques such as high-resolution magnetic resonance imaging (MRI), functional MRI (fMRI), diffusion MRI and others, clearly highlighting all the areas of the brain involved in the fear network. An example of an fMRI image of the structures involved is shown in Figure 2 showing “hot spots” of activity. The table in Figure 3 further distinguishes the anatomic structures and roles in anxiety. Major Depressive Disorder (MDD) is listed as well and highlights the differences in structural changes based upon the type of disorder.

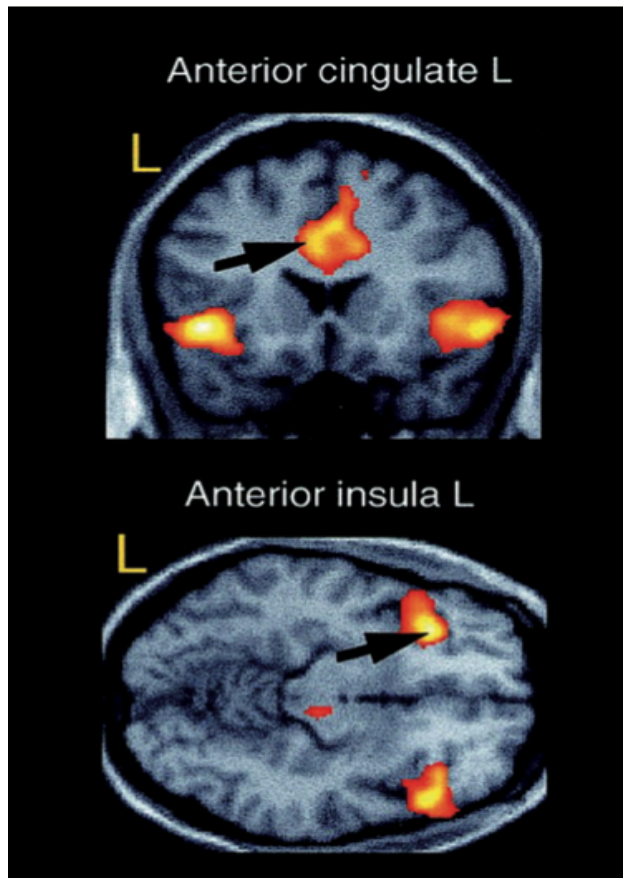


Figure 2 fMRI showing activation in the insula and cingulate regions of the brain from Holtzschneider.¹²

Functional anatomy of normal and pathological sadness and anxiety

Anatomic Area	Normal and Pathological Sadness	Normal and Pathological Anxiety
Insular cortex	Acute sadness activates dorsal insula	Acute anxiety activates ventral insula
Cingulate cortex	Pregenua ACC deactivated in euthymic MDD Pregenua ACC activated in acute MDD Subgenual ACC normal in acute MDD but hypoactive in patients who have remitted MDD ACC and PCC activated by acute sadness	Acute anxiety has no effect on ACC but deactivates the PCC
Amygdala	Overactive at rest in primary mood disorders Magnitude of activity correlates to severity Overactivity without conscious perception Normal activity after treatment Smaller volume of left amygdala versus controls	Not overactive at rest Overactive during symptom provocation Right amygdala most relevant to anxiety

Figure 3 Table highlighting anatomy and involved brain regions both with anxiety and depression from Martin.⁹

More recently, Milad and Rauch¹³ have done further work looking at the anterior mid-cingulate cortex and the ventromedial prefrontal cortex (vmPFC) as also having important roles in fear expression and extinction through EEG (electroencephalogram) recordings with different forms of evoked potentials. In particular, the vmPFC has been implicated in impaired fear learning. This structure appears to have an integrative function that varies between individuals based upon its thickness and other factors. For example, people with thicker vmPFCs show greater fear extinction memory. Cha et al.¹⁴ have found that 3 factors, thickness, functional connectivity, and structural connectivity, independently predict how one

responds to fear and threat, highlighting the circuit wide changes from person to person.

Animal Models

Much of the traditional research on the fear network has been well demonstrated in animals where fear is inferred from an animal's behavior like freezing and other autonomic activity like increased heart rate, blood pressure, etc. Davis's³ landmark work confirmed the many roles of the amygdala. The animal models have given us the basis for the fear and anxiety network allowing humans studies, although there are some neural system dysfunctions and individual differences.¹⁵ Davis confirmed that the amygdala has direct projections from its central nucleus to the hypothalamus and many other areas which accounts for the varied reactions of fear in individuals such as increased heart rate, freezing, decreased salivation, etc. (Figure 4) Interestingly, alterations in the functional connectivity of the amygdala-based networks in adolescents with generalized anxiety disorders have been shown to be identical to those found in adults suggesting that there may be inherent developmental and pathological processes which could be identified and treated much sooner.¹⁶



Figure 4 Varying projections of the amygdala from Davis.³

Neurochemistry

In anxiety disorders, it is also important to look at the different neurochemical pathways. Specific neurotransmitters are the reason for the communication between all the regions of the brain. Anxiety disorders can result from a decrease in signaling γ -amino-butyric acid (GABA) or from an increased signaling from glutamate. Often times, other neurotransmitters are released side by side with neuropeptides which are influenced along with the hippocampus, stress and emotion circulation.⁹ Some of these will be discussed further in the pharmacology section, but the two tables below give an overall look at the different neurochemical roles and abnormalities. (Figures 5 and 6)

Neuropeptides in stress and psychopathology

Neuropeptide	Role in Stress-neurobiology	Role in Psychopathology
Cholecystokinin (CCK) (Brawman-Mintzer et al., 1997; Koszycki et al., 2004)	Weak ACTH secretagogue	Anxiogenic Exogenous CCK evokes anxiety; patients who have anxiety disorders are hypersensitive
Galanin (Gal) (Barrera et al., 2005; Karlsson and Holmes, 2006)	Increased by physiological and psychological stress and pain	Depressogenic Galanin antagonists are being developed and possess antidepressant properties
Neuropeptide Y (NPY) (Hashimoto et al., 1996; Heilig, 2004; Martin, 2004; Sajdyk et al., 2004; Hou et al., 2006; Yehuda et al., 2006; Karl and Herzog, 2007)	Increased during stress Endogenous alarm system Stress-induced increase in feeding Modulate behavior to cope with chronic stress.	Antidepressant and anxiolytic in laboratory animals Depressed patients have low plasma concentrations of NPY, especially in first episode Plasma NPY concentration is normalized by antidepressants
Oxytocin (OT) Gimpl and Fahrenholz, 2001)	Weak ACTH secretagogue	Low OT in CSF is associated with depression in women
Vasopressin (AVP) (van Londen et al., 1997; Ma et al., 1999; Wigger et al., 2004; Goekoop et al., 2006)	Increased by stress Moderate ACTH secretagogue synergize to stimulate ACTH production and release	Potentially elevated in depression
Corticotropin-releasing factor	Increased by stress Primary ACTH secretagogue	Elevated in MDD, PD, PTSD; associated with HPA axis hyperactivity in MDD and HPA axis hypoactivity in PTSD

Figure 5 Table of neuropeptides and their roles in anxiety from Martin.⁹

Summary of select neurotransmitter abnormalities in MDD, GAD, and normal sadness and anxiety

Neurotransmitter	Normal and Pathological Sadness	Normal and Pathological Anxiety
GABA	Inconsistent GABA-A agonists not approved for MDD by the Food and Drug Administration	Decreased GABA-A receptor density in GAD; GABA-A agonists are anxiolytic Affinity for GABA-A predicts efficacy of benzodiazepines
Serotonin	Decreased 5HIAA CSF concentrations in suicide victims Normal in non-suicidal MDD patients Blunted prolactin response to 5-HT agonists	Decreased 5HIAA CSF concentrations in some studies
SERT	Decreased density in midbrain Density correlates negatively with anxiety symptoms in MDD	Density correlates negatively with anxiety symptoms in GAD
5HT1A	—	Anxiolytic as DRN autoreceptors Anxiogenic as hippocampus postsynaptic receptors
5HT2	Desensitized by antidepressants	Anxiogenic Antagonists are anxiolytic
Norepinephrine	Elevated in CSF and plasma of patients who have severe melancholic MDD Unchanged in patients who have non-melancholic MDD Blunted growth hormone response to clonidine Blunted rapid-eye-movement response to clonidine	Unchanged in GAD

Figure 6 Select neurotransmitter from Martin.⁹

II. Fear Conditioning/Fear Extinction

Pavlov's work with classical conditioning in animals has set the foundation for examining the fear network, ultimately leading to the translation of animal studies into human studies. It's a simple experimental tool for looking at fear conditioning in animals. (Figure 7) In fear conditioning studies, a conditioned stimulus is able to elicit a fear-conditioned response. Conditioning occurs when a neutral stimulus, like a tone, is associated with an aversive stimulus like a shock to the foot. The animal then reacts from the pain. When the tone is heard over and over again, the animal will ultimately still show a fear response even if no shock occurs. This is called fear conditioning and provides a powerful opportunity to look at the entire fear network both structurally and behaviorally particularly in humans. However, one of the challenges in studying anxiety disorders in humans is that we can also acquire fear and anxiety through social-cultural means. We can show fear responses with objects and events that have emotional significance through observation or following verbal instructions/abuses.¹

Startle Reflex

The fear state can be measured in a variety of ways in animals and includes the startle reflex. This fear-potentiated startle effect seems to only occur following prior conditioning with the sound or light-shock pairing and is easily studied because the experimenter can control the stimulus.^{10,17} In other words, the experimenter can increase or decrease the loudness of the stimulus to get the desired response effect. Again, this startle reflex in animals can be linked to the same neural structures in humans. We show additional signs like rapid eye closure which can be measured with

electrodes along the eyelid muscles. So all species have this startle reflex and it forms the basis for studies involving fear conditioning and extinction.

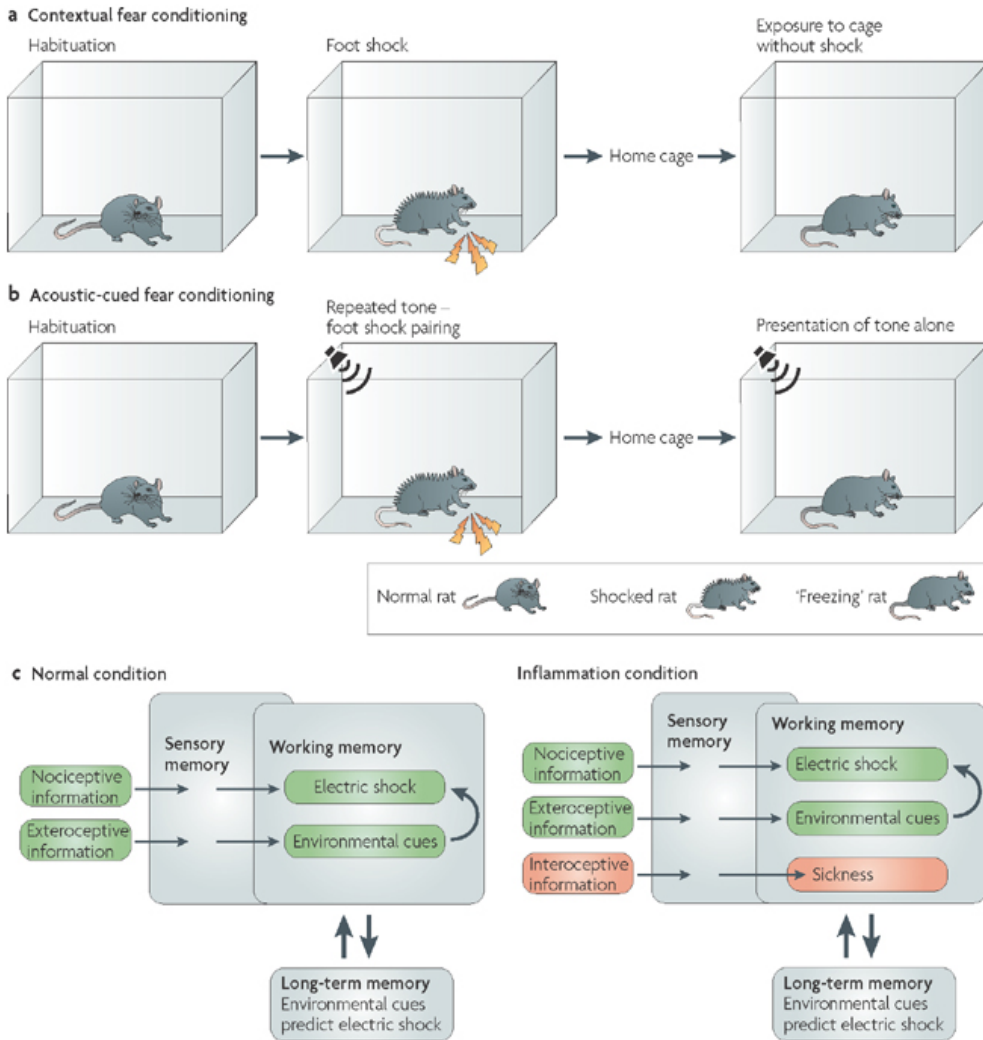


Figure 7 Pavlov's conditioning model

Fear Extinction

Fear reversal or extinction means trying to reduce the conditioned fear response following exposure to the fear conditioned stimulus. This may actually represent a new type of learning that continually updates the circuitry that caused the fear response so that the expression of the fear is inhibited.¹ The amygdala is involved during the extinction of fear learning with a reduction of activity normally seen during the conditioned stimulus. Animal models have shown much more success in highlighting extinction learning in the amygdala and PFC regions. Less work has been done in humans because it is harder to measure due to the activity in the amygdala being so rapidly reduced; however, the model of using EEGs has been helpful in looking at brain activity and connectivity in fear conditioning and extinction.¹³

From this research, two approaches have been suggested to help modify or modulate fear [extinction]. These are use of pharmaceutical agents and use of behavioral-based therapies such as exposure-based therapy (EBT) and cognitive behavior therapy (CBT). However, brain stimulation and neuromodulation techniques have also been employed to try to change brain activity and connectivity. Technologies like giving electric charges (deep brain stimulation) both surgically and non-surgically might act like pacemakers to regulate the firing of the network at a certain rate to alter or correct the faulty pattern.¹⁸ As mentioned in the introduction, EBT means that a person is repeatedly exposed to the feared agent or situation usually first starting with pictures. Then the feared situation will be physically encountered, but often with the support of the therapist. The hope is that this repeated confrontation will reduce or eliminate the fear and subsequent anxiety. Cognitive Based Therapy (CBT) is also a type of therapy utilized when treating people who have experienced traumatic events or who suffer

from anxiety disorders to help them overcome the negative psychological effects of the behavior. Generally, it is only used when the person decides he or she is ready for it, so it is not a form of therapy that would be given initially. It will also be highly variable from one person to the next.

While EBT has been shown to be successful, the degree or extent to which it actually changes the functional connections in the fear network has not been studied extensively until recently. An exploratory fMRI study was performed in patients with PTSD.¹⁹ Exposure-based therapy is the primary modality for treatment (in addition to pharmaceutical agents) for this form of anxiety. The individual with PTSD is asked to repeatedly recount the traumatic event in detail. These events become the conditioned stimuli. The concept is that repeated recounting of the event will weaken the fear response over time so that the inciting event does not elicit or create the anxiety behavior. Cisler's¹⁹ work attempted to look *in vivo* at the neural mechanisms that were engaged or modified during this repeated exposure to the traumatic memory of the event. They found strengthened activity of the right amygdala with the right hippocampus and right anterior insular cortex, left amygdala with the right insular cortex, medial PFC with right anterior insular cortex, left hippocampus with striatum and dorsal amygdala cortex, and right hippocampus with striatum and orbitofrontal cortex. The more severe the PTSD, the less change in the functional connective with the right insular cortex was found. This work leads to promising discoveries and treatment modalities for those suffering from PTSD.

III. Role of Genetics

Over the last two decades, there has been significant effort to investigate and research the genetic bases for anxiety disorders.²⁰ One of the issues when

looking at genetics in humans has to do with the varied classifications or categorizations of anxiety disorders in the psychiatric literature because some cross the complex spectrum of others forms of mental illness such as depression. For example, there is some debate as to whether PTSD should even remain in the category of anxiety disorders. It is beyond the scope of this paper to address these issues, but a general schema of genetic findings for anxiety disorders will be presented here.

Like most human genetic studies or research, the bases for exploration comes from evaluating family members, looking at the affected family member's genetic profile (or proband) compared to those of unaffected members and then comparing those profiles with normal controls. and their family member who haven't been diagnosed with an anxiety disorder. Twin studies have formed a foundation for research as well, particularly in the area of PTSD. Several commonly reported gene variants believed responsible for the symptoms of PTSD have been well documented and researched.⁹ These include Serotonin (5-HT) Transporter, otherwise known as SERT, and pharmacologic treatments such as selective serotonin reuptake inhibitors (SSRIs) are a very common mode of treatment. Other proteins such as FKBP5 have also been implicated in large genetic studies of PTSD so that adults found to have this mutation may be at high risk of developing PTSD.²⁰ This gene pathway may interact with more early life trauma predicting adult PTSD. Specifically, exposure to early childhood trauma or stress combined with gene variations of FKSP5 might result in sensitization of the amygdala which in turn predicts or affects adult response to the trauma.²¹ (Figure 8)

2013 ADAA Scientific Symposium: Neurobiology of Extinction and Improved Clinical Treatments

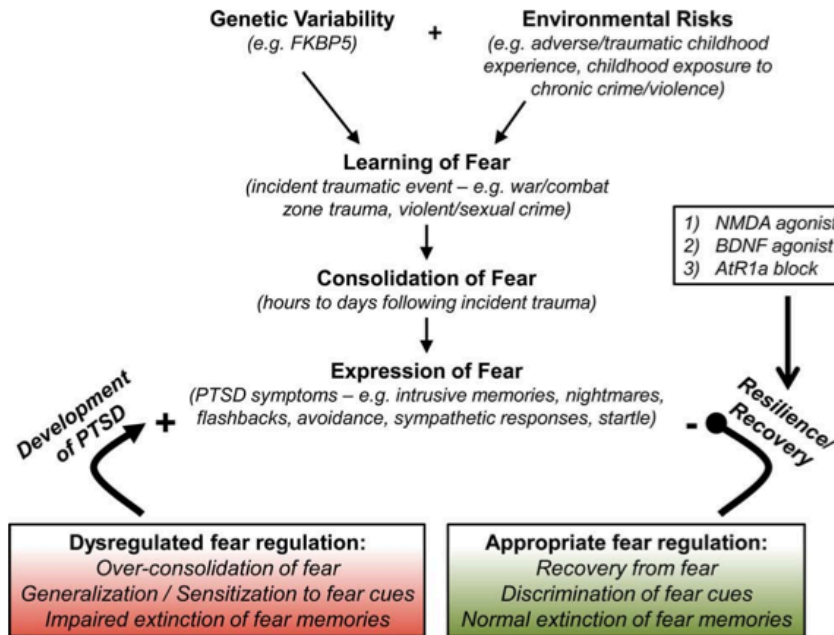


Figure 8 Diagram of genetic influence for the fear network in PTSD.²¹

Specific candidate genes have also been identified for other anxiety disorders related to fear, such as for phobias and panic disorders. Some of these are adenosine 2A receptor, catechol-o-methyltransferase, cholecystokinin, serotonin 2A receptor and monoamine oxidase A. Again, many of the pharmaceutical interventions are directed against these pathways. Other research has been directed at looking at the whole genome analysis, meaning researchers are trying to identify regions on specific chromosomes that may be altered, giving susceptibility to fear disorders. One direction for the future may be actually looking at more phenotypes or expressions of risk factors like personality traits, etc.²⁰ One study looked at behavioral characteristics in anxious children who were

between seven and nine years of age.²² No single underlying factor was identified, but they did find commonly shared and specific genetic effects on anxiety-related behavior demonstrating that specific symptom subtypes, e.g., phenotypes, create a general predisposition for anxiety behavior.

Opr11 Gene

Employing a mouse model using dysregulated fear as a basis, researchers found that the Opr11 (opioid receptor-like 1) gene was altered in mice that were traumatized. They immobilized a group of mice by strapping them down to wooden boards for two hours.²³ A week later, the researchers did classical fear conditioning using a tone and slight shock on the feet on both a control group of mice and the traumatized group. The traumatized group showed more signs of being startled and seemingly unable to extinguish their fear behavior, similar to PTSD. More compelling, however, was that when the amygdala was examined at autopsy in both sets of mice, those that had been traumatized showed selective turning on of the Opr11 gene. From there, a collaboration of researchers looked at a pharmaceutical agent called SR-8993 to selectively target the Opr11 receptor pathway in hopes of modifying the traumatized mice response to fear. Sure enough, when Kessler's group repeated the same experiment using SR-8993 in the traumatized mice, after a week, the mice acted identically to the control mice and did not show any PTSD-like symptoms.²⁴ The concept for future work is to try to predict and prevent PTSD by finding other brain-based biomarkers. Some of the work involves taking blood samples from trauma victims from emergency rooms and seeing if there are any commonalities in their genes that might suggest who might go on to exhibit PTSD vs. who might not, thereby giving early intervention, whether pharmaceutically or

otherwise, to those that may be at most risk. Other areas of interest are looking at families and their DNA to try to predict risk.

IV. Pharmacology Review

Neuroendocrine and Neurotransmitters

The activity of each brain region in fear and anxiety has been described. However, it's also crucial to understand and consider the neuroendocrine and neurotransmitters providing communication between all these regions.⁹ In general, there appear to be four main categories having an effect on signaling for the anxiety disorders. These are: 1) Amino acid neurotransmitters; 2) Monoamines; 3) Neuropeptides; and 4) Corticotropin-releasing factor. Probably the most common amino acid studied to date is N-Methyl-D-aspartate (NMDA), which is a neurotransmitter receptor system pertaining to glutamate.²¹ These receptors are highly expressed in the amygdala and have been successfully identified as important for fear learning.²¹ Fear learning requires NMDA receptor activation and learning or the extinction of fear is blocked by antagonists at the NMDA receptor.²¹ What this means is that therapeutic intervention, like pharmaceutical agents, directed at either enhancing NMDA receptors (agonists) or those that block the antagonists are highly successful in anxiety disorders, especially PTSD. One such partial agonist, D-cycloserine (DCS), acts at the glycine/serine modulatory site. It can be given systemically or directly infused into the amygdala and has been used and studied extensively in conjunction with exposure-based therapy in human subjects after robust animal studies.²⁵ While mostly successful, the drug can also impair fear extinction if, during the combination therapy with cognitive behavior therapy (CBT), no reduction in fear is achieved. (Whittle) Promoting long

term fear extinction continues to be the target of much research looking for other cognitive-enhancing substances.

Histones and BDNF

Histone deacetylases (HDACs) inhibitors have also been examined as an approach to augment fear extinction/CBT training. Histone acetylation and de-acetylation are important processes for the regulation of genes and transcription occurring at the tails of the N-terminal during post translation.⁷ (Figure 9). Histone acetylation is believed to have a role in cognition, accompanying different forms of learning and memory particularly in the amygdala and prefrontal cortex pertaining to fear extinction so that increased acetylation supports gene expression necessary for memory formation.⁷ Therefore, any pharmaceutical agents that enhance histone acetylation or inhibit deacetylation will improve fear extinction by acting as a cognitive enhancer. The various HDACs inhibitors include such agents as vorinostat, entinostat, trichostatin A, sodium butyrate and valproic acid. This represents an exciting new area of therapeutic intervention for those suffering from fear-related disorders showing clear evidence of fear extinction in rodents. Much research is yet to be done for determination and development of specific HDACs inhibitors for more precise modulation of anxiety and trauma therapy.

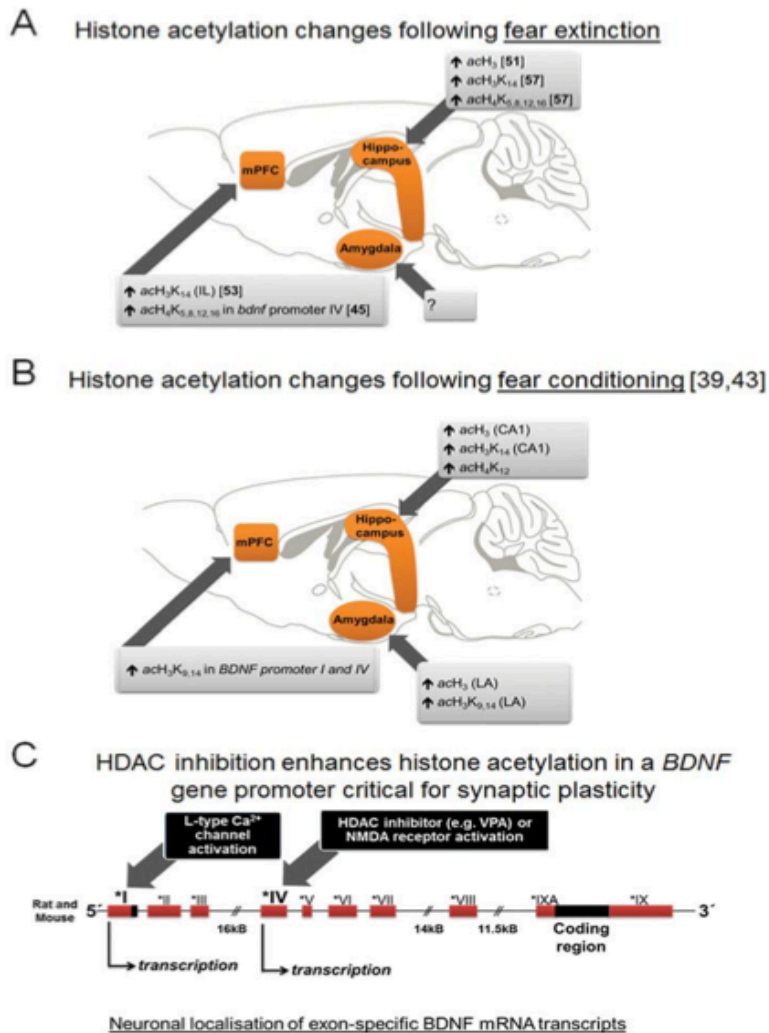


Figure 9 Histone acetylation process in fear network and *BDNF* gene.⁷

Brain-derived neurotrophic factor (BDNF) is a secreted protein that, in humans, is encoded by the *BDNF* gene. BDNF is a type of protein that is important in giving support to connections or synapses to enhance neurological activity.²⁶ It is believed that BDNF along with its action at the TrkB receptor plays an important role in fear extinction and learning and has been demonstrated in human and animal models.²⁶ Post-

traumatic stress disorder and other anxiety disorders seem to have a defect in the BDNF gene along position 66.²⁶ Any agents that act as agonists or antagonists in the signaling pathway may enhance fear recovery/extinction assisting in the treatment and prevention of fear-related anxiety disorders in humans.²¹

Monoamines

It's been well known that excessive monoamine activation is present in anxiety disorders and that monoamine oxidase inhibitors (MAOIs) are very effective as a pharmacologic treatment in addition to selective serotonin reuptake inhibitors (SSRIs), the same class of drug. Inside the brain tissues, monoamine oxidase destroys neurotransmitters like serotonin and norepinephrine. Look to Figure 6 for overview. These inhibitors support the breakdown of monoamine to enhance presence of the neurotransmitters.

The most widely used agent studied is paroxetine (Paxil™), which prevents the reuptake of serotonin and disrupts monoaminergic signaling in patients with anxiety disorders, but there are many other drugs studied and available for this condition.⁹

Neuropeptides and HPA axis

Neuropeptides (oxytocin and vasopressin) and corticotropin-releasing factor/ hypothalamic-pituitary-adrenal (HPA) axis, mainly cortisol, have also been the subjects of research in fear-related anxiety disorders.⁹ (Figure 10) Both are of particular interest in PTSD and researchers have looked at the differences in circulating cortisol levels in healthy controls and even soldiers vs. those who have been hospitalized or diagnosed with PTSD. Other

neuropeptides like Neurokinin 2 have been identified as having a potential role in PTSD as well.²⁷

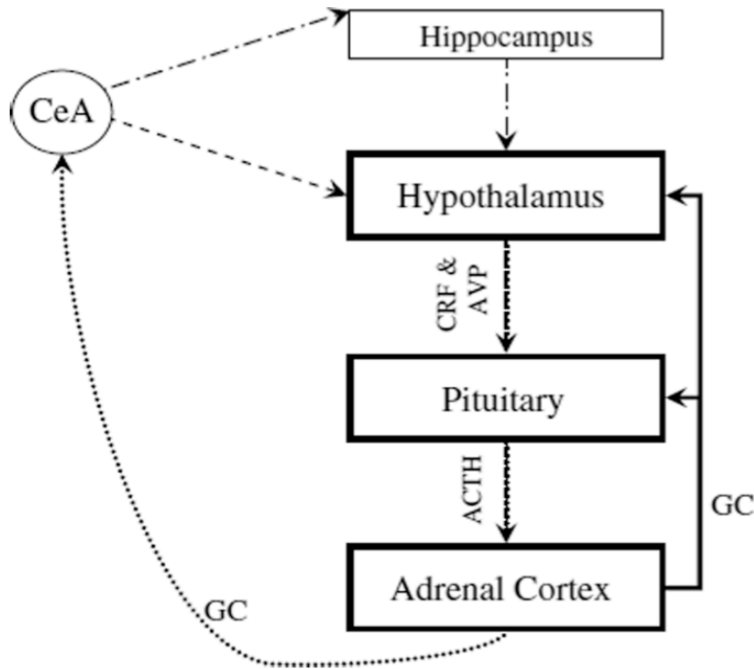


Figure 10 The HPA axis. Black line- Suppression connection; dotted line- Facilitory connection; dots and dashes line- Suppression connection indirect pathway (via BNST and other limbic regions); and dashed lines- Facilitory connection indirect pathway (via BNST and other limbic regions) from Martin.⁹

Renin-angiotensin

Lastly, very recent research has looked at the renin-angiotensin system in stress and anxiety-related disorders.²¹ There may be a role for medication that traditionally treats hypertension or high blood pressure. This form of thinking seems to lend itself to the concept that stress plays a major role in anxiety, and often those with PTSD are more likely to have hypertension, high cholesterol and obesity. Angiotensin-converting enzyme (ACE)

inhibitors are being explored as potential therapeutic treatment for the prevention of PTSD based upon the fact that there are large amounts of angiotensin receptor expressed in the amygdala. Mice have been shown to demonstrate enhanced fear extinction with the administration of Losartan, an angiotensin receptor antagonist.¹⁹

Conclusion

This literature review summarized the complex neuroanatomy and neurophysiology of the structural and neural pathways of anxiety disorders, fear conditioning, fear extinction and behavioral therapies as well as the role of genetics and pharmacology. My hypothesis stated that our tangled **fear and anxiety network connections are best modulated long term with a select and tailored combination of exposure and cognitive-based therapy along with pharmacologic intervention.** We know that the limbic system and particularly the amygdala play pivotal roles in the expression of fear both through fear learning and fear extinction. Without a clear understanding of the structural pathways, new targeted therapies, invasive or non-invasive, can't be undertaken to help alter or untangle the involved tissues and pathways. Pavlov paved the way for understanding fear conditioning both in animals and ultimately humans. Not only has this opened doors for various research but has led the way for many aspects of behavioral therapy, which is a critical and essential part of treating anxiety disorders. Modulating and repairing the fear extinction process is pivotal to successfully managing our brain's response to feared situations.

Genetics play a fascinating role in individual responses to fear behavior and learning. Our genetic profile may simply predispose us to how we are going to respond to fear and anxiety. Being able to identify the genetic

alteration early in life may save families much heartache from costly and time-consuming interventions. The hope would be that quality of life can be predicted and improved in those who we know will have adverse outcomes from anxiety. Finally, pharmaceutical intervention for the anxiety disorders has been a mainstay of treatment for many, many decades. Deeply understanding the neurochemical pathways in different forms of anxiety, such as PTSD, could lead to the development of potentially new, select drugs specifically targeting or untangling the faulty neurotransmitter pathways.

Considerable research has been directed at my hypothesis with much more research still needed to find effective ways to tailor therapies. In reality, my hypothesis may be too obvious or overly simplistic, and it might actually cost more in the short term to run all these tests like genetics and fMRIs, but in the long term, it may save money with more successful outcomes amidst shortened therapeutic intervention. If we can identify those people who may be at risk and identify them sooner, time and money could be saved in the long run, especially for disorders like PTSD. Furthermore, research directed at looking at individual factors such as genetics and brain circuitry will help untangle the complex network and better tailor successful treatments for the different types of anxiety disorders. Whether pharmaceutical, electrical or behavioral, all these potential therapies must be tailored in the right fashion to be most effective in a given individual. This modality remains a great avenue for further research to help reduce the societal burden of managing painful and traumatic anxiety disorders.

References

1. Delgado MR, Olsson A, Phelps EA. Extending animal models of fear conditions to humans. *Biological Psych* 73: 39-46; 2006.
2. National Institutes of Mental Health at <http://www.nimh.nih.gov/statistics/index.shtml>. Last accessed October 10, 2014.
3. Davis, Michael. The role of the amygdala in fear and anxiety. *Annual Review of Neuroscience* 15(1): 353-375; 1992.
4. Davis, Michael. Are different parts of the extended amygdala involved in fear versus anxiety? *Biological Psychiatry* 44(12): 1239-1247; 1998.
5. Mueller EM, Panitz C, Hermann C., Pizzagalli DA. Prefrontal oscillations during recall of conditioned and extinguished fear in humans. *J Neurosci* 34(21): 7059-7066; 2104.
6. Myers, Karyn M., and Michael Davis. Behavioral and neural analysis of extinction. *Neuron* 36(4): 567-584; 2002.
7. Whittle N, Singewald N. HDAC inhibitors as cognitive enhancers in fear, anxiety and trauma therapy: where do we stand? *Biochem Soc Trans* 42: 569-581; 2014.
8. Sandkuhler J, Lee J. How to erase memory traces of pain and fear. *Trends in Neuroscience* 38 (6): 343-351; 2013.
9. Martin EI, Ressler KJ, Binder E, Nemeroff CB. The Neurobiology of Anxiety Disorders: Brain imaging, genetics and psychoneuroendocrinology. *Psychiatr Clin North Am* 32(3): 549-575; 2009.
10. Lang PJ, Davis M, Öhman, A. Fear and anxiety: animal models and human cognitive psychophysiology. *Journal Affective Disorders* 61(3): 137-159; 2000.

11. Milad MR, Quirk GL, Pigman, BK, Orr SP, Fischl B, Rauch SL. A role for the human dorsal anterior cingulate cortex in fear expression. *Biol Psychiatry* 62(10):1191-1194; 2007.
12. Holzsneider K, Mulert C.. Neuroimaging in Anxiety Disorders. *Dialogues in Clinical Neuroscience*. 4th ed. 13: 453-461.
13. Milad MR, Rauch SL. The role of the orbitofrontal cortex in anxiety disorders. *Ann NY Acad Sci* 1121: 546-561; 2007.
14. Cha J, Greenberg T, Carlson JM, DeDora DJ, Hajcak G, Mujica-Parodi LR. *J Neurosci* 34(11): 4043-4053; 2014.
15. Holmes A, Singewald N. Individual differences in recovery from traumatic fear. *Trends Neurosci* 36(1): 23-31; 2013.
16. Roy AK, Fudge JL, Kelly C. et al. Intrinsic functional connectivity of amygdala-based networks in adolescent generalized anxiety disorder. *J Am Acad Child Adolesc Psychiatry* 52(3): 290-299; 2013.
17. Morgan III, C. A., et al. Fear-potentiated startle in posttraumatic stress disorder. *Biological Psychiatry* 38(6): 378-385; 1995.
18. Marin MF, Camprodon JA, Dougherty DD, Milad MR. Device-based brain stimulation to augment fear extinction: Implications for PTSD treatment and beyond. *Depress Anxiety* 31: 259-278; 2014.
19. Cisler JM, Steele JS, Lenow JK, Smitherman S, Everett B, Messias E, Kilts CD. Functional reorganization of neural networks during repeated exposure to the traumatic memory in posttraumatic stress disorder: An exploratory fMRI study. *J Psychiatric Res* 48:47-55; 2014.
20. Norrholm SD and Ressler KJ. Genetics of anxiety and trauma-related disorders. *Neuroscience* 164(1):272-287; 2009.

21. Morrison FG, Ressler KJ. From the neurobiology of extinction to improved clinical treatments. *Depress Anxiety* 31: 279-290; 2014.
22. Hallet V, Rijdsdij F et al. Phenotypic and genetic differentiation of anxiety-related behaviors in middle childhood. *Depress Anxiety* 26: 316-324; 2009.
23. Andero R, Brothers SP, Jovanovic T, Chen YT, Salah-Uddin H, Cameron M, Bannister TD, Almlil L, Stevens JS, Bradley B, Binder EB, Wahlestedt C, Ressler KJ. Amygdala-dependent fear is regulated by *Oprl1* in mice and humans with PTSD. *Sci Transl Med* 5(188):188ra73; 2013.
24. The Anatomy of Fear. *Emory Magazine*, Spring Edition 2014 pages 10-13.
25. Bontempo A, Panza KE, Block MH. D-cyclosporine augmentation of behavioral therapy for the treatment of anxiety disorders. *J Clin Psychiatry* 73(4):533-537; 2012.
26. Andero R, Ressler KJ. Fear extinction and BDNF: Translating animal models of PTSD to the clinic. *Genes Brain Behav* 11: 503-512; 2012.
27. Kent JM, Matthew SJ, Gorman JM. Molecular targets in the treatment of anxiety. *Biol Psychiatry* 52: 1008-1030; 2002.



Constructing Multiple Identities: Language, Adaptation, and Culture

Mengyao Yuan

Author background: Mengyao grew up in China and currently attends The High School Affiliated to Renmin University of China in Beijing. Her Pioneer seminar program was titled "Introduction to African American Literature."

Introduction

How do you define your identity? In a world that is becoming more and more internationalized, people nowadays are experiencing diaspora more than ever. It's becoming increasingly common for people to encounter different cultures and to deal with situations in which they have to define themselves in order to present themselves to people from other cultural backgrounds. It's inevitable for people who experience diaspora to deal with differences in cultures and to find approaches to adapt into another social context that is different from their ethnic background. But why is it necessary for them to adapt for good? And what initiatives do they take to explore other cultures? What should people do when they realize that there is a change in their identity?

One of the important reasons for adapting into the new culture is that people will find it easier to determine their position in the culture and to be more comfortable to live their lives. An even more pragmatic perspective

would be the fact that people can shift from minority or marginal identities to the mainstream, actively engaging in the new society around them and acquiring opportunities to contribute to the community, to maximize the chances of increasing their socio-economic status, and to pursue their happiness in a new environment. It is desirable to think in a positive way, picturing adaptation to be natural and comfortable in the adjustment to living. However, it is also necessary to recognize the obstacles which prevent people from adapting in an ideal way, a way that they expect could somehow promise opportunities for them to thrive. One of the fundamental factors that creates problems is language barriers. If immigrants can't overcome language barriers, they won't be able to communicate to better understand new environments. There are surely many other factors that vary among individuals and play an important role in a person's adapting process, such as gender, age, and personality.

Since there are various potential obstacles that come into play and many uncertainties that upset people, why do they still choose to move into another culture, taking risks and encountering challenges? There are many reasons, but one of the most common is that people are seeking new opportunities through diaspora, either because their ethnic society cannot satisfy their objectives or they believe or assume that the place they are going to provides a better quality of life.

Then comes the last question raised at the beginning of this paper. This will be the core issue this paper will discuss: possible methods for people who experience diaspora to take in order to embrace their multiple identities.

Therefore, in this paper, I will investigate possible methods for people who are confronted with diaspora to navigate through new cultures and adapt to a new society without forgoing their original identity or cultural heritage but rather embracing multiple cultural identities.

The paper will develop its thesis from different angles: 1) the extreme either-or approach in dealing with conflicting identities in a typical diasporic literary work; 2) possibilities suggested by several diasporans who have succeeded in integrating into a foreign culture while embracing multiple identities; and 3) limitations in possible methods concluded from real life experiences and suggested possibilities for improving existing diasporic methodologies.

Background

There have been different types of diaspora throughout history: European diaspora, African diaspora and Asian diaspora. Various factors stimulated diasporas in different regions. For example, in European diaspora, Vikings expanded out of Scandinavia into other parts of continental Europe and the British Isles, as well as into Greenland and Iceland. This expansion was due to colonizing migrations, in which Vikings assimilated into the new regions they colonized and settled down, living there as their new homeland.

For African diaspora, though, the reason is different. In historical context, scholars refer to African diaspora as the one that happened during the Atlantic slave trade, which led millions of Africans to be enslaved and scattered into Brazil, the United States and other places in the world.

However, for our purposes, the concept becomes broader: African diaspora points to African descendants who have been scattered because of slavery, genocide and other external forces. Thus, the cause for African diaspora is not an active colonization but a passive reaction for Africans who were unfortunately enslaved.

The third type of diaspora is Asian diaspora which was started by Chinese migration dating back thousands of years ago. It was caused by wars and, later on, by starvation and political instability or corruption. The first wave was followed by two other waves, Indian diaspora and Nepalese diaspora.

However, this paper will focus on the broader definition of African diaspora and current Asian diaspora.

Analysis

When people encounter various cultures while settling into diaspora, the challenge they have is to manage their different identities in various cultural contexts, especially conflicting ones. One typical perspective on self-identification in diaspora -- forgoing an original ethnic identity but pursuing a new identity -- is demonstrated in *The Namesake* (2003), by Jhumpa Lahiri. The protagonist, Gogol Ganguli, the son of a Bengali couple that immigrates to the United States to live a life outside of everything they are accustomed to, hates his background as a Bengali, and therefore hates his name. Not only does Gogol Ganguli become more remote from his family, he also moves farther and farther away from his identity as a Bengali by

listening to music of the Beatles and losing his virginity to an American girl. The story presents an approach which some people use, relinquishing their original identities but embracing their new identities after they attempt to find ways of joining in a totally new culture.

This viewpoint explains the reason why Ashima, Gogol's mom, moves to the States with her husband: they are seeking a land filled with freedom and opportunities that they cannot get in Calcutta. With the person she loves, Ashima joins in American culture, a culture which is totally unfamiliar to her and one in which she feels isolated and finds it hard to fit in. In Ashima's case, the chief benefit of moving to America is that she has more opportunity to pursue a decent life and happiness. However, as mentioned in the book, the tradeoffs are her struggles to identify herself in a totally new culture into which she tries hard with incessant inquiries to fit but fails. Other tradeoffs are her isolation from her family where she finds a sense of belonging, and her inability to express her struggle to her son who was born in America. There's a clear contrast between her and Gogol. Ashima is one of the first generation immigrants, a group of people who moved to a totally new place, America. She represents a typical group of immigrants who can't overcome the isolation brought by diaspora, finding it hard to assimilate. The main cause of this isolation is that Ashima still has problems speaking fluent English, which is essential for her to get to know the America around her and to communicate with people and build up connections. The language barrier prevents her from being an American. Therefore, it's not a surprise that, Ashima, though she stays in the States, preserves her identity as a

Bengali, an identity that is incompatible for integrating with a new one.

At the other end of the spectrum is Gogol, who goes for another extreme, trying hard to relinquish his original ethnic identity as a Bengali and embracing his identity as an American to the greatest extent. His change in name is caused by external pressure: his classmates find his name different, and weird, to some degree. He resents being called a “weirdo” by a group of American classmates because he wants to be one of them, one of the typical Americans. However, Gogol experiences struggles and discomforts several times after he changes his name because he frequently feels that he may belong to neither Bengali culture nor to American culture – he becomes nobody.

It’s also helpful to analyze the psychological process going on in both Ashima’s and Gogol’s minds. Ashima feels depressed and confused when she is isolated by American culture, when she fails to adapt into a new environment after she struggles, and when she can’t get past the discomfort resulting from her lack of familiarity with American culture and language. She also feels anxious when she acknowledges repeatedly her inability to fit in, so that isolation and anxiety has forced her into a corner on the edge of American culture. For Gogol, emotions such as anger, hypersensitivity and stress are embedded in his interactions with American culture. He feels angry about the recurring feeling of discomfort that is brought by his ethnic identity as a Bengali. He doesn’t want to have any association with his original identity because he figures out that the reason his parents brought him to the States is to seek a better life. However, though he seems angry

from the outside, Gogol is vulnerable inside; he realizes that, though he tries so hard, he can never eliminate his previous identity without feeling a sense of guilt and discomfort. After all, Bengali is the root from which Gogol has grown from the start of his life. Therefore, the contrast between Gogol and his mom presents an either-or choice of identity that indicates incompatibility between different cultures.

The standpoint held by both Gogol and his mom is challenged by Edward Casey (1997, 304), who holds the concept of “non-limited locality” in identity articulation. He claims, “As deeply localized, nomad space always occurs *as a place – in this place*. But as un-delimited, it is a special kind of place. It is a place that is not just *here*, in a pinpointed spot of space, but in a ‘non-limited locality.’” In this case, locality is not constrained by geography but is open to a place where diasporans can push the boundary, crossing and re-crossing multiple borders of language, history, race, time and culture. According to Benzi Zhang (2006), diasporans, have a space where their multiple identities mingle in a mixture of multiple distinctive cultures so that they can enjoy the multiplicity of inter-relationships. However, this viewpoint directly contradicts what Gogol and his mom believe – different cultural identities are incompatible. Instead of pointing out the impossibility for the mix, Edward Casey finds the sweet spot where diasporans’ multiple identities can blend together and can transfer to each other. Therefore, there are several options for diasporans to present themselves in plural contexts with different cultures, opening up more opportunities for diasporans to adapt into various cultures by showing

different identities that match with multiple situations. Similar to Edward Casey's point of view, the idea of Fred Wah, a Chinese diasporan poet, shows the possibility of translating each local place not into separate terms but into an amalgamation of various cultural passages. As a Chinese diaspora poet, Fred Wah writes, " You looked out at it all but you never really cared if you were there or elsewhere. I think you were prepared to be anywhere." (1991, 177) Wah indicates the notion of "place" to be a concept that transcends the conventional definition of location as homogeneous locality. To a further extent, Wah emphasizes the meaning of diasporic identity which is unaffected by the change of place. Since places are interrelated in Wah's perspective, there are spaces for corresponding identities to mix and, seemingly paradoxically, co-exist in the same person, the same entity. Therefore, from both Edward Casey and Fred Wah's viewpoints, it can be concluded that there's a space for diasporans to correlate their multiple identities in different localities, knowing that the definitions of place are unconventional, are hybrid, and are broad enough for them to extend the boundary. The possibility of managing multiple identities, then, is clear and promising.

The contradictory standpoints explained above allude to a consideration about the reasons why embracing multiple diasporic identities matters. In *Namesake*, the excruciating lives of Gogol and his mom prove that an either-or approach cannot help diasporans to undertake authentic self-scrutiny but instead mislead them to be troubled by self-doubts and ceaseless conflicts in their identities. But as seen in the opinions from the

two writers in the previous paragraph, accepting multiplicity in identity opens more space for diasporans to build up their self-awareness, more easily accepting realities they are facing rather than escaping from them. Since there are ways for diasporans to lead a more adaptive lifestyle, why should they enclose themselves in the quagmire of isolation?

But here we raise several questions that are worth contemplating: What are the factors that affect the way people manage their diasporic identities? How do we move from a resistive attitude towards multiple identities ultimately to a proactive perspective to embrace multiple diasporic identities? Why does it matter that we embrace multiple identities rather than apply an either-or approach?

The life experience of one of several people I interviewed gives some reasonable answers to the questions raised above. Linda Majani, a second-generation immigrant to the United States, was a Cornell University graduate student, a member of the Big Red Toastmasters, and a mom who has a son. Linda's mother brought her from Kenya to America 20 years ago, hoping to give her a chance to experience higher education of high quality and a bright future to develop in the land of opportunity. When she first came to the States, Linda had a hard time finding her identity in this unfamiliar place, and so did her parents. When talking about her early years in the States, Linda said:

It was a tough time for my family. My parents could hardly speak fluent English and their happy time still belonged to Kenya. We were in a life that lacked interactions with the society around us.

I then asked her whether the language barrier was the single, most severe

factor that affected their interactions, and Linda replied:

Language was definitely one of the main obstacles for us to engage ourselves with the new community. But there were other factors which may or may not have related to language barriers, such as our fear of uncertainties, our anxiety of being judged by others and our reluctance to step out of the comfort zone.

Later in the interview, Linda told me about how she overcame the obstacles. She thought that her pursuit of independence was an essential stimulus for her to reach out to new people and build up connections with them. Her longing for independence derived from her transition in age, seventeen to eighteen, transforming from an adolescent to an adult. From then on, she became more and more active in interacting with people and trying her best to keep herself engaged as a participant rather than an observer in her class or outside her classroom. As an ambitious young lady, Linda also held onto her “American Dream” which motivated her throughout her life, empowering her to attend Cornell University to achieve her academic objectives. And then, after she chose her major of medical science but ended up pursuing a career that had no direct relevance to her major, Linda formulated another personal philosophy: There is no predetermined way to live your life. So with an open heart, Linda kept navigating and seeking new opportunities to achieve in her career and also in her life. Linda said:

I was unfettered by any barriers once I found my way to accept my multiple identities. I previously held myself back as a Kenyan because I was worried and scared by uncertainties and judgments. Now, I can very well define myself as an American but I still preserve my identity as a Kenyan because I find it really helpful for me to communicate with my parents and to present myself in an authentic way. Only showcasing my genuine identities can I have more chances to make solid and trustworthy connections with people...

Linda was very well aware of the benefits of embracing multiple identities. As Pawan Dhingra states in her book *Managing Multicultural Lives*, by adopting a margins-in-the-mainstream perspective, a viewpoint that encourages minorities or immigrants to lean in, engaging themselves in activities happening in the mainstream of society, second-generation immigrants have multiple identities that they define both in conflicting situations and in dialogue, not just the former. What's more, they can act accordingly: When they encounter situations in which one identity has to be highlighted, they embrace it over the others; when they face circumstances in which multiple identities apply, they bring them together, regardless of whether those identities are supposedly contradictory or not. Linda got access to more connections with people as she opened herself up and kept pushing herself to break the barriers she had before. What's more, she thought it mattered a lot because she wouldn't have had so many opportunities and made such remarkable progress if she hadn't realized the importance of keeping multiple identities in the first place. The sooner one realizes that there's a way to live a life with various diasporic identities, the better one can adapt into new cultures and the quicker one can engage him or herself in the mainstream.

There are limitations to Linda's approach, though. What if Linda were not a girl? Would that affect the way she behaved or the decisions she made? What if she weren't at a transitional age when she conceived of the methodology of embracing her multiple identities? What if she were a first-generation immigrant? It's hard to tell whether if the variables changed,

the outcome would still stay the same. However, the unpredictability of the outcomes should not be an excuse for not trying one's best to explore the practical methodologies for people who experience diaspora but have a hard time managing their multiple identities. Therefore, I'm going to use my personal experience as a reference to suggest several possible ways that can be applied to people in a wider range.

This summer, I took a credited summer course at Cornell University. After an exhausting flight alone, I had to engage in socializing with new people to build up connections on the first day. However, because I was in the late arrival group, I was at a relative disadvantage compared to other students who had time to make friends in advance, forming their social circles early. I was thinking hard how to engage myself and to be one of them, though I was in a challenging situation. Apart from overcoming the obstacle that I'm an international student, with whom American students were unfamiliar, I had to get over another problem, which was the fact that social groups were established before my arrival. Instead of feeling anxious, I kept calm and thought about the things that I could do to link up my experience with those of the other students.

My eagerness urged me to find my network as soon as possible because the longer I stayed on the edge of the conversations, the more anxious and uncomfortable I would feel. Like Gogol, I felt anxious and angry as I stayed isolated longer, belonging to nowhere like a feather lofting in the air. I was in a situation that left no room for me to sit back because I had a clear goal in mind and I was aware that holding myself back would not solve the

problem. I felt very strongly about turning my situation into a better one, so I kept seeking chances to find the tipping point to change it. The accumulation of continuous and intense thinking helped me to come up with the first method that was a prerequisite for embracing my multiple identities: Try hard to turn disadvantages into advantages, and try to turn problems or obstacles into opportunities. So I thought: Yes, I am stuck in the middle of different groups of people, not belonging to any one of them. However, I am the only one that gets the chance to try out each group and to figure out which one is to my taste. Then I took the initiative to engage myself into different styles of conversation and make friends with those with whom I share many common interests. As I tell the story, I've already pointed out two additional useful methodologies. One is to be active and dare to take risks without fear of uncertainty. This may be challenging for older people who would prefer to keep situations safe and conservative. However, it is not the end of the world if people don't apply this.

There's another method that may help: Examine your differences from the people you want to interact with so that you can find ways to contribute to the community with things they are lacking. In other words, let them know the uniqueness you have and show them your values so that you can figure out common interests with the other people. And the last tactic is the hardest one to achieve: Keep an open mind. It is challenging to accept sudden change in identities but still hold an open attitude because it takes time to change from a defensive attitude to civil acceptance of a new situation. However, as analyzed in the previous examples, the longer

diasporans stay isolated, the more they will feel discouraged, depressed and lost. I suggest that these four methodologies can be utilized in a really individualized way. This means they can be helpful at times when they are combined or when they are used separately; after all, it really depends on the situation and the person. But no matter what the variables are in different circumstances, as long as diasporans believe in their potential to finally embrace their multiple identities in a new cultural context, there is always a way for them to pursue their life objectives with a hybrid of roles.

Conclusion

After acknowledging the historical context of diaspora, people can better understand their native identities, and discover approaches to embracing their multiple diasporic identities in the future. Since the world is becoming more and more interactive culturally, it is advisable to become proficient in the skills or techniques that can master diaspora and a new life experience with various identities. The core value is to keep an open mind, which can inspire people to redefine the concept of “locality,” or the definition of “place.” And then, the other methods come after to support the core value. Daring to take risks in order to overcome fears of uncertainties is a practical approach for taking control of the situation. Trying to turn problems into opportunities is crucially important when one is at a disadvantage that blinds him or her to understanding identities. The last recommendation is to examine the differences and find ways to contribute to the new community or culture.

This paper has proved that it is possible for people to embrace multiple identities in diaspora, even though at times they may be contradictory. Language is the basis and tool for people to get to know their new environments and their new cultures. Adaptation is the process for people to realize their diasporic identities. And finally, culture is the larger context for people to present their various identities.

Indeed, the discovery of methodologies for multiple diasporic identities is a dynamic field for more people to explore. This paper includes multifaceted perspectives for the exploration of diasporic identities. But why is it necessary to integrate many aspects to take into consideration? Isn't that confusing?

To better explain the necessity of breaking the issue down into specific and different perspectives, it is advisable to look at the current world that people are living in. This is an era of technology that expedites communication and opens up more possibilities for cross-cultural interactions. Therefore, it becomes more common for people nowadays to deal with cultural clashes. More essential for diaporans, the ability to adapt themselves into different cultural contexts in a limited period of time helps them lead an easier and more fruitful life filled with opportunities which cannot be acquired if diasporans are isolated, refusing to embrace their identities in an open-minded way.

There really isn't a single methodology for this issue, but rather mushrooming new perspectives to be explored by more diasporans who figure out how to overcome obstacles when transitioning into a different

culture. Without closing the topic with a definite conclusion, I would like to leave room for more people to explore and discuss possible approaches to a progressive lifestyle such that each diasporan can find his or her better quality of life in a new context.

Bibliography

Benzi Zhang. *“Of Unlimited Locality/ Identity: Chinese Diaspora Poetry in America”*, Cambridge University Press, 2006.

Casey, Edward S. *The Fate of Place*. Berkeley: University of California Press, 1997.

Dhingra, Pawan. *“Managing Multicultural Lives”*, Stanford University Press, 2007.

Jhumpa, Lahiri. *The Namesake*, 2003.

Majani, Linda. *Big Red Toastmasters*. Cornell University, Ithaca, NY. 2014.

Shmoop Editorial Team. "The Namesake." Shmoop.com . Shmoop University, Inc., 11 Nov. 2008. Web. 16 Aug, 2014.

Wah, Fred. “Elite,” in Bennett Lee and Jim Wong- Chu, eds. *Many-Mouthed Birds: Contemporary Writing by Chinese Canadians*. Vancouver and Toronto: Douglas and McIntyre, 1991, 169-79.



Cryptography, the RSA method, large primes, and finding non-trivial square roots of 1 mod $p(p + a)$.

Fatima Haidari

in collaboration with Professor Gregory P. Dresden

Author background: Fatima was born in Iran, grew up in Afghanistan, and currently attends St. Timothy's School in Maryland. Her Pioneer seminar program was titled "Number Theory, Cryptography, and Secret Codes."

1 Number theory background.

We began with a study of some basic facts about number theory.¹

Perhaps the most significant topic is that of *equivalence mod m* . We know what it means when we say that x equals 5 (written as $x = 5$), and we know that there is only one solution (namely, 5). We now introduce what it means for x to be *equivalent* to 5 (which we write as $x \equiv 5$) with a certain number called a *modulus* (for our first example, we will use 10 as our modulus). In particular, we say that

$$x \equiv 5 \pmod{10}$$

means that x has remainder 5 when divided by 10. So there are many possible x values that satisfy $x \equiv 5 \pmod{10}$, such as 5, 15, 25, 35 and also -5 , -15 , -25 , and so on. Of course, this is dependent on that modulus 10; if we change the 10 to some other number, then we could get different solutions.

In general, we say that

$$x \equiv a \pmod{m}$$

¹ This part is written by Greg Dresden.

means that x and a have the same remainder when divided by the modulus m , using the division algorithm where we write $x = q_1m + r_1$ and $a = q_2m + r_2$ with $0 \leq r_1, r_2 < m$. Hence, we can say that $2 \equiv 12 \pmod{10}$, and also $3 \equiv -5 \pmod{4}$, and so on, but we note that $3 \not\equiv 8 \pmod{4}$.

Returning to the mod 10 situation, we typically just use the numbers $\{0, 1, 2, \dots, 9\}$. Since $10 \equiv 0 \pmod{10}$, and $11 \equiv 1 \pmod{10}$, and $12 \equiv 2 \pmod{10}$, and so on, then we can replace any 10, 11, 12... we might come across with their equivalent values 0, 1, 2.... This allows us to do mathematics in the closed and finite “world” of $\{0, 1, 2, 3, 4, 5, 6, 7, 8, 9\} \pmod{10}$, which we casually call a “mod 10 world”, although the technical term is \mathbb{Z}_{10} . In particular (and this is really important), since 10 is equivalent to 0, then we can freely add and subtract a 10 wherever we want to. So, this would allow us to say things like

$$(x^2 + 10x + 23)^2 \equiv (x^2 + 3)^2 \pmod{10}$$

because we replaced the 10 in $10x$ with 0, and the 20 in 23 with 0 (leaving behind the 3). This makes it particularly easy to deal with negative numbers; for example, $-3 \pmod{10}$ is the same as $10 - 3 \pmod{10}$ which is 7, and that’s particularly nice because as mentioned above, we prefer to always stay in the standard set $\{0, 1, 2, 3, 4, 5, 6, 7, 8, 9\}$ when operating mod 10. Using the same trick of adding in 10’s at will, we see that $-4 \equiv 6 \pmod{10}$ and $-5 \equiv 5 \pmod{10}$ and so on.

However, while negatives are easy (and always defined), fractions are rather tricky (and sometimes they’re not even defined). Our book talks about division on page 75,² but it’s a little bit confusing. The basic idea is this. So long as a number a is *relatively prime* to the modulus m , then the fraction $1/a$

² Coutinho, S. C. *The Mathematics of Ciphers: Number Theory and RSA Cryptography*. Natick: AK Peters, 1999. Print.

$(\text{mod } m)$ which is also written as $a^{-1} (\text{mod } m)$ will be defined as the number x with $0 < x < m$ such that $ax \equiv 1 (\text{mod } m)$. In other words,

$$\frac{1}{a} \equiv x (\text{mod } m) \quad \text{means} \quad 1 \equiv ax (\text{mod } m),$$

which is exactly what you'd expect if you were to multiply both sides of the first equation by a .

But can we find this x such that $ax \equiv 1 (\text{mod } m)$? Of course we can, because $ax \equiv 1 (\text{mod } m)$ is the same as $ax = mq + 1$ for some q , which is the same as $ax - mq = 1$, which can be easily solved using the Extended Euclidean Algorithm on page 27 of our textbook.³ Using this (or just by guessing and checking), we find that $3^{-1} \equiv 7 (\text{mod } 10)$ because $3 \cdot 7 \equiv 1 (\text{mod } 10)$, and also $9^{-1} \equiv 9 (\text{mod } 10)$, and so on.

Finally, let's talk about square roots. A number y is a square root of 1 $(\text{mod } m)$ if $y^2 \equiv 1 (\text{mod } m)$, and to make things simple we also ask that $0 < y < m$ so that y is in our "mod m world". Note that there can be lots of square roots of 1; when we look at \mathbb{Z}_8 (or as we like to say, "a mod 8 world") then the numbers 1, 3, 5, 7 are all square roots of 1 because all of them squared will give us 1 $(\text{mod } 8)$.

2 The RSA Method.

The RSA method is a very useful and efficient way of encrypting and decrypting secret codes.⁴ In RSA we learn how to make a code so that people can easily write secret codes to us, but decrypting it will be very difficult for others. RSA stands for the inventors' last names: Ron Rivest, Adi Shamir and Leonard Adleman.

³ Coutinho, S. C. *The Mathematics of Ciphers: Number Theory and RSA Cryptography*. Natick: AK Peters, 1999. Print.

⁴ This part was written by Fatima Haidari.

In the RSA method, prime numbers and factorizations play the most important roles. In order to encrypt a code in the RSA method, two prime numbers p and q must be chosen. p and q are the secret codes. The product of p and q is n , $n = (p)(q)$. n is used as the modulus for the public message.

For example, if we pick $p = 13$ and $q = 23$, n is equal to 299. $n = 32$ times 13, $n = 299$. If we build our code on this, our code will be easy to hack. We need a more complicated version of p and q in order to secure our code as much as possible, and, at the same time, let everybody else encrypt messages based on this code.

Now we have a more secure base for our code. $\Phi(n)$ is a very difficult number to factor into our original co prime numbers. $\Phi(n) = (q - 1)(p - 1)$ is a crucial element in encrypting the code, which can be deduced by multiplying 1 less than both numbers p and q together.

$$\Phi(n) = (q - 1)(p - 1) \quad (1)$$

$$\Phi(299) = (13 - 1)(23 - 1) \quad (2)$$

$$= 12 \times 22 = 264 \quad (3)$$

In this part, we must choose another number e that is coprime with $\Phi(n)$. Two numbers are coprimes when their greatest common factor is 1. We choose $e = 5$. 5 and 264 are coprimes. In other words, they do not have any common factors other than 1. The next step is to find “ d ” which is our decryption key.

$$ed \equiv 1 \pmod{\Phi(n)} \quad (4)$$

$$5d \equiv 1 \pmod{264} \quad (5)$$

$$d = 53 \quad (6)$$

The public keys are $e = 5$ and $n = 299$. d must be kept secret as it is the key to decrypt the secret code.

If we want to encrypt the letter N, we need to have the number correspondence to letter N. With this strategy we even could encrypt words and sentences. According to the box below, $N=23$

A	B	C	D	E	F	G	H	I	J	K	L	M
10	11	12	13	14	15	16	17	18	19	20	21	22

N	O	P	Q	R	S	T	U	V	W	X	Y	Z
23	24	25	26	27	28	29	30	31	32	33	34	35

To encrypt the message $N = 23$ we raise it to the power of $e \pmod{n}$:

$$23^e \pmod{n} = 23^5 \pmod{299} \quad (7)$$

$$= 69 \quad (8)$$

In order to decrypt the encrypted message 69 to the original message, we raise 69 to the power of $d = 5 \pmod{299}$:

$$69^d \pmod{n} = 69^{53} \pmod{299} \quad (9)$$

$$= 23 \quad (10)$$

Keeping in mind that n and e are public keys, anybody could encrypt a message using our code. For example, if someone wanted to say “HI” to us, he or she would find the corresponding numbers to H and I, which are 17 and 18 = 1718. Then he or she will raise it to $e \pmod{n}$. Which will be

$$1718^5 \pmod{299} = 6$$

However, only we can decrypt the code to 1718 by raising 6 to $d \pmod{n}$, which will translate it back to “HI”.

3 Finding Square Roots of 1.

The RSA method relies on having two large primes (and by large, we mean over 100 digits long).⁵ And this leads us into our current topic of research. We were inspired by the following quote from page 9 of Andrew Granville's article, "It Is Easy To Determine Whether A Given Integer Is Prime":

There are at least four distinct square roots of 1 (mod n) for any odd n which is divisible by two distinct primes. Thus we might try to prove n is composite by finding a square root of 1 (mod n) which is neither 1 nor -1 , though the question becomes, how do we efficiently search for a square root of 1?⁶

This raised the question of how, exactly, one can find these special square roots of 1 (mod n) which are neither 1 nor -1 (mod n).

We discussed the special case of $n = p(p + 2)$, and it turns out that the number $x = p + 1$ is a square root of 1, as follows:

$$x^2 = (p + 1)^2 = p^2 + 2p + 1 = p(p + 2) + 1 \equiv 1 \pmod{p(p + 2)}$$

Sadly, we can not play this same game with other values of n , such as $n = p(p + 4)$ or $n = p(p + 6)$ or $n = p(p + 10)$. If you try $x = p + 2$ or something like that, you won't get that $x^2 \equiv 1 \pmod{n}$, which is a shame.

But then we came up with that strange little formula for the case $n = p(p + 10)$, which is:

$$x = (p + 10) \frac{9p + 1}{10} - p \frac{1p + 9}{10} \quad \text{is a square root of 1.}$$

Unfortunately, this only works when p is of the form $10w + 1$, or in other words when $p \equiv 1 \pmod{10}$, so we're missing out on lots of other primes. But it's still a nice little result.

It's not hard to show that in the general case, for $n = p(p + a)$, then so

⁵ This part was written by Greg Dresden and Fatima Haidari.

⁶ *Bulletin of the American Mathematical Society* 42.1: (2004) 3-38. Web. 20 Nov. 2014.

long as p is equivalent to 1 mod a , the square root of 1 will be:

$$x = \frac{(p+a)[(a-1)p+1]}{a} - \frac{p(p+a-1)}{a}.$$

Fatima was able to verify that x is indeed an integer. She wrote $p = ak + 1$, and substituted this into the formula for x as follows:

$$\begin{aligned} x &= \frac{(p+a)[(a-1)p+1]}{a} + \frac{p(p+a-1)}{a} \\ &= \frac{(ak+1+a)[(a-1)(ak+1)+1] - (ak+1)(ak+1+a-1)}{a} \\ &= \frac{(ak+a+1)[(ak-k+1)] - (ak+1)(a(k+1))}{a} \\ &= \frac{a[(ak+a+1)(ak-k+a) - (ak+1)(k+1)]}{a} \\ &= (ak+a+1)(ak-k+1) - (ak+1)(k+1) \\ &\quad \dots \text{an integer.} \end{aligned}$$

Finally, we have the question of whether or not this x is greater than 1. Fatima proved that $x > 1$ as follows (she's starting by assuming that $x > 1$ and is then working to get a verification of that assumption).

If $x > 1$ then ...

$$\begin{aligned} \frac{(p+a)[(a-1)p+1] - p(p+a-1)}{a} &> 1 \\ \frac{p^2(a-1) + p + a(a-1)p + a - p^2 - p(a-1)}{a} &> 1 \\ \frac{(a-1)(p^2 + ap - p) + p + a - p^2}{a} &> 1 \end{aligned}$$

Fatima then replaced the p with $ak + 1$, and so the above expression became (after a bit of simplification):

$$\frac{(ka + 1)(a - 1)(ka + 1 + a - 1) + (ka + 1)(1 - ka - 1) + a}{a} > 1$$

$$\frac{(ka + 1)(a - 1)a(k + 1) + (ka + 1)a(-k) + a}{a} > 1$$

$$(ka + 1)(a - 1)(k + 1) + (ka + 1)(-k) + 1 > 1$$

$$(ka + 1)[(a - 1)(k + 1) - k] + 1 > 1$$

$$(ka + 1)[(a - 1)(k + 1) - k] > 0$$

Fatima noted that since $p \equiv 1 \pmod{a}$, then a must be greater than 1 (which was a very nice observation!) and so $(a - 1) > 1$, and so $(a - 1)(k + 1) > k + 1$, and so $(a - 1)(k + 1) - k$ is positive, which means that we've verified the final expression:

$$(ka + 1)[(a - 1)(k + 1) - k] > 0$$

This implies that x is indeed greater than 1, as desired. A nice result by Fatima.

References

- Coutinho, S.C. *The Mathematics of Ciphers: Number Theory and RSA Cryptography*. Natick: AK Peters, 1999. Print.
- Granville, Andrew. "It Is Easy to Determine Whether a Given Integer is a Prime." *Bulletin of the American Mathematical Society* 42.1: (2004) 3-38. Web. 20 Nov. 2014. <<http://www.dms.umontreal.ca/~andrew/PDF/Bulletin04.pdf>>

Insider/Outsider: Jewish Connection to Space and Place in Early Modern Europe

Ziqi Qiu

Author background: Ziqi grew up in China and currently attends the High School Affiliated to Renmin University of China in Beijing. Her Pioneer seminar program was titled “Jewish Life in Medieval and Early Modern Europe.”

Introduction

Space and place are basic components of the world we live in. The objective reality of “place” – defined as “a location” or “a large area” – is distorted when personal and cultural experiences are added in. We ascribe significance and concrete memories to places, thus differentiating one place from another. Places also represent space, which is an abstract notion of “being.” The characteristics of certain significant places may set the tone for our impression of the more abstract space.

These notions of ‘space’ and ‘place’ are very helpful when we consider the preservation of identity within the Jewish diaspora in the early modern era. Studies on Jewish perception of space and place have focused on the sense of displacement and memories associated with particular places¹, and the production of Jewish space². This paper further explores some specific Jewish strategies of place-making in early modern Europe.

¹ For example, Tim Coles’ *Holocaust City: The Making of a Jewish Ghetto* (New York: Routledge, 2003) examines how the ordinary spaces and places of a city were divided into Jewish and non-Jewish space and how a city was manipulated to become a Holocaust city in 1944. Another example is David Cesarani’s *Place and Displacement in Jewish History and Memory: Zakor V’makor* (London: Vallentine Mitchell, 2009), which examines the sense of displacement in general.

² For example, Caryn Aviv and David Shneer’s *New Jews: The End of the Jewish Diaspora* (New York: New York University Press, 2005) explores how Jews created a balance between rootedness and movement and made their home in a post-diasporic world.

Stereotypical expressions such as the “wandering Jew” with the book as a “portable homeland” tell more than the diaspora in a physical sense; they convey a general impression of displacement and lack of attachment to place among the dispersed. Indeed, in early modern Europe, “My heart is in the East [Jerusalem], my body in the extreme-West [Spain]”³ was a typical Jewish sentiment. However, consciously or unconsciously, Jews still made a myriad of interactions with places, the local residents and the general social environment. It seems that on the other side of the historical connection with the “land that flows with milk and honey” (the land of Israel) was an attachment to the place where one was born, raised, and resided in continental Europe. In the effort to find a balance between maintaining their specific identities and acculturation to the larger European society, Jews gradually developed specific ways of perceiving space and place. The main purpose of this article is to examine how Jews perceived and experienced their spatial environments and how they engaged with certain places. More specifically, I examine how places shaped Jews’ perception of their own identities, and by proposing the concept of “symbolic places,” I will present four typical strategies that allowed Jews as either individuals or communities to alleviate the sense of otherness and become an “insider” of a place, thus creating a space, along with a sense of familiarity and entitlement, for themselves.

To investigate Jewish perceptions of space and place and Jews’ engagement in foreign territory, I employ memoirs and autobiographies written in the early modern era as a large proportion of the evidence in this paper. Even though the depiction in such writings is of things, persons and

³ Verse by Judah Halevi, the greatest poet of the Jewish Golden Age in Spain, as cited in Elie Barnavi, Miriam Feldon, and Denis Charbit, introduction to *A Historical Atlas of the Jewish People: From the Time of the Patriarchs to the Present* (New York: Schocken Books, 2002), VI

events, it is unavoidably tinted by the personal experience of the narrator, or more specifically, in the case of Jews in early modern Europe, their cultural and ethnic perspectives in observing the world, the range of their previous experiences, and the ways the narrators were inwardly affected by it. Sensory perception and its recording is a personal and creative process, in which one selects certain points in a holistic picture or within the continuous flow of events and gives those points an explanation, interpretation or meaning. The narrator's experience of abstract feelings, from discrimination and displacement to belonging and rootedness, is constructed from the documentable and less subjective sensations and perceptions. Thus, the cognitive power of perception and recording makes it possible to reconstruct the experience of space and place of the narrator from his or her memoirs.

Place and Identity

In her memoir *The Life of Glückel of Hameln*, Glückel, a German Jew and wealthy woman merchant (b. Hamburg 1646- d. Metz, 1724), mentioned a myriad of places she and her relatives, friends, and clients or business partners once visited or lived in. According to Barnavi, et al.'s *Historical Atlas of the Jewish People*, "She and her husband Chaim regularly frequented the great fairs in Frankfort-on-Main, Leipzig, and Brunswick. But their network extended as far north as Copenhagen, to the northeast as far as Danzig and Stettin..., to the east, as far as Prague..., to the southeast, as far as Vienna, to the west as far as Amsterdam, and ... even ... England."⁴

However, though Glückel travelled far and wide, and documented her life meticulously, words indicating certain common ways of perceiving space and place rarely appear in the text. For example, the words "north"

⁴ Elie Barnavi, Miriam Feldon, and Denis Charbit, introduction, VII-VIII.

“south” “east” and “west,” which are commonly used both to pinpoint a specific place in a larger area and to describe the relative location between two places in the modern world, are not to be found.

By comparison, abundant examples seem to indicate another habit of description: two places and the distance between them. When, at the age of three, her family was driven from Hamburg, her birth-place, to Altona, she recorded that “Altona is about a quarter of an hour’s distance from Hamburg.”⁵ On her way from Hameln to Hamburg, she noted that it was “half an hour from the village [where] they found my good Jacob,” her drunken servant, but still believed that “God helped us to Harburg, which is a mile distant from Hamburg, where my husband and father met us.”⁶ After her second wedding she set out for Metz, carefully noting that she traveled from Baiersdorf to Bamberg to Frankfurt-on-Main [*sic*], that “two miles from Metz we were met by my husband’s clerk on horseback,” and that “When, on Friday, the 22nd of Sivan, we were an hour from Metz, Lemle Wimpfen came riding to meet us.”⁷

This inclination is not a unique feature of Glückel’s account. Expressions such as “In the month of Elul, at the end of the year [5]338 [August-September 1578], we left Cologne and moved to Montagnana, a village five miles away”⁸ were also common in *An Autobiography of a Seventeenth-Century Venetian Rabbi: Leon Medena’s Life of Judah*. As we can glean from both Glückel’s and Leon Medena’s words, as well as from other sources, for Jews in early modern Europe, space was experienced as

⁵ Glückel and Beth-Zion Abrahams, *The Life of Glückel of Hameln: A Memoir* (Lincoln: University of Nebraska Press, 2012), 13

⁶ *Ibid.*, 58

⁷ *Ibid.*, 160

⁸ Modena, Leone, and Mark R. Cohen. *The Autobiography of a Seventeenth-century Venetian Rabbi: Leon Modena’s Life of Judah* (Princeton, N.J.: Princeton University Press, 1988), 84

“the relative location of objects or places, as the distances and expanses that separate or link places, and – more abstractly – as the area defined by a network of places.”⁹ Unlike the perception of space with a clear boundary line, such relative-location-based perception puts the emphasis on individual points (cities), instead of the continuous space of a vast territory. With home base as a definitive starting point, other points spread out, thereby forming a complex network.

The following two examples may further explain the significant role cities played in Jewish mentality and identity.

In Book VII of her memoir, Glückel wrote the following account of a dilemma faced by five partners who had moved from Metz to Lorraine to take over the mint of the Duke of Lorraine:¹⁰

The war between the King of France and the Emperor raged more fiercely, and the former issued a prohibiting order... The order named the five partners who had moved from here [Metz] to Lorraine and further stated: if they wished to remain in Lorraine, well and good, but in that event they must nevermore set foot on French soil under pain of heavy penalties. They had the choice of returning to Metz and taking up residence again or of remaining where they were...

The time drew near in which they had to give their decision. Jesse Willstadt was the first who decided to return; Jacob Krumbach followed him. I do not know how they settled with the Duke. The goods in the shop were shared out, and each came with wife, children, and all their possessions to his house in Metz. But Rabbi Samuel [the son of Glückel's second husband, from his previous marriage], Moses Rothschild [a householder who had done business in Lorraine and for a while engaged himself to supply the mint with silver] and his son decided to remain where they were. This hurt my husband, and he took it so very much to heart that he could no longer withstand his troubles and afflictions... Although his son Rabbi Samuel allowed him to suffer no want, sending him everything he needed, and even giving orders to his agents in Metz that his father should be given whatever he wanted, nothing helped.

Even though being a Jew unavoidably involved a diasporic identity and nomadic lifestyle, it seemed that the word “return” (not necessarily to Jerusalem) still meant a great deal. Jesse Willstadt and Jacob Krumbach

⁹Tuan, Yi, *Space and Place: The Perspective of Experience* (Minneapolis: University of Minnesota Press, 2002), 13

¹⁰ Glückel and Abrahams, *The Life of Glückel of Hameln: A Memoir*, 173-174

made such great effort to return to their original city, giving up valuable business opportunities and facing the danger of breaking the contract and infuriating the Duke, while the son who did not return caused his father to suffer such great agony that it may have hastened his death.

Similarly, when Leon Modena contracted to stay in Ferrara and teach the sons and grandsons of the wealthy Joseph Zalman in his house, the thought of returning to Venice was constantly in the back of his mind. Such a desire was not alleviated by the company of his wife and children, or his handsome salaries, or the great affection and honor which he received from both the household and the entire community, among the great and humble alike. He wrote that “despite this, I was overcome by depression and did not live there willingly, due to my great longing and love for Venice, the city of my birth.”¹¹

In conclusion, it seems that the Jewish perception of space and place in the early modern era went beyond the mere polarity of Land of Israel-diaspora: it also incorporated a myriad of places where the Jews had left their footprints. A city (or sometimes a larger area), with its unique political, economic, cultural and religious environment, was itself a strong indicator of identity. Therefore it is not surprising to find how “Modena could note with pride the presence of ‘Levantine Jews’, who at that time abounded in important persons,”¹² or that the Sephardic Jewish exiles in the Ottoman Empire retained some of their distinctive Spanish features and that “the pride that the Sephardim cherished for their Spanish culture is reflected in the fact

¹¹ Cohen. *The Autobiography of a Seventeenth-century Venetian Rabbi: Leon Modena's Life of Judah*, 103

¹² Mark R. Cohen and Theodore K. Rabb. "The Significance of Leon Modena's Autobiography for Early Modern Jewish and General European History." In *The Autobiography of a Seventeenth-century Venetian Rabbi: Leon Modena's Life of Judah*. ed. Modena, Leone, and Mark R. Cohen (Princeton, N.J.: Princeton University Press, 1988), 4

that they continued to stay abreast of literary developments in Spain, which entered its own golden age in the sixteenth century.”¹³

But how did the Jews manage to engage or integrate themselves into the spaces of the other societies which had had more continuous settlement and therefore stronger and more stable territorial power?

One can never know a place comprehensively, in each and every detail. However, it can be represented by different symbols, and an involvement with these symbols allows an outsider to establish a relatively intimate relationship with the more abstract idea of the place itself. As human geographer Yi-fu-Tuan pointed out, “it is a characteristic of the symbol-making human species that its members can become passionately attached to places of enormous size, such as a nation-state, of which they can have only limited experience.”¹⁴ If, however, one fails to find a symbolic entry to the city, he/she is very likely to be overwhelmed by loneliness and marginalization.

In the specific case of Jews in early modern Europe, there were three typical symbols for a city: long-time local residents, their knowledge or experience with the city as the setting, and particular places, which share the same underlying logic that once one has a close connection with an already qualified insider, he or she is less an outsider. In addition, a less common and more defiant strategy was making oneself a symbol of the city, and then needing only to obtain the recognition of others.

Shared Knowledge and Experiences

¹³ Raymond P. Scheindlin. *A Short History of the Jewish People: From Legendary Times to Modern Statehood* (New York: Oxford University Press, 2000), 126-127

¹⁴ Tuan, *Space and Place: The Perspective of Experience*, 30

For different individuals, shared knowledge and experiences often effectively enhance group identity and a sense of community. For Jews in the early modern era, cultivation of such a common understanding with others in the places where they lived was not only an attempt to reduce the hostility or revulsion between people of fundamentally different faiths and lifestyles, but also a stepping stone to further active involvement in a city's affairs.

Specifically, "language allows us to name, and thus to identify, feelings and practices... Just as breathing is to life, language is to identity; it makes us people and makes a sense of self and group belonging possible."¹⁵ As long as a specific language is used to communicate, and to articulate our individual spiritual selves, it is possible that language barriers will deliberately or unintentionally enforce the exclusivity of different language groups, preventing people from having the same impression or interpretation of common experiences. This was the same for Jews who could not speak the language being used in the environment they were living. When she was married to her second husband Hirsch Levy in Metz, Glückel noted her frustration and uneasiness over not being able to speak French:

Everyone respected and feared him [Hirsch Levy], Jews as well as gentiles. The week following our wedding all the most important people called to welcome me and wish me *mazal tov*. I wished for nothing but that I could talk French, to speak and answer everyone. As it was, my husband spoke for me.¹⁶

Therefore, a general trend among Jews living in a different community was the adoption or acquisition of the vernacular, and certain knowledge of European culture. In the seventeenth century a number of German Jews were able to read and write letters in the German language and in the eighteenth

¹⁵ Laada Bilaniuk, "The Contested Logics of Jewish Identity", in *Boundaries of Jewish Identity*, ed. Glenn, Susan A., and Naomi B. Sokoloff (Seattle, WA: University of Washington Press, 2010), 203.

¹⁶ Glueckel and Abrahams, *The Life of Glückel of Hameln: A Memoir*, 162

century even more mastered German, a bit of Latin, and sometimes even French. It was recorded that “when, in 1711, Jews were forced to seek temporary lodgings with Christians after the great conflagration in the Frankfurt ghetto, they surprised many of their hosts by their level of general culture.”¹⁷

In the same way, books, magazines, and newspapers had a subtle binding power, for they allow one to know both what is happening and the opinions and reactions of those who have a voice. This may further explain why in the early modern era in Germany, German newspapers (*Gazetten*) were widely read, and even Rabbi Jacob Emden permitted the readings of such papers, save the business section, on the Sabbath.¹⁸

Human Networks

When an infant and his mother are left in an unfamiliar environment, as early as in the second half of his first year, the baby begins to “experience anxiety when his mother leaves the room, and may manifest this by crying or, after locomotion develops, by attempting to follow her.”¹⁹ In the same way, in an unfamiliar place, a person will instinctively follow only the ones who lead him in (or his acquaintances), for they are the only representatives of this foreign place with whom he has so far established a connection. This connection is the starting point of the complex process whereby one forms an attachment to a place.

¹⁷ Breuer, Mordechai, Michael Graetz, and William Templer, *German-Jewish History in Modern Times*. Vol.1 (New York: Columbia University Press, 1996), 240

¹⁸ *Ibid.*, 239.

For information about how books and newspapers influenced people's sense of community, see Benedict R. O. Anderson's *Imagined Communities: Reflections on the Origin and Spread of Nationalism*. Rev. and Extended ed. (London: Verso, 1991), 24-36

¹⁹ Ainsworth, Mary D. Salter, Mary C. Blehar, Everett Waters, and Sally Wall, *Patterns of Attachment: A Psychological Study of the Strange Situation*, ([S.I.]: Psychology Press, 2014), 21

Moving into a new city is a similar process. Jews as newcomers approached the new city from their personal connections with those who were already “insiders,” that is, those who knew the city well and contributed to the daily functioning of the city and, therefore, could be regarded as representatives of the city.

Before she was twelve years old Glückel was betrothed, and at the age for fourteen she was wedded to Chaim of Hameln. After the wedding her parents returned home and left her “in a strange town, among strangers.” Glückel, born and raised in Hamburg, described herself as a young child who “was taken from parents, friends, and everyone I knew, from a town like Hamburg to a village where only two Jewish families lived.” However, Glückel reiterated the happiness that quickly overtook her, thanks to the connections brought by the marriage. She wrote that “I was not unhappy but even had much joy because my parents-in-law were respectable, devout people and looked after me better than I deserved.” Later she praised her father-in-law again for his piety. “Every morning he rose at three and wrapped in talith, he sat in the room next to my chamber studying and chanting Talmud in the usual sing-song. Then I forgot Hamburg. What a holy man he was!” Following this change in perception of her surroundings, Glückel started to narrate her pleasure in getting to know her father-in-law’s children, and started to integrate herself into the life of the Hameln family.²⁰

In a similar way, when after one year in Hameln the couple decided to move to Hamburg in search of better business opportunities, Glückel’s father offered them *Kest*²¹ for two years. With such help from his father-in-law, Glückel’s husband, “being a stranger to the city, looked about, to see what

²⁰ Glueckel and Abrahams, *The Life of Glückel of Hameln: A Memoir*, 33-34

²¹ *Kest* is an undertaking to board and clothe the bridal pair for a stated period.

he could do,” and eventually made good profit by trading in gold, establishing himself in the Jewish community in Hamburg.²²

When Glückel’s eldest daughter was to be married in Cleve, the family set out from Altona to Amsterdam, where they lodged with a Jewish associate and did business. On their way back, they arrived at Delftzil and stayed with a Jew “whose brother’s wife was the daughter of Chaim Fürst of Hamburg” for the Jewish New Year *Rosh ha-Shanah*; in Emden, they lodged with Abraham Stadthagen, “who was a close relative of my [Glückel] husband’s – his father, Reb Moses Kran, of Stadthagen, was an uncle”; in Wittmund, they spent *Yom Kippur* with Breinelé, one of Chaim’s cousins.²³

When Glückel’s stepson, Rabbi Samuel, moved to Lunéville and took over the mint of the Duke, a householder, Moses Rothschild, decided to follow in his footsteps. Glückel recorded in her memoir that “when he [Moses Rothschild] heard what good business Rabbi Samuel and his partners were doing, he and his son, who was son-in-law of Rabbi Samuel, moved to the same town... And soon this Moses Rothschild too engaged himself to supply the mint with silver.”²⁴

In the four examples above, such active utilization of personal connections facilitated the integration process for both long time residence and temporary sojourns alike. Places were given a meaning only when Glückel “could find business, relatives, or co-religionists”²⁵ and thus find an entry into an unfamiliar space.

It should be noted that not every personal connection was well-established beforehand. Inviting an acquaintance as a guest in turn provided

²² Glueckel and Abrahams, *The Life of Glückel of Hameln: A Memoir*, 37-38

²³ *Ibid.*, 78-83

²⁴ *Ibid.*, 172-173

²⁵ Elie Barnavi, Miriam Feldon, and Denis Charbit, introduction, VIII.

a valuable opportunity to promote mutual relationship. Mordecai, a young man from Hanover who once worked for Glückel's brother-in-law Lipman, visited Hamburg and became her guest. Glückel "took a liking to him and engaged him to travel for us in such places where business could be done." This young man from Poland quickly contributed to Glückel's business, when he "was sent to Danzig to buy seed pearls."²⁶ In this virtuous circle, both the visitor and the host benefited. A rather weak link was strengthened. However, whether such occasions were the main opportunities for Jews from different communities to socialize and expand their networks remains to be further studied.

On the other hand, life could be very hard without connections in a city, not only because of the lack of support, but also because such disconnection made it extremely difficult to integrate into the local community. In his autobiography, a young man who endeavored to pursue further education in areas where he had no direct connections, felt that "I was there all alone with no relative near; all the townspeople noticed my appearance and questioned me."²⁷

The network of families and close relatives proved to be the most basic and prevalent form of connections, shaping the perception of space and place for the Jewish people. The mention of a city name was directly related to the clan members or, sometimes more broadly, acquaintances living inside or near the city, who became either the impetus for the move, or played a very important part in a visitor's or immigrant's life.

²⁶ Glueckel and Abrahams, *The Life of Glückel of Hameln: A Memoir*, 42

²⁷ Alexander Marx, "A Seventeenth-Century Autobiography: A Picture of Jewish Life in Bohemia and Moravia. From a Manuscript in the Jewish Theological Seminary," *The Jewish Quarterly Review*, New Series, Vol. 8, No. 3 (Jan., 1918), 269-304. <http://www.jstor.org/stable/1451286>

A Sense of Ownership and Inner Communities

The Jews, being dispersed from their original land, maintained a common memory and belief. As Shaye Cohen pointed out, “It [Jewishness] has no empirical, objective, verifiable reality to which we can point and over which we can exclaim.”²⁸ The diaspora Jews, therefore, tended to use physical places where one could directly relate to Jewish identity to narrate and construct a general Jewish community. However, such activities did more than just maintain traditions and Jewish identity. If individuals found themselves too powerless to establish a connection with a physical place, the entire ethnic group’s active use gave other Jews a confidence to claim (or even publicly announce) the ownership of that specific space – even in a “foreign” territory.

This theory may bring new insight into the role synagogues played for Jewish communities. As the central institution of the community, the synagogue²⁹ assumed a significance beyond regular religious functions. Its high socio-religious value not only lies in the fact that it “harbored a sufficient number of fellow worshipers to satisfy the most elementary cultural and religious needs of the group,”³⁰ but also in that it allowed Jews to directly connect themselves to a particular place without having to win the approval of other “insiders,” as illustrated by the firm distinction between “our” and “their” synagogue in the following example.

In Book II of her memoir, Glückel recorded the following story. In about 1655, seven years after the Council of Aldermen issued an order expelling all German Jews from Hamburg, her father managed to resettle

²⁸ Cohen, Shaye J. D. *The Beginnings of Jewishness: Boundaries, Varieties, Uncertainties*. (Berkeley: University of California Press, 1999), 5.

²⁹ If one did not yet exist, the prayer room would be set up in a private home to fulfill similar purposes.

³⁰ Bonfil, Roberto. *Jewish Life in Renaissance Italy*. (Berkeley: University of California Press, 1994), 55

there, leading a wave of German Jews to return from Altona, which was about a quarter of an hour's distance. They had "no synagogue and no privileges and lived only by the grace of the town council," but they still met together and held services in private rooms. Even when this was forbidden and Jews from Hamburg were "driven to attend the Altona synagogue," they "crept back to our little synagogue, had peace for a time, and then were driven back away again." Glückel even directly expressed her concern that "this will last as long as we are in Hamburg and the town council rules."³¹

Such uneasiness demonstrates that within the large ethnic group of "Jews," each individual also drew his or her identity from the local space symbolized by its synagogue. People from the same "subgroup" attended the same synagogue, and when one was not available, met together and held services.

Moreover, this completely different method of finding an entry to establish a connection with a particular place is an alternative to actively reaching out to already existing connections, or voluntary assimilation or acculturation to win the acknowledgement of the already qualified "insiders." Instead of connecting themselves with the qualified members of a new community, or acting in accordance with the social expectation of their surroundings, some Jews confidently engaged themselves with a new environment by building their own circles or openly acting in their own ways, challenging the "insiders" to accept them as an integral social force or subculture because of the strikingly good impression they left on them.

The advocacy of *bom judesmo*, i.e., worthy Judaism,³¹ is a demonstrative example of this mentality. The privileged Portuguese Jews in Amsterdam endeavored to create an image of the wealthy, intellectual,

³¹ Glueckel and Abrahams, *The Life of Glückel of Hameln: A Memoir*, 15

decorous, and generous Jews. Those with fabulous wealth sought higher social status, dealing in international commerce on a large scale and assuming important positions in the royal courts of Europe. The same emphasis was placed on the display of indisputable wealth and power. They intentionally imitated the manners of the European aristocracy, collected objects indicating the richness and virtues of Jewish heritage, managed to conceal the presence of poor and less-educated Jews from the public, and enacted a plethora of rules and regulations covering most aspects from religion to daily life in order to maintain such good impressions. But their most obvious attempt at presenting power was in the outward grandeur and openness of their synagogues.

When the Frenchman Maximilan Misson visited Amsterdam in the early eighteenth century, he wrote that “the Portuguese Jews here are extraordinary Rich, and their Synagogue is a stately Building whereas that of the High-Dutch is but mean and contemptible.”³²

Significant apart from the size and magnificence of the synagogue, was its openness to outside observers, especially to Christians. The following painting, *Interior of the Portuguese Synagogue of Amsterdam*, by Emanuel de Witte, showed a typical arrangement inside a synagogue.

³² Maximilan Misson, *A New Voyage to Italy, with Curious Observations on Several Other Countries, as Germany, Switzerland, Savoy, Geneva, Flanders and Holland: Together with Useful Instructions for Those Who Shall Travel Thither*. Done out of French. The second Edition, Enlarg'd above one third, and enrich'd with several New Figures, vol. 1, (London 1699), 25



Painting: Emanuel de Witte, *Interior of the Portuguese Synagogue of Amsterdam*, 1680. Oil on canvas.

Source: Rijksmuseum, Amsterdam

One notable feature of this painting is its focus on the audience, rather than the Jews. In fact, the emphasis on the audience was also true in the ritual. Yosef Kaplan made the following comparison between the synagogue and the theater:

In the congregation of Amsterdam, the worshipers sitting behind the reader's platform (*tebah*) functioned as ushers when necessary, to permit non-Jews to sit in the synagogue, on condition that this was arranged in an orderly manner, such as in a theater. Indeed, to some degree those Jews felt that the synagogue service was similar to theater, and they, the actors, were supposed to arouse a feeling of earnestness in the visitors. Their leadership viewed the gentiles as a group whose values, culture, manners, and aesthetic taste had to be taken into consideration, so that the spectacle performed before them would please them.³³

³³ Yosef Kaplan, "Bom Judesmo", in *Cultures of the Jews*. Vol. 2, ed. Biale, David, 351

Such performances were very successful. Gregorio Letti, one of the European visitors who were interested in the Jews and came to visit their houses of worship wrote the following: “The synagogue of the Portuguese seems to be a seat of noblemen, a well-made people, almost all civil, well dressed, rich, and who make a fine impression.”³⁴

One may deplore such cultural pretension, but it should be remembered that for more than a thousand years Jews were persecuted and oppressed as a minority group, and when a relatively tolerant environment allowed them to thrive, it is understandable why they chose this way to prove their worth: they wanted to count, and they were fulfilling the criteria of the Europeans. Therefore it was at once defiance and accommodation to the dominant culture.

This logic may be applied on a smaller scale. For example, when one moved to a city where few connections had already existed, he or she might start anew by bringing over old connections to the same city. Glückel’s stepson, Rabbi Samuel decided to move to Lunéville from Metz, and “six months before he took over the mint he had opened a shop... As Rabbi Samuel alone could not conduct the shop in the style that it had to be carried on, he took into business his two brothers-in-law who lived in Metz” and the three “left their fine houses in the Judengasse and moved to Lunéville.”³⁵

The construction of the synagogue not only fulfilled a religious need, but also allowed Jews to claim ownership of a particular place, thus establishing a direct connection with the city they dwelled in. Moreover, with increasing wealth and power came confidence in one’s ethnicity, and certain Jews managed to win the recognition of the already qualified insiders

³⁴ Brasz, Chaya, and Yosef Kaplan. *Dutch Jews As Perceived by Themselves and by Others: Proceedings of the Eighth International Symposium on the History of the Jews in the Netherlands*. (Leiden: Brill, 2001), 24

³⁵ Glueckel and Abrahams, *The Life of Glückel of Hameln: A Memoir*, 171-172

by the display of this opulence and social status, as exemplified by the advocacy of *bom judesmo* in Amsterdam.

Conclusion

How did Jews, being unable to return to their original homeland, establish connections with places where they were born, raised, and resided? How did they endeavor to alleviate the sense of strangeness and exclusion they felt as outsiders?

I conclude that Jews had four strategies to develop their own identities amongst the foreign cities in which they were scattered in the early modern era: 1) assimilation into the city through the knowing or participating in ongoing events and developing shared knowledge and experiences with local residents; 2) personal connections with qualified insiders; 3) developing a sense of ownership over a particular space; and 4) making themselves impressive enough to be the symbols in the community themselves.

While people could never achieve an absolutely comprehensive understanding of a new place, these symbolic entries allow them to establish an intimate sense of connection. These strategies, evident in the chronological boundaries of this paper, may give us insights into how a foreign ethnic group could have integrated into the dominant culture.

Works Consulted

Primary Sources

Glüeckel, Beth-Zion Abrahams. *The Life of Glückel of Hameln: A Memoir*.

Lincoln: University of Nebraska Press, 2012.

Misson, Maximilan. *A New Voyage to Italy, with Curious Observations on Several Other Countries, as Germany, Switzerland, Savoy, Geneva,*

Flanders and Holland: Together with Useful Instructions for Those Who Shall Travel Thither, 2nd ed. London, 1699.

Modena, Leone, and Mark R. Cohen. *The Autobiography of a Seventeenth-century Venetian Rabbi: Leon Modena's Life of Judah*. Princeton, N.J.: Princeton University Press, 1988.

Secondary Sources

Ainsworth, Mary D. Salter, Mary C. Blehar, Everett Waters, and Sally Wall. *Patterns of Attachment: A Psychological Study of the Strange*. [S.I.]: Psychology Press, 2014.

Anderson, Benedict R. O'G. *Imagined Communities: Reflections on the Origin and Spread of Nationalism*. London: Verso, 2006.

Barnavi, Elie, Miriam Eliav-Feldon, and Denis Charbit. *A Historical Atlas of the Jewish People: From the Time of the Patriarchs to the Present*. New York: Schocken Books, 2002.

Biale, David. *Cultures of the Jews, Volume 2*. New York: Schocken Books, 2006.

Bonfil, Roberto. *Jewish Life in Renaissance Italy*. Berkeley: University of California Press, 1994.

Breuer, Mordechai, Michael Graetz, and William Templer. *German-Jewish History in Modern Times Vol. 1. German-Jewish History in Modern Times*. New York: Columbia University Press, 1996.

Cohen, Shaye J. D. *The Beginnings of Jewishness: Boundaries, Varieties, Uncertainties*. Berkeley: University of California Press, 1999.

Glenn, Susan A. *Boundaries of Jewish Identity*. Seattle [u.a.]: Univ. of Washington Press, 2010.

Lipphardt, Anne, Julia Brauch, and Alexandra Nocke. *Jewish Topographies: Vision of Space, Traditions of Place*. Aldershot: Ashgate, 2008.

Marx, Alexander. "A Seventeenth-Century Autobiography: A Picture of Jewish Life in Bohemia and Moravia. From a Manuscript in the Jewish Theological Seminary." *The Jewish Quarterly Review* 8, no. 3 (1918): 269-304. <http://www.jstor.org/stable/1451286>.

Scheindlin, Raymond P. *A Short History of the Jewish People: From Legendary Times to Modern Statehood*. New York: Oxford University Press, 2000.

Tuan, Yi-Fu. *Space and Place: The Perspective of Experience*. Minneapolis: University of Minnesota Press, 2002.



Introduction and Applications of Sperner's Lemma

Haoyu Sheng

Author background: Haoyu grew up in China and currently attends Woodside Priory School in California. His Pioneer seminar program was titled "Pioneer Course: Introduction to Combinatorics and Graph Theory."

Introduction

This essay will attempt to unveil the mystery of the complex yet ingenious Sperner's Lemma and discuss how it can be employed to prove other significant theorems and lemmas and to solve partitioning problems. Partitioning problems will be defined later.

Sperner's Lemma

Background

Before we examine the proof and applications for Sperner's Lemma, we should first introduce some of the combinatorial terminologies that will be seen in the following proofs. *Sperner's Lemma*, by definition, states that *every Sperner-labeled simplex has at least a full cell. More specifically, this simplex has an odd number of full cells.* *Triangulation* is the subdivision of a triangle into many small subtriangles. A *simplex* is the generalization of a triangle into arbitrary dimensions. For example, a 1-simplex is a line, a 2-simplex is a triangle, and a 3-simplex is a tetrahedron. A *full cell* is a simplex with all vertices labeled differently. Moreover, a Sperner labeling is the labeling of the subdivisions of a simplex such that 1) the vertices of the simplex are labeled differently, and 2) each vertex on the outer edge has

to be colored with one of the two colors at the end of its edge. Last but not least, it is extremely important to introduce the idea of a barycentric coordinate. The *barycentric coordinate system* is a coordinate system in which the location of a certain point on a simplex can be represented in regard to the barycenter (center of mass) of the simplex.

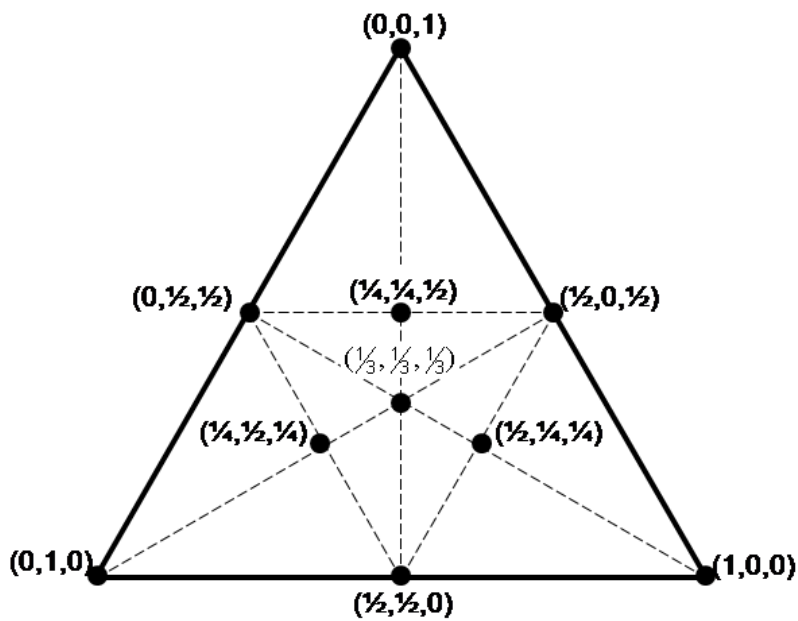


Figure 1: An example of Barycentric Coordinates

The diagram above is a simple illustration of how points on a 2-simplex can be represented by barycentric coordinates.

Proof:

One-dimensional:

When a line that has multiple vertices labeled 0 and 1 starts with 0 and ends with 1, and the only values in this line are 0 and 1, the label of these vertices must alternate an odd number of times in order to get from 0 to 1.

Two-dimensional [4]:

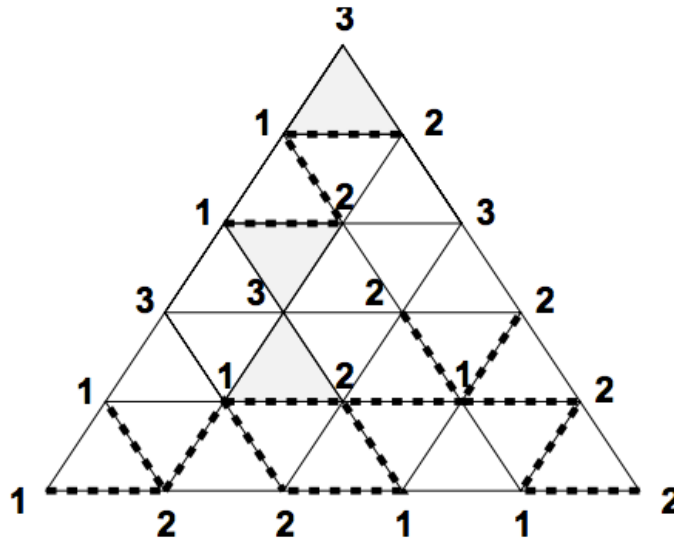


Figure 2: A Sperner-labeled triangle [3]

Let G be a graph of the Sperner-labeled triangle with all the little triangles' labeled as vertices. Also, we can consider the space outside of the Sperner-labeled triangle as a vertex. Moreover, the line segments between two arbitrary vertices of one triangle that are labeled 1 and 2 respectively are edges that connect two triangles, which, according to what we just defined, are vertices of the graph G . In the following proof, we will use the notion of 1-2 edge to represent the sides of a triangulation that have ends labeled 1 and 2 respectively.

On the side from vertex 1 to 2 of the Sperner-labeled triangle, since a vertex of a triangle on this side can only be labeled 1 or 2 according to the Sperner-labeling, it must switch an odd number of times in order to traverse from 1 to 2 according to the one-dimensional proof. In other words, there are only an odd number of edges that have their ends labeled 1 and 2 respectively on the side of 1-2. Thus, since the space outside the triangle is only connected to an odd number of edges on the big Sperner-labeled

triangle's 1-2 side, it follows that the space, which is defined as a vertex, has an odd degree.

Due to the fact that the sum of the degrees of the vertices of a graph is equal to twice the number of edges, it is clear that the sum of the degrees of all the vertices is even. In the graph G , we can summarize the different possibilities for the degree of a vertex. The first circumstance occurs when a triangle, which we refer to as a vertex in graph G , has no side whose ends are labeled 1 and 2 respectively. This means it is isolated and has degree 0 since we have defined a 1-2 edge as a bridge to connect two triangles. The second circumstance takes place when a vertex has exactly one 1-2 edge, which indicates it is connected to another vertex in G and has degree 1. The third circumstance happens when the triangle, which is a vertex in G , has a 1-2 edge with an addition of 1 or 2 labeling on the remaining vertex of the triangle, and it is clear that the triangle, as a vertex in graph G , will have degree 2 because it has two 1-2 edges. However, any degree that goes beyond three cannot exist because the triangle has only 3 vertices and in order to reach degree 3, 3 pairs of 1-2 edges, which need a minimum of 4 vertices, will be required. Thus, according to the above circumstances, the vertices inside graph G can only have possible degrees of 0, 1, and 2.

However, there is an exception to the three circumstances listed above. This exception occurs at the space outside the triangle, which as stated above, must have an odd degree that doesn't need to be 1. Therefore, since we have an even number of total degrees and the vertices that have even degrees do not influence the parity of the total degree, we must have an even number of vertices with odd degrees to make the total degree even. In the graph G , it is clear for us to see that only the space outside and the triangles with degree 1 have odd degrees. Thus, if we subtract the vertex

that represents the space outside of the Sperner-labeled triangle from the vertices with odd degrees, we can conclude that there are an odd number of triangles with degree 1. And the existence of only one 1-2 edge in these triangles indicates their identity of being a full cell. Thus, in the Sperner-labeled 2-Simplex, there are an odd number of full cells.

Multidimensional Case via induction:

Suppose there is a k -simplex with labels from 1 to $k+1$. If the hypothesis that in a Sperner-labeled triangulation there are an odd number of full cells is true up to dimension k , we can conclude that this k -simplex maintains an odd number of full cells that are labeled from 1 to $k+1$.

Imagine the k dimensional simplex has increased its dimension into $k+1$. Thus, the k -simplex becomes the base of the new $k+1$ -simplex. Let G become the graph of the Sperner-labeled $k+1$ - simplex where all the small $k+1$ -simplices and the space outside the $k+1$ -simplex are vertices as all the k -simplices with labels 1 to $k+1$ are edges. Since all the fully labeled k -simplices are considered as edges, if we consider the space outside the $k+1$ simplex as a vertex, it is connected to an odd number of edges. Therefore, there are three possible degrees that a vertex can have. First,, while a $k+1$ -simplex is fully labeled from 1 to $k+2$, it only maintains one 1 to $k+1$ labeled k -simplex and has degree one. Second, when a $k+1$ -simplex maintains one 1 to $k+1$ labeled k -simplex with the only remaining vertex labeled arbitrarily from 1 to $k+1$, it contains a total of two 1 to $k+1$ labeled simplices and has degree two. Last but not least, a $k+1$ -simplex with no vertex from 1 to $k+1$ can contain no 1 to $k+1$ labeled simplex and thus has a degree of 0. Because a $k+1$ simplex has only $k+2$ vertices, three 1 to $k+1$ labeled simplices cannot be found because they require at least $k+3$

vertices. Hence, we only have possible degrees of 0, 1, and 2 with the exception of the odd degree of the space outside of the $k+1$ -simplex. Since G is a graph consisting of vertices and edges, it has a total degree that is even. In order to achieve an even total degree, neglecting the vertices with degree 0 and 2 that are not going to impact the parity, we must have an even number of vertices with an odd degree, which in this case is either one or the odd degree that the outer space has. Therefore, without further counting the outer space, we have an odd number of $k+1$ -simplices with degree one, which, as stated, are full cells that have degrees from 1 to $k+2$.

Applications of Sperner's Lemma

It might sometimes seem pointless to look for a full cell in a Sperner triangle. Yet, when thinking about labeling vertices as representing certain conditions, Sperner's lemma is extremely applicable and helpful in finding a solution satisfying all the conditions of a particular problem. The examples of cake-cutting and rental harmony highlight how looking for a full cell in a simplex helps find an optimal solution to a certain problem.

1. Cake-Cutting [4]:

Imagine there is a cake that is about to be divided by n people who, by assumption, have different desires on which cake pieces they want. In order to divide the cake into n pieces, we need to have $n-1$ knives on the cake. Assume that the total size of the cake is 1. Thus, by dividing the cake into n pieces, we have that $x_1 + x_2 + \dots + x_n = 1$. Let S be the space of possible partitions that indicate the different ways the cake can be distributed to the people. Since n pieces of cake are cut by $n-1$ cuts, we can perceive the space as an $(n-1)$ -simplex. If we call the set of cuts that partition the cake a cut-set, each point in S represents a cut-set. Within a cut-set, we assume

that our players prefer at least one single piece of cake. Also, each player is able to make an independent choice without interference from the choices of others. Also, players are allowed to prefer multiple pieces of cake at the same time just in case two or more players prefer the same piece of cake. In order to establish some rules, we make the following assumptions: 1) Players are hungry such that they will prefer cake with mass over no cake. 2) Any player that prefers a piece of cake in a converging sequence of cut-sets prefers a piece of cake in the cut-set of the limit of this sequence. (This means the player has a closed preference set)

Thus, we will prove that for hungry players with closed preference sets, there is a cut-set that is the *envy-free partition*, which means all players are able to pick the piece they prefer.

Proof ($n=3$)[2]

As we have described before, the space S of possible partitions is an $(n - 1)$ -simplex. When $n = 3$, S is a 2-simplex, which is a triangle. Then triangulate S and assign owners to each vertex of the triangulations as well as to the triangle. Assume the three players have names A , B , and C . Since the total cake size is 1, the maximum amount of cake that can be distributed to an individual player is 1. Therefore, we can create another labeling that is auxiliary to the existing one and can be proven to be a Sperner labeling. Through barycentric coordinates, we know that one of the three vertices has coordinate $(1,0,0)$. Since we have given all the vertices owners, we know that this vertex has an owner, whose name we can assume is A , to be given a prioritized pick. Based on the assumption that players are hungry, the player who is given the whole cake will definitely mark this cut-set as his preference. Therefore, this vertex can be given a label 1 since it is the partition that A prefers. Similarly, we can give the vertex $(0,1,0)$ with owner

B label 2, and $(0,0,1)$ with owner C label 3. In order to prove that this is a Sperner labeling, we need to verify whether the labeling on the sides of the triangle satisfy the criterion of a Sperner labeling. On the side from 1 to 2, all the vertices of the triangulation are going to have barycentric coordinates $(a,b,0)$. Based on our assumption that players are all hungry and will not be satisfied with an empty cake, we know that 3 cannot be labeled on the side from 1 to 2 because of the presence of empty cake in the cut-set, which will not be preferred by C. Similarly, we know that 2 cannot be on the side from 1 to 3, and 1 cannot be on the side from 2 to 3. Thus, we know that this labeling is indeed a Sperner labeling.

Since the labeling is a Sperner-labeling, the space S is a Sperner Triangle. According to Sperner's Lemma, we know that there is at least one full cell within this Sperner triangle. As we are triangulating S with smaller and smaller size triangles, the sequence of full cells by smaller and smaller triangulations will eventually converge to a point that is labeled 1, 2, and 3 simultaneously. Let's take a look at what this point represents. As defined above, a vertex can be labeled 1, 2, and 3 respectively when the owner of this piece is assigned his piece of preference. In this circumstance, however, labels 1, 2 and 3 converge to this point, which indicates all three players are given their piece of preference. This completes the proof for $n=3$.

Essentially, for cases in which $n>3$, we can always show that there is a point of convergence that contains all possible labeling. By using methods similar to the proof for $n=3$, we can always find a point in the simplex that represents a cut-set that satisfies all players.

2. Rental Harmony[4]:

Suppose there are n roommates in an n -bedroom house who are

trying to decide which person gets which room for what rent. Before we explore the statement and the proof for “rental harmony,” we need to make certain assumptions. 1) Each rent payer can have an acceptable room in the house. 2) Each person will always prefer to pay zero rent. 3) A person who prefers a converging sequence of prices for rooms prefers the price of the limit of this sequence.

If the partition of rent can satisfy all individuals while satisfying all the assumptions, this partition is said to be a *rental harmony*.

$N=3$

The proof for Rental Harmony follows the proof of cake-cutting with a slight twist.

Suppose that the total rent is 1 (if the real rent is higher, we just multiply each person's rent by the actual value of the total rent), then $x_1 + x_2 + \dots + x_n = 1$ and no term can be negative. We can therefore perceive the space S of possible rent distributions as an $(n - 1)$ -simplex. When $n=3$, S turns out to be a 2-simplex, which is a triangle.

Now let's triangulate this triangle with triangles of small size. Assign each vertex an owner who can get a prioritized pick. Also, keep in mind that each vertex resembles a way of distributing rents. Now, we can build a new labeling based on the existing one. In this labeling, we ask the owner of each vertex the following question: “If the rent is distributed as this vertex represents, which room will you choose?” For example, for the vertex with barycentric coordinate $(1,0,0)$, a housemate will probably choose the second room or the third room because of the assumption that a rent payer will always prefer a room without paying any rent. Therefore, we are able to label the triangle as below:

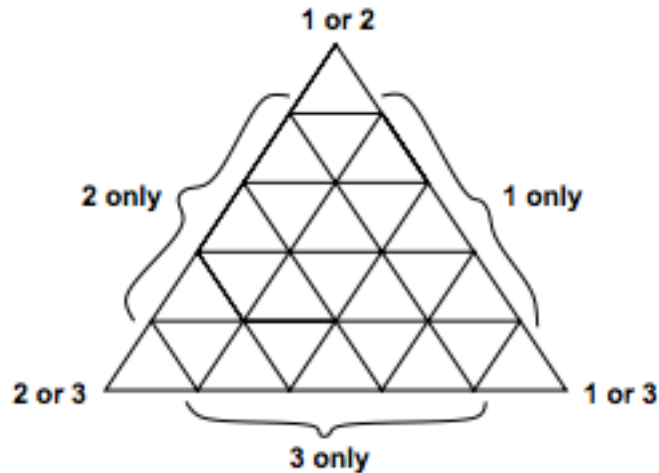


Figure 3: The Labeling of a Rental Division [4]

However, the labeling above is not exactly a Sperner labeling because the vertex of the triangle labeled by this particular labeling can have two options of labeling, whereas the sides only have one. Therefore, we need to prove that in this triangle, there must exist at least one full cell. Consider this triangulation as a graph G . Similar to what we have done in the proof of Sperner's Lemma, we identify each of the smaller triangles as a vertex of G while the 1-2 edges are the edges that connect the vertices. Looking at the three sides of the triangle, whether the vertex that has barycentric coordinate $(0,0,1)$ is labeled 1 or 2, there only exists one 1-2 edge on the sides of the triangle S . Therefore, we know that only one full cell can be followed into the interior of the triangle and the space outside has degree 1. Furthermore, similar to the condition in a Sperner triangle, a vertex in G can only have degree 0, 1 and 2. Therefore, since the total degree of G is even, there must be an even number of vertices with odd degrees. Because the space outside has an odd degree and is considered a vertex, we can conclude the number of full cells must be odd. Thus, we have proven that

there exists at least one full cell.

We can hence use smaller and finer triangulations to find the converging point of the sequence of full cells. Since the converging point is a full cell with label 1, 2 and 3, according to the question we asked earlier in order to label a vertex, we know that in this distribution of rent, the rent payer is satisfied with the rent for each room and thus rental harmony is achieved.

KKM Lemma

Sperner's Lemma implies the KKM Lemma, which is significant in proving Brouwer's Fixed Point Theorem.

KKM Lemma: Suppose an n -simplex is covered by $n+1$ closed set such that all the faces of the n -simplex belongs to certain closed set c_i that $i \in n + 1$, then all the c_i has a common intersection point [3].

Two-dimensional:

Suppose there is a 2-simplex that is covered by the closed sets C_i and all the vertices in the triangulations are marked by the closed set that they are covered by.

Assume the triangulations are initially coarse. Thus, the full cell found in the Sperner-labeled triangle is not necessarily a subset of the region shared by the closed sets. Therefore, since no optimal triangle has been found, more detailed triangulations with smaller sizes of small triangles are required.

While the triangulations become smaller and more precise, the triangulations ultimately resemble points. As stated, the vertices of all the

triangulations should be within the closed sets that their labels identify with. Also, according to Sperner's Lemma, there must be at least one full cell within a Sperner-labeled triangle. As a result, resembling almost a point and having labels 1,2,3, a full cell must be within C_1, C_2, C_3 simultaneously. Thus, the full cell stated above is the KKM point that is stated in the KKM Lemma [3].

Brouwer's Fixed Point Theorem (for n=2)

Sperner's Lemma can also lead to one significant theorem in Topology- Brouwer's Fixed Point Theorem, which can be used to conduct the Minimax Theorem.

Brouwer's Fixed Point Theorem: *Every continuous function that is continuous from a triangle to itself has a fixed point such that $f(x)=x$.* [2]

Proof[5]:

Let f be a continuous function from a 2-simplex T into itself. We can represent $f(x,y,z)=(x',y',z')$ by using barycentric coordinates, which is a coordinate system constructed by appointing a point in a simplex as the barycenter.

Based on the continuity of (x,y,z) we want to introduce a certain labeling:

If $x' < x$, the barycentric coordinate (x,y,z) is labeled 1.

If $x' \geq x, y < y$, the barycentric coordinate (x,y,z) is labeled 2.

If $x' \geq x, y' \geq y, z' < z$, the barycentric coordinate (x,y,z) is labeled 3.

In order to prove that the continuous function has a fixed point, we need to first examine whether the labeling is a Sperner labeling.

First, we need to examine the corners .

As the graph has shown, the three vertices of this triangle have barycentric coordinates $(1,0,0)$ $(0,1,0)$ and $(0,0,1)$

Because of the continuity (can use definition of coordinate system, not continuity) of $f(x,y,z)$, for corner $(1,0,0)$, x' must be smaller than or equal to 1. However, if x' is equal to 1, we will have a fixed point. Since $x' < 1$, we can thus conclude that this vertex has label 1.

Similarly, we can conclude that the corner $(0,1,0)$ is labeled 2, and $(0,0,1)$ is labeled 3.

If we look at the point on the sides where 1 and 2 connect, we will have a barycentric coordinate $(x,y,0)$ and either x' needs to be smaller than x or y' needs to be smaller than y . Otherwise, there will be a fixed point on the continuous function if $x=x'$, $y=y'$, $z=z'=0$. Therefore, it is clear that the vertices on the side that connects vertices 1 and 2 can only have labels 1 and 2. Similarly, the vertices on the side that connects 2 and 3 can only have labels 2 and 3 and the ones on the side that connects 1 and 3 can only have labels 1 and 3. Thus, this method of labeling has been shown to be a Sperner labeling.

Since T is a Sperner-labeled triangle, when the triangulations of a Sperner-labeled triangle become smaller and smaller and the diameter of the triangulations approaches zero, the full cell in the n -th triangulation will eventually converge—meaning that a sequence approaches a finite limit as its terms are increasing—to a point. Therefore, $x_1 = x_2 = x_3, y_1 = y_2 = y_3, z_1 = z_2 = z_3$. Since the full cell has become a point, (x',y',z') becomes a point too. From the Sperner labeling, we know that $x'_1 \leq x_1, x'_2 \geq x_2$ (I include the circumstance when they are equal because we do not want to exclude the case where the graph has a fixed point). When the full cell becomes a point, we have $x_1 = x_2 = x_3, x'_1 = x'_2 = x'_3$. Therefore, since we have $x'_1 \leq x_1, x'_2 \geq x_2, x_1 = x_2, x'_1 = x'_2$, $x'_1 = x'_2 = x_1 = x_2$. Similarly we have $y' = y, z' = z$, and thus it is clear that $f(x,y,z) = (x,y,z)$ after

many steps of smaller and smaller triangulations.

The Minimax Theorem[1]

Brouwer's Fixed Point Theorem, which is implied by Sperner's Lemma, contributes significantly to the field of game theory, a branch of mathematics studying the payoff resulting from different strategies, by proving the Minimax Theorem. In order to introduce the idea of the Minimax Theorem, we are to first introduce the properties of a zero-sum game—a game in which the payoff of all players adds up to zero and everything lost by one player is going to be gained by another.

The properties of a 2 person zero-sum game:

1. There are two players P1 and P2.
2. P1 has a set of strategies $A = \{a_1, a_2 \dots a_m\}$ and P2 has a set of strategies $B = \{b_1, b_2 \dots b_n\}$
3. For each pair of actions (a_i, b_j) , the payoff of P1 is denoted by $M(a_i, b_j)$.

For P1, there is a set of probabilities for his action such that $p = (p_1, p_2 \dots p_m)$. For P2, there is a set of probabilities $q = (q_1, q_2 \dots q_n)$ as well.

Note that $\sum_{i=1}^m p_i = 1$

$$\sum_{j=1}^n q_j = 1.$$

So, we can denote $M(p, q)$ as $M(p, q) = \sum_{i=1}^m \sum_{j=1}^n p_i M(a_i, b_j) q_j$

Maximizing Security

In the game, the objective of each player is to maximize the profit for himself as well as minimizing the profit for his opponents. Also, the rules of

the game require each side to make choices with complete ignorance of what the opponent is going to choose.

Thus, the *security level* of P1 is determined by the circumstance at which P2 chooses a strategy to minimize P1's profit. It is denoted as $v_1(p) = \min_q M(p, q)$.

If we assume that P1 wants to maximize his security level, he has to choose p^* that $v_1(p^*) \geq v_1(p)$ for all $p \in P$

If we denote $v_1(p^*)$ as v_1 , then

$$V_1(p) \leq v_1(p^*) = \min_q M(p^*, q) \leq M(p^*, q) \text{ for } q \in Q$$

Therefore, we know that if P2 doesn't choose well, P1 can still get higher than v_1 . Also, we know that V_1 is superior to $V_1(P)$ such that any selection of P that is not P^* does not always maximize the security level.

Minimizing Regret

Similarly, we can develop a concept for P2 that is called "regret." Regret indicates the revocation of security level. Just as in security level, where we want to make sure P1 is pursuing maximum security, in this case we are trying to let P2 minimize regret. If a player utilizes a strategy p , then P1 cannot have a return that is more than $v_2(q) = \max_p M(p, q)$

In order to minimize regret, we establish q^* such that $q^* = \min_q V_2(q)$. Since q is the choice P2 makes to minimize regret, we know that any other choice of q is going to make $V_2(q)$ larger than V_2 . Thus, we have inequality $V_2(q) \geq V_2(q^*) \geq M(p, q^*)$ for $q \in Q$.

Nash Equilibrium

A pair of actions (p', q') is said to be a Nash Equilibrium if they satisfy

$$M(p, q') \leq M(p', q') \leq M(p', q).$$

In this situation, neither player would have an incentive to change without knowing the other side's strategy.

Theorem: *For every two-person, zero-sum game, there exists an equilibrium strategy.* [6]

Proof: Map strategies (p, q) by transformation T such that $T(p, q) = (p', q')$.

Now, we need to define T as below:

$$c_i(p, q) = \begin{cases} M(a_i, q) - M(p, q) & \text{if } M(a_i, q) - M(p, q) > 0 \\ 0 & \text{otherwise} \end{cases}$$

$$d_j(p, q) = \begin{cases} M(p, q) - M(p, b_j) & \text{if } M(p, q) - M(p, b_j) > 0 \\ 0 & \text{otherwise} \end{cases} \quad [6]$$

From the definition above, we should be able to tell that c_i measures the improvement of P1 by switching his strategy from p to a_i . Similarly, d_j denotes the improvement of P2 by switching his strategy from q to b_j .

Noting that $T(p, q) = (p', q')$, we define a relationship between p and p' , and q and q' such that

$$p'_i = \frac{p_i + c_i(p, q)}{1 + \sum_{k=1}^m c_k(p, q)}$$

$$q'_j = \frac{q_j + d_j(p, q)}{1 + \sum_{k=1}^n d_k(p, q)}$$

After declaring the relationship between p and p' , q and q' , we need to examine whether this transformation is truly a valid transformation of probability. Since $\sum_{i=1}^m P_i = 1$, $\sum_{j=1}^n q_j = 1$, if $\sum_{i=1}^m P'_i = 1$, $\sum_{j=1}^n q'_j = 1$, this would be a valid transformation. In order to prove this, we have

$$\sum_{i=1}^m P'_i = \sum_{i=1}^m \frac{p_i + c_i(p, q)}{1 + \sum_{k=1}^m c_k(p, q)} = \frac{1 + \sum_{i=1}^m c_i(p, q)}{1 + \sum_{k=1}^m c_k(p, q)} = 1.$$

First, we want to know whether $T(p^*, q^*) = (p^*, q^*)$ when (p^*, q^*) are

optimal. As stated above, c_i measures the improvement of P1 by switching his strategy from p to a_i and d_j denotes the improvement of P2 by switching his strategy from q to b_j . Since they all measure the improvement and p^* and q^* are optimal strategies, no improvement can be made. Therefore, $p_i^* = \frac{p_i}{1} = P_i$. Similarly, $q_j^* = q_j$.

Since we have proven that when both p and q are optimal, $T(p^*, q^*) = (p^*, q^*)$, we need to prove that every fixed point offers an optimal solution. Suppose (p, q) is a fixed point. We first need to prove that there doesn't exist an i for $M(p, q) < M(a_i, q)$ for all i such that $p_i > 0$. This can be proven by contradiction.

$$M(p, q) = \sum_{i=1}^m p_i M(a_i, q) > \sum_{i=1}^m p_i M(p, q) = M(p, q) \sum_{i=1}^m p_i = M(p, q)$$

Therefore, for at least one $p_i > 0$, there exists $M(p, q) \geq M(a_i, q)$. Thus, $M(a_i, q) - M(p, q) \leq 0$. Since $C_i(p, q)$ is non-negative by definition, $C_i(p, q)$ and $\sum_{k=1}^m C_k(p, q)$ are both zero. Thus, we have shown that $M(p, q)$ is larger than $M(a_i, q)$ for all i . $M(p, q) \geq M(p', q)$ for all p' and for all q , so p is the optimal strategy against all q . Similarly, we can prove that q is the optimal strategy against all p . [6]

Last but not least, we need to prove that T has at least one fixed point. Since T is a continuous function that stretches from a Euclidean space into itself, it has at least one fixed point. Thus, the proof is complete.

Closing Remarks

In this essay, we have shown how a combinatorial lemma can be used to conduct other lemmas and theorems that are related to topology and game theory. Although we focus a great deal on how to prove these theorems and

lemmas, we haven't taken care of the application side of conceptual theorems such as Brouwer's Fixed Point Theorem and the Minimax Theorem to a more realistic context. Even though we investigate the problem of cake cutting and rental harmony, we have only proved the possibility of finding an optimal solution without further discovering how to find the exact value of such an optimal solution set when the conditions of the games are given. Therefore, in the future, I will further investigate how to apply the theorems and lemmas to more applicable ways such that the optimal strategy can be found based exactly on the input.

References

- [1] Goodrich, Michael. Proof of the Minimax Theorem.
<http://students.cs.byu.edu/~cs670ta/MinimaxTheoremProof.pdf>
- [2] Longueville, Mark De. *A Course in Topological Combinatorics*. New York, NY: Springer, 2013. Print.
- [3] Su, Francis. Geometric Combinatorics- Combinatorial Fixed Point Theorems I :Sperner's Lemma.
Available at <https://archive.org/details/lecture10584>
- [4] Su, Francis. Rental Harmony: Sperner's Lemma in Fair Division. *Amer. Math. Monthly*, **106**(1999), 930-942.
- [5] Wright, Alex. Sperner's Lemma and Brouwer's Fixed Point Theorem.
<http://web.stanford.edu/~amwright/BFPT.pdf>
- [6] Yerger, Carl. Math 384- Lecture 3: The Minimax Theorem.



On Anne Elliot's Rebellion:

New Women and New Marriage in *Persuasion*

Feng Ye

Author background: Feng grew up in China and currently attends Beijing National Day School. Her Pioneer seminar program was titled "Overview of Jane Austen's Works."

As the last published work of Jane Austen, *Persuasion* portrays a mature romance unparalleled by either Catherine Morland's intriguing and satirically adventurous love story or Elizabeth Bennet's lively relationship of twists and turns. The novel introduces us to Anne Elliot, a sensible and responsible young woman "with an elegance of mind and sweetness of character" (Jane Austen, 6), traits which are unarguably lovable. But questions remain as to whether or not Anne is an ideologically and politically valuable heroine. Many critics claim that besides her capacity for heartfelt romance, Anne poses few serious questions of social import. Lacking the outlook of a progressive rebel like that of Elizabeth Bennet's, Anne has sometimes been viewed as proof of Jane Austen's conservativeness. I believe that these views are outcomes of misinterpretation and failure to comprehend *Persuasion* in the proper historical context. However, *Persuasion* must be placed within the particular time period to which it belongs and considered in light of both modern

critics and those of Austen's time. Under this scrutiny, it is clear that Anne becomes a "new woman," developing an unconventional relationship that rebels against conservative views of women and marriage and becoming an advocate for social justice and equity.

Jane Austen lived in a crucial historical period abundant with controversies over "conservativeness" and "progressiveness." Women such as Mary Wollstonecraft stepped onto the stage of history, questioning conventions and traditions and advocating for women's rights. Even though Austen did not write feminist essays, her works are centered on women's social roles and matrimonial issues. Does Austen oppose women's subordinate role to men in her novels? If she does, does she highlight the problem sufficiently?

The discussion begins with a consideration of decorum and feminine gentleness. Many critics, Jacqueline Reid-Walsh, for example, assert that "women's physical and mental frailty, delicacy, and softness suggest otherwise" than women's being "equal companions to men" (Walsh, 216). Wollstonecraft also claims that "the soft phrases, susceptibility of heart, delicacy of sentiment, and refinement of taste, are almost synonymous with epithets of weakness, and that those beings who are only the objects of pity and that kind of love, which has been termed its sister, will soon become objects of contempt." However, while Austen puts Fordyce's *Sermons to Young Women* in Mr. Collins' hands, adding satiric color to conventional expectations of young women to be tender and proper ladies, she also creates characters like Anne, who, under no suspicion of criticism, bears a strong

resemblance to the feminine ideals of Fordyce's description. These apparently contradictory representations create confusion. Some say that "the tone of Jane Austen's criticism of her novel's father- and mother-figure—together with its fictional source, in the conscience of a selfless and dutiful daughter—belong to a familiar kind of conservative social comment" (Marilyn Butler, 284). Others strive to explain this seemingly paradoxical characterization, defending Austen against any accusation of conservative leanings.

Shaw thinks this "surrender" to convention "can be used to go beyond convention...it eases rather than blocks communication" (Valerie Shaw, 283). In other words, Jane Austen includes many traits of apparent subordination in her female characters in order to best address her audience by placing them in an environment they are familiar with and comfortable in. Johnson significantly points out that "the idea that great literature is genderless was entirely alien to Austen's [novels]" (Claudia L. Johnson, XXIII) and that Austen's sex played an important role in the whole issue. The Wollstonecraft scandal of 1798 was a huge shock, when, after Wollstonecraft's death, her husband Godwin revealed her "sexual improprieties and suicide attempts" (Johnson, XXIII). After that revelation, "Wollstonecraft was...branded as a whore and an atheist, and other women who dared to show sympathy with her ideas could not expect to escape calumny" (Margaret Kirkham, 49). Consequently, "moderately progressive novelists [were obliged] to appear more conservative than they really were" and they had to "smuggle in their social criticism" (Johnson, XXIII).

According to Johnson, those who wanted to criticize and invite reform without running the danger of being suspected “uppity and insubordinate” did so by creating “the freakish feminist,” who “espouses the feminist principles of the 1790s in a ridiculously caricatured form, and is duly mocked throughout the novel and contrasted unfavorably to modest and sensible young ladies” (Johnson, 19). I find this argument to be highly useful in thinking about *Persuasion*. In *Persuasion*, Louisa Musgrove is an example of this kind of character. Her over-valued firmness of mind and the nut¹ that Wentworth complimented are mocked when Louisa has her bad fall. Anne’s flexibility and sweetness, on the other hand, show her to be one of the “modest and sensible young ladies.”

But why is this discussion important? If Austen only writes domestic novels that describe trivially serene family scenes and simple romantic stories, why should we care if she is conservative or not? As it turns out, Austen’s subject happens to be essential to not only personal happiness but also national order during her time. Family had become “a basic political unit in its own right” (Johnson, 6) and “women’s lives already serves a political agenda;” “women’s education, their manners, their modesty, their reading, their opinions about personal happiness, their power of choice in matrimony, and their expectations from married life were all matters of

¹ The nut that Wentworth complimented: “...To exemplify, -a beautiful glossy nut, which, blessed with original strength, has outlived all the storms of autumn. Not a puncture, not a weak spot anywhere. - This nut, while so many of its brethren have fallen and been trodden under foot, is still in possession of all the happiness that a hazel-nut can b, while so many of its brethren have fallen and been trodden under foot, is still in possession of all the happiness that a hazel-nut can be supposed capable of.” (Austen, 103) The nut symbolizes firmness of mind and character.

increasingly anxious public concern” (Johnson, 2). Within this context, Anne and Wentworth’s relationship and the kind of companionship they appreciate become indicative of social and political issues beyond mere personal happiness. I will closely trace the development of Anne and Wentworth’s romance and discuss the relationship with respect to the historical stage the novel is presented on.

Anne and Wentworth’s romance endures much uncertainty and suffering. Eight years before their marriage, there had been a passionate engagement abandoned and two young hearts broken. Anne’s choice in yielding to Lady Russell’s advice is seen by some to be weak and made from filial obedience. Although at the start of the novel Anne thinks she “should have been a happier woman in maintaining the engagement” (Austen, 34), she later tells Wentworth that she was right in listening to Lady Russell because she would have “suffered in my [her] consciousness” (Austen, 291). Fordyce stresses that daughters should “do nothing to make them [parents] unhappy.” “When a daughter...disappoints the hopes she had raised; when she throws herself away on a man unworthy of her, or if disposed, yet be his or her situations unqualified to make her happy...her parents in any of these cases must necessarily suffer” (James Fordyce, 6-9). The resemblance of situation leads some to believe that “[Anne’s] statement suggests an absolute moral code modeled on the conduct books” (Walsh, 217) and that she is using conduct book phraseology when she tells Wentworth, “a strong sense of duty is no bad part of a woman’s portion” (Walsh, 218). This inconsistency is sometimes misunderstood to be enforcing a conservative

tone in accord with traditional filial duty. However, after closely examining the structure of the novel, I find that these seemingly contradictory languages actually point out something significant in the development of a new kind of romance.

The most obvious and essential difference between *Persuasion* and other Jane Austen novels is that *Persuasion* has the longest time span. Wentworth and Anne have not found any other people equal to each other in affection and bond, youthful love, or time apart, and therefore their mature romance can be studied as a whole, the evolving of a single relationship. Thus, the romance created in *Persuasion* contains the most growth; both the characters and the romance itself change significantly over time. The almost total narrative approval is given to the twenty-seven-year-old Anne rather than the Anne who is previously blooming but immature. Thus, to fully comprehend Anne and Wentworth's relationship as well as Anne's character development, we should consider Anne's opinion of filial duty and romance at different stages separately.

Filial duty was a major cause of Anne's breaking the engagement with Wentworth. However, the duty Anne assigns to herself is not the kind conservative social conventions invite. First of all, Anne's lack of regard for Sir Walter, her birth father, should not be overlooked. "What Mary Wollstonecraft had said about fashionable women as incapable of the one task allotted to them, the management of children, is here applied to a vain baronet, who cares more about his mirrors than his estate or his daughters" (Kirkham, 145). Obviously, Anne does not yield to such a vain parent as

Fordyce most probably would have advised. In *A Vindication of the Rights of Women*, Wollstonecraft makes a distinction between foolish parents and sensible parents; listening to parental advice blindly is “sheer weakness,” while obeying a parent after determining him or her to be someone who “sedulously endeavours to form the heart and enlarge the understanding of his child” is correct and humane. Given Wollstonecraft’s insight into filial duty, the advice of Lady Russell, who is Anne’s friend and near substitute for a mother, is surely worthy of serious consideration.

However, this doesn’t exempt Lady Russell from “err[ing] in her advice” (Austen, 291). Anne’s taking the advice proves not that she was conservative, but that she was immature at the age of nineteen. She had not had experience enough to understand how to open “her own definition of duty to include her own happiness” (Naomi L. Itokazu, 1) and to trust Providence instead of “being prudent... and self-denying...for his [Wentworth’s] advantage” (Austen, 16). Wentworth, at the same time, had misunderstood Anne, blindly labeling her with “weakness and timidity” (Austen, 72) while relying on luck in an impetuous manner. Anne herself later comments on her personal growth: “...but Anne, at seven and twenty, thought very differently from what she had been made to think at nineteen” (Austen, 34), and “had begun to learn that she and her excellent friend [Lady Russell] could sometimes think differently” (Austen, 172). Although she does not “blame herself for having been guided by her [Lady Russell],” Anne does reproach “such certain immediate wretchedness, such uncertain future good” (Austen, 34). When she says that she “should have suffered in my [her] conscience,” Anne

is referring to the younger Anne who emphasized “a strong sense of duty” (Austen, 291), not the more mature Anne, who decidedly and most happily accepts Wentworth’s second proposal before seeking support from either Sir Walter or Lady Russell. Her renewed independence is also illustrated by her refusing to marry Mr. Elliot, who is most cordially recommended by Lady Russell; she regards “marrying a man indifferent to me [Anne]” as a “risk” which makes “all duty violated” (Austen, 289).

The novel invites us to consider how Anne accomplished this transformation. It is significant to realize that the change Anne underwent was laborious, considering what most women characters in *Persuasion* were going through. Anne is right in saying that “...we [women] certainly do not forget you [men], so soon as you forget us...we live at home, quiet, confined, and our feelings prey upon us. You are forced on exertion... continual occupation” (Austen, 274). When men like Wentworth lose their women, they want “to be afloat again” (Austen, 51) and their suffering is effectively lessened, while women are permanently settled at home with few aids of exertion. Elizabeth, for example, can do nothing when Mr. Elliot, who supposedly would marry her for inheriting the Kellynch property, marries another woman for quick money. Gradually, she comes to see her life as full of “such the cares to alloy, the agitations to vary, the sameness and the elegance, the prosperity and the nothingness, of her [Elizabeth’s] scenes of life—such the feelings to give interest to a long, uneventful residence in one country circle, to fill the vacancies which there were no habits of utility abroad, no talents or accomplishments for home, to occupy” (Austen, 10).

Anne had shared the same problem eight years prior. "She had been too dependent on time alone; no aid had been given in change of place...or in any novelty or enlargement of society" (Austen, 33).

However, Anne did not yield. Anne's eagerness to escape her home, where she "was nobody with either father or sister" (Austen, 6) differentiates her from her sister and the old, dogmatic generation Elizabeth represents. Anne values being "thought of some use," is "glad to have any thing marked out as a duty" (Austen, 39) and endeavors to perform her abilities as much as possible. When traveling at Lyme, Anne took "all the toil of keeping up a slow and unsatisfactory correspondence with Elizabeth" (Austen, 126). After Luisa had the horrible fall, Anne acted proactively and rationally to be of use, giving practical suggestions and winning Wentworth's respect "as a proof of friendship, and of deference for her judgment" (Austen, 138).

Anne also seeks mobility. Shaw correctly claims that "the impulse is not towards stasis and calm, but towards movement and change" (Shaw, 301). "She [Anne] believed she must now submit to feel that another lesson, in the art of knowing our own nothingness beyond our own circle, was become necessary for her" (Austen, 49). Anne adores the Navy because she appreciates its distinct unsettled nature. The varieties in the Harvilles' small but comfortable and warm house, "with something curious and valuable from all the distant countries Captain Harville had visited, were more than amusing to Anne: connected as it all was with his profession, the fruit of its labours" (Austen, 116). When she had to go to Bath to reunite with her sedentary father and sister, Anne "entered it with a sinking heart,

anticipating an imprisonment of many months” (Austen, 160) and whenever her father and sister appear, Anne feels “an instant oppression” from the “heartless elegance of her father and sister” (Austen, 266).

Although Anne constantly tries to reach out and interact with society, *Persuasion* focuses more on Anne’s solitariness and her often sensitive meditations. Compared with other Austen heroines like Elizabeth Bennet and Marianne Dashwood, Anne lacks liveliness. In Butler’s opinion, this is another proof of weakness in Anne. “...Here Anne is before us, and no one else...The implication, as so consistently in the presentation of Anne, is that the senses have a decisive advantage over reason and fact” (Butler, 277). Shaw approaches the same question oppositely: “these ordeals,” instead of being a sign of Anne’s inability to be courageously progressive, are part of Austen’s writing device to reveal “the rampant selfishness of the societies they inhabit” (Shaw, 290-291). Sodeman innovatively looks at Anne’s improvement during the novel. When, near the end of the story, she can finally embrace her happiness and exultation in her solitariness, Anne finds “domestic pleasure within public space,” and begins perceiving “crowds as made up of acquaintances and of social networks to which she herself belongs” (Melissa Sodeman, 791). I agree with Sodeman’s interpretation. Lady Russell wishes Anne to “enter a state for which she held her to be peculiarly fitted by her warm affections and domestic habits” (Austen, 31). Anne does enter such a place. Her meditations, at first, are mainly inner sufferings from the inability to speak her feelings, but they gradually become rational interpretations of the situations she is in and enforce a sense of

warm domestic pleasure. Despite the Musgroves' occasional shallowness, Anne has come to like them for "a heartiness, and a warmth, and a sincerity which Anne delighted in the more, from the sad want of such blessings at home" (Austen, 260). At Lyme, Anne has to "struggle against a great tendency to lowness" (Austen, 115) when she thinks she has lost the sailor friends that she would have had were she married to Wentworth; once she does marry Wentworth, it is only reasonable to predict that Anne will find her surroundings full of friends and frank acquaintances who make her feel at home.

Anne's more significant growth is her new identity as a rational creature instead of being limited to narrow ideas about what it means to be a woman. She is able to make correct judgments, choose rationally, and go beyond being only a girl or a woman who has not mind and strength enough to act for herself without a man. "A rational creature" is a most uncommon and even rebellious role that the new women assigned to themselves in Austen's time and Anne's time². Despite "a false system of education, gathered from the books written on this subject by men, who, considering females rather as women than human creatures, have been more anxious to make them alluring mistresses than rational wives" (Wollstonecraft), many did expect women to be "rational creatures." "They must only bow to the authority of reason, instead of being the MODEST slaves of opinion... [and] acquire virtues which they may call their own, for how can a rational being

² Anne was born "August 9, 1787" (Austen, 3) and the narration takes place in 1814. Austen was born in 1775.

be ennobled by any thing that is not obtained by its OWN exertions” (Wollstonecraft)? Both Anne’s language and her conduct resonate with Wollstonecraft’s description.

But before examining Anne’s own growth, we should look at Mrs. Croft, who serves as a role model for Anne. She is full of life and has the type of confidence that Anne initially lacks. “Mrs. Croft, though neither tall nor fat, had a squareness, uprightness, and vigour of form, which gave importance to her person...Her manners were open, easy, and decided, like one who had no distrust of herself, and no doubts of what to do” (Austen, 56-57). When Wentworth claims that he does not want any woman on board of his ship, Mrs. Croft vehemently protests. “But I [Mrs. Croft] hate to hear you [Wentworth] talking so, like a fine gentleman, and as if women were all fine ladies, instead of rational creatures. We none of us expect to be in smooth water all our days” (Austen, 82). Her wish to be at sea and not in the “smooth water” of a domestic and confined life is very similar to what Anne desires. At the same time, Mrs. Croft is a woman with good manners and genuine frankness. Even when Mrs. Musgrove gives a narrative with “many undesirable particulars” and without any “advantage of taste and delicacy” (Austen, 271), Mrs. Croft is “attending with great good humour” and whenever she speaks, she does so “very sensibly” (Austen, 271).

Anne has an earnest wish to become a “rational creature” like Mrs. Croft. She hopes “to be wise and reasonable in time” (Austen, 210), and although she appreciates the young Miss Musgroves as “some of the happiest creatures of her acquaintance,” “she would not have given up her

own more elegant and cultivated mind for all their enjoyments” (Austen, 47). Anne’s rationality is first exemplified when she helps Lady Russell design a retrenchment plan for the financially endangered Kellynch estate. Despite her mild character and delicate manners, “every emendation of Anne’s had been on the side of honesty against importance. She wanted more vigorous measures, a more complete reformation, a quicker release from debt, a much higher tone of indifference for every thing but justice and equity” (Austen, 14). At Lyme, she recommends that the troubled Captain Benwick read something of reason other than sentimental poems. The works that Anne suggests are “such works of our best moralists, such collections of the finest letters, such memoirs of characters of worth and suffering...the strongest examples of moral and religious endurances” (Austen, 118). After Louisa’s incident, which is caused by a blind stubborn firmness of mind, Anne poses such a strong contrast as someone with real strength of mind that “Both [Charles Musgrove and Captain Wentworth] seemed to look to her for directions” (Austen, 130). Anne also shows “a quickness of perception... a nicety in the discernment of character, a natural penetration” (Austen, 294), qualities which Lady Russell does not possess. When others, including the usually perceptive Lady Russell, willingly receive Mr. Elliot’s compliments, Anne draws “a little back” (Austen, 167). Anne also gives Wentworth credit for being honest and frank. And when Wentworth is passionately giving the speech about the “nut” after listening to Louisa’s announcement of being always firm in character, Anne can rationally recognize the danger of not having “proportions and limits” when it comes to firmness of character and

the value of “a persuadable temper” (Austen, 137). According to Anne’s inner thoughts and conduct, we have every reason to believe that Anne’s continuous effort to follow Mrs. Croft’s example has made her indeed a “rational creature” with sense and delicacy on which even men rely.

But for women to be a “rational creatures,” especially after the scandal of Wollstonecraft broke out, they not only had to act rationally and effectively but also become “free agents... to frame their own desires and pursue happiness on their own terms, rather than be content as dutiful daughters or submissive wives” (Johnson, 15). Anne’s refutation of passivity is illustrated at the concert during which she becomes sure of Wentworth’s returned affection. “...and making a little advance, she instantly spoke. He was preparing only to bow and pass on, but her gentle ‘How do you do?’ brought him out of the straight line to stand near her” (Austen, 214). This proactive effort to seek conversation is a huge step that differs from Anne’s behaviors a few months earlier, when she kept all her longings to herself and suffered silently. A similar situation occurs when “by some other removals, and a little scheming of her own, Anne was enabled to place herself much nearer the end of the bench than she had been before, much more within reach of a passer-by” (Austen, 224). The supposed women’s role of waiting for man’s courtship and having only the right to refuse (as expressed in *Northanger Abbey*) is denied.

Thus, Anne earns the rekindled romance which will certainly be a perpetual source of happiness for her. But this romance, is a transformed and mature one, different from the “youthful infatuation” (Austen, 5) eight years

earlier. It has evolved into a companionate marriage with more equality and understanding of each other. Conventionally, men stand higher than women, commanding with an authoritative manner while women remain subordinate and intellectually inferior. As Anne herself says, "Education has been theirs [men's] in so much higher a degree; the pen has been in their hands." Men like Mr. Elliot "delighted in being asked, but he would not tell" (Austen, 221). Thus, Wentworth's dropping the pen is a significant symbol. In *Persuasion*, the ideal man, like Wentworth, yields some of his authority and the ideal woman, like Anne, is able to gain a voice and stand as a moral equal. Again, before discussing Anne and Wentworth's relationship, we should examine the Crofts, because they are obviously models for Anne and Wentworth. Wentworth respected them immensely: "The Crofts...were people whom her [Anne's] heart turned to very naturally" (Austen, 191).

The Crofts are "almost always together", which is "a most attractive picture of happiness to her [Anne]" (Austen, 198). Mrs. Croft has the kind of rationality that, previously mentioned, brings much stability to their marriage. When they are driving Anne to Uppercross after Anne's long walk with the Musgroves and Wentworth, Anne observes that Mrs. Croft takes command when they are in danger of a post. "...by coolly giving the reins a better direction herself [Mrs. Croft], they happily passed the danger" (Austen, 108). Meanwhile, Admiral Croft is happy to have a woman like Mrs. Croft to accompany him without feeling offended. When he shows Anne around the new Kellynch, he says that "...My wife should have the credit of them [the moderations]" (Austen, 149). To Admiral Croft, Mrs. Croft, who represents

the new women, is an indispensable partner in life. When walking alone, Admiral Croft asks Anne: “There, take my arm; that’s right; I do not feel comfortable if I have not a woman there” (Austen, 200). The Crofts are a team. “While we [the Crofts] were together, you know, there was nothing to be feared...as long as we could be together, nothing ever ailed me, and I [Mrs. Croft] never met with the smallest inconvenience” (Austen, 83). The Harvilles are very similar. Receiving the ill Louisa, “a look between him [Mr. Harville] and his wife decided what was to be done” (Austen, 131).

A companionate marriage is different from a relationship in which men and women have entirely the same responsibilities. Women are naturally more suited to domestic issues. When Wollstonecraft exclaimed that “Surely these weak beings [the conventionally subordinate women] are only fit for the seraglio! Can they govern a family, or take care of the poor babes whom they bring into the world?” she was, *de facto*, pointing out that women should be both physically and mentally strong enough to perform women’s domestic duties as mothers. Austen obviously agrees with this notion. When Mary complains that women have to take care of children while men can go out and meet interesting people, Anne says, “I [Anne] cannot wonder at your husband. Nursing does not belong to a man, it is not his province. A sick child is always the mother’s property; her own feelings generally make it so” (Austen, 66). Anne’s mother, Lady Elliot, has been a dutiful wife, who kept up “method, moderation, and economy” (Austen, 10). And Mr. Sheperd is right in saying that “A house was never taken good care of, without a lady” (Austen, 26). This agrees with the Crofts’ situation when they moved to

Kellynch. The new women are not supposed to be equal with men by taking over men's jobs. As Anne says, "you [men] are always laboring and toiling...it would be too hard indeed if woman's feelings were to be added to all this" (Austen, 275). Instead, they ought to have their importance as equal rational creatures established by proving their natural advantages.

Anne and Wentworth do create such a team as the Crofts'. Anne's tenderness and ability to make the right judgments and Wentworth's openness and courage complement each other and make their marriage as satisfactory as that of the Crofts. More importantly, it is a marriage of real happiness. When Mary announces that "...I [Mary] do not think any young woman has a right to make a choice that may be disagreeable and inconvenient to the principal part of her family," she is showing the essence of marriage in Austen's age: people marry to strengthen their families, not to find personal happiness. Anne most decidedly rebels against this presumption that society tries to impose upon her. She refuses to marry the wealthy well-established Mr. Elliot and chooses to marry Wentworth, someone with no titles or estates, for love. Anne's manners may be mild, but her feelings are unmistakably strong. She admires the "burst of feeling, warmth of indignation or delight, at the evil or good of others" (Austen, 190). For Anne, good company "is the company of clever, well-informed people, who have a great deal of conversation" (Austen, 176) and Wentworth certainly fits this description. And "...it would be an insult to the nature of Anne's felicity, to draw any comparison between it and her sister's; the origin of one all selfish vanity, of the other all generous attachment...her

happiness was from within” (Austen, 219). Even before Anne and Wentworth reunite, Anne is sure of the irreplaceable role they play in each other’s lives: “Their union, she believed, could not divide her more from other men, than their final separation” (Austen, 226). “As he [Wentworth] admits that his notion of ‘honourable toils and just rewards’ has been a little superficial, that he has not quite seen how Anne, in her much more restricted life, also deserves happiness, Jane Austen reaches a new point in her treatment of men and women as moral equals, no matter how different their lives and their opportunity of independent action” (Kirkham, 146). Unlike a conservative writer who, “presenting marriage as a social duty and not as a source of personal felicity...frowns on marriages of affection” (Johnson, 16), Austen praises Anne and Wentworth’s marriage of genuine affection and love.

Although having a relationship that develops gradually over time adds depth to both Anne’s marriage and her role as a “rational creature,” the extended time span and the laborious process Anne undergoes deprives *Persuasion* of the more lively and comic tone that Austen is otherwise famous for. Without imprudence and constant bursts of strong sentiments, Anne is the oldest and most mature of all Austen’s heroines, giving *Persuasion* an “autumnal tone.” As Shaw observes, “Verbal wit may be toned down, but possibly because Jane Austen wants to heighten social comment without coloring it too highly with satiric comedy” (Shaw, 282). Johnson has another explanation: “By centering her novel on a mature heroine, of course, Austen is free to explore female independence without

being obliged to explore the concomitant impertinence which always seems to accompany the self-assurance of younger heroines” (Johnson, 146). This is not necessarily a disadvantage. Walsh argues that “ultimately, the tone of *Persuasion* is not autumnal as has so often been claimed, but springlike in its return to the spirit of youthful love and intensity” (Walsh, 222). I, on the contrary, would argue that “the spirit of youthful love and intensity” is not so much a “return” as a refinement. Anne and Wentworth’s love was ignited, but this new love is more mature than their original love just as autumn is more mature than spring. Over eight years of separation, both have improved their understanding of romance.

The twenty-seven-year-old Anne sees how excessive and unnecessary her early caution has been: “How eloquent could Anne Elliot have been, - how eloquent, at least, were her wishes on the side of early warm attachment, and a cheerful confidence in futurity, against that over-anxious caution which seems to insult exertion and distrust Providence! – She had been forced into prudence in her youth, she learned romance as she grew older – the natural sequel of an unnatural beginning” (Austen, 35). Although Anne has lost her youthful bloom, she has cultivated a stronger mind and heart, which can now bravely trust Providence and instinct while remaining rational. Meanwhile, she has become more independent of Lady Russell. At the concert, though Lady Russell was present, “she [Anne] did not mean, whatever she might feel on Lady Russell’s account, to shrink from conversation with Captain Wentworth, if he gave her the opportunity” (Austen, 223). Anne has also learnt to have confidence in her own judgments

of people. "...she [Anne] was most thankful for her own knowledge of him [Mr. Elliot]...in that quarter of the mind which could not be opened to Lady Russell, in that flow of anxieties and fears which must be all to herself" (Austen, 250-251).

At the same time, Wentworth comes to understand Anne better. Anne's rational and practical conduct, especially when at Lyme, have, to some extent, guided Wentworth to grow. Previously, Wentworth "has persuaded himself that his confident will has enabled him to master the unruly elements of life because such mastery is the only way he can prove Anne Elliot wrong" (Kathryn Davis). But at Lyme, Wentworth "learnt to distinguish between the steadiness of principle and the obstinacy of self-will, between the darings of heedlessness and the resolution of a collected mind" (Austen, 286). At last, "her [Anne's] character was...fixed on his mind as perfection itself, maintaining the loveliest medium of fortitude and gentleness" (Austen, 285). Thus, Anne and Wentworth are "...more exquisitely happy, perhaps, in their re-union, than when it had been first projected; more tender, more tried, more fixed in a knowledge of each other's character, truth and attachment; more equal to act, more justified in acting" (Austen, 284).

Anne and Wentworth's marriage has far more important implications than their personal happiness. Wedded to a naval officer, without an estate or a house, Anne's destination is different from that of all other Austen heroines. "The years which bring the Admiral into prominence are those which mark off the disparity between the "old English style" of the senior Musgroves, and the "new" English style of their "accomplished" daughters"

(Johnson, 147). As a representative of a new time, Anne appreciates the way sailors gain their social importance: “The navy, I [Anne] think, who have done so much for us, have at least an equal claim with any other set of men, for all the comforts and all the privileges which any home can give. Sailors work hard enough for their comforts, we must all allow” (Austen, 22). Anne “gloried in being a sailor’s wife” (Austen, 298). These “defenders of the nation” “are envisioned as alternatives to, rather than representatives of, the establishment” (Johnson, 147). Furthermore, the Navy officers’ frankness and “warmth of indignation or delight” that Anne adores “threatens to explode the genteel reserve and false politeness that structures her social world” (Sodeman, 795). When she acknowledges “Admiral and Mrs. Croft as more worthy of Kellynch than the spendthrift baronet whose debts forced him to leave, Anne endorses a middle-class ethos in which one’s social position is earned rather than inherited” (Sodeman, 794). The fact that “Lady Russell and Mrs. Croft were very well pleased with each other” (Austen, 150) highlights the reconciliation between reasonable women from the traditional setting and pioneering women for a future of social justice.

Early in the novel, Anne Elliot, “with an elegance of mind and sweetness of character, which must have placed her high with any people of real understanding, was nobody with either father or sister: her word had no weight; her convenience was always to give way; she was only Anne” (Austen, 6). This first direct description of Anne Elliot gives her an embarrassing and slightly melancholic character profile. However, by the novel’s end, a mature “Anne” seems to invite matchless praise. Unlike her

families, who are obviously criticized because of their idleness and boredom, “Anne – who was not one of the ‘Marys and Elizabeths’ – strikes out on her own, with vigor, courage and determination, marrying one of the ‘coming’ men of England, and beginning a new family based on integrity, ambition and personal endeavour” (Eileen Sutherland, 61). Such “vigor, courage and determination” clearly speak against the traditional and oppressive social order that Sir Walter and Elizabeth Elliot represent. Although born in a dogmatic family, Anne educates herself to embrace an open and frank world, in which she and Wentworth complement each other to create a companionate marriage based on equality, understanding and great passion. Being rebellious, prudent and decorous at the same time, Anne Elliot is a model of the perfect woman for a new time.

Works Cited

Austen, Jane. *Persuasion*. Penguin Group, 2006. Print.

Butler, Marilyn. *Jane Austen and the War of Ideas*. Oxford: Clarendon, 1987. Print.

Davis, Kathryn. "Austen's "providence" in *Persuasion*." - *Free Online Library*. *Persuasions: The Jane Austen Journal*, 1 Jan. 2013. Web. 12 Sept. 2014.

Fordyce, James. *Sermons to Young Women*. Philadelphia: M. Carey, 1809. Print.

Johnson, Claudia L. *Jane Austen: Women, Politics, and the Novel*. Chicago: U of Chicago, 1988. Print.

- Kirkham, Margaret. *Jane Austen, Feminism and Fiction*. Sussex: Harvester, 1983. Print.
- Shaw, Valerie. "Jane Austen's Subdued Heroines." *Nineteenth-Century Fiction* 30.3, Jane Austen 1775-1975 (1975): 281-303. *JSTOR*. Web. 12 Sept. 2014. <<http://www.jstor.org/stable/10.2307/2933071?ref=no-x-route:f95c5d82c09830d5868662bef583c8b3>>.
- Sodeman, Melissa. "Domestic Mobility in *Persuasion* and *Sanditon*." *SEL Studies in English Literature 1500-1900* 45.4 (2005): 787-812. Web.
- Sutherland, Eileen. "The Rise and Fall of the House of Elliot." *Jane Austen Society of North America Persuasions* #15 (1993): 57-62. Web.
- Walsh, Jacqueline Reid. "'She Learned Romance as She Grew Older': From Conduct Book Propriety to Romance in *Persuasion*." *Jane Austen Society of North America Persuasions* #15 (1993): 216-25. Web.
- Wollstonecraft, Mary. *A Vindication of the Rights of Woman*. N.p.: The Project Gutenberg Etext, n.d. EPUB.
- Itokazu, Naomi L., "Duty and Feminist Narration in Austen's *Persuasion*"(2011). *Research Papers*. Paper 139. http://opensiuc.lib.siu.edu/gs_rp/139



On the Relationship Between Biology and Ethics

Angela Liu

Author background: Angela grew up in Taiwan and currently attends Pacific American School in Hsinchu, Taiwan. Her Pioneer seminar program was titled "Science, Technology and Society."

The relationship between biology and ethics has been a turbulent one since the beginning. Racked by dissent between those who believe in human uniqueness and those who support evolutionary biology, the age-long conflict is still distinctly persistent, albeit countless attempts to bridge the two disciplines. Even among those who stand with the sciences at the great rift that separates the two, there exist vastly different opinions on the relationship between biology and ethics. Despite their shared belief that human nature is nothing but a composition of its most fundamental elements, E. O. Wilson, Richard Dawkins, and Stephen Pinker have contrasting views on human nature and its implications for morality. Wilson argues that ethics are human contrivances, while, on the other hand, Pinker argues for the direct opposite, stating that ethics are derived from moral facts and are independent of human judgment and beliefs. Although Dawkins shied away from explicitly advocating a morality based on evolution, one can infer from his arguments that morality, especially altruism, is just gene-selfishness in disguise. Last, but not least, Midgley, unlike the others, opposes the idea of reductionism and argues that there is more complexity to human nature. Ever the most distinct of the four, she states that human morality arises from human freedom and from an individual's awareness of his or her conflict of motives. The four divergent perspectives can be distinguished through their

differing opinions on five themes—their attitude towards human nature, their definition of the different ethical perspectives, their view of the origin of ethics, the problems that arise from the conflicts, and the proposed solutions to these problems.

Defining human nature is one of the most sensitive processes in that its implications affect humanity as a whole and point out the purpose of our existence, if there is any in the first place. As a result, many tread lightly while discussing this subject, but there are many who are not afraid to present more unprecedented views. E. O. Wilson and Stephen Pinker have fairly similar perspectives on the subject of human nature. Both take a particularly scientific approach in explaining the human being, which is no surprise given that Pinker is a renowned evolutionary psychologist while Wilson, in his book *Consilience*, argues for a unification of knowledge through evolutionary biology. They seek to define human nature as products of our body and its functions, and at the same time, argue against the equally widespread belief that places humans on levels higher than all other living creatures on the planet. As Pinker puts it, all who are educated

know that perception, cognition, language and emotion are rooted in the brain. But it is still tempting to think of the brain...as a control panel with gauges and levers operated by a user – the self, the soul, the ghost, the person, the 'me.' But cognitive neuroscience is showing that the self, too, is just another network of brain systems.

(42)

Arguing against dualism, Pinker seeks to unite the human mind with the human body. Nonetheless, Pinker and Wilson both argue against genetic determinism, stating that although humans are predisposed to act in accordance with their “gene-based epigenetic rules” (Wilson 181), it would be wrong to jump to the conclusion that humans are rigidly programmed to be that way and can never escape their genetic shackles.

Richard Dawkins, while also supporting a scientific explanation of the human being, gives an entirely different argument. To him, the gene is the center of natural selection and of evolution, and so of course it would be appropriate to suggest that human nature is also dependent on the gene. However, Dawkins focuses on one particular characteristic of the gene—its selfishness. He argues that “a predominant quality to be expected in a successful gene is ruthless selfishness” (2), and since “we [human beings], and all other animals, are machines created by our genes” (2), human nature, as a result, tends to reflect selfishness. Nevertheless, like Pinker and Wilson, Dawkins shuns genetic determinism, insisting that just because genetic composition results in a propensity towards selfishness, that does not mean that there is no choice but to succumb to it. Humanity, he declares, is still salvageable.

Unlike the perspectives mentioned above, Mary Midgley’s view of human nature leans toward a human uniqueness that sets our species apart from the others. Midgley argues against Wilson that there is more to human nature than just electrical signals in the brain; “[Wilson] is plainly wrong...in supposing neurobiology to be the only source...we find out about human nature from a thousand sources, most obviously from everyday life and from history” (73). Humans, she contends, are unique in that they are much more aware of their individuality and their surroundings than other animals, and thus, human behavior is more than just animal impulses.

While the arguments are centered mainly on one overarching problem, different perspectives towards the gap between the sciences and the humanities have developed. Wilson defines the conflict between science and culture, specifically evolution and ethics, as one between empiricists and transcendentalists. Transcendentalists are those who believe that ethics and

moral guidelines exist independent of the human mind. This position is often tied to supporters of the humanities and particularly to religion, as most advocate a set of rules established by a deity that all those who follow the religion are expected to obey and respect. Empiricists, on the other hand, argue that ethical precepts are contrivances of the human mind, and have been established through natural selection of different cultures that exalt different moral principles. Empiricists are often referred to as the scientists of the debate and insist that the “accumulation of objective evidence” is what is needed to reach the “true answer” of the origin of ethics. Midgley lays out the problem similarly, interpreting it as a conflict between reductionists and obscurantists. The goal of the reductionists, as Midgley puts it, is to “unite humans to the rest of the biosphere by...paring all human peculiarities down to a size which fits easily into the supposedly universal evolutionary pattern” (5). They started, following English philosopher Thomas Hobbes’ lead, with the advocacy of self-interest as the main driving force behind human nature and behavior, but have since moved on to gene-selfishness, of which Dawkins is a huge supporter. Midgley specifically calls out their pleasure in shocking others with “the truth” and sounding “harsh, strident and paradoxical” (5) because, according to her, they see these qualities as marks of realism. They are like Wilson’s empiricists, the ones who believe in evolution and its ability to explain human nature. Midgley’s obscurantists, who closely resemble Wilson’s transcendentalists, stress “mystery and discontinuity with other species” (6), and were formed in direct response to the reductionists’ attack on the sacredness of human nature. And because of this, their tone is often “grieved, parental, mature, concerned, in fact genuinely outraged.” (6) However, Midgley specifically states that the reductionist and the obscurantist views are not direct reflections of the

conflict between scientists and Christians, respectively, for there are many who argue for the reductionist position that are not affiliated with the sciences and, similarly, there are many who argue in favor of the obscurantist view that are not religious.

Dawkins' conflict is mainly focused on "the erroneous assumption that the important thing in evolution is the good of the species (or the group) rather than the good of the individual (or the gene)" (2). The distinction between group selection and individual selection, he argues, is one that many educated scholars often miss. However, the two positions have differing implications that hint at differing views of human nature. The debate is centered on two values—altruism and selfishness. According to Dawkins, an entity is said to be altruistic if it "behaves in such a way as to increase another such entity's welfare at the expense of its own" (4), and selfish if it behaves oppositely. Group or species selection suggests that humans are innately less selfish, or even selfless, because natural selection between species has benefited the groups that are composed of selfless individuals, for together, they work towards the good of the whole species. However, individual or gene selection argues that human nature, on a very basic level, tends to be selfish because in an environment filled with individuals, it is the selfish ones that survive and produce offspring, for the selfless ones have sacrificed their lives for the good of the group.

Pinker presents three different views of human nature that have been presented and supported by philosophers both in the past and in the present. The first is the Blank Slate, introduced by John Locke, which corresponds to empiricism (in its objective definition, different from Wilson's empiricism) and compares the mind to a blank sheet of paper. It argues that at birth, the mind is clear of ideas and is later on molded by environment and experience,

which helps explain why people view and experience the world differently. The Ghost in the Machine, synonymous with dualism, was suggested by Rene Descartes. It postulates that the mind and body are separate entities because while the body can be separated and still exist, the mind is not divisible. Finally, the Noble Savage was the contrivance of Jean-Jacques Rousseau, which “captures the belief that humans in their natural state are selfless, peaceable, and untroubled, and that blights such as greed, anxiety, and violence are the products of civilization” (6). This view most reflects that of the romanticist and has an extremely optimistic view of human nature, placing the blame for the wrongdoings and blunders of humanity on society as opposed to innate human characteristics.

The origin of ethics, arguably, is one of the most controversial topics in that it has huge implications for human nature and is one of the most essential connecting points between science and the humanities. Fathoming the origin of ethics would bring us one step closer to the union of the two fields and hopefully facilitate the process. In this sensitive attempt at consilience, Wilson takes the stance of the empiricist as opposed to the transcendentalist. Here, he argues that ethics are by definition “conduct favored consistently enough throughout a society to be expressed as a code of principles” (262), all the while being driven by hereditary dispositions. Ethics rose from evolution, and were created from the bottom up—from the people to their culture—as a necessary device of survival in social organisms. Individuals are first biologically predisposed to make certain choices, then gradually, cultural evolution and natural selection hardens some of these choices into precepts. Some of these precepts are then, in turn, hardened into law, and if they are strong enough, they become a supreme principle, a belief in the command of, or the natural order of, the universe.

As an example, he discusses the ethical precept known as sacrifice. Sacrifice, he claims, arises when acting disadvantageously and submitting oneself to the needs of the group is more than offset by the personal advantages gained by the group as a result. In the long run, groups of selfish people who at first seem to have the advantage are replaced by those who ensure the prosperity of their group by adopting selflessness instead of selfishness when at a crossroads. This, in turn, gave rise to the ethical precept of selflessness and sacrifice. And so ethics is “not the translation of human nature but of public will” (274); it is not predetermined, but is instead a product of choices and natural selection—a contrivance of humanity.

Although Dawkins articulates that he does not argue for a morality based on evolution, the implications of his arguments point somewhat in this direction. However, instead of discussing all moral guidelines, he specifically focuses on two—selfishness and altruism. As he justifies his gene-centered view of human nature, he explicitly states that “both individual selfishness and individual altruism are explained by the fundamental law that I am calling gene selfishness” (6). He then defines altruism as behavior that increases another entity’s chances of survival at the expense of one’s own, and selfishness as the exact opposite. In opposition to Wilson’s argument, Dawkins states that natural selection does not favor true altruism, but instead, favors selfishness disguised as altruism as well as selfishness in and of itself. An example that he offers is “kin altruism,” which is when a gene assists replicas of itself that are sitting in other bodies. This, at first glance, may seem like genuine altruism, but with closer scrutiny, turns out to be brought about by gene selfishness.

Midgley, surprisingly, takes a slightly more “scientific” view when discussing the origin of ethics. She praises Darwin, agreeing with his “more

realistic derivation of morality as a response to natural conflicts of motive,” which are “continuous with the responses of other animals” (20), since humans, as mammals, often experience conflicts similar to those of other animals. However, what sets us apart as human beings is freedom as well as our awareness of our conflicts of motives. She then goes on to suggest that our feelings also play an important role in forming our morality and should be taken seriously, but at the same time, warning that they are not infallible guides.

On the other hand, Pinker steps away from the evolutionary perspective and, instead, stands at the opposing pole to Wilson by supporting moral realism. Comparing moral realism with the notion of numbers, Pinker argues that the fact that the concept of morality and ethics was developed through evolution should not undermine the credibility of its existence. He maintains that moral facts and moral values exist and are independent of human perception of said beliefs: “no creature equipped with circuitry to understand that it is immoral for you to hurt me could discover anything but that it is immoral for me to hurt you” (193). The world presents individuals with scenarios in which it is better, in the end, for both parties to act in the interests of the established ethical precepts than not. Pinker also claims that morality is intrinsic, and that “a moral sense is part of the standard equipment of the human mind” (193).

As always, the irreconcilability of two perspectives or matters leaves conflicts trailing in its wake. The split between science and humanities behaves no differently. However, these conflicts, again, are subject to differing opinions and perspectives on their importance as well as their nature. To Midgley, “reductivism,” which is the oversimplification of human nature and the human processes, poses one of the greatest threats to the

understanding of the human being as a whole. Human motives, she stresses, are too complicated to be explained by an underlying structure and any attempt at oversimplification only serves to distort the facts, as is the case of reductivism, which she argues, is simply not realistic. In clarification, reductivism is a general term that applies to any form of oversimplification that refers not only to the reductionist view, but also to the obscurantist view—a view that stresses mystery and discontinuity with other species. Midgley argues that the obscurantist view is also reductivist, and therefore incomplete, because it focuses only on discontinuity with other species of animals and not enough on our biological nature. She also argues that one of the most serious mistakes of reductivism is “the territorial claim that this whole topic [on human nature] belongs not to ordinary people, but to experts ...one that dismisses the concepts by which we normally live as mere ‘folk-psychology’” (12). By categorizing human nature as something only to be discussed by scientists, the so-called ‘experts’ automatically close the subject to the obscurantist view, which then leads to reductivism that errs on the reductionist side. Pinker also places the blame on all three perspectives of the conflict that he proposed, and argues that people should start to recognize differences in other individuals instead of placing the responsibility for the construction of individual characteristics on what he calls the “official theory”—the Blank Slate, the Noble Savage, and the Ghost in the Machine. He complains that the Blank Slate model of human nature “perverts education, childrearing, and the arts into forms of social engineering” and is an “anti-life, anti-human theoretical abstraction that denies our common humanity, our inherent interests, and our individual preferences” (421). Of the Ghost in the Machine, he argues that it “threatens to outlaw biomedical research that could alleviate human suffering” (421),

referring to examples such as bans on stem cell research. Last but not least, the Noble Savage "invites contempt for the principles of democracy and of 'a government of laws and not of men'" (421) because the blame for all problems that have arisen in society is then placed on society itself, which in turn, seems to advocate for anarchy, or a return to a state in which democracy and society are nonexistent. The consequences, of course, would not be pretty. None of the three theories, Pinker contends, should be used to define human nature, individual character, or ethics because all three are fatally flawed. Although not explicitly stated, Dawkins hints that one of the problems that would arise from accepting a human nature based on gene selfishness is the propensity for individuals to turn to genetic determinism and succumb to its implications. Since human beings are supposedly innately selfish creatures because they are machines built by naturally selected selfish genes, many may think that it is inevitable that all humans will, in the end, turn out to be selfish creatures despite all attempts by culture and education to turn them away from such outcomes. Wilson, always the empiricist, argues that the troubles in society are caused by the rift between moral reasoning and science. "Both ethics and political science lack a foundation of verifiable knowledge of human nature sufficient to produce cause-and-effect predictions and sound judgments based on them" (278), he argues, explaining why political science, which he defines as "the study of applied ethics," is so problematic. He then goes on to blame the little progress that we have in consilience on the nature of human beings, stating that people are inclined to resist biological explanations, or as Midgley would put it—reductionist explanations, and so the application of science to the humanities on a large scale has yet to occur.

It would be foolish to discuss the problems but not its solutions or its implications, for often it is by the solutions one proposes that others judge one's arguments. Wilson calls for consilience between the humanities and science on the basis of evolutionary biology. He argues that the split between moral reasoning and science can be understood if one pays attention to the definition, genetics, development, and history of moral sentiments, and when that is done, the "true origin and meaning of ethical behavior may come into focus" (279). Wilson firmly believes that in the end, when all is said and done, science will triumph over the humanities in their attempts to unify the two disciplines. However, he also recognizes the importance of the humanities and religion to human beings, and encourages people not to abandon their religions and traditions, but in the process, not to forget that humans are biological creatures through and through. Midgley, on the other hand, urges others not to succumb to reductionist views and, instead, to take both angles—reductionist and obscurantist—seriously for both are needed to find the right explanation that does not ignore or twist facts in its attempt to illuminate the bridge between science and the humanities. She argues that there can be more than one way of describing something, "all of which...are legitimate in their own terms, can be usefully related, and do not need to be reduced to one another" (63). This solution, then, does not choose between two differing perspectives, like that of Wilson's, but seeks to combine two opposing views to find the bridge between the two unlikely proponents of each other, for both are needed in a complete explanation of human nature. Dawkins addresses the issue of genetic determinism in a society susceptible to gene-selfishness by arguing that we should not surrender to our predisposition, and that we should work against it. He advises to first learn about gene-selfishness and its implications so that it can be understood

clearly, then to “upset their [the genes’] design” (3) and work against it so that society will not be overrun by selfishness. In other words, expect selfishness but “teach generosity and altruism” (3) so that society may still stand and not fall victim to genetic predispositions. Like Wilson, Pinker stresses the need to join biology and culture, but unlike Wilson, he reveals that bridges between the two disciplines are already being created. Cognitive science, neuroscience, behavioral genetics, and evolutionary psychology are all slowly chipping away at the barrier that stands between science and the humanities, and once these subjects are mature, the barrier will fall away, and the centuries-old conflict between philosophers and biologists will finally be resolved. At this stage, the dominant theory will not be the Blank Slate, the Noble Savage, or the Ghost in the Machine, but instead, consilience will rest soundly on the prospect of evolutionary psychology.

After a century and a half of struggle to resolve the division between science and the humanities, we are still, arguably, not much closer to consilience than we were at the beginning of the conflict, for as science develops, there will inevitably be new discoveries that will force old theories into exile and oblivion. But whether the marriage of the two fields comes in the near future or centuries from now, one thing is certain—consilience will be the biggest step in knowledge our species has yet to take.

Bibliography

- Dawkins, Richard. *The Selfish Gene*. Oxford: Oxford UP, 1989. Print.
- Midgley, Mary. *The Ethical Primate: Humans, Freedom, and Morality*. London: Routledge, 1994. Print.
- Pinker, Steven. *The Blank Slate: The Modern Denial of Human Nature*. New York: Viking, 2002. Print.

Wilson, Edward O. *Consilience: The Unity of Knowledge*. New York: Knopf, 1998. Print.

Wilson, Edward O. *On Human Nature*. Cambridge: Harvard UP, 1978. Print.



An Overview of the Brazilian Economy: 1979-2014

Luccas Borges

Author background: Luccas was born in Brazil, grew up in Malaysia, and currently attends Lincoln Park High School in Chicago, IL. His Pioneer seminar program was titled "An Overview of the U.S. Macro-Economy."

Abstract

This paper gives an overview of Brazil's recent economic history, highlighting major economic characteristics, and analyzing its trends. Even though Brazil's economy has struggled historically, it has shown tremendous improvement since 1994. However, the current recession raises questions about its capacity for continued success. The level of education among its people is growing, and its exports are diversified. Brazil has already shown that it is capable of remarkable economic recoveries, and now we will wait to see whether or not President Rousseff will enact new policies that will lead Brazil into another phase of economic prosperity.

I. Introduction

Alex is a typical eleven-year-old boy of European descent living in a modern, upscale, five-bedroom apartment that cost his parents the equivalent of \$2.9 million. He attends one of the premier private schools of the region and expects to study at a top university. He always has the latest and greatest soccer equipment, from brand new shoes to original jerseys of his favorite professional team, and he trains with the academy of one of the many local soccer teams. He has never had to worry about his family's finances as his mother is a respected doctor, and his father is a manager in a bank in the

country's growing financial sector. They often travel internationally and always have at least one domestic worker at home to take care of the house and Pedro's younger sister. The family frequents a Catholic church on Sundays, and they often visit their local museums and art galleries. In the recent election, his parents were one of the supporters of the social democrat Aécio Neves, who represented a more centrist party, promising fiscal policies favorable to business.

Gabriel is also a typical eleven-year-old boy of African descent, however, he lives in a small makeshift shack with his five siblings. The walls have innumerable cracks and are made of whatever bricks were left over from nearby construction sites. The roof is made of a thin metal and is virtually useless once it begins to rain. Air conditioning is a foreign concept. Televisions and computers are seen as objects of extreme luxury for the rich people of the world. His community is constantly plagued by violence and crime, and his uneducated mother finds work whenever she can, whether it is as a domestic servant or factory worker. His father abandoned him when he was young, and he has been expected to help provide for the family from the moment he enrolled in school. His public school is severely underfunded and has low standards of education. Because of his experiences at home and at school, Gabriel has developed no ambitions of going to college. He has never owned a pair of soccer shoes and the only jersey he wears was found outside a local restaurant. Despite its baggy fit, tattered condition, and perpetual uncleanliness, he cherishes it and dons it often. Nevertheless, he has a relentless passion for soccer and enough talent to rank him as one of the best eleven-year-olds in the city. Every day he plays barefoot on the street, using rocks to mark the goals, and on Sunday mornings, he goes with his entire family to the Catholic church. In the recent Presidential election,

his parents voted initially for Marina Silva of the Socialist party, and then for Dilma Rousseff in the runoff because of their promises to help the masses.

These two boys represent the two poles of modern society in Brazil, the extremely wealthy and the very poor. However, they do not live on different continents or even different cities. They both reside in Sao Paulo, the biggest city and financial capital of Brazil. Moreover, their homes are within walking distance from one another, and they often play street soccer together. They attend the same church, and regularly interact, harboring minimal contempt for the other.

While this may be a hypothetical example, it is certainly feasible not only in Sao Paulo but many Brazilian cities. Moreover, it also portrays ubiquitous facets of Brazilian society as a whole. They represent the contribution of immigrants to the economy as well as the widespread Catholicism that brings them together. They also portray the growing successes of the economy and upper class while the poor continue to suffer in the slums, or *favelas*, where crime, drugs, and violence are commonplace. This also drives the varying political beliefs among societal classes and their support of different parties. On the other hand, soccer remains extremely popular across all social classes and regions, serving to unite the people with a common passion. The two boys also illustrate how Brazil is becoming more and more similar to developed western countries such as the United States and Great Britain. The products that are available, the jobs that are being created, the educational system, and the economic structure are all developing similarly to those in the developed world.

The purpose of this paper is to give an overview of Brazil's recent economic history, highlighting major economic characteristics and analyzing trends and their impact on the future of Brazil's economy. Even though

Brazil's economy has struggled historically, it has shown tremendous growth for the past twenty years. However, now it is in a recession that leads us to question whether Brazil's success can continue or if it has already peaked. We proceed by giving an overview of Brazil's geographic and political attributes, as well as background on the country's resources and demographics. Then we will briefly discuss the economic history from 1822, before analyzing the economic struggles of 1979-1993, as well as the plans for reform and the events of 1998-2001. We will continue by investigating the increased economic success from 2002-2008 and Brazil's reaction to the world recession of 2008-2012 before ending with an evaluation of the current situation, education's progression, and the potential economic outlook over the coming years.

II. Geopolitical Overview

Located along the Atlantic coast of South America, Brazil is the fifth largest country in the world and sixth most populous with approximately 202.6 million inhabitants (CIA, 2014). It is also the 7th largest economy in the world, with a GDP of 2.253 trillion US dollars (World Bank, 2014). Its population is 47.7% White, 43.1% Mulatto, 7.6% Black, 1.1% Asian, and 0.4% Indigenous. The population growth rate is quite low at 0.8%, which ranks as 137th worldwide. Portuguese is the official and most widely spoken language, though Spanish is common especially around the borders with other Spanish-speaking nations. 64.4% of the population is Roman Catholic, and 84.6% of the population lives in urban areas, with an additional 1.15% urbanization rate. A city of 3.8 million people in central Brazil, the capital is Brasilia, while São Paulo is the financial capital, with a population of 19.9

million. The most popular tourist destination is Rio de Janeiro, a city of 11.96 million located on the Atlantic coast (CIA, 2014).

The climate is tropical in most areas, and natural resources are plentiful. The Amazon Rainforest in Brazil's northeast possesses extreme biological diversity as well as resources such as timber. Only 19.6% of electricity is generated with fossil fuels while 71% comes from hydroelectric plants. On the other hand, Brazil is the world's 11th largest crude oil producer at 2.6 million barrels per day. In regard to transportation, Brazil has the 2nd largest number of airports in the world, 4th most roadways, and 3rd most waterways (CIA, 2014).

Officially known as the *Federative Republic of Brazil*, it has a federal republic form of government divided into 26 States. It gained independence from Portugal on September 7th, 1822, and has a civil law code, which was updated in 2002. The latest constitution was passed in 1988. From age 16-18 and above 70, voting is optional, though it is compulsory for ages 18-70. Military conscripts cannot vote. For executive office, officials are elected for four-year terms and there is a two-round election system if absolute majority is not achieved in the first round (CIA, 2014). In the previous election of 2010, the first round had nine candidates from different political parties running for President. Since none achieved majority, the two candidates with the most votes faced each other in a runoff election. Eventually Dilma Rousseff of the left wing Workers' Party was elected President (BBC News, 2012). In the most recent election, the incumbent, Dilma Rousseff, and her most prominent challenger, Aécio Neves, gained the most votes during the first round on October 5, 2014. In the runoff election on October 26, Dilma Rousseff was elected President, by a margin of approximately 3.2% (Elizondo, 2014).

III. Brief Economic Overview (1822-1979)

Originally established as a Portuguese colony, slavery was a vital component of Brazil's economy for most of its history (CIA, 2014). It was largely agricultural as well, producing great quantities of coffee and sugar cane. Even though slavery was abolished in 1888, by 1902, Brazil produced 65% of the world's coffee (World Bank, 2014). Brazil's south and southeastern areas benefitted most from this, and even today are the most successful economically. The northeast stagnated, while the Amazon basin prospered during the rise of rubber, producing large amounts of rubber for exports (BBC News, 2012).

During the 1930s the great Depression had deep economic impacts on Brazil by reducing the demand for coffee upon which its economy was based. Overproduction became a huge problem, as the price of coffee fell 50% between September 1929 and January 1930. The economy recovered gradually as World War II started and the country began industrializing as well. After the end of the War, it implemented a policy of import substituting industrialization to prevent extreme dependence on foreign products (BBC News, 2012). This diversified the economy and laid the foundation for future economic growth.

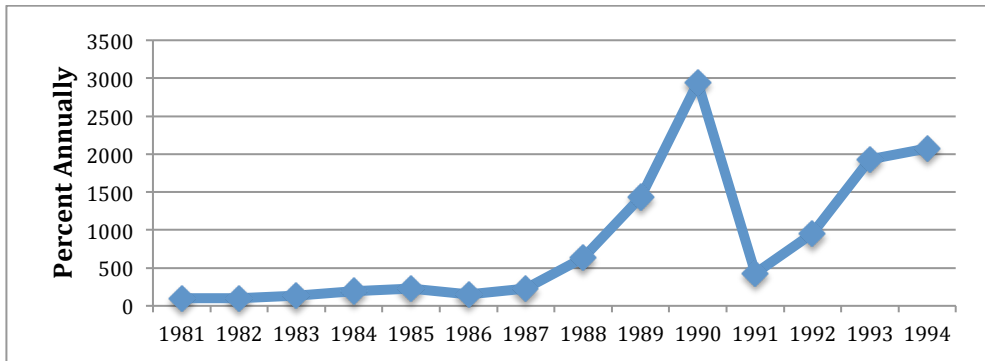
Brazil experienced tremendous economic growth during the 1960s and early '70s until the first oil crisis of 1973. Between 1960 and 1973, the average GDP growth rate was 7.63% and economic indicators were all positive. However, by 1973, it imported approximately 80% of its oil, and because of the crisis, the price of imports doubled from "USD 6.2bn in 1973 to USD 12.6bn in 1974" (BBC News, 2012). In response, Brazil was forced to borrow large amounts of money to prevent further harm to the economy.

Nevertheless, the GDP growth rate dropped 4 percentage points in a single year (World Bank, 2014). This foreshadowed issues that would come back to haunt the Brazilian economy in the 1980s and '90s.

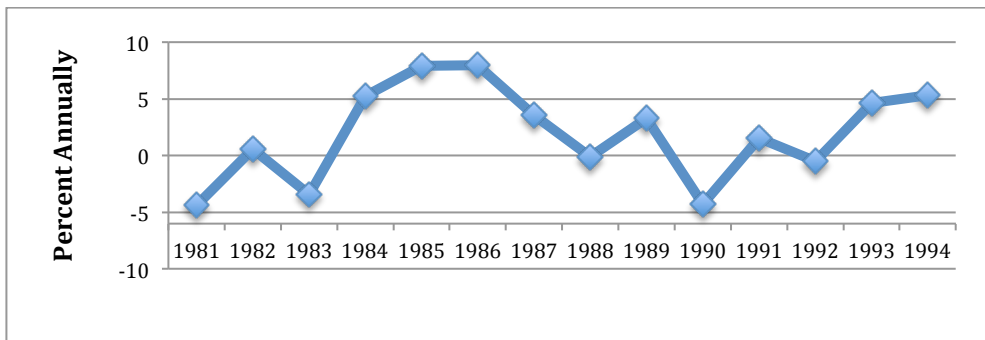
IV. Economic struggles of 1979-1993

The biggest issues between 1979 and 1993 were the large amounts of foreign debt, and the hyperinflation that followed. The second Oil Crisis of 1979 caused a further worsening of Brazil's terms of trade, and worse still was the rise of global interest rates (Country-Data.com, 1997).

Immediately after the oil crisis, the GDP growth rate remained high, at 9.11% in 1980; however, this was in large part due to the immense amounts of borrowing done by the Brazilian government (World Bank, 2014). Once the global interest rates peaked and lending tightened, the aftermath of the crisis caught up with the Brazilian economy. Inflation was incredibly high, at 101.7% annually, and the GDP growth rate fell by nearly 15 percentage points to -4.39% in 1981. Throughout the 1980's, GDP gradually recovered, and by 1994, it averaged 2.45% annual growth (World Bank, 2014). Yet this was not the recovery it seemed to be, as it was mostly because of increased loans taken by Brazil from various sources, including the IMF and World Bank (Country-Data.com, 1997). As a result, inflation averaged 878.78% annually over the same time frame (World Bank, 2014).

Figure 1: Inflation between 1981 and 1994

Source: World Bank World Development Indicators

Figure 2: GDP Growth Rate between 1981 and 1994

Source: World Bank World Development Indicators

The economy struggled and growth virtually stopped. In 1987, Brazil was unable to make payments toward its debt, and as such, inflation spiked and public debt had to be rescheduled (Loman, 2014). The hyperinflation affected the poor most of all, and prompted several attempts to lower the inflation rate.

V. Failed Plans for Reform

It was clear that something needed to be done about the extremely high inflation rates, and each of the political groups had a different belief as to how to proceed.

José Sarney, of the Social Democratic Party, implemented the first plan in early 1986 and it was called the *Economic Stabilization Plan*, or more commonly, the “Cruzado Plan.” It implemented a freeze on all prices, as well as a freeze and readjustment of mortgage payments, rents, and wages. It also fixed the currency, the Cruzado, to 13.88 per US dollar (Watkins). In the short term, the plan was extremely effective and inflation rates fell to nearly zero for the first few months. However, by the end of the year, it was obvious that the plan had failed spectacularly. Some economists blame its failure on maintaining the freezes for too long, while others point out that the readjustment of wages and mortgages was too large (Country-Data.com, 1997). While it is likely to have failed because of a combination of both factors, the result was a return of inflation at an accelerated rate.

There were a series of similar plans between 1987 and 1993. The Bresser plan of 1997 again froze wages and prices, and again proved to be ineffective as inflation stayed high. Similarly, the Summer plan, implemented in 1989, froze prices, and proposed privatization of state owned companies, but it too failed (Beting, 1996). The most radical plan, the Collor plan of 1990, was implemented by newly elected President Fernando Collor who promised to tackle inflation with strict fiscal policies. The plan involved freezing prices and salaries, in addition to raising taxes, adopting a floating exchange rate, and a freeze on bank accounts containing private assets exceeding approximately 500 US dollars (Fleischer, 2013). The plan drastically reduced inflation, which dropped to 432.7% annual rate in 1991,

after nearly reaching 3000% in 1990. However, the plan ultimately failed because an inflation rate of 432.7% is still extremely high, and that figure only accelerated again until 1994. Further, the plan also caused a recession, lowering the GDP growth rate to -4.3% in 1990, 1.5% in '91, and -0.46% in '92 (World Bank, 2014).

VI. Plano Real

In 1994, newly elected President Fernando Henrique implemented the *Plano Real*, or “The Real Plan,” that would ultimately end hyperinflation, and start a period of economic prosperity in Brazil. In the words of Gustavo Franco, who served as Director and President of Brazil’s Central Bank, “the *Plano Real* focused on three major topics: Fiscal strategy, monetary reform, and opening the economy.” (Beting, 1996)

Regarding fiscal strategy, the plan successfully privatized several state owned companies, including banks, steel plants, mining companies (Most notable of these was Vale, one of the largest mining companies in the world, with current market cap of over 55 billion USD) and telecommunications companies, while also reducing the monopolistic features of petroleum giant Petrobras (The Economist, 2010). A new balanced budget, with reduced spending and plans to reduce debt was also formed (Beting, 1996).

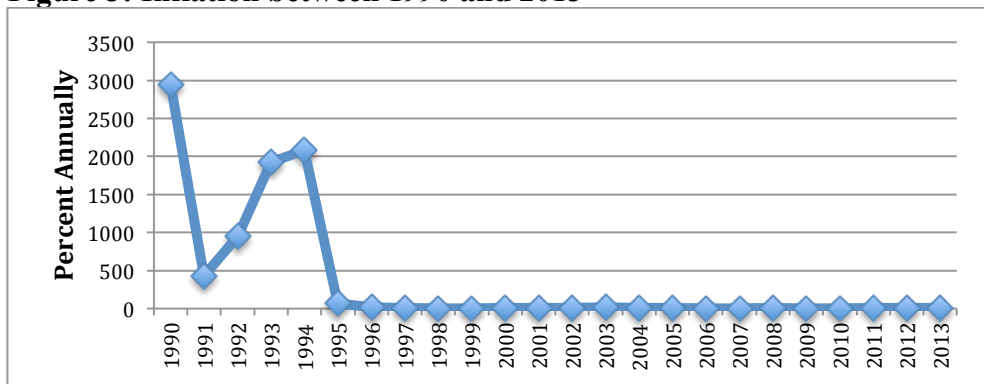
In terms of monetary reform, every previous plan had failed because they froze prices, and there was no efficient standard for indexing prices. Therefore, some prices became outdated on a daily basis, as some economic agents realigned prices at “any given moment.” In their realignment, their lack of confidence in the government and the economy manifested itself in their high expectation of inflation. This process of indexing prices with high expectations of inflation caused a cycle of perpetually high inflation that

every other plan failed to address. However, the *Plano Real* created a standardized index called the “URV (Unidade Real de Valor - Real Unity of Value)” which was updated daily and pegged to the dollar. Economic agents quoted prices in both the URV, which remained stable, and Cruzeiros Reais, facilitating the transition until it was phased out in July, 1994 (Beting, 1996). The URV became the Real, which was the new currency, and what remained of the old currency was converted to Reais at 1 Real per 2750 Cruzeiros Reais. The standardized index and gradual transition between currencies made the plan more effective than its predecessors and allowed Brazil to ultimately beat inflation (Beting, 1996).

The final part of the plan was to open the economy, and restrictions to trade were lowered. The real performed quite well, and despite the failure of some companies, trade flourished (Beting, 1996).

The *Plano Real* successfully ended Brazil’s problem of inflation, and inflation rates have remained quite stable since it lowered from 2075.89% in 1994, to 66% in 1995, to a low of 3.2% in 1998 (World Bank, 2014). It also encouraged investing in Brazil, which strengthened the Real, increasing the exchange rate as shown in figure 4.

Figure 3: Inflation between 1990 and 2013

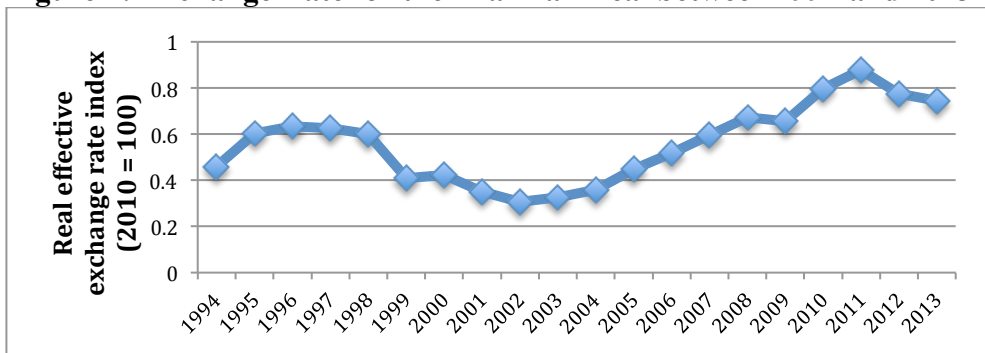


Source: World Bank World Development Indicators

VII. Economic Transition of 1998-2008

The 1990s saw continued economic prosperity by Brazil, with stable economic indicators. The inflation rate remained low, while the GDP continued to rise (World Bank, 2014). However, by the late '90s, investors that had boosted the value of the Real began pulling their money out of Brazil, foreshadowing an impending crisis (Madslie, 2002). Seeing the potential effects of such a crisis, the Clinton administration worked with the IMF to sponsor a 41.5 billion US dollar rescue package for Brazil in 1998, which caused Brazil's public deficit to rise dramatically (Ito, 1999). In return, Brazilian President Cardoso was supposed to enact his promised austerity reforms, such as social security reform of the public sector and tax reform (Beting, 1996). However, by 1999, investors had lost confidence in Brazilian markets and began liquidating Brazilian assets, which caused the value of the Real to fall (Ito, 1999).

Figure 4: Exchange Rate for the Brazilian Real between 1994 and 2013



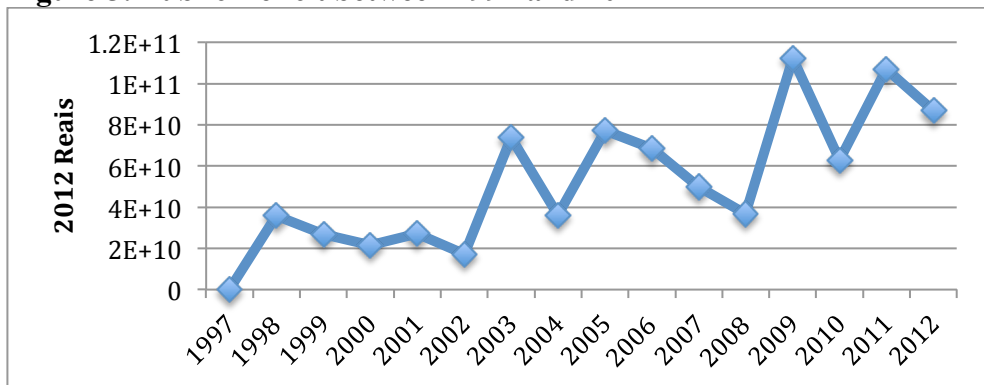
Source: World Bank World Development Indicators

After losing much of the Dollar reserves that were used to keep the value of the Real up, the Brazilian government allowed the Real to float freely, no longer pegging it to the dollar as they had since 1994 (Ito, 1999).

This caused a further devaluation of the Real,; however, the worst of the crisis had passed by 2000, and the value of the Real stabilized, albeit at a lower rate than the pre-crisis years of 1995-'97 (World Bank, 2014).

Be that as it may, South America would enter into another series of crises that would also threaten the Brazilian economy by association. Most significant of these was Argentina's crisis that began in 2001 (BBC News, 2002). It caused Brazil's GDP growth rate to drop to 1.3% and caused the value of the Real to drop by 17% in 2001 (World Bank, 2014). In 2002, the crisis continued in Argentina, and the value of the Real continued to fall. However, when Argentina defaulted on several loans in 2002, Brazil was not as badly affected as investors anticipated, and its GDP growth rate actually went up to 2.66% (BBC News, 2002). In 2003, while working with the United States, Brazil secured another 30 billion US dollars from the IMF (Schott, 2002). Even though this caused a sharp increase in the public deficit as shown in figure 5, it also marked the start of a new era in Brazilian economics.

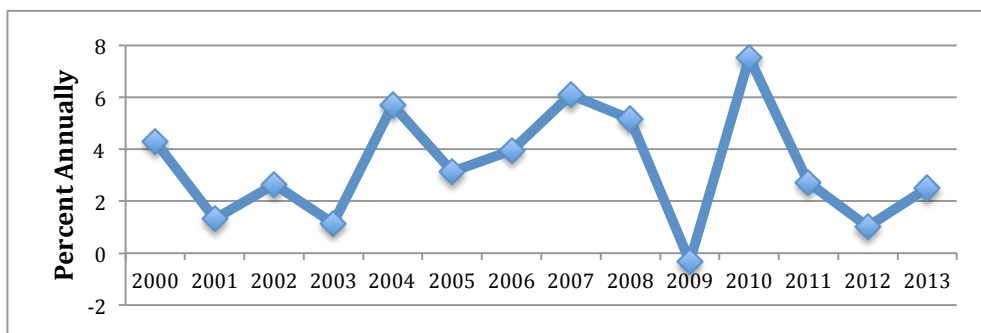
Figure 5: Public Deficit between 1997 and 2012



Source: World Bank World Development Indicators

The value of the Real increased in 2003 and every subsequent year until it more than doubled by 2008. The GDP growth rate increased to 5.7% in 2004, allowing Brazil to pay off much of its public debt in 2004. Between 2004 and 2008, Brazil experienced tremendous economic growth, averaging a growth rate of 4.8% over those five years. Its public deficit also decreased every year between 2005 and 2008 (World Bank, 2014). Further, “Poverty (people living with US\$2 per day) has fallen markedly, from 21% of the population in 2003 to 11% in 2009. Extreme poverty (people living with US\$1.25 per day) also dropped dramatically, from 10% in 2004 to 2.2% in 2009.” (World Bank, 2014)

Figure 6: GDP Growth Rate between 2000 and 2013



Source: World Bank World Development Indicators

VIII. Great Recession and Recovery (2008-2013)

However, this period of rapid growth and economic prosperity would end with the Global Recession of 2008, more commonly known as the Great Recession. Yet, Brazil experienced an extraordinary recovery in 2010, reaching unparalleled levels of growth, largely because of a dramatic improvement in its terms of trade, resulting from the effects of the global recession. However, the exceptionally high growth rate would be reduced in

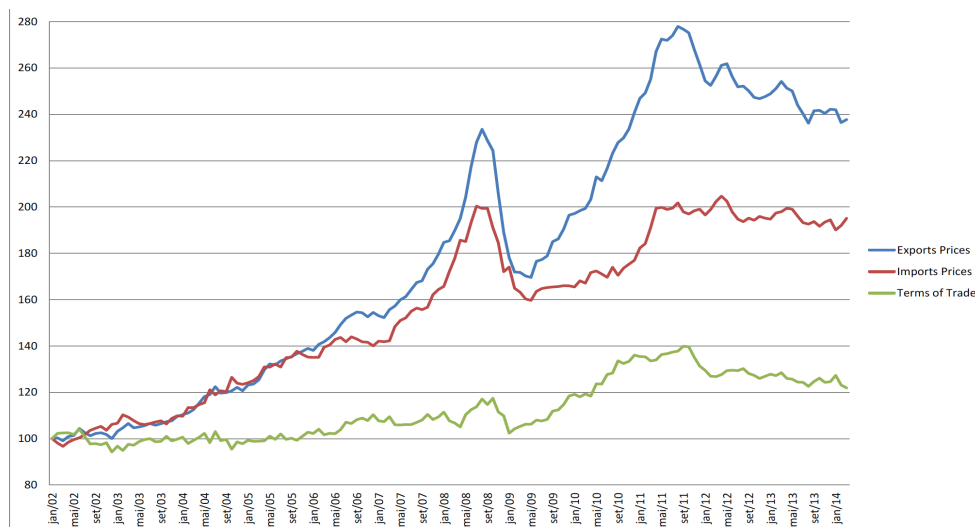
2011, and it continued to stay relatively low in 2012, 2013, and 2014 (World Bank, 2014). The reason for this was twofold: Firstly, the terms of trade were not as favorable as they were in 2010 because the price of Brazil's imports, largely manufactured products, went back up, while the prices of exports, especially commodities in Brazil's case, did not perform as well in comparison. Further, the election of President Dilma Rousseff began a new era of interventionist policies less favorable to business, which reduced investor and consumer confidence (Watson, 2014). In addition, her social and reform plans led to a less fiscally responsible budget that increased the public deficit between 2011 and 2014 compared with its level before her election in 2010 (World Bank, 2014).

In 2009, the GDP growth rate fell by nearly 5.5% to -0.33% annually (World Bank, 2014). The public deficit also rose as the government passed a stimulus package, but the package was quite small compared with those of other countries, including the United States. Brazil's stimulus package was composed of 3.6 billion US dollars, only 0.2% of its GDP, which was low compared with America's stimulus, which was approximately 5.5% of its GDP (Morss, 2009). By the end of 2009, the Brazilian market was only down 8.3%, also quite low considering the S&P 500 was down 32% (Loman, 2014). Based on the aforementioned factors, it is clear that Brazil was indeed affected by the "Great Recession" but not nearly to the extent of most economies, including the United States and those in Western Europe.

Its recovery was also quite rapid, and indicators pointed to a very prosperous year in 2010, largely because of an improvement in its terms of trade. "Brazil is the world's largest exporter of beef, iron ore, sugarcane ethanol, and the second largest exporter of soy products. Other leading exports include wheat, minerals, [and] oil" (Barbosa, 2014). While its

exports are mainly commodities and natural resources, its imports are mainly manufactured products. As figure 7 shows, the crisis of 2008 caused the price of both exports and imports to decrease. However, from mid-2009 to mid-2011, the price of exports recovered at more than twice the rate at which the price of imports recovered. This gap between the price of exports and imports drastically improved Brazilian terms of trade, which were extremely favorable in 2010 and early 2011. However, as the rest of the world recovered from the recession, the price of commodities went down at a much faster rate than the rate at which the price of manufactured goods fell (Barbosa, 2014). As the gap between the price of Brazilian exports and imports narrows, its terms of trade also worsen. However, even though they are not as advantageous as they were in 2010, they remain at levels higher than those of pre-recession years.

Figure 7: Brazilian Terms of Trade between 2002 and 2014



Source: Brazilian Central Bank

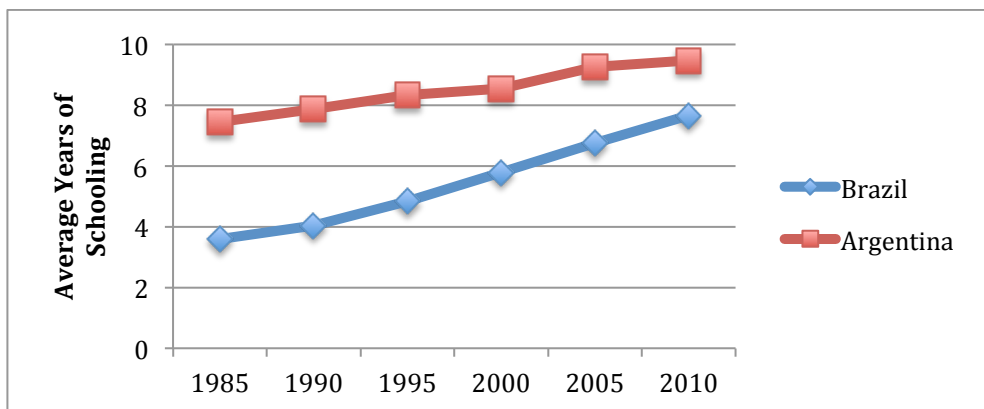
This mirrors the condition of the Brazilian economy as a whole during the same time frame. In 2010, the GDP growth rate was at an unparalleled level of 7.53%, which allowed the government to lower the public deficit that had spiked because of the recession. Nevertheless, once the terms of trade worsened, the GDP growth rate also fell to an average of 2.1% between 2011 and 2013 (World Bank, 2014).

Yet this drop was also caused in part because of the election of Dilma Rousseff, who took office in 2011. Her interventionist policies stymied the growth of businesses and reduced confidence regarding the economy (Watson, 2014). Further, her social reform plan caused the public deficit to again increase in 2011 and 2012 (World Bank, 2014).

IX. Education's Progress

Another important aspect of a country's economic development is the level of education among its people.

Figure 8: Average Years of Schooling for ages 25+



Source: Barro-Lee Educational Attainment Dataset

Figure 8 shows that the average number of years of schooling more than doubled, going from 3.59 to 7.66 between 1985 and 2010. In the same time frame, in Argentina, that number went up by approximately 2 years, from 7.45 to 9.48 (Barro, 2012). This highlights the years of economic success Brazil had that allowed such an explosion of education.

Furthermore, the difficulty of doing so in Brazil is dramatically greater since the population of people ages 25 and above is more than four times larger in Brazil. In 2010, there were 111.5 million people age 25+ in Brazil, while only 23.7 million in Argentina. Educating a much larger population is considerably harder and was made possible largely because of the increased economic success Brazil experienced. Likewise, as Argentina's economy struggled in the late 1990s and 2000s, the expansion of education also stagnated. While some may argue that there is a ceiling that Argentina may have reached, such a claim would not be taking into consideration that the average number of years of schooling in the United States in 2010 was 13.4 (Barro, 2012). The level of education also highlights the social stratification in Brazil in the '80s. Even though the majority of people were uneducated and the average number of years of schooling was quite low, 4.1% of the population completed secondary education and another 4% of the population completed tertiary education (Barro, 2012). Economically, this disparity was also visible, as the higher class was extremely small but extraordinarily powerful and wealthy. However, "Between 2001 and 2009, the income growth rate of the poorest 10% of the population was 7% per year, while that of the richest 10% was 1.7%." (World Bank, 2014) That helped narrow the gap between the rich and poor, and today, as education becomes more accessible, social stratification still exists, but to a lesser extent than before.

X. Economic Outlook/Conclusion

Currently, the largest factor shaping the state of the Brazilian economy is the recent Presidential election in which incumbent Dilma Rousseff was reelected by a margin of 51.6 to 48.4, the closest in Brazilian history (Elizondo, 2014). The economy is waiting in anxious anticipation to hear the fiscal and monetary policies of her second term and will undoubtedly respond, whether in appreciation or contempt. Some economists are even claiming the recent dip into a shallow recession was caused by the buildup to the election. The political strength of candidate Dilma Rousseff, whose first term policies hurt the economy, worried many investors and consumers. However, there is a hope that she will change some of her policies, as she promises to be more “pro-business” if elected for a second term (Watson, 2014). The Brazilian economy is waiting to see.

During her first term, she focused primarily on the poor and lower middle class, whose support was crucial in her campaign. This had several effects. On one hand, unemployment rates hovered around 4.8-5% throughout 2014, which is what most economists consider to be full employment (Biiler, 2014). On the other hand, GDP growth suffered, and the rate was at -0.2% in the first quarter, and -0.6% in the second (J.P., Why recession won't affect the result of Brazil's presidential election, 2014). This means it is technically in a recession, but not a severe one, although, Brazilian bank Itaú claims the poor performance of the second quarter was largely because of fewer working days due to the 2014 World Cup (J.P., Not Junk, Not Great, 2014). Also, the public deficit has gone up, also partly because of spending for the Cup, which cost approximately 11 billion US dollars (Rapoza, 2014). As a result of this poor performance, the S&P reduced Brazil's credit ratings. “Debt denominated in local currency, the

real, and foreign-currency bonds both fell by a notch, to BBB+ and BBB-, respectively.” (J.P., Not Junk, Not Great, 2014) However, critics claim this is unlikely to have much practical impact.

At this point, Brazil finds itself at a crucial crossroad. It has had significant economic prosperity in recent history and has the potential to continue that into the future, with the right policies. Brazil will find itself benefitting as natural resources become more and more important in the 21st century, due to its immense supplies. Further, the level of education among its people is growing, and its exports are diversified. It has already shown that it is capable of remarkable economic recoveries, and now the world will wait to see whether President Rousseff will enact new policies that will lead Brazil into another phase of economic prosperity.

Bibliography

- Barbosa, Fernando de Holanda, Filho. *International Macroeconomic Impacts on the Brazilian Economy*. 2014.
<http://www.oecd.org/eco/International-Macroeconomic-Impacts-on-the-Brazilian-Economy-paper.pdf> (accessed October 27, 2014).
- Barro, Robert and Jong-Wha Lee. *Educational Attainment Dataset*. 2012.
http://www.barrolee.com/data/work_display.jsp (accessed October 27, 2014).
- BBC News. *Argentina's Financial Crisis*. November 21, 2002.
http://news.bbc.co.uk/2/hi/talking_point/2480639.stm (accessed October 27, 2014). *Timeline: Brazil*. August 14, 2012.
<http://news.bbc.co.uk/2/hi/americas/1231075.stm>.

- Beting, Voelmir. *The Real Plan*. December 1996. <http://www.v-brazil.com/business/Real-Plan.html> (accessed October 27, 2014).
- “Better than Ukraine.” September 6, 2014. <http://www.economist.com/news/finance-and-economics/21615624-government-shrugs-brazils-descent-recession-better-ukraine> (accessed October 27, 2014).
- Biiler, David. *Brazil’s August Unemployment Rate at Record Low for the Month*. September 25, 2014. <http://www.businessweek.com/news/2014-09-25/brazil-s-august-unemployment-rate-at-record-low-for-the-month> (accessed October 27, 2014).
- CIA. *World Factbook: Brazil*. June 23, 2014. <https://www.cia.gov/library/publications/the-world-factbook/geos/br.html> (accessed October 27, 2014).
- Country-Data.com. *The 1981-84 Period*. April 1997. <http://www.country-data.com/cgi-bin/query/r-1736.html>. Elizondo, Gabriel. *Dilma Rousseff re-elected Brazil president*. October 27, 2014. <http://www.aljazeera.com/news/americas/2014/10/dilma-rousseff-re-elected-brazil-president-2014102621945179938.html> (accessed October 27, 2014).
- Fleischer, David. *Brazil’s “Collor Plan,” 1990*. March 27, 2013. <https://waisworld.org/go.jsp?id=02a&o=75868> (accessed October 27, 2014).
- Ito, Tim. *Brazil: A History of Political and Economic Turmoil*. January 1999. <http://www.washingtonpost.com/wp-srv/inatl/longterm/brazil/overview.htm> (accessed October 27, 2014).

J.P. *Not Junk, Not Great*. March 25, 2014.

<http://www.economist.com/blogs/americasview/2014/03/sp-downgrades-brazil> (accessed October 27, 2014).

Loman, Herwin. *Brazil's macro economy, past and present*. January 9, 2014.

<https://economics.rabobank.com/publications/2014/january/brazils-macro-economy-past-and-present/> (accessed October 27, 2014).

Madslie, Jorn. *Brazil's Looming Economic Crisis*. August 5, 2002.

<http://news.bbc.co.uk/2/hi/business/2173296.stm> (accessed October 27, 2014).

Morss, Elliott. *Brazil: Effects of Global Recession and Future Prospects*.

December 2, 2009. <http://www.morssglobalfinance.com/brazil-effects-of-global-recession-and-future-prospects/> (accessed October 27, 2014).

Rapoza, Kenneth. *Bringing FIFA To Brazil Equal To Roughly 61% Of Education Budget*. June 11, 2014.

<http://www.forbes.com/sites/kenrapoza/2014/06/11/bringing-fifa-to-brazil-equal-to-roughly-61-of-education-budget/> (accessed October 27, 2014).

Schott, Jeffrey. *Challenges to the Free Trade Area of the Americas*. October 2002.

<http://www.iie.com/publications/papers/print.cfm?ResearchId=480&doc=pub> (accessed October 27, 2014).

Valuable Vale. September 23, 2010. (accessed October 27, 2014).

Watkins, Thayer. *José Sarney, Hyperinflation and The Cruzado Plan in Brazil in the Late 1980's*.

<http://www.sjsu.edu/faculty/watkins/cruzado.htm> (accessed October 27, 2014).

Watson, Katy. *Brazil elections: Dilma Rousseff promises reform after poll win*. October 27, 2014. <http://www.bbc.com/news/world-latin-america-29782073> (accessed October 27, 2014).

Why recession won't affect the result of Brazil's presidential election. September 1, 2014. <http://www.economist.com/blogs/economist-explains/2014/09/economist-explains>.

World Bank. *Brazil Overview*. 2014. <http://www.worldbank.org/en/country/brazil/overview> (accessed October 27, 2014).

"World Development Indicators Data." *data.worldbank.org*. October 17, 2014. <http://data.worldbank.org/data-catalog/world-development-indicators> (accessed October 27, 2014).



Paralanguage of English-Speaking Teachers with Chinese Students vs. with English-Speaking Colleagues

Miaoxin Wang

Author background: Miaoxin grew up in China and currently attends Zhengzhou Foreign Language School. His Pioneer seminar program was titled “Nonverbal Communication.”

Abstract

This study was conducted to find out how the paralanguage of English speaking teachers differs in communication with Chinese students versus their communication with fellow English speakers. Six English-speaking teachers were chosen as subjects for this study. There were two Americans, two Filipinos, a Czech, and a Pakistani. The study included recordings of discussions in classroom context, real conversations and simulated one-to-one conversations between English speaking teachers and interviews with these teachers. Over 750 minutes of recording were collected, and over 150 voice images were analyzed. The results showed that English speaking teachers had lower rates of speech, higher volume, more accentuation, and more prolonged pronunciation in communication with Chinese students as compared with English speaking colleagues. Because several other factors such as gender, age, relationship between speakers, and features of audiences can affect properties of speakers’ paralanguage, such factors were taken into consideration in analysis of voice qualities.

1. Introduction

Non-verbal communication has attracted researchers for decades. Given its

broad contents, studies have been carried out in a variety of dimensions of non-verbal communication. These studies help to illustrate the role played by cultural differences as well as paralanguage in communication. Although boundaries between linguistic and paralinguistic features are still arbitrary (Karpinski 2012), non-verbal features, such as gestures and voice quality, still make a very significant contribution to communication. There have been some studies on emotions expressed by non-verbal cues. Non-verbal signs like gestures and vocal cues can facilitate teaching, especially in dual language classes where teachers need to overcome linguistic difficulties with students. Expression of certain meanings can be made clearer by a speaker's voice quality and prosody, (Karpinski 2012) and gestures are observed to be more frequent in speakers than listeners, since they assist in conceptualizing ideas and thus, in producing speech (Jarmolowicz-Nowikow & Karpinski 2011). Nevertheless, other factors should be taken into account. Karpinski (2012) found that voice quality should be separated into two types: anatomically-determined and volitional. Otherwise the interpretation of voice quality would lose accuracy. For example, a man has thicker vocal cords than a woman. He can produce deeper sounds, but he should not be regarded as a serious or grave man due to such voice quality because this voice quality is anatomically determined rather than volitional. Though gestures and other non-verbal cues are indispensable when comprehensively discussing cross-language communication, in this study, I focus on speakers' voice quality, that is, paralanguage.

Another study that is related to this one was conducted by Brown (1977) regarding a kind of speaking called "baby talk." Brown found some properties of "baby talk," such as low rate of speech, exaggerated tones, common vocabulary, high pitch, simplified consonants, exceptional clarity,

repetitions, questions, and short, simple sentences. In another study, “baby talk” was found to be used in communication with foreigners and retarded adults (DePaulo & Coleman 1986). In my study, Chinese students are surely regarded as foreigners though clearly not retarded, but given the context, English speaking teachers are still expected to adjust their paralanguage in order to achieve educational purposes. Paralanguage of English speaking teachers in communication with Chinese students should be different from that used when communicating with other English speakers.

This research is carried out for two main reasons. First, from this research we learn that students should pay more attention to paralanguage used by English speaking teachers. With the knowledge of such differences, students should be better at communicating with their English speaking teachers and get used to more natural ways of communicating. For teachers, it is rewarding to notice and utilize voice cues in class that are different from those in communication with same-language speakers because language barriers may undermine the effectiveness of the class and relationships with students.

2. Methodology

2.1 Samples

The research was conducted in an international school in China. Six English speaking teachers were selected as subjects for this research. The six English speakers were from different countries with differences in their cultural backgrounds and individual profiles such as age and gender. The six subjects included two Americans, two Filipinos, a Czech, and a Pakistani. Clearly, cultural differences existed among these speakers, a factor which should be included in the discussion of this anthropologic study. Paralinguistic

differences were expected to be found in speakers to whom English was sufficiently familiar, so researchers took into account familiarity with English in this research. The two Americans were obviously native speakers of English, and the two Filipinos were brought up and educated with English, so they were also considered to be native speakers. As for the Czech and the Pakistani, they had been using English from a very young age and had a good command of English. They were also regarded as English speaking teachers like the other four, though their native languages had an influence on their speech, which should be taken into account. Also, voice qualities might differ in different genders.

2.2 Recording in two contexts

In this research, video records were the main sources of data. Given the purpose of this research, two contexts were selected where recording was done. First, English speaking teachers were filmed during class where there were approximately 20 Chinese students. The recordings were conducted without my presence, as a researcher, to assure natural conversation. The distance was kept to three to five meters. Since speakers kept moving in the classroom, distance was taken into account as a factor in analysis. Second, in contrast with the first context, the second was recorded in the office of English speaking teachers, where it is expected that communication without a language barrier would take place. The camera was placed as covertly as possible to ensure natural communication. In this context, speakers tended to be more static, but exchange of words happened more frequently, so I had to make sure voices were matched with their speakers.

2.3 Interviews and simulated conversation

Besides recording real conditions, I also conducted interviews with six

English speaking teachers. The interviews were in one-to-one format and the interviewer was a Chinese student. These interviews were conducted with the following questions.

Table 1: Questions in Interviews

1. Please read this paragraph in a way that crosses linguistic difficulties and in a way that does not.
2. Can you describe your subjective experience when communicating with the presence of language difficulties?
3. Can you tell some differences you can detect when you speak with Chinese students?
4. Can you recognize the listener of these talks?
5. What factors do you think contribute to the differences? Or what do speakers do that causes differences?

The first question was designed to help teachers amplify their paralanguage changes because the content was given, which was meant to eliminate contemplation of simplified word use and show the change in paralanguage purely. Although these changes were expected to be relatively intentional, they should reflect what an English speaker does in making every effort to overcome language difficulties.

The second, third, and fifth questions were designed to find out whether English speaking teachers were conscious of making vocal adjustment based on different audiences. Additionally, these questions gave me a basic insight into the reasons behind vocal differences.

In the fourth question, I gave the interviewees clips of voice recordings of two other teachers. The voice recordings included one from an American

teacher and one from the Pakistani or Czech teacher, because in this study, the two American teachers were considered to be the standard, or base-line samples, against which the most prevailing paralinguistic differences would be judged. On the other hand, the Pakistani and Czech teachers were not native speakers of English, and therefore the difference in their paralanguage was anticipated to differ from other English speaking teachers. Therefore, the recording included the most and the least typical voice samples. The six teachers were still expected to distinguish between listeners of these two tapes, Chinese students or English speaking teachers, because though speakers on the tape were different, they should still share similarities in paralanguage changes that helped overcome the linguistic barrier. These recordings of speech came from two contexts described above.

To make this thesis stronger, I also asked these six teachers to carry out simulated conversation. Each of the six teachers had a chance to talk with the other five, so there were fifteen conversations in total. I chose the topics and aimed at making them as commonplace and familiar to speakers as possible to stimulate natural conversation. These conversations were analyzed in terms of voice qualities that emerged in communication without a language barrier. Since the relationships between teachers might affect the way they spoke, a number of voice samples from different simulated conversation were needed.

2.4 Analysis

The paralanguage of six English speaking teachers was analyzed in terms of the two most fundamental qualities of speech: volume and speed. Tone and rhythm were based on different combinations of volume and speed.

Figure 2-1: Voice with Increasing Volume

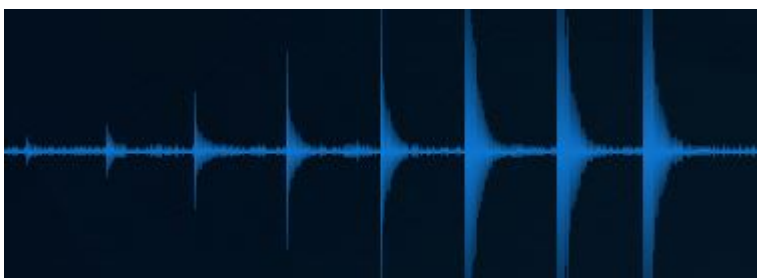
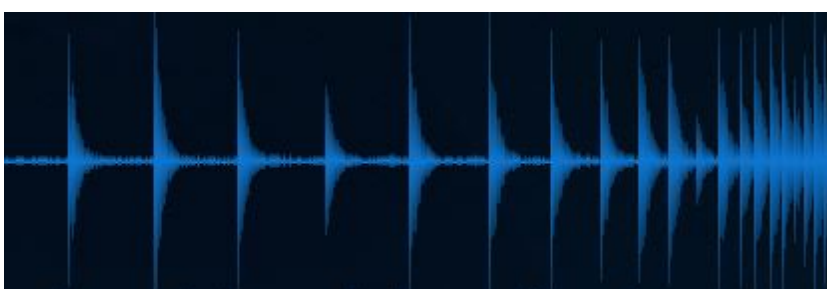


Figure 2-2: Voice with Increasing Rate



Paralanguage can be analyzed with the help of figures similar to those above. For example, a dense occurrence of peaks means fast, continuous speech or a prolonged word. On the contrary, a sharp, sudden peak means an increase in volume, and discrete peaks mean discontinuous speech.

Paralanguage in terms of volume, accentuation, rate of speech, prolonged pronunciation, and pauses were observed and presented in tables.

3. Results

Voice samples from six English speaking teachers

The voice images of six teachers in two different contexts are shown in this section. In each context, three voice images of each teacher are shown.

3.1 In classroom with Chinese students

Table 3-1: Paralanguage of English speaking teachers in classroom

	Volume	Accentuation	Rate	Prolonged Pronunciation	Pauses
US male	high	moderate	119w/m	frequent	rare
US female	high	frequent	131w/m	rare	moderate
Filipino male	high	frequent	151w/m	rare	frequent
Filipino female	high	frequent	137w/m	moderate	rare
Czech male	high	moderate	114w/m	frequent	frequent
Pakistani male	high	moderate	126w/m	rare	frequent

The volume of the six teachers' voice was consistently higher than normal. US male, Czech male, and Pakistani male tended to use less accentuation than the other three. The rate of speech was usually between 110 words/minute and 150 words/minute, and US male and Czech male had relatively slow rates of speech and frequent use of prolonged pronunciation. With higher rates of speech, US female, Filipino male, Filipino female, and Pakistani male had a rare use of prolonged pronunciation. US male and Filipino female tended to speak with few pauses. On the contrary, Filipino male, Czech male, and Pakistani male spoke with frequent pauses. Sample 6 was observed to have the highest frequency of pauses. All samples were found to use simple vocabulary and short sentences. Pauses were found both

in and between sentences in Czech male, Pakistani male, and US female, but Filipino male showed more pauses between sentences.

US male, US female, Filipino male and Czech male had more continuous voice images than Filipino female and Pakistani male. Peaks in voice images of US male, Czech male, Filipino male, and Pakistani male were not as distinctive as those in the other two teachers'. Pauses were most frequent in the voice images of Czech male and Pakistani male. (see table 3-2 in Appendix)

3.2 In conversations with English speaking teachers

Table 3-3: Paralanguage of teachers in conversation with English speaking teachers

	Volume	Accentuation	Rate of speech	Prolonged pronunciation	pauses
US male	moderate	rare	219w/m	rare	rare
US male*	moderate	rare	166w/m	rare	rare
US female	moderate	rare	195w/m	rare	rare
US female*	moderate	rare	179w/m	rare	rare
Filipino male	moderate	rare	162w/m	rare	moderate
Filipino male*	moderate	rare	150w/m	rare	moderate
Filipino female	moderate	rare	138w/m	rare	rare
Filipino female*	moderate	rare	153w/m	rare	moderate
Czech male	moderate	rare	162w/m	rare	moderate
Czech male*	moderate	rare	170w/m	rare	moderate/ frequent
Pakistani male	moderate	rare	128w/m	rare	moderate

Pakistani female*	moderate	rare	129w/m	rare	moderate
-------------------	----------	------	--------	------	----------

Note: for US male, US female, Filipino male, and Filipino female, * stands for the conversations with non-native English speaking teachers; in Czech male and Czech female, * stands for the conversation with a native English speaker. The first set of data of each sample was from conversation with the same nationality, e.g. it was from conversation between US male and US female, Filipino male and Filipino female. For Czech male and Pakistani male, the first set data was from their conversation with each other. The data has been averaged.

For four native English speaking teachers, the rates of speech tended to decrease when they talked with non-native English speaking teachers, while Czech male and Pakistani male increased their rate when communicating with native English speaking teachers. US male had the most evident change while Pakistani male had the slightest differences. US male and US female spoke with rare pauses no matter who they were speaking to. Filipino male, Czech male, and Pakistani male showed more pauses in communication. As in classroom context, Czech male, and Pakistani male showed pauses both in and between sentences, and Filipino male was observed to use more between sentences.

In terms of similarities, high volume of speech, accentuation, and prolonged pronunciation almost disappeared, although some was still observed.

Overall, boundaries between peaks in Table 3-4 were less distinctive and were grouped more closely, which made the pattern of images more continuous. Except for voice images of US female, the rest had smaller amplitudes than in Table 3-5. Filipino female had the voice images with the

least amplitude, and the voice images of other teachers in conversations with Filipino female had less amplitude than in other conversations. Voice images of Czech male and Pakistani male had the most gaps among all six teachers and other teachers' voice images show more gaps when they were in conversations with Czech male and Czech male. (see table 3-4 in Appendix)

3.3 Interview

Images in Table 3-5 show the voice pattern of a section of speech by six English speaking teachers with given contents. Voice images in imagined situations with American students are shorter than those in imagined situations with Chinese students. Only Pakistani male showed a decrease in amplitude in two situations. In the interview, US male added a few brief explanations within sentences in the first situation. (see table 3-5 in Appendix)

The two non-native English speakers, Czech male and Pakistani male, were asked to speak a little of their own language. Except for their accent in the pronunciation of English words, there wasn't much perceivable impact that their own language had on their English.

In the interview, although teachers had different nationality, cultural backgrounds, proficiency in English and so forth, they still had consensus on some differences they could detect when communicating with Chinese students versus English speakers. All teachers except Pakistani male successfully recognized audiences of given speech. Six teachers provided both paralinguistic and verbal differences.

Table 3-6: Detectable differences in speech with Chinese students and English speakers

1. Teachers tended to have a slower rate of speech with Chinese students.
2. Clarity of speech was enhanced when they communicated with Chinese students. Teachers would mumble when talking with each other while syllabicate words when talking with Chinese students.
3. Volume increased when teachers communicated with Chinese students.
4. Teachers used simpler and shorter sentences with easy vocabulary, but sentences could be long when explanations accompanied.
5. Short sentences were also used between English speakers when advanced vocabulary or slang and indigenous English expressions were used.
6. "You know" was used much more frequently in communication with English speakers and rarely used when talking with Chinese students. Teachers tended to consider usage of words, which partially led to pauses in sentences and a slower rate of speech.

In interviews, all samples manifested the intention to adjust their way of speaking based on the audience and the audience's English level. The American male teacher, showed a deeper concern about differences in Chinese and American values, which could lead to cultural violation. Additionally, he made a point of getting vocal feedback from Chinese students to assure their comprehension, such as "Did you understand?" The American female teacher, stated that the relationship between two English speakers could influence their ways of communicating, and she stated that the type of audience had significant influence on her way of speaking. The Filipino male teacher emphasized the influence of audiences as well, and his voice and speech would become more emotional when he was speaking to Chinese students. The Filipino female teacher spoke of facial expression

being important feedback from students to make sure of their understanding. Similar points were made by Pakistani male, who stated that he was prone to encourage Chinese students to speak out, and he would also pay attention to students' facial expression in communication. The Czech male teacher showed concern for correcting Chinese students' English speech while he was talking because he spoke English as a second language. In addition, he showed a more sophisticated understanding about ways to communicate with difference targets by pointing out differences like English speakers' mumbling and use of "you know."

4. Analysis

All six teachers were observed to have a higher volume, more accentuations, lower rate, and more prolonged pronunciation in a classroom with Chinese students. In addition to these similarities, the six teachers also showed variation regarding their paralanguage in communication with each other, and there are various possibilities accounting for these differences.

4.1 Volume

A greater volume should improve the clarity of teachers' speech. Although teachers consistently spoke louder to Chinese students, there is another possibility that greater volume was used because of the number of students. In other words, teachers tended to speak loudly because they had to address 20 students simultaneously. With each other, English speaking teachers used a lot lower volume and sometimes even mumbled. Filipino male and Filipino female had a low volume in speaking with each other, and this may be the result of their relationship—they are spouses—since low volume can express more intimacy. However, US male and US female spoke with higher volume

than the Filipino couple, despite their spousal relationship. Their age might account for this because non-verbal signals that show intimacy like touching and eye gazing occur more in early spousal relationship (Andersen, Guerrero, & Jones, 2006; Emmers & Dindia, 1995; Guerrero & Andersen, 1991; Guerrero & Floyd, 2006; McDaniel & Andersen, 1998; Manusov, Floyd, & Kerssen-Griep, 1997).

4.2 Accentuation

More use of accentuation by English speaking teachers must be intentional because it was not found as frequently in classrooms as in any conversation with other English speakers. A noteworthy point is that the accentuation of speech is usually accompanied by prolonged pronunciation, but not always. For example, US female, Filipino male, and Filipino female seemed to want to put stress on several words in a sentence with higher volume to manifest accentuation, but they were rarely observed to prolong words.

4.3 Rates of speech

The rate of speech is the most evident sign to differentiate communication with Chinese students and English speakers. Besides an increased rate of speech in conversation with English speakers in general, there are also variations in rate among teachers. In Table 3-2, US male and US female showed the highest rate among all teachers possibly because of their extremely high proficiency in English. By contrast, Pakistani male had the lowest rate presumably due to a relatively inferior proficiency in English. In addition, the other party of the conversation plays a role in the speaker's style of communication. Native English speakers tended to speak slower with non-native speakers while non-native speakers tended to speak faster with them. The explanation might be that they both took the other side's

English level into account when they were in conversation, which conforms to the teachers' consensus that speakers should adjust their communicative styles based on their audience. In Table 3-4, teachers' speech in conversations with Filipino female was influenced by her. Based on Table 3-4, Filipino female's way of speaking seemed to be contagious, in that others teachers' voice images in conversations with her showed resemblance with her voice images.

Some exceptions should be taken into account. Filipino male spoke at a rate of 151 words per minute which is higher than that of any other teacher. This may be attributed to his expressiveness. In observation, Filipino male showed a greater number of gestures and changes in tones, which conveyed his expressiveness. Additionally, Filipino female spoke with the same nationals at a rate lower than that in discussion with non-native English speakers, while under other conditions, the opposite was observed. One possibility is that their spousal relationship had an effect on her rates of speech.

4.4 Pauses

Pauses and prolonged pronunciation seem to complement each other. Six teachers showed one or the other of them at a moderate or higher level, and Czech male showed both frequently. Both of these qualities were primarily aimed at giving listeners time to digest and understand what speakers had said. Moreover, in classroom context, pauses occurred for allowing English speaking teachers to come up with appropriate vocabulary and convert expression into a way that Chinese students could easily understand. However, these were just partial explanation for pauses because some of these six English speakers still showed pauses in conversations with other English speakers. Czech male and Pakistani male had less frequent pauses

than they did with Chinese students, but more than other English speakers did. Proficiency in English should account for this. Although Czech male could speak at a rate like a native speaker, pauses were found mainly between sentences when, perhaps, he considered his next sentences. However, this wasn't the only factor that could contribute to pauses. Filipino male was regarded as a native English speaker, who showed pauses as frequent as Czech male and Pakistani male in both contexts. In addition to the influences of the other party, his pauses can be seen as his speech style. In observation, Filipino male tended to show pauses when he was expecting feedback, or answers, or when he was empathizing with the conversation partner, who was either a Chinese students or an English speaker. This can be applied to Czech male and Pakistani male as well. It is possible to conclude, then, that there is not only one way to explain differences in pauses in these two contexts. There are more sophisticated factors that could express purpose, personal style, or signs of English proficiency.

4.5 Voice images

In this study, voice images were tools directly showing what cannot be manifested by calculation or observation. Some paralinguistic differences shown above were also presented in voice images in Table 3-2 and Table 3-3. Amplitude of peaks in voice images in Table 3-3 was more evident than that in Table 3-2 on average. This remains consistent with the fact that volume in classroom is significantly higher than that in conversations with English speakers. Second, peaks in voice images in Table 3-3 were more concentrated, indicating that speakers had more continuous speech with higher velocity.

However, as voice qualities have two types, this factor was taken into consideration. US male, Filipino male, Czech male, and Pakistani male had

voice images in which peaks were not as distinctive as those in the other two teachers'. This is because male teachers tend to have rougher voices than females due to their thick vocal cords and different anatomical features. Furthermore, disappearances of peaks were parallel with pauses occurring in their speech. In a word, voice images revealed not only consistency with what had been observed but also with what could not be directly seen or heard; they presented similarities as well as variations in terms of speakers' paralanguage, just like the data in the tables.

4.6 Interview

The six samples were asked to read the same paragraph in two imagined situations: to Chinese students and to American students. Their voice images in these two contexts did not vary significantly except for the lengths of images. The six samples had shorter voice images when they imagined they were reading to American students. This suggests that the six samples accelerated their reading in this imagined situation. Accentuation, prolonged pronunciation, and pauses did not change noticeably in the two imagined situations. It is possible that speakers increased their rates of speech more intentionally than changing other paralinguistic features when they crossed a linguistic barrier. The six samples also provided many verbal differences like use of easier words, but they didn't recognize as many paralinguistic differences as there actually were. They pointed out differences in rates of speech and efforts to make speech clear, but did not specifically explain how. This is probably because these English speaking teachers were more conscious of helping Chinese students understand verbally rather than paralinguistically.

5. Discussion

This study was dedicated to uncovering the difference in paralinguistic of English speaking teachers in communication with Chinese students as opposed to other English speakers. The result was that English speaking teachers showed lower rates of speech, higher volume, more accentuation, and more prolonged pronunciation in communication with Chinese students. Pauses in speech seem not to be one of these differences, possibly because they are affected by other, more complex factors such as communicative purpose, personal style, and command of English.

There is always bias in scientific studies, including this one. The size of sample in this study may have had great influence on its reliability. A greater number of subjects are needed to improve similar studies. Despite this possible flaw, paralinguistic differences found in this study can be applied to improve Chinese students' understanding of the speech of English speaking teachers, which can also be accomplished by usage of easy words and gestures. In this study, although gestures were not discussed, I noticed that the six teachers also differed regarding the gestures they used and the frequency of gestures. For example, US female and Filipino female were observed to use certain gestures in classroom context, gestures which were also observed in conversations with English speakers but less frequently. Are there personal stereotyped gestures that a teacher is prone to use? There are many other non-verbal cues in classroom context that are different from those in conversation without the presence of a language barrier, and there should be more studies in the future dealing with these differences.

Acknowledgments

I'm sincerely grateful to a number of people who gave extremely important assistance in my study. Specifically, Douglas Raybeck has provided mentorship that helped me go through the whole study and sincere suggestions that contributed to the accomplishment of this work. Here is also my appreciation to the teachers in Cornerstone International High School who volunteered to be samples of this study. In particular, they were David Kudela, Gadehi A. Ali, Honey O. Anglog, Julie A. Martin, Michael R. Martin, and Oliver D. Anglog. Without these people's help and support, there would have been many more difficulties in completing this study.

Bibliography

- Andersen, Peter A., Laura K. Guerrero, and Susanne M. Jones . "Nonverbal Behavior in Intimate Interactions and Intimate Relationships." *The Sage handbook of nonverbal communication*. Ed. Valerie Manusov, and Miles L. Patterson. Thousand Oaks: SAGE Publication. Inc, 2006. 259–277. Print
- Brown. R. Introduction. *Talking to Children; Language Input and Acquisition*. By C.E. Snow and C.A. Ferguson. Cambridge: Cambridge University Press, 1977. i-xxvi. Print
- DePaulo, Bella, and Lorita Coleman. "Talking to Children, Foreigners, and Retarded adults." *Journal of Personality and Social Psychology* 51.5 (1986): 945-959. Print.
- Emmers, Tara, and Kathryn Dindia. "The Effect of Relational Stage and Intimacy on Touch: An Extension of Guerrero and Andersen." *Personal Relationships*, 2.3 (1995): 225–236. Print.
- Guerrero, Laura K., and Peter A. Andersen. "The Waxing and Waning of

Relational Intimacy: Touch as a Function of Relational Stage, Gender and Touch Avoidance.” *Journal of Social and Personal Relationships* 8.2 (1991): 147–165. Print.

Guerrero, Laura K., and Kory Floyd. (2006). *Nonverbal Communication in Close Relationships*. Mahwah: Erlbaum, 2006. Print.

Jarmołowicz-Nowikow, Ewa, and Maciej Karpiński. 2011. “Communicative Intentions behind Pointing Gestures in Task-oriented Dialogues.” *Proceedings of GESPIN 2011 Conference*, Bielefeld.

McDaniel, Ed., and Peter Andersen. (1998). “International Patterns of Interpersonal Tactile Communication: A Field Study.” *Journal of Nonverbal Behavior*, 22.1 (1998): 59–73. Print.

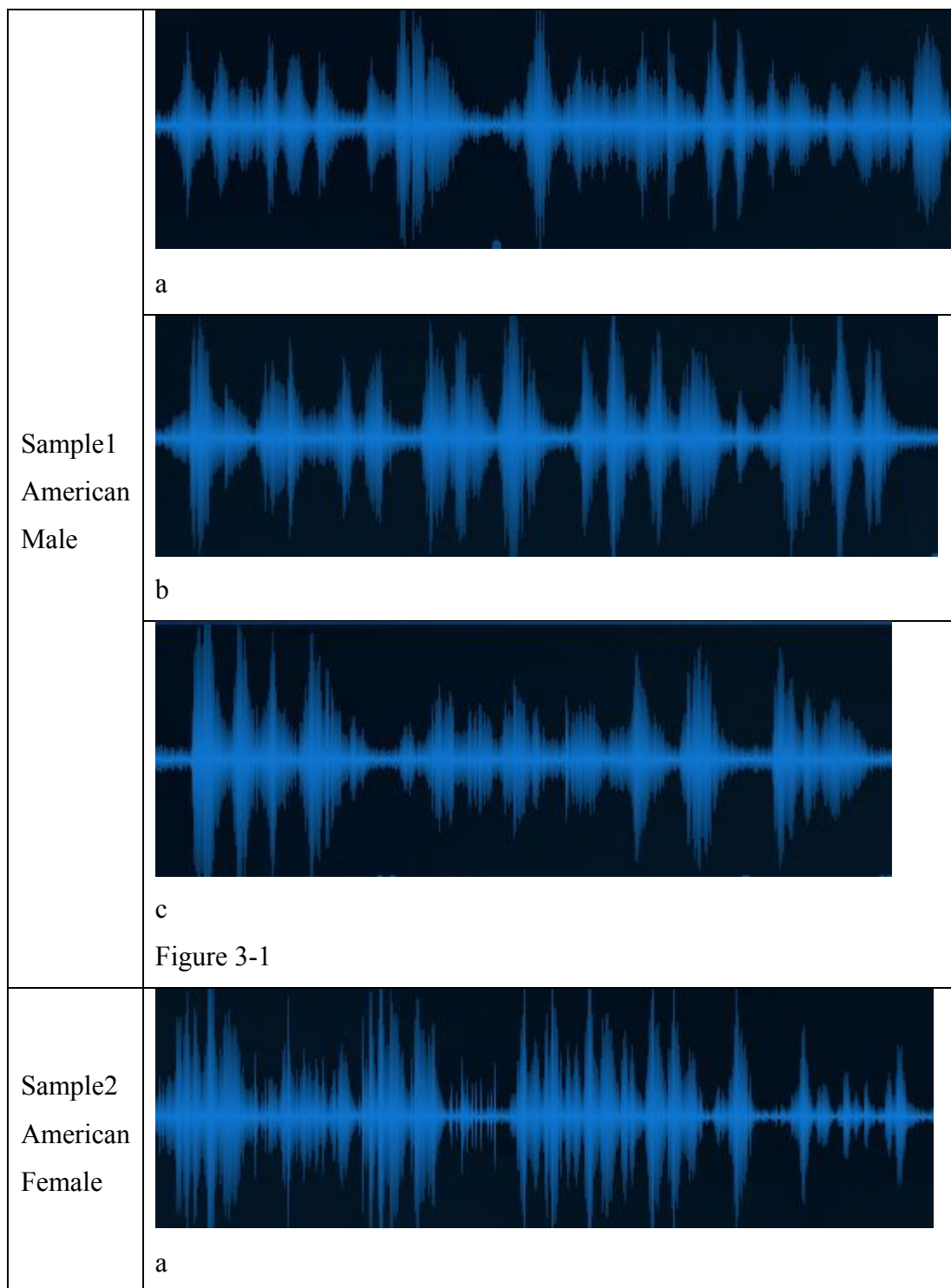
Karpinski, Maciej. “The Boundaries of Language: Dealing with Paralinguistic Features.” *Lingua Posnaniensis*, 54.2 (2012): 37–54.

Manusov, Valerie, et al. “Yours, Mine, and Ours: Mutual Attributions for Nonverbal Behaviors in Couples’ Interactions.” *Communication Research*, 24.3 (1997): 234–260.

Appendix

In all tables below, Sample 1 is for US male; Sample 2 is for US female; Sample 3 is for Filipino male; Sample 4 is for Filipino female; Sample 5 is for Czech male; Sample 6 is for Pakistani male.

Table 3-2 Voice images of English speaking teachers in classroom





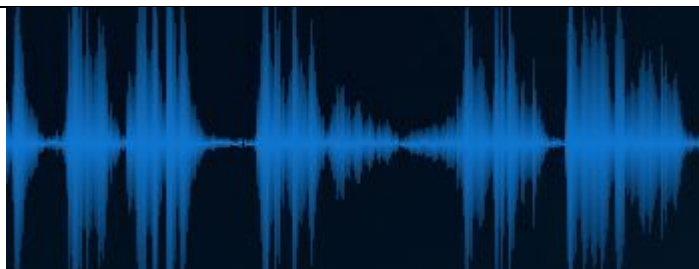
b



c

Figure 3-2

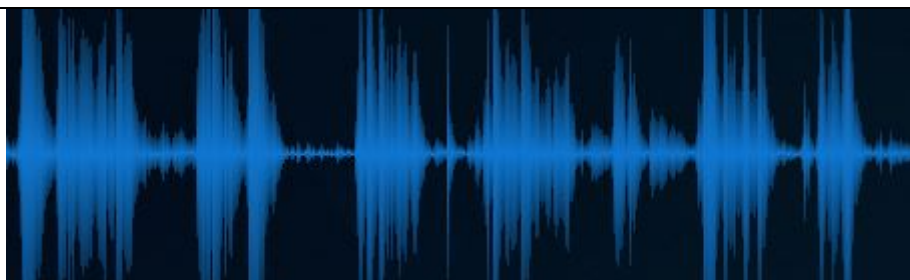
Sample3
Filipinos
Male



a



b



c

Figure3-3



a





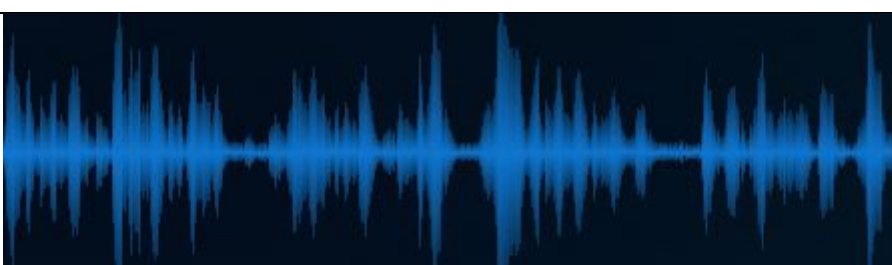
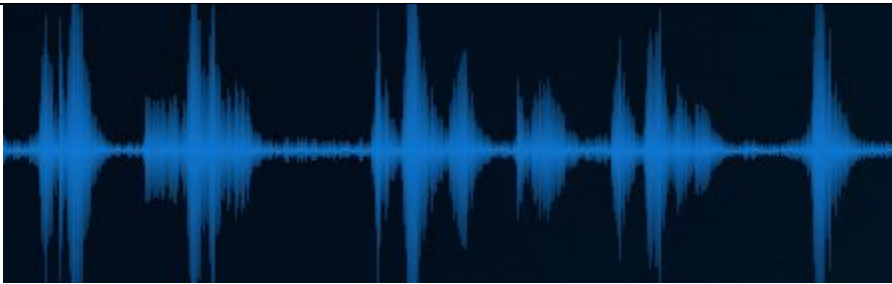
b



c

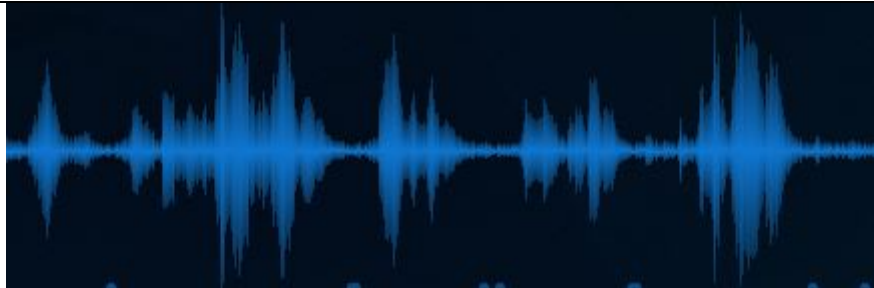
Figure3-4

Sample4
Filipinos
Female

<p>Sample5 Czech Male</p>	 <p>a</p>  <p>b</p>  <p>c</p> <p>Figure3-5</p>
<p>Sample Pakistani Male</p>	 <p>a</p>







b



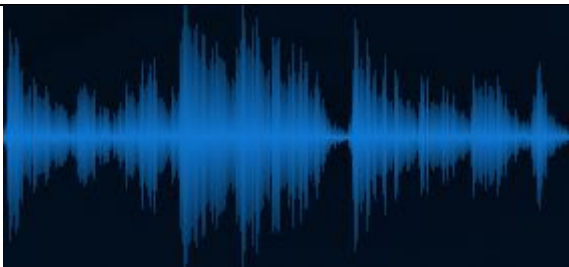



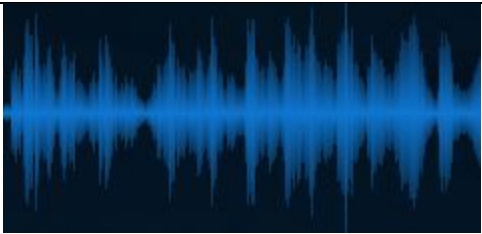



c






Figure3-6






Table 3-4 Voice images of English speaking teachers in talk with each other




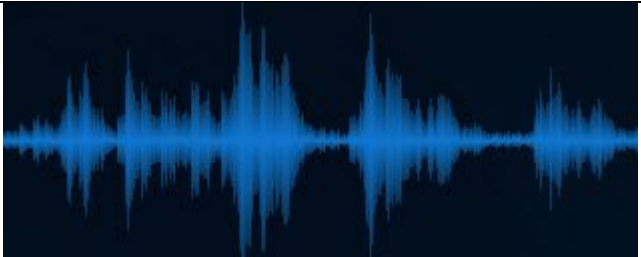
Sample1 American male teacher		 <p>a</p>
	with nationals	 <p>b</p>
		 <p>c</p> <p>Figure 3-7 Conversations with Sample2</p>
	with teachers of different nationalit	 <p>Figure 3-8 Conversations with Sample6</p>





	y	 <p data-bbox="495 479 1007 517">Figure 3-9 Conversations with Sample5</p>
		 <p data-bbox="495 826 1023 865">Figure 3-10 Conversations with Sample4</p>
Sample2 American female teacher	with nationals	 <p data-bbox="495 1164 513 1203">a</p>
		 <p data-bbox="495 1499 513 1537">b</p>





		 <p data-bbox="495 479 1022 569">c Figure 3-11 Conversations with Sample1</p>
with teachers of different nationalit y		 <p data-bbox="495 865 1022 898">Figure 3-12 Conversations with Sample6</p>
		 <p data-bbox="495 1203 1022 1236">Figure 3-13 Conversations with Sample5</p>
		 <p data-bbox="495 1541 1022 1574">Figure 3-15 Conversations with Sample3</p>

Sample3 Filipinos male teacher	with nationals	
		a
		
	b	
		
	c	
Figure 3-16 Conversations with Sample4		
with teachers of different nationalit y		
	Figure 3-17 Conversations with Sample5	
		

		<p>Figure 3-18 Conversations with Sample2</p> 
	<p>with nationals</p>	<p>Figure 3-19 Conversations with Sample1</p>  <p>a</p>  <p>b</p>  <p>c</p> <p>Figure 3-20 Conversations with Sample3</p>
	<p>with teachers of different</p>	

	nationality	Figure 3-21 Conversations with Sample6
	y	 <p>Figure 3-22 Conversations with Sample5</p>
		 <p>Figure 3-23 Conversations with Sample6</p>
Sample5 Czech male teachers	with Sample6	 <p>a</p>
		 <p>b</p>

		 <p>c</p> <p>Figure 3-24 Conversations with Sample6</p>
with native English speakers		 <p>Figure 3-25 Conversations with Sample2</p>
		 <p>Figure 3-26 Conversations with Sample1</p>
		 <p>Figure 3-27 Conversations with Sample4</p>

<p>Sample6 Pakistani male teacher</p>	<p>with Sample5</p>	 <p>a</p>
	<p>with native English speakers</p>	 <p>b</p>
<p>Figure 3-28 Conversations with Sample5</p>		 <p>c</p>
<p>Figure 3-29 Conversations with Sample1</p>		



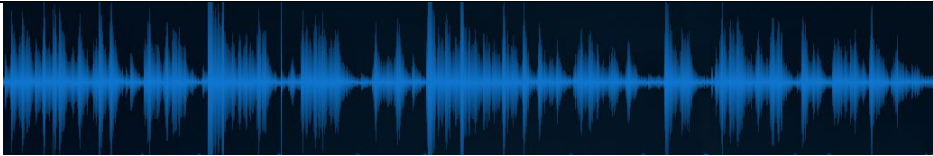

		 <p data-bbox="495 517 1019 556">Figure 3-30 Conversations with Sample2</p>
		 <p data-bbox="495 852 1019 890">Figure 3-31 Conversations with Sample3</p>

Table 3-5 Voice images of six teachers who were asked to read a paragraph in two imagined context

S1	 <p data-bbox="253 1242 816 1280">Figure 3-32 Sample1 with Chinese students</p>
	 <p data-bbox="253 1499 838 1537">Figure 3-33 Sample1 with American students</p>

S2

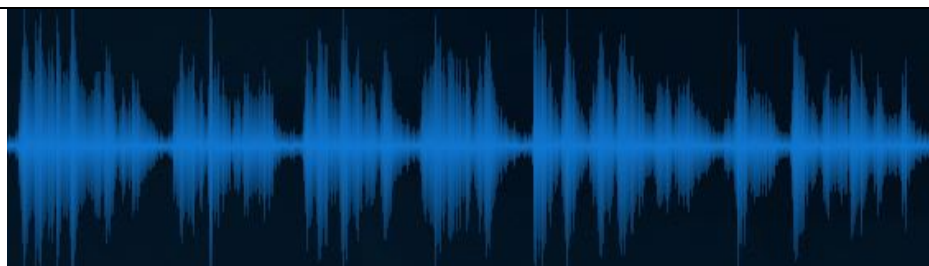


Figure 3-34 Sample2 with Chinese students

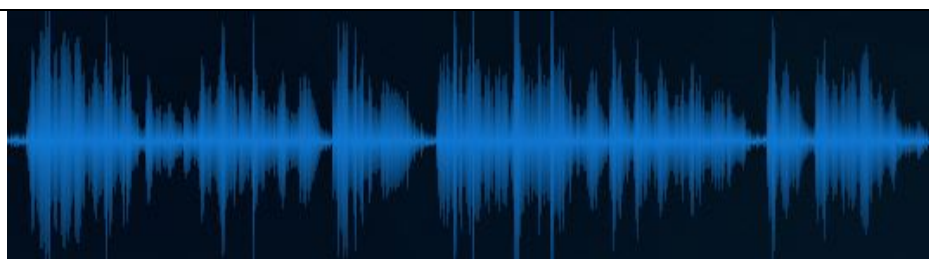


Figure 3-35 Sample2 with American students

S3



Figure 3-36 Sample3 with Chinese students



Figure 3-37 Sample3 with American students

S4



Figure 3-38 Sample4 with Chinese students



S5



Figure 3-40 Sample5 with Chinese students



Figure 3-41 Sample5 with American students

S6

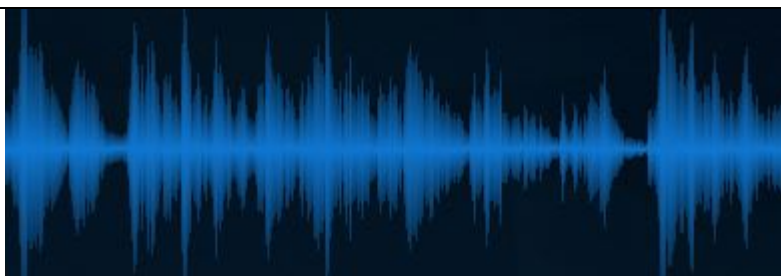


Figure 3-42 Sample6 with Chinese students



Figure 3-43 Sample6 with American students



**Riding the Elephant in Our Mind:
A Research Into the Relationship Between Happiness and
Forming Habituated Activities**

Xinxiang Liu

Author background: Xinxiang grew up in China and currently attends the Affiliated High School of South China Normal University in Guangzhou. Her Pioneer seminar program was titled "The Pursuit of Happiness."

The study of happiness is essentially a study of human beings. In other words, the pursuit of happiness is universal. Everybody has his or her own interpretation of happiness. Since ancient times, philosophers have tried to explain human nature in terms of rationality and logic. We humans are such unique creatures that we are constantly fighting against our instincts and habits. When our instincts, habits and reason are not in harmony, we are in a state of conflict, which tends to result in pain and misery.

How should we, then, resolve this conflict? As a former sufferer of bulimia, I understand first-hand the difficulties and struggles between the two parts of my brain, and I have gradually shaped my own perspective on the relationship between habits and happiness. Deeply rooted in our brains are the primal genetic programs formed after a long period of evolution. Thousands of pieces of theoretical and practical evidence suggest that it is unwise, if not impossible, to try to reason with the primal unconscious of our

mind. Habits largely relate to happiness because they set routines for our behaviors without forcing us to dwell on them every time, trying to change what our instincts lead us to believe.

Incorporating intensive research, I intend to show that insofar as our happiness is the result of our conscious pursuit, it is determined largely by our habituated activities, formed over time and in harmony with our conscious self. Insofar as happiness is not the result of conscious pursuit but, rather, has an innate set point that is not affected by our will or action, it should not be our concern, since there are limits to human beings that are out of our control. Therefore, we should focus on what we can control through conscious pursuit: our habits. I will establish my thesis by examining Daniel Kahneman's dual processing theory of the brain and by comparing it to the rider and elephant metaphor of Jonathan Haidt. Next I will consider Charles Duhigg's theory of habits and the application of forming habits in our daily life. I anticipate that both Christine Vitrano's theory of happiness as life satisfaction and the genetic determinism view of happiness will pose the major objections to my thesis, to which I will attempt to respond.

Theoretical Basis

The world of advertising is full of applications of the habit-forming process:

Dabbing a bit of sunscreen on your face each morning significantly lowers the odds of skin cancer. Yet, while everyone brushes their teeth, fewer than 10 percent of Americans apply sunscreen each day. Why?

Because there's no craving that has made sunscreen into a daily habit. Some companies are trying to fix that by giving sunscreens a tingling

sensation or something that lets people know they've applied it to their skin. They're hoping it will cue an expectation the same way the craving for a tingling mouth reminds us to brush our teeth. They've already used similar tactics in hundreds of other products. (Duhigg 59)

After we are “conditioned” by the advertisement to form certain habits, like brushing our teeth with a particular brand of toothpaste, we stop thinking about why we formed the habit, stopping the two parts of the brain from conflicting with each other. After a long period of using the toothpaste, we have a sense of achievement when we see we have whitened our teeth and kept them in good condition. This is how we form habits.

The same mentality can be applied to our everyday life. Forming good habits is the only way to really “rationalize” the primal brain—it's the only way our instincts and habits can function. The instincts don't really understand any more than a programmed computer does. They just get trained or programmed. Advertisers know the importance of keeping the two parts of the brain in harmony while changing a behavior, so they successfully manipulate their audience by creating the “illusion” of happiness in consumers when they consume their products.

Dual processing theory of the brain

Before I explain the mechanism of habit-forming, I shall start by introducing the two parts of the brain that are central to the decision making process involved, namely, the dual processing theory of the brain.

I adopt terms originally proposed by the psychologists Keith Stanovich and Richard West, and will refer to two systems in the mind, System 1 and System 2.

System 1 operates automatically and quickly, with little or no effort

and no sense of voluntary control.

System 2 allocates attention to the effortful mental activities that demand it, including complex computations. The operations of System 2 are often associated with the subjective experience of agency, choice and concentration. (Kahneman 49)

Researchers in thinking and reasoning have proposed recently that there are two distinct cognitive systems underlying reasoning. System 1 is old in evolutionary terms and shared with other animals: it comprises a set of autonomous subsystems that include both innate input modules and domain-specific knowledge acquired by a domain-general learning mechanism. System 2 is evolutionarily recent and distinctively human: it permits abstract reasoning and hypothetical thinking, but is constrained by working memory capacity and correlated with measures of general intelligence. These theories essentially posit two minds in one brain with a range of experimental psychological evidence showing that the two systems compete for control of our inferences and actions. (Evans 32)

The dual processing theory of the brain can be further interpreted by a corresponding rider and elephant metaphor by Jonathan Haidt. In *The Happiness Hypothesis*, Jonathan Haidt made an analogy of the conscious, rational, slow brain as the rider, and the unconscious, non-rational, automatic brain as the elephant:

The image that I came up with for myself, as I marveled at my weakness, was that I was a rider on the back of an elephant. I'm holding the reins in my hands, and by pulling one way or the other I can tell the elephant to turn, to stop, or to go. I can direct things, but only when the elephant doesn't have desires of his own. When the elephant really wants to do something, I'm no match for him. (Haidt 4)

We've all experienced the difficulty of fighting against our "animal" brain. When beginning runners plan to go jogging early in the morning and set an alarm clock the night before, a part deep down in their minds knows

that they will continue sleeping after they turn off the alarm, even though they are fully aware of the benefits of exercising.

There are other similar analogies for the two parts of the brain, such as Plato's chariot allegory. However, compared to the chariot allegory, which tends to view rationality as the dominant part of the brain, dual processing theory focuses on creating a balance between the two systems. The two parts of the brains control our everyday activities and therefore constitute a major determinant of the quality of our life. Any conflict between them puts us in a state of unhappiness as they constantly compete for control over our mind.

It is important to note that it is natural for the two parts of the brain to be in conflict, since the conditions of our modern society have changed rapidly from the primordial era when humans struggled to survive in the wild, bringing instinct and habit into harmony with reason and the environment. While 90% of our time on the planet we lived on the Savannah where our harmony was attained, we no longer live in that that environment or social order. We have not been away from the Savannah or in a single environment long enough for our instincts to change and adapt. So we have conflict among the parts of the brain.

In the process of making decisions, however, allowing either part of the brain to take control completely will be harmful in the long term. This is why forming good habits is central for our development: to make the two parts of the brain stay in a state of harmony. Habits are malleable compared to instincts. Habits can override instincts as we see often in the powerful

fight-or-flight response as word? when we suffer stress in modern consumer society. When we have good habits, making our lives better doesn't take much time or energy because it is a subconscious choice. A lot of habits, however, require our conscious attention and the process can be seen as training our "primal brain," the elephant. That is why there are people who jog regularly: no one is born a runner; it is the acquired process of training that resolves the conflict in our brain and makes us healthier and happier.

The harmony of the two systems of the brain is a key factor in determining happiness. Of course, to assume that happiness is nothing more than forming healthy habits would be wrong. However, it is the primary concern of this paper to discuss how we should resolve the disharmony, which will lead to unhappiness. Furthermore, the concept of harmony between the two systems of our brain also needs clarification: it does not mean that there is a definite percentage of control that either part should have over the other. Rather, harmony requires the system 2 brain to train the system 1 brain so that the system 1 brain will be able to respond to what system 2 wants. It trains by instilling habits that bring harmony like our ability to deal with stress rather than fight or flee in the workplace or school.

Charles Duhigg in *The Power of Habits*

Habits are powerful in terms of affecting our happiness. Charles Duhigg, in his book, *The Power of Habit*, explained the process of forming habits and its impact on our life:

We know two things from studies done by a woman named Wendy Wood. She monitored people's daily behavior and found that 45% of the decisions we make are actually habits. They're not really decisions and from that, we know that every habit happens at a kind of border: It's a decision we made at some point but then stopped making and continued acting on. (Duhigg 75)

Habits also determine our decision-making process. When we have good habits, making our lives better takes less time and energy because it has become a subconscious choice. The mechanism of that process, according to Duhigg, is as

follows:

The Habit Loop has three stages: the cue, which is the trigger that causes the habit to occur in the first place; the routine, which is the behavior itself; and then there's the reward, which is really how the brain learns to save the habit and encode it for future use. (Duhigg 35)

Let's take the runner example again. If, instead of only hearing the unpleasant sound of the alarm clock each morning, the runner makes a smoothie every night and places it in the fridge; it becomes an incentive for waking up early. Because of this incentive, the runner is more likely to get up. After enjoying the refreshing smoothie, she goes for a jog and feels good after the exercise. She then gets the rewards: a sense of achievement, a stronger body and the release of endorphins. The runner is now more likely to repeat the routine each day until she reaches the state where she no longer needs the smoothie, or even an alarm clock to get up early in the morning and go jogging. Though her conscious brain remains unaware, her primal animal brain has accepted the fact that jogging is actually good for her. This is similar to the situation tested by Pavlov; his dogs did not realize that the ringing bell made them hungry because their system 1 brain wasn't

conscious. In the case of our jogger, it just responds to stimuli habitually or instinctively and no longer tries to protect her from the potential of losing sleep or energy from the run. She did not persuade her instincts that jogging is a healthier lifestyle. Rather, she trained her non-rational brain by conscious decision in such a way that abided by the rules of her instincts.

Anticipated Objections

Christine Vitrano

Philosopher Christine Vitrano, when discussing the life- satisfaction view of happiness, holds that

Although the life-satisfaction view does require a person to have a positive attitude toward her life, it does not specify the causal origin of that state of satisfaction and, therefore, does not require the positive attitude to be stable or ‘well-grounded in important facts’ about one’s life. One can be pleased with her life, even if she is utterly confused about the actual conditions of her life and even if she has intentionally taken drugs that make her deluded about the actual conditions of her life. As long as the subject views her life positively, she will be happy, regardless of how she reaches that state. (Vitrano 117)

Essentially, Vitrano holds that happiness is nothing more than a feeling. The theory itself is not necessarily wrong, but it directs us to focus merely on the present, fleeting moments, and instant gratification, often a bad strategy for pursuing happiness. People often underestimate the intensity of future happiness when it comes through delayed gratification. According to Daniel Gilbert’s affective forecasting theory:

Time discounting (or time preference) is the tendency to weigh present events over future ones. Immediate benefits are normally preferred over

delayed ones, especially in longer time periods and with younger children or adolescents. The longer the duration of time, the stronger people discount the effect of the future. Because of this, people expect their affective reactions to an event to be less intense in the future than in the present. This pattern is sometimes referred to as hyperbolic discounting or “present bias” because people’s judgments are biased to present events. (Kassam et al. 40)

Our time discounting tendency in affective forecasting gives us yet another reason to give in to instant gratification or primal instincts while in reality, only the harmony between the “rider” and the “elephant” could bring a higher form of happiness and a flourishing mental life. The process does so by training our “second nature” or habituated system 2 to override our “first nature” or instinctual system 1. Second nature can override first nature and it is rational to do so when doing so improves happiness. We do so by training our elephant, system 1, to accept the habit of delayed gratification.

Based on the idea above, even if Vitrano is right that our feelings are the only measure of whether or not we are happy, sometimes we are not capable of deciding what is best for our long-term happiness based solely on our temporary feelings. What’s more, the happiness that we gain after developing beneficial habits gives us a more meaningful and flourishing life, thus making those habits authentic. This is preferable to the delusional and momentary instant gratifications that are purely dominated by our animal instincts. We should always strive for authentic happiness if for no other reason than it is more stable in the long-run. Inauthentic happiness ends when the delusion ends.

Genetic determinism view of happiness

There has long been a pessimistic view concerning the acquisition of

happiness that any active pursuit of it is futile. This view advocates that our happiness is predetermined by genetics:

First is the idea of a genetically determined set point (or set range) for happiness. Lykken and Tellegen (1996) have provided evidence, based on twin studies and adoption studies, that the heritability of well-being may be as high as 80% (although a more widely accepted figure is 50%; Braungart, Plomin, DeFries, & Fulker, 1992; Tellegen et al., 1988; cf. Diener et al., 1999). Whatever the exact coefficient, its large magnitude suggests that for each person there is indeed a chronic or characteristic level of happiness. Consistent with this idea, Headey and Wearing (1989) found, in a four-wave panel study, that participants tended to keep returning to their own baselines over time (see also Suh, Diener, & Fujita, 1996). Thus, although there may be substantial variation around this baseline level in the short term, in the long term people perhaps cannot help but return to their set point. (Lyubomirsky et al. 5)

Obviously there is nothing we can do about the happiness set point if it is genetically determined. But that still leaves 20-50% of happiness that can be affected by our habits, consciously chosen and formed through repetitive behavior as

described above. In fact, happiness is just one of many things partly controlled by genetics. Intelligence is another example. We are all born with different IQs, yet we face the same exam papers at school. We have to work hard to improve our given conditions by discipline and studying. The same is true with happiness.

Application

The struggle between eating and restricting food is one of the oldest substance abuse problems against which human beings fight. Eating

disorders illustrate the struggles between the two parts of the brain:

Areas of the brain that handle self-control and rational decision making are underdeveloped in young people, so it's their primitive brains and instincts that dominate. They have strong survival mechanisms which make them sensitive to any threat of starvation (which is what the body perceives a diet to be). When the primitive brain senses that food is scarce, it slows the metabolism, and produces strong cravings - usually driving the person to break the diet and regain the weight (often even more weight than was lost). Sometimes, however, this reaction is more extreme, and the starved brain will drive the person to binge eat, which can lead to bulimia or binge eating disorder. Conversely - in susceptible individuals, or after a prolonged period of dieting - the body/brain will "adapt" to starvation by shutting down the appetite and drive for food, which happens in anorexia. (Hansen 148)

My recovery from bulimia is an important life experience that has taught me in practical terms how to form healthy habits by finding the proper balance between the two parts of my brain.

The first and most important step was to acknowledge the existence of a primal “animal” part of my brain that is rather child-like: you can't reason with it and it just keeps on crying if you don't pay enough attention to it properly. After a series of failed attempts to fast, I came to realize that I was not to blame for not being able to control my cravings for eating.

But the urges to binge on food did not stop when I consciously decided to go back to healthy eating. The previously established habit loop had trained my “elephant” to believe that bingeing on food could protect my body from losing too many vital nutrients. I began to follow the advice from Kathryn Hansen's book and replaced the bingeing process by listening to my “animal” brain's thoughts without actually acting on them. I would sit quietly, not trying to rationalize with my primal instincts, and concentrate on

the waves of cravings I'd been feeling. I stopped trying to divert my attention with "a small walk, a warm bubble bath, or light music" like conventional therapies suggest, but directly acknowledged my instinctive urges. This way, the child-like "elephant" was addressed, and it stopped crying. The neurological connection between urges and binges was weakened after several successful practices.

Extension and Conclusion

Experiencing happiness is a mental process. The dual processing theory applies to the explanation and pursuit of happiness. Finding the balance between the two systems of our brain creates the best mental and emotional conditions to achieve well-being and happiness. When habituated activities form from conscious decisions over time, we put the two parts of our brain in harmony. The ways to happiness are complex and sometimes impossible to theorize, and establishing the harmony between the different parts of our brain might be only one of many. However, by resolving the conflicts between the two parts of the brain and developing healthy and beneficial habits, we free ourselves to experience a more meaningful and flourishing life.

Bibliography

Duhigg, Charles. *The Power of Habit*. New York: Random House Company, 2012. Print.

Evans, J. (2003). "In two minds: dual-process accounts of reasoning".

TRENDS in Cognitive Sciences 7. Print.

Haidt, Jonathan. "The Happiness Hypothesis". 2011. PDF file.

Hansen, Kathryne. *Brain over Binge: Why I Was Bulimic, Why Conventional Therapy Didn't Work, and How I Recovered for Good*. Columbus: Camellia Publishing LLC, 2011. Print.

Haybron, Daniel. *Happiness: A Very Short Introduction*. Oxford, Oxford University Press, 2013. Print.

Kahneman, Daniel. *Thinking, Fast and Slow*. New York, New York: Penguin Books, 2012. Print.

Kassam, Karim S., Gilbert, Daniel T., Boston, Andrew, Wilson, Timothy D. "Future anhedonia and time discounting". *Journal of Experimental Social Psychology* 44 (6): 1533–1537, 1 November 2008. Print.

Lyubomirsky, Sonja. Schkade, David. Sheldon, Kennon M. "Pursuing Happiness: The Architecture of Sustainable Change," *Review of General Psychology*, Vol. 9, No. 2, 111–131, 2005. Print.

Vittrano, Christine. *The Nature and Value of Happiness*. Boulder, Colorado: The Westview Press, 2014. Print.



The State of the Nigerian Economy: The Natural Resource Curse

Zurum Okereke

Author background: Zurum grew up in Nigeria and currently attends Sandy Spring Friends School in Maryland. His Pioneer seminar program was titled “An Overview of the U.S. Macro-Economy.”

Abstract

Nigeria’s title as the giant of Africa is no small achievement. The country stands as the most populated on the continent and has one of the strongest GDPs in Africa. Nigeria is blessed with massive natural resources especially crude oil. It ranks as a large oil exporting country in the world and as Africa’s largest. The country’s economy is pre-set by the standing of global oil prices. This research displays Nigeria’s deep reliance on the oil sector. Nigeria has been able to provide an example of how overreliance on any one aspect of an economy can be detrimental.

I. Introduction

The world is full of ironies and paradoxes, and to observe an example of this, all you have to do is to step out in the streets of Nigeria and notice the extensive poverty. This is surprising because Nigeria is blessed with an abundance of resources. There are not many countries around the world where the potential and the economic level have such a negative correlation. Chidi, at fifteen years old, is the proud first son of his family. His name in his native Igbo language means ‘God Exists,’ and upon looking at his family, it is hard to argue with the decision to give him that name. Chidi has

experienced nothing short of the best since he was born. His parents had the financial resources to travel to North Carolina to give birth to him, thereby granting him United States citizenship. Chidi and his brother and sister each have their own private bedroom and bathroom in their family's six-bedroom house that sells on the market for 3.2 million US Dollars. He has the latest smartphones and video game systems scattered around the house. As the first son, he is expected to go on to one of the top international universities and come back to run the offshore drilling company that his father started a decade after the first oil boom in 1977. Meanwhile his mother is also successful, working as the CEO of a travel and resort agency in the travel industry. Chidi is hard working in his own right, but he has barely had to do anything on his own, with domestic servants and cooks around the house. While still in Nigeria, he attends a prestigious private British school.

Meanwhile 14-year-old Dayo is also the proud first son of his family. Dayo is the jewel of his family, the oldest of seven children. He has 'brought joy' to the family just as his name suggests in Yoruba. Dayo is an intelligent and respected older brother to his siblings. He shares a room with them in a low-income apartment-housing program; the household also includes his parents, of course, and his father's parents. Dayo's father, a carpenter, is a hard-working, respected man in the community. His mother sells sweets and fresh foodstuffs from her rundown shack. Dayo's intelligence is obvious and is noticed by family and neighbors in his community, but there is nothing that can be done to develop his abilities much further. His father and mother are barely able to make ends meet for the family, meaning that additional income must be brought in by others. From the age of eight, Dayo was forced to become a hawker. He sells quick snacks and food while darting between cars on the busy highways and down the traffic-filled roads from

dusk till nine at night. He must also look after his younger siblings, some of whom sell items with him on the streets, while the younger ones stay at their neighbor's apartment when everyone is away. To entertain himself and his siblings, Dayo builds contraptions, toys, and games out of the junk pieces he picks up on the streets, such as the old tire tubes that he spins down the road with sticks. Dayo is good at figuring out how to chase down cars and sell products to them while avoiding being hit by them.

Based on these two lifestyles, it would be easy to think that these two boys are living in completely different cities, regions, or even countries. However, this is not the case. They both live in Lekki, a city in Lagos State. The only thing that separates Chidi's gated community from Dayo's shoddy apartment is a four-lane highway; their lives cross paths every day. Since the age of eleven, Chidi has seen Dayo selling snacks on the road, and he has even bought some as his driver took him home from school. These are two boys from completely different backgrounds, one full of ever-growing wealth, one of unbelievable poverty. However, it is only in this short transaction between the boys that their lives flash before each other's eyes.

This is obviously but one example of stratification in Nigeria. What makes it more unfortunate is that this type of co-existence occurs in one of the richer parts of Nigeria. If this happens here, then what might the picture look like in less fortunate cities and states across the country? Differences in lifestyles separate people for much of the time, but simple exchanges and certain events during each and every day bring them together. Only a small percentage of the country's population enjoys the benefits of the oil industry, while the rest are left to fend for themselves and their large families. However, the country finds other ways to come together, for example through religion, soccer, and the love of young ones who are treasured in

every family.

The purpose of this paper is to provide an overview of the state of Nigeria's economy, analyze past government economic policies, and present possible future solutions to existing problems. The paper seeks to answer the question of why a country, blessed with such abundance in natural resources, lags behind much of the rest of the world. First the paper reviews the McKinsey Global Institute's report on the Nigerian economy. From there the ideology of the "natural resource curse" is analyzed, and Nigeria as an example of it is examined. The country's economic potential from natural and human resources is explained and its stagnant economic growth as well. Factors in and explanations of Nigeria's disappointing economic growth are presented. A final section concludes by making recommendations for the country to follow to achieve optimum economic growth.

II. Literature Review: McKinley Global Institute Annual Economic Review 2014 (Nigeria)

The McKinsey Global Institute (MGI) evaluates and analyses economies around the world.¹ As a result, MGI is able to explain a country's current economic state, present its potential growth, and generate strategies for industries and governments to follow.

In its report, MGI restates the well-known fact that Nigeria has to overcome corruption on a path to economic success. Corruption is one of the major factors in the economic literature that is seen as preventing a country from

¹ *Nigeria's Renewal: Delivering Inclusive Growth in Africa's Largest Economy*. McKinsey Global Institute, 2014.

reaching a higher per capita income. Corruption resembles a tax, and hence companies, both foreign and domestic, are skeptical of investing in a country where numerous bribes have to be paid. (See inter alia, Barro 1996)² It simply lowers their return on investment. According to the MGI report, paying bribes in Nigeria raises the cost of business by 3.2%. In the oil industry, which accounts for a large percentage of Nigeria's GDP, corruption is rampant. Oil pipes that cross the country are broken, and crude oil is stolen and sold in the black market. The lost oil adds up to almost 1.7 million barrels of oil monthly with a potential loss of approximately \$20 billion dollars annually.

The MGI report predicts that if Nigeria could attain its full potential growth, the real annual GDP would surpass \$1.6 trillion by 2030. While the country has experienced a real annual GDP growth of over 8% since the turn of the century, the percentage of people living in poverty has remained at a relatively high rate of around 60%. As the economy has expanded, the number of jobs in the country has remained fairly stagnant. For the country to feel the benefits of the high annual growth rates in GDP, more jobs must be created for the general population. Attaining this sort of GDP growth would place Nigeria in the top twenty of country economies.

An increase in jobs would coincide with an increase in household consumption. According to the MGI report, the 7.8% growth in household consumption would result in the trade sector contributing \$279 billion to annual GDP by 2030, compared to the \$87 billion we observed in 2013.

In addition, the report recommends more investment in infrastructure. Compared to other rapidly developing countries, Nigeria has fallen behind significantly in terms of residential and commercial investment and building

² Barro, Robert J. *Determinants of economic growth: a cross-country empirical study*. No. w5698. National Bureau of Economic Research, 1996.

of infrastructure, such as road networks, Internet service, and electricity. Countries such as China and Malaysia largely invested in their infrastructure through joint ventures with the private sector. This has expanded their road networks exponentially. In order for the country to reach its full economic potential of \$1.6 trillion by 2030, Nigeria will have to invest \$839 billion into its infrastructure. Such a broad investment strategy in infrastructure would also lead to significant growth in agricultural , which currently employs the bulk of the working class population as shown in Figure 1. In addition, Nigeria would also be able to tap into its population potential by increasing the manufacturing sector. With optimum infrastructure, manufacturing could contribute as much as \$144 billion to the overall economy by 2030, compared to the \$35 billion it does currently.

Besides the emphasis on eliminating corruption and increasing infrastructure investment, the MGI report recommends revising the current tariff policy. A cut in tariffs would increase consumption and investment. It would also drastically cut the cost of basic household items.

Overall, the MGI report captures the economic state of Nigeria adequately and provides strategies for Nigeria to reach its production possibility curve by using the full potential of its resources and human capital.

Figure 1: GDP Composition Sector³

III. The State of the Nigerian Economy

Few countries can claim to have the same array of resources that typify Nigeria. The country's resources consist of both natural resources, such as natural gas, crude oil and gold, and a vast population of approximately 170 million people. As of 2011, Nigeria had approximately 37.2 billion barrels of crude oil reserves and more than 100 trillion cubic feet of natural gas (Igberaese, 2013).⁴ However, in spite of this wealth of reserves, Nigeria continues to grapple with economic challenges. These include, among others, declining gross foreign and government spending, diminishing

³ Economy Watch - Follow The Money." Nigeria Economic Structure. Accessed October 1, 2014.

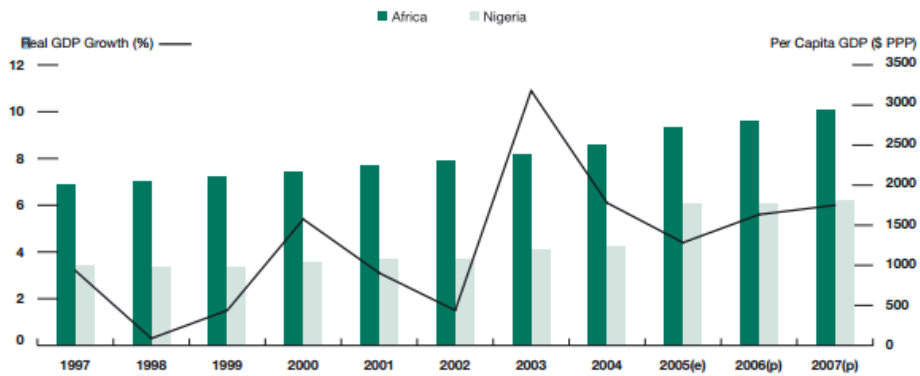
⁴ Tracy Igberaese, "The Effect of Oil Dependency on Nigeria's Economic Growth." *International Institute of Social Studies*. 2013. file:///C:/Users/USER/Downloads/Effect_of_Oil_Dependency_on_Nigeria_s_Economic_Growth%20(1).pdf (accessed September 28, 2014).

growth in important sectors such as agriculture, and income inequality within the population.

Although Nigeria has recently experienced significant GDP growth – 5.4% in 2013, and an average growth of 6.1% over the past ten years⁵-- the growth is small when compared to potential GDP growth. Figure 2 shows Nigeria's GDP growth since 1997 together with per capita real GDP levels. Nigeria outperforms Africa by both measures. However, when comparing that the GDP growth rate to a sample of other oil-producing countries such as the UAE and Indonesia, Nigeria's GDP performance is not that impressive (see Figure 3). Part of the reason for this underperformance may be the so-called "natural resource curse," also referred to as the "paradox of plenty." This theory attempts to explain why a country with bountiful natural resources is suffering from a low standard of living (per capita GDP) and poor economic growth. In Nigeria, symptoms of the curse include variable revenues from the natural resource sector, unstable institutions, widespread corruption, a lack of competitiveness, and geopolitical factors.

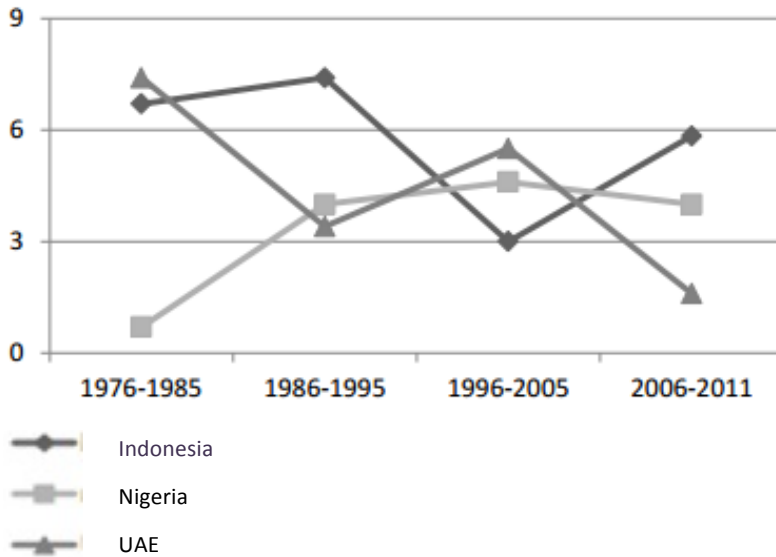
⁵ Trading Economics. "Nigeria GDP Annual Growth Rate 2005-2014 | Data | Chart | Calendar." Nigeria GDP Annual Growth Rate. Accessed October 1, 2014.

Figure 2: Real GDP Growth and Per Capita GDP⁶



Source: IMF Data estimates

Figure 3: Average Annual GDP Growth: Indonesia, Nigeria and United Arab Emirates 1976-2011⁷



Source: World Bank Databank

⁶ African Development Bank, and Organization for Economic Co-operation and Development, “Nigeria,” African and Organization for Economic Co-operation and Development. 2008. <http://www.oecd.org/dev/36741748.pdf> (accessed October 3, 2014).

⁷ Tracy Igberaese, *The Effect of Oil Dependency on Nigeria’s Economic Growth*, 32.

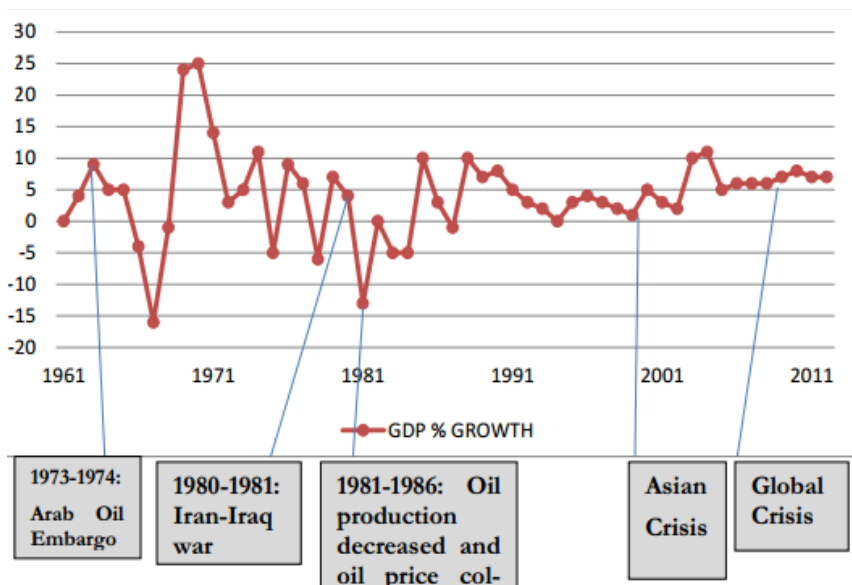
The World Bank (2014) reports that Nigeria currently faces a poor economic standing after experiencing diminished earnings in oil revenues.⁸ Nigeria, the leading producer of crude oil in Africa, relies primarily on its oil sector for economic development, overlooking other viable sectors such as agriculture and manufacturing. The 1970s oil price boom resulted in Nigeria abandoning its vibrant light manufacturing industry and also its agricultural sector. This resulted in an overreliance on crude oil revenues. Igberaese (Igberaese, 1) reports that the oil sector makes up at least 75 percent of Nigeria's federal government earnings.⁹ This means that Nigeria's infrastructure development and government spending rely heavily on the performance of a single sector. This causes widespread uncertainty within the economy as a result of fluctuating oil prices in international markets as well as economic changes in countries that are exporting or importing crude oil. Take the US as an example: while the US once met 10% of its crude oil needs by imports from Nigeria, by 2012 its imports declined to 5%, resulting in a major decline in revenue for Nigeria from this source.

The Nigerian government's reliance on oil is ill advised because of unpredictable oil price fluctuations. Figure 4 displays the effects that price shocks had on Nigeria's oil revenues. Nigeria's non-oil sector contributed a meager 4.1% to government earnings. Although the country's service sector increased its share from 25% in 2000 to 37% in 2011, production of basic goods still dominates the country's economic performance (Igberaese,15).¹⁰

⁸ The World Bank, "Nigeria Economic Report," The World Bank. 2014 http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2014/07/23/000470435_20140723133415/Rendered/PDF/896300WP0Niger0Box0385289B00PUBLIC0.pdf (accessed September 28, 2014).

⁹ Tracy Igberaese, *The Effect of Oil Dependency on Nigeria's Economic Growth*, 1.

¹⁰ Tracy Igberaese, *The Effect of Oil Dependency on Nigeria's Economic Growth*, 15.

Figure 4: Nigeria GDP Growth and Oil Price Shocks (1961-2011)¹¹

Source: World Bank

Nigeria's poverty rate, according to the World Bank, is extremely high. 46% of the nation's population lived below the poverty threshold in 2009-2010. This is astonishingly high to an outside observer given the country's overall economic performance and growth. The poverty rate is inconsistent with countries experiencing similar levels of growth. Statistics such as the poverty rate raise the question as to why Nigeria's rapid growth, its large economy, and its wealth have done so little to reduce the country's poverty rate. The answer to the puzzle lies in the country's overreliance on the oil sector. Generally this has caused other sectors to be ignored.

Another hindrance to Nigeria achieving higher growth rates is the result of institutions and, in particular, the nation's political and ethnic clashes that

¹¹ Igberaese, Tracy. *The Effect of Oil Dependency on Nigeria's Economic Growth*. United States: Institute of Social Studies, 2013 (accessed October 1, 2014).

have led to major conflicts within the country. Since gaining its independence in 1960, Nigeria has experienced constant civil struggles, mostly prompted by regional and ethnic differences. These disagreements continue to occur despite measures towards regional power sharing. Ironically, the failure of institutions in Nigeria is attributable in large parts to the nation's abundant oil resources, as well as its dependence on these resources. The presence of plentiful oil resources may be a necessary but not sufficient condition to the explanation of Nigeria's regional and ethnic conflict. Uhumwuangho and Ekpu (2011) point out that these resources continually deter the optimal practice of federalism, as there is friction between the oil rich south, the north, and the central government. This, in turn, creates a lack of trust between the different levels of government.¹² The existence of numerous states within Nigeria classifies the country as a federalist state, and helps to provide solutions that allow ethnic groups to participate in the central government while allowing separate groups to maintain their individual identities. Nigeria has its shortcomings as a federalist state since the non-oil regions are disadvantaged in both the political process and the national wealth distribution. The existing constitution has been ineffective in preventing civil conflict and military coups. The country's oil wealth paves the way for large income inequalities, ultimately causing constant violent ethnic conflict.

Nigeria's income inequality gap is quite vast, with the top 20% of the population holding 48.9% of the national income.¹³ The country's development has been slow due to its reliance on oil and the central

¹² Okungbowa, Sunday, and Christopher Ekpu. *FEDERALISM: PROBLEMS AND PROSPECTS OF POWER DISTRIBUTION IN NIGERIA*. 5th ed. Vol. 13. Benin City, Nigeria: (Accessed October 1, 2014).

¹³ World Bank. "Income Share Held by Highest 20%." Data. Accessed October 1, 2014.

government's mismanagement in the form of poor revenue distribution. This has ultimately resulted in regional and ethnic conflict in several regions of Nigeria and in the Niger Delta. Due to the overreliance on the oil sector, the Federal government has invested almost exclusively in this sector, resulting in substantial control over its economic capacity. Another issue is that the state basically controls all the revenue from natural resources, meaning that government positions have become roles in which some people steal money. This has led to widespread corruption and the opportunity for some officials to favor individuals and contractors linked to their ethnic or political groups.¹⁴ This patronage leads to religious and ethnic conflict because certain groups benefit at the expense of others.¹⁵ Political leaders use oil revenue to bribe regional groups and governments to obtain political support. This leads to an imbalanced revenue sharing system, with those linked to government officials receiving more of the revenue than the rest of the country.

IV. Recommendations and Conclusion

All is not lost for Nigeria, however. Practical actions have to be taken to reverse the potential outlook of this oil-centered economy. These include the diversification of the economy to include different economic activities such as agriculture and manufacturing. Also, regional governments and the central government should invest in the grassroots jobs of their different regions. Tapping into the potential gains that each respective region holds

¹⁴Olarinmoye, Omobolaji Ololade. *Politics Does Matter: The Nigerian State and Oil (resource) Curse*. 2008. file:///C:/Users/USER/Downloads/The_Nigerian_State_and_Oil_Resource__Curse.pdf (accessed October 1, 2014).

¹⁵Xavier-Sala-i-Martin, and Arvind Subramanian, "Addressing the Natural Resource Curse: An Illustration from Nigeria," Columbia University and International Monetary Fund. 2013. file:///C:/Users/USER/Downloads/Addressing_The_Natural_Curse-_A_Nigerian_Illustration.pdf (accessed October 3, 2014).

will counter rural-urban migration and allow for proportionate development in all regions of the country. Nigeria has enormous unexploited potential within its borders, from its vast human resources to its massive geographical space. Effectively exploiting these resources means shifting away from reliance on a single sector and instead mixing up different sectors in a single pot. Investing in Nigeria's agricultural and manufacturing sectors will be essential. A key step, especially with Nigeria's population, will be investing in more significant industries. The country has the basic framework for a booming service industry in places such as Nollywood, Nigeria's film industry, the third biggest in the world after Hollywood and Bollywood. Meanwhile, further developing Nigeria's vast telecommunications network, particularly with the high usage of phones by the general population, will go a great distance in boosting the economy. Most important would be investing in the electricity and power-generating capabilities of the country. If the country can be provided with constant electricity, it would save the general population money that can be used to spur the economy. Furthermore, this would help small businesses, and the total aggregate of the economy would be larger than the current one, in fact, comparable to that of the big multinational companies residing in the country. This would lesson Nigeria's issues and curtail most regional, political, and ethnic conflicts; mismanagement and misallocation of resources; and corruption. It would also lead to a much-improved spread of the country's wealth and, most importantly, would lead to a positively growing and unified country.

Bibliography

African Development Bank, and Organization for Economic Co-operation and Development, "Nigeria," African Development Bank and

- Organization for Economic Co-operation and Development. 2008. <http://www.oecd.org/dev/36741748.pdf>.
- Barro, Robert J. *Determinants of economic growth: a cross-country empirical study*. No. w5698. National Bureau of Economic Research, 1996.
- Economy Watch - Follow The Money." Nigeria Economic Structure. Accessed October 1, 2014.
- Igberaese, Tracy. "The Effect of Oil Dependency on Nigeria's Economic Growth." *International Institute of Social Studies*. 2013. [file:///C:/Users/USER/Downloads/Effect_of_Oil_Dependency_on_Nigeria_s_Economic_Growth%20\(1\).pdf](file:///C:/Users/USER/Downloads/Effect_of_Oil_Dependency_on_Nigeria_s_Economic_Growth%20(1).pdf).
- Olarinmoye Omobolaji Ololade, "Politics Does Matter: The Nigerian State and Oil (Resource Curse)," *Africa Development* XXXIII, no. 3, (2008), 21–34. file:///C:/Users/USER/Downloads/The_Nigerian_State_and_Oil_Resource_Curse.pdf
- Trading Economics. "Nigeria GDP Annual Growth Rate 2005-2014 | Data | Chart | Calendar." Nigeria GDP Annual Growth Rate. Accessed October 1, 2014.
- Uhunmwuango, Sunday Okungbowa, and Ekpu Barr. "Federalism: Problems and Prospects of Power Distribution In Nigeria," *Journal of Sustainable Development in Africa* 13, no.5 (2011), 183-192. http://www.jsd-africa.com/Jsda/Vol13No5_Fall2011_A/PDF/Federalism.pdf.
- World Bank, The. "Nigeria Economic Report," The World Bank. 2014 <http://www-wds.worldbank.org/external/default/WDSContent>

Server/WDSP/IB/2014/07/23/000470435_20140723133415/Rendere
d/PDF/896300WP0Niger0Box0385289B00PUBLIC0.pdf.

Xavier, Sala-i-Martin, and Arvind Subramanian, “Addressing the Natural Resource Curse: An Illustration from Nigeria,” Columbia University and International Monetary Fund. 2013.

