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The production of the Hilltop Review is a collaborative endeavor. Without the assistance and cooperation of numerous faculty and graduate students this issue of the Review would not have been possible. Back in October when I took over as editor of the Review, a call for papers was sent to all the chairs of the various departments. I thank all the chairs and graduate advisors who followed up on the Review’s request to forward the call for papers to all their graduate students. Once the papers started coming in, the chairs of the departments were once again called upon. For each author, the chair of the graduate student’s home department provided the names of one faculty member and one graduate student to serve as peer-reviewers. In some cases there was a need for extended communication between myself and the chairs in order to find suitable and willing peer-reviewers. The chair’s contributions to this Review are greatly appreciated.

The work of the peer-reviewers cannot be applauded enough. I am grateful that the peer-reviewers were able to take time out of their busy schedules to review these papers and to do so with unconventionally short deadlines. Next, the editorial board is to be applauded for completing a number of tasks in a timely manner and always with the highest quality of work. The editorial board not only judged the various articles and pieces of artwork, they also provided important feedback to the authors themselves. The editorial board members also met short deadlines and provided impressive feedback that has translated in innumerable ways into this issue of the Review. In terms of institutional support, the Graduate Student Advisory Council (GSAC) provided all the funding through the Graduate Student Assessment Fee. The GSAC leadership team provided unfailing support and I duly thank Joel Luc Raveloharimsy, Michelle A. McWilliams, and Ochas Kashinge Pupwe for their efforts.

In this issue we have six outstanding articles. They come from various social and natural sciences. Every paper went through an extensive peer-review process. I have resisted the urge to make dramatic changes to the papers – I am a political scientist after all – and not an expert in all areas of academic endeavor.

This issue features articles from English, Political Science, Public Administration, History, Physics, and Mathematics Education. The Review’s desire to be interdisciplinary has been achieved in practice to some degree. The Review encourages this eclecticism and looks forward to receiving more and more submissions from all areas of research at Western Michigan University. It may be that the call to be interdisciplinary rings hollow to some readers, but the Review is by definition an interdisciplinary journal of Western Michigan University graduate student research. In order to be an interdisciplinary journal in more than name only it is imperative that we receive more submissions from outside the social sciences and humanities. Only one article from the
natural sciences was submitted for this issue and we are happy to be able to publish it along with the other five articles from the social sciences and the humanities. In my experience, social scientists never tire of talking about and drawing examples from the natural sciences. This affection for using examples drawn from the natural sciences is evident in more than one authors’ contribution to this issue. The Review wants natural scientists to submit their work for publication and even encourages them to talk back to the social sciences in their work.

This issue also features the artwork and digital photography of two different artists. The inclusion of artwork is an important aspect of the Review’s image and we hope more and more graduate students will submit their artwork and photography in the future. As the reader can see, there is no requirement that one be pursuing a degree in the fine arts or aspire to be a professional artist in order to submit digital photography or artwork. The published submissions come from graduate students in the School of Social Work and the Department of English. We welcome the submissions from the more traditional areas of artistic training at WMU, but any graduate student’s artwork and digital photography will be reviewed as a potential addition to the next issue of the Review.

Finally, a special thanks is in order to Brandon Bruce Dellario whose artwork has been featured in the past three issues of the Review. His “Michigan Ruby-Throated Hummingbird” has appeared in one form or another in the last three issues and his artwork has been used on the cover of the last three issues.
The development of distinct varieties of English is a diverse and interesting process. In places over the entire globe where once existed exclusively non-English speaking peoples, various forms of English are now used as the primary means of communication in many different settings: governmental, business, educational, and home. Frequently, new varieties of English form out of necessity as a way for groups of people with differing linguistic and cultural backgrounds to communicate and effectively coexist. Two such languages, Australian Aboriginal English and African American Language, though they developed within different circumstances, have some interesting similarities in terms of their origins and source language influences, linguistic features, and social stations. In analyzing these similarities and why they exist, we can draw some important conclusions about language as a frequently overlooked form of social injustice as well as its role in developing cultural and individual identity.

Australian Aboriginal English (AAE), like many other varieties of English, does not exist as a single, fixed language variety, but instead is constituted by a language spectrum with variation among its speakers. This spectrum has come about as a result of the combination of English with what were once around 250 “mutually unintelligible” Aboriginal languages when the British arrived in the 1770s (Kirkpatrick 79). Kirkpatrick explains that at the time, “[t]he multilingual nature of Aboriginal society meant that a single Aboriginal language was unlikely to assume the role of the language of communication among all Aboriginal Australians” (79). Because of this, the need for Aboriginal groups to communicate with one another and with the British was fulfilled by English, specifically AAE, interestingly the very language that would eventually eradicate many of the original source languages. Today more than half of the Aboriginal languages “have ceased to be spoken at all” and “[f]ewer than 10” of the remaining languages “have more than 1000 speakers,” as most of the Aboriginal people now communicate solely in AAE (Butcher 625). On one end of the AAE spectrum, speakers use language varieties close to the mainstream variety used and valued in academic and professional settings in Australia. These varieties tend to have vocabulary that is also used in this more mainstream variety (Butcher 636). On the other end of
the spectrum, AAE speakers use varieties that resemble creoles, or early yet stable forms of language originating as a combination of two distinct languages—in this case, one or more of many possible Aboriginal languages and English. In these varieties, much of the vocabulary is comprised of “loanwords from local indigenous languages” (Kirkpatrick 79; Butcher 636). Though there are differences in the lexicon used by speakers of AAE, for the vast majority of varieties of AAE along the entire spectrum, many of the prominent syntactic and grammatical features are derived from Aboriginal languages (Kirkpatrick 79).

There is a debate among linguists concerning the origin of African American Language (AAL), also commonly referred to as African American English, Black English, Ebonics, and other terms. (Herein, it will be referred to as AAL in order to maintain its difference from the other language variety of consideration and because this term is currently widely accepted among linguists.) Most linguists agree that AAL found its origin in the late seventeenth and early eighteenth centuries, around “the point at which African slaves were thrust into a linguistic situation in which they had to learn English” (Green 8). However, Rickford and Rickford explain the debate about how the language formed:

Some scholars contend that [AAL] bears the vivid imprint of the African languages spoken by slaves who came to this country in waves from the seventeenth to the nineteenth centuries. Others maintain that the devastating experience of slavery wiped out most if not all African linguistic and cultural traditions, and that the apparently distinctive features of [AAL] come from English dialects spoken by white (British) peasants and indentured servants whom Africans encountered in America. (129)

Essentially, the argument stems from whether or not AAL was originally formed as a creole, with its basis being deeply affected by African languages, or as a result of slaves adapting the languages of native English speakers, with its basis in other varieties of English, particularly southern varieties. Similar to AAE, the uncertainty of the origin of the variety is further fueled by the variation that exists within the variety, affected by each speaker’s geographic location, generation, socioeconomic status, and other factors. Despite the origin debate and internal variation of AAL, many linguists agree that the vocabulary of the variety can be linked most closely to English, while, like AAE, there is influence from African languages on the variety in terms of its grammatical rules, sound patterns, and pragmatic usage (Rickford and Rickford 145; McLaren 101).

Within countless linguistic studies, both AAE and AAL have been
identified as unique, rule-governed language varieties with set patterns that govern their usage (see Melchers and Shaw, Kirkpartick, Green, Smitherman, and Rickford and Rickford, among others). Just as the mainstream varieties in each country (those currently valued in academic and professional settings) can be spoken or written incorrectly according to their rules for usage, AAE and AAL can also be used incorrectly. Because of this, each language variety can be deemed linguistically equivalent to its mainstream counterpart. However, this research has not yet been saturated into broader society, and as a result, the marginalized and mainstream varieties are unarguably socially unequal. Certain linguistic features of AAE and AAL, by nature of how they are perceived by those who are not users of the varieties, seem to contribute to this social inequality and set them apart from their corresponding mainstream varieties. Three of those features, common to both language varieties, are explained in-depth below.

Auxiliary deletion is a linguistic feature of both AAE and AAL that occurs in declarative and interrogative constructions when the verb “to be” is omitted. Butcher explains that “[AAE] is sometimes said to have verbless sentences . . . but it would be more accurate to say that AAE, like many other languages, including many indigenous Australian languages,” uses auxiliary deletion as a feature of its grammatical structure (631). Butcher offers these examples to illustrate: “That my brother house” and “They really big” (631). Green provides the following AAL examples of the same feature: “They walking too fast” and “He be there in a minute” (40). This construction, though it regularly and systematically occurs in both languages, has been pinpointed as a stigmatizing feature in both languages—a feature that some have used to show that the varieties are “lacking sophistication” in some way, as compared to the mainstream varieties in America and Australia.

Multiple negation is another grammatical attribute of both languages that occurs regularly in their usage. This construction is used in negative sentences in which more than one element can be marked with the negative, even if this causes what some would refer to as a “double negative” or “triple negative.” This rule nullifies the “traditional prescriptive” teaching which “states that ‘double’ negatives are not grammatical because they make a positive” (Green 77). In fact, Rickford and Rickford point out that “double negatives [in AAL] are virtually never interpreted as positives . . . the meaning is crystal clear in context” (123). The following examples illustrate multiple negation in AAL: “She wadn’t no young lady, neither” and “I don’t want nothing nobody can’t enjoy” (Rickford and Rickford 123). It is clear in these examples that each item in the sentence that can be marked with the negative is indeed marked, following the pattern for usage. AAE also has these constructions, as illustrated in these examples: “They not give us nothing” and “I never
got no pay‖ (Butcher 633). Like auxiliary deletion, multiple negation is one of a very small set of features of AAE and AAL that have been used to marginalize these varieties. Ironically, these constructions are “often used incorrectly by the same people who try to show that what is taken as AAE is illogical speech” (Green 35). This incorrect overemphasis on features that differ from the mainstream varieties, coupled with a lack of understanding and misuse of the varieties’ constructions, causes many to cast negative viewpoints on these varieties and their speakers.

Another interesting feature used in both languages is the verbal marker *bin* to signify “remote past” tense (Green 54). Green provides the following AAL example of the construction, “She BIN [capitalized to indicate stress] running,” represented in more mainstream English as, “She has been running for a long time” (55). Melchers and Shaw illustrate this quality in AAE with the example, “[T]hat man bin come inside the bar,” alternatively represented as, “That man came into the bar a long time ago” (103). In addition, Green indicates a particular phonological aspect of this verbal marker: “The stress (or pitch accent) distinguishes *BIN* phonetically (i.e., pronunciation) and semantically (i.e., meaning) from *been* (the unstressed form), which also occurs in [AAL]” (55). This element of using phonetic difference to illustrate meaning is not easily misinterpreted by those who have grown up learning and using AAE or AAL; however, it can be and is frequently misunderstood by those who are not speakers of these varieties. The use of *bin* and other constructions that are indicated by pitch or stress variance is sometimes misinterpreted by those who do not understand the pronunciation intricacies of the language as unintelligence or a lack of grammatical understanding on the part of the speaker.

An additional aspect of both language varieties is their quality of having maintained some of the speech pragmatics common in their source languages. For example, Kirkpatrick explains that speakers of AAE frequently use indirectness, a “communicative strategy of Aboriginal languages” (81) when answering and/or asking questions. “Speakers of Aboriginal English may not respond at all to a direct request, but provide what has been called the ‘yes of gratuitous concurrence’ . . . This ‘yes’ lets the speaker know that the listener is attending to what is being said, but it does not mean that the speaker agrees with what is being said” (Kirkpatrick 81). Speakers of AAL have also inherited many pragmatic traits inherent of the linguistic tradition and culture of Africa, the country which most linguists believe to be at least a part of the source of the language. Smitherman explains: “‘Oral Tradition’ . . . refers to games, stories, proverbs, jokes, and other cultural productions that have been passed on from one generation to the next by word of mouth” (223). One specific aspect of “Oral Tradition” is called “signifyin” or “playin the dozens,” in
which two (usually friendly) parties compete against one another in a battle of insult and wit (Smitherman 224). Outsiders to AAE or AAL who encounter the “yes of gratuitous concurrence” or witness two people “playin the dozens” might misunderstand the significance of these speech events, viewing the speakers as rude or callous. However, in relating this concept to another culture, to immediately draw those conclusions would be just as severe as judging a Japanese person to be aloof or impersonal because he bows rather than shaking hands. Each of these practices is an important part of the cultural heritage that has been passed down through the traditions of these groups of people.

In terms of the social factors surrounding AAE and AAL, there are some further commonalities between the two, albeit discouraging ones, especially with regards to education. Many students who are raised speaking AAL or AAE in their families and communities enter schools in which the more mainstream varieties of American and Australian English are spoken, valued, and taught as the correct and only option for verbal and written communication. These students’ languages (and therefore cultures) are denigrated, and students’ voices are invalidated; many students are judged and treated unfairly, which causes problems for them, both academically and socially. Sharifian writes: “[S]tudents speaking Aboriginal English or an Aboriginal language [are] more likely than other students to miss school and show lower levels of academic performance” (131). These factors are caused, in part, by students’ internalization of their teachers’ attitudes towards their language use, as they may come to view themselves as less capable of learning than those who speak more mainstream varieties and ultimately disengage from school. Smitherman adds that teachers of AAL-speaking students “correct constantly to the point of verbal badgering [and] exclude [students] from regular classes in order to take speech remediation” (141). While the teachers of these students may think that they are actually putting the students’ needs first in adamantly teaching them the language variety more widely accepted in professional settings, they are, as a detriment to all of their students, missing key opportunities to teach about language and cultural variation, as well as acceptance, tolerance, and social justice for people with different backgrounds. And ultimately, they put students who use marginalized language varieties at a grave disadvantage.

In both America and Australia, there is a call from scholars, linguists, and educators for change in the way speakers of AAL and AAE are taught mainstream English varieties as well as in the way language variation is presented to all students. The educational gaps between mainstream and marginalized speakers are only widening; teachers, curriculum developers, and administrators must take action to remedy this situation, and it doesn’t involve assigning more worksheets on “correct” verb tense. Sharifian explains:
Students speaking Aboriginal English may believe “the school is not respecting my home language, which is part of me and my identity, so school is not about me”... [Schools should] acknowledge the home language/dialect of students, while empowering them further by teaching them SAE. This does not mean simply saying to students, “Your language/dialect is fine and I respect it, but keep it for outside the school”, but that they be given opportunities to use their dialect appropriately at school (132).

These shifts in educational practices would require new teaching strategies that honor and validate students’ home languages in addition to using them as an important tool in the teaching of the more mainstream varieties. Even more importantly, teachers must examine their own language prejudices and biases in order to truly change their internal language attitudes, enabling them to take a healthy stance towards language diversity and advocate for that stance in the classroom. Smitherman reverberates this call, saying: “Now don’t nobody go trippin cause ain none of dese proposals suggesting that schools shouldn’t teach ‘standard’ English... My point has to do with how you teach [mainstream English] and the social and political messages that should accompany language and literacy instruction.” (161)

Though both AAL and AAE formed and continue to develop for their speakers as distinct varieties in different parts of the world, they clearly bear some interesting linguistic and social resemblances. The study of these commonalities seems to serve two purposes. The first is to provide a reminder that though cultural, social, and linguistic differences can negatively affect the combining of groups of people, communication, as a necessary condition for coexistence, will always prevail. And though there is a delicate balance between language as a marker of identity and as a tool for interaction, emerging language varieties do not always evoke the “power of the oppressor,” but can be owned by a group of people to present a prevailing statement of culture, identity, and belonging. Furthermore, all people, whether speakers of mainstream varieties or marginalized varieties should come to view language variation as a positive aspect of diversity among peoples, rather than as a factor to create hierarchy or as difference that should be leveled through assimilation.

The second purpose is to offer further evidence that no rule-governed language variety is linguistically “better” or “worse” than another. Daily, people are persecuted, judged, and left behind as a result of their language, a trait which for most people, is not chosen—it is merely an accident of birth. The fact that AAE and AAL, simultaneously evolving across the world from one another, contain the same stigmatized features that are so censured by speakers of more mainstream varieties proves that these features do not insinuate stu-
pidity or lack of sophistication on the part of their speakers. They are simply linguistic negotiations, formed as a result of language combination. If this fact were to be internalized by those in positions of power—those who, by accident of birth, were probably born into families speaking more mainstream language varieties—perhaps we could allow people all over the world another step, a linguistic step, toward educational, occupational, and societal equality.

References


THE MYTH OF PROGRESS IN SCIENCE: DIALECTICS, DISTORTION AND LYSENKOISM IN THE SOVIET UNION

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The scientific controversy surrounding Lysenkoism is both unparalleled and well known amongst historians and philosophers of science (Joravsky 1970, McMullin 1987, Pollock 2009, Wolfe 2010). Yet, while this may be true for scholars and students a generation ago, I argue that the controversy of Lysenkoism is not widely known today. Particularly in political science, this historical period and phenomenon in the Soviet Union remains irrelevant or at least, inconsequential to the scientific study of politics.

What value then, would an examination of an already well discussed, yet largely forgotten scandal in science accomplish? First, the unique socio-political and historical material circumstances surrounding the controversy can offer a re-evaluation of the politics of science and the process by which scientists and the general public understand and conceive the notion of "progress." While easy to dismiss as inconsequential or as a historical "fun-fact," T.D. Lysenko's theories and practices were considered revolutionary within his homeland. They were progress for Soviet science, and although largely discredited today, some would argue that Lysenko's ideas retain value and are indeed contributions to science (Liu 2004, Rolls-Hanson 2005).

Second, Lysenko is also relevant for political science because any examination of politics adds to understanding in general. More specifically, the controversy involves political explanations, in terms of the social phenomenon of Lysenkoism, but also in terms of the structure and processes involved in the creation of political science itself. Lastly, while not arguing the case of Lysenko can or should be enveloped in a larger typology or pattern of controversies in science per se, general knowledge can be gleaned about understanding past or current controversies.

A common myth within and outside of the scientific establishment has been the conception of scientific "progress" towards a grand vision of generalize, universal "big T truth." What this position presupposes is that the accumulation of scientific knowledge is both teleological and ahistorical. By scientific establishment, I am conflating processes, individual scientists, organizations and distinctions between different spheres of scientific endeavors. A crucial distinction should be made between the natural and social sciences, but while there are certainly important differences and logics at work within these spheres, my argument generalizes these differences to maintain a man-
Contrary to the conception of science in a vacuum, I argue, scientific practice and the meaning of progress are socially and historically bound. Illustrative of the political and social processes that constitute scientific practice and knowledge is the case of T.D. Lysenko and what became known as the scandal of “Lysenkoism” in the former Soviet Union. Rather than offer a definitive explanation or "cause" of Lysenkoism in the positivistic sense, I employ a Marxist perspective. This Marxist lens can uncover the processes of Lysenko’s case but also to help gain insight into science as myth and progress as concretely determinable.

Science, whether in the West or the East, does not stand on its own, but occurs within the context of social processes, political decision-making and social relations. Pursuing how science or scientific theories are constituted, legitimated and discarded reveals how conceptions of an objective measure of “progress” simply do not conform to historical circumstance. It is not that various facts and knowledge have never “accumulated” or that data collection strategies or techniques have not progressed substantially, but rather, that the myth of “progress” has been largely characterized as ahistorical and apolitical.

Scholars like Thomas Kuhn have long since shown that scientific “progress” is political and changes have a revolutionary character. Marxist scholars such as Lewontin and Levins (1985) have challenged the concept of “progress” in the field of biological evolution which has broader implications for science in general; progress, both theoretically and materially, is dialectical, historical and political (27-28). Thus, the history of Lysenkoism is best approached by analyzing both the historical and social context in which Lysenko was born, in addition to the trajectory of theoretical and practical genetics, biology and agronomy in Russia and the subsequent Soviet Union.

Trofim Denisovich Lysenko was born in 1898 in Karlovka in Poltava Province, Ukraine (Young 1983). Born to peasants and humble surroundings, Lysenko would become an influential figure in the USSR and eventually become a “dictator” of an entire academic field (Graham 1993:126). According to Graham, “Lysenko was strikingly different from the majority of biologists and agronomists... he was a vociferous champion of the Soviet regime and its agricultural policies” (127). The force and success of what has become known as “Lysenkoism”, the tacit acceptance and promotion of Lysenko's system throughout the bureaucracy, has many facets and defies singular explanations of “cult of personality” or “corrupted bureaucracy”. To understand Lysenko and his doctrines fully requires a historical and holistic approach.

Lewontin and Levins (1976) contend that, “The Lysenkoist movement of the 1930s-60s in the Soviet Union was an attempt at a scientific revolution” (33). Although the movement would eventually produce failure, they
identify several factors that contributed to its fruition and success. First, Ly-
isenkoism developed during a time in Soviet society receptive to radical pro-
posals due to the pressing needs of Soviet agriculture. Second, there were
strands of non-academic agricultural traditions and practices along with dis-
credited Lamarckian conceptions such as the transmission of inheritance
through acquired characteristics, from which to draw intellectual content.
Third, due to high literacy and the popularization of science, the debates over
theory and method was made a public affair. Fourth, a budding cultural revo-
lution put tension between the youth and exacerbated the view of an elitist
academy. Finally, there was a widespread belief in the relevance of philosophi-
cal and political issues which kept discourse at the most general level. In ad-
dition, these circumstances were nested in a larger, international political con-
text of competition with a rival superpower (i.e. Cold War, etc.) and a repres-
sive and dogmatic bureaucratic and administrative apparatus (33)

Methodological Dialectics

Substantiating and defining what employing a "Marxist" perspective
consists of, at least in methodological terms, requires two caveats. First, the
proliferation and history of Marxist thought has produced a variety of strains,
differing camps and persuasions which make it difficult to reduce all Marxian
thought into a comprehensive definition or criteria. For example, one may call
themselves "Marxist" but would that be orthodox, neo-Marxist, structural, post
-structural, young Marx, mature Marx or Leninist-Marxist etc.? Second, be-
cause of this, there remains on-going debates, disagreements and continual
specifications and reinterpretations which will be eschewed and/or conflated in
favor of a general, less technical specification. For elaboration, Resnick and
Wolff (2006) offer a selection of essays which address contemporary debates
and work in Marxian theory.

In methodological terms, a Marxist perspective involves historical ma-
terialism and materialist dialectics. Simply, historical materialism contends
that phenomenon are contextual situated in time and space (be that social
space as well) and cannot be understood as existing independent of context.
This means that objects and ideas which seem natural, eternal or generalizable
are dependent upon the time, place and culture in which those objects and ide-
as are situated. In addition, the driving force (kinetics as Lewontin and Levins
(1985) conceive) that move history are based in material reality, social rela-
tionships and economy. This would be in contrast to idealist conceptions of
reality which posits that consciousness, ideas or ideology are the kinetics of
history shaping it and bringing material phenomenon into being. Elements of
dialectical thinking are not strictly Marxist and can be found in the writings of

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ancient Greek thinkers. G.W.F. Hegel is the modern wellspring of dialectics, his being idealist, but Critical Theorists such as the Frankfurt School (Horkheimer, Adorno, Habermas, Marcuse, Siebert etc.) have expanded modern dialectical thinking extensively.

Under positivistic methodologies, phenomenon are reducible to their constituent parts which is necessary for understanding the fundamental essence of a thing. What positivistic methodologies allow is for propositions to be posited which can then be verified as established fact or truth. Steinmetz (2005) makes a distinction between positivism at a philosophical level and a historically situated "methodological positivism" which is closer to the conception that I employ. The main features of methodological positivism include an epistemological commitment to the discovery of universal laws, empiricism as necessary to understand the world and assumptions that methods in the social and natural sciences are identical (3).

Dialectics, in contrast, do not reduce phenomenon into their constituent parts but rather attempt to create knowledge in a holistic fashion. This logic defies singular explanations for phenomenon and attempts to reconcile aspects of things that appear as contradictory. In positive science, objects and phenomenon fall into mutually exclusive categories. Examples of this include distinctions of political versus economic or science versus religion. Whereas, under dialectical logic, politics cannot be fully understood without reference to the economy and mutually exclusive categories dissolve making reduction problematic.

As an example of differentiating the two logics, take the topic of scientific controversies. Under positivism, it would be useful to determine the exact causes of controversies and define the essential and constituent parts that make a controversy a "controversy" in general. The next step could be to reduce all historical examples of scientific controversy into the framework and explain the root causes and effects throughout all cases of controversy reducing them to their essential and constituent parts. This would concretely establish what a controversy would consist of regardless of time or contingent circumstance.

Dialectical logics would instead examine the contradictions and antagonisms involved in a case or cases of controversies. What would be crucial would be to examine the processes which bring the controversy into being or what factors influenced this or that particular controversy in relation to the context. More importantly, dialectically logics would resist isolating the controversy as such since it would be interconnected to the forces producing change and its initial creation. The key questions would not be "what does a controversy ultimately consist of or what are their ultimate causes?", but rather "what processes and factors brought this controversy into being or what forces
and interrelations allow it to persist or be defined as such?"

While the above discussion makes effort to delineate the two logics, in a dialectical fashion, however, these two logics themselves are not mutually exclusive. Both are useful for understanding a complex reality and share overlap in terms of how scholars apply them. Critical Theory and the Frankfort School for example, draw conclusions and accept knowledge created by both positivist and dialectical methodologies.

The Rise and Characteristics of T.D. Lysenko

Bracketing explanations for a moment, the biography of Lysenko's life is the most well known and straightforward aspect covered by scholars. Graham (1993) states, “Lysenko began his career in Ukraine and in Azerbaidzhan, southern regions of great agricultural importance to the Soviet Union” (124). Educated at the Kiev Agricultural Institute, he applied his mix of formal education and peasant “mentality” to his postings at remote research stations. According to Sheehan, Lysenko “...first came into the limelight in 1927 in connection with an experiment in the winter planting of peas to precede the cotton crop in the Transcaucasus. His results, in his remote station in Azerbaidzhan, were sensationalised in Pravda. The article projected an image of him as a sullen 'barefoot scientist' close to his peasant roots” (MIA Sheehan 1978). His skill in using the news media to publicize his discoveries and his “masterful way with journalist” would be an important feature of his career (Joravsky 1970 59).

What put Lysenko on the map was his discovery of vernalization. Although he himself did not “discover” the technique, his use and application was as innovative and original as it was forceful. Vernalization was an agricultural technique which attempted to obtain crops in winter that were planted during summer months but were soaked and chilled for a period of time (MIA Sheehan 1978). With the promise of higher yields in a time of famine, the Ukrainian Commissariat of Agriculture Aleksandr Shlikhter, ordered wide-scale use of the technique (Soyfer 1994 17). A promotion was in order for his discovery and in 1929, “Lysenko was moved to a newly created department for vernalisation at the All-Union Institute of Genetics and Plant Breeding in Odessa. While in Odessa, he began to publish the journal Yarovizatsiya (Vernalisation) in which he disseminated his ideas on a wide scale and created a mass movement around vernalisation” (MIA Sheehan 1978). What Lysenko offered was “progress” in the science and techniques of agronomies- for which he was handsomely rewarded.

Lysenko's fame began to grow and he began to be known, not so much for the accuracy or applicability of his theories and techniques, but for his abil-
ity to “get things done.” His success as an agrobiologist and his practical achievements were difficult to assess and nearly impossible to replicate. Echoing sentiments of what Joravsky calls a “peasant mentality,” Sheehan comments:

His methods were seriously lacking in rigour, to put it mildly. His habit was to report only successes. His results were based on extremely small samples, inaccurate records, and the almost total absence of control groups. An early mistake in calculation, which caused comment among other specialists, made him extremely negative toward the use of mathematics in science.

Yet he continued to climb higher in the bureaucracy. By 1938 he became president of the Lenin Academy of Agricultural Sciences. By 1940 he ascended to his highest position as director of the prestigious Institute of Genetics of the Academy of Sciences. While it is tempting to account for this transition due to personal qualities or “bossism,” the story is more complicated. Structural, historical and political factors all contributed to Lysenko's progression from an agronomist in remote Azerbaidzhan to the most powerful agrobiologist and figurehead of an entire academic field. This ascension was by no means bloodless or apolitical; the path was littered with the bodies of dissenters.

Structure, Science and Politics in the Soviet Union

Born a Ukrainian peasant, Lysenko's rise seems a proletarian triumph and was largely regarded in that way by his supporters. The combination of collectivization and state ideology helped to bring many individuals into positions within the bureaucracy once open only to “bourgeois” specialists or highly vetted professionals. Budgetary constraints also played a distinct role in helping to foster “peasant scientists,” since trained agronomists were not able to be placed at every village (Joravsky 1970:54). Accordingly, by 1929 there were 23,000 participant peasant scientists working in “hut labs” throughout the Soviet Union (54). These factors would lay the foundation of Lysenkoism: the widespread promotion and acceptance of, as authoritative, Lysenko's scientific theories and leadership.

As Joravsky points out, these peasant scientists would specialize in many techniques and aspects of agronomy or agriculture, from “Weed control, proper collection and spreading of manure, introduction of clover, purchase of certified improved varieties of seed, sprouting potatoes before planting...” and other innovative techniques (54). The work of those peasants participating in the “hut lab movement” was met with ridicule and hostility by many villages and other peasants. Advice was often given to peasants by village leaders to
form groups under the guise of civil defense organizations to avoid ridicule (58). Jorasky contends that these conditions produced a “peasant mentality” among the scientists to psychologically manage the anxiety of taking chances, along with, a general hostility to interference; “If he thought his 'experiment' might fail, he would not try it himself, much less urge it on others” (58). Lysenko, according to Joravsky (1970), had just such a mentality.

While peasant ideology certainly would play a role in decision-making, this conception only highlights a singular psychological aspect, which authors such as Lecourt (1977) or Lewontin and Levins (1976) contend as overly simplified and inaccurate. The historical circumstances do not lend themselves to explanations given by scholars such as Joravsky, “The books of Medvedev and Joravsky show clearly the way in which dogmatism, authoritarianism and abuse of state power can help to propagate and sustain an erroneous doctrine and even establish its primacy for a time. But a theory of 'bossism' is not sufficient to explain the rise of a scientific movement with wide support nor to explain its form and context” (Lewontin & Levins 1976 39). What is significant about Joravsky's “peasant mentality” thesis is that it illustrates Lysenko's connection to the social circumstance of other peasants who would enter formal education or continue the expansion of what would eventually constitute agricultural science and practice in the Soviet Union.

Before elaborating upon the events that helped to consolidate Lysenkoism, some explanation of the basic tenets of the doctrine and of traditional genetics are in order. According to Lewontin and Levins (1976) there are six tenets underpinning the theoretical structure of Lysenkoism: First, heredity is conceived as physiological process extending over the lifespan of an organism as it interacts with its environment. Second, assimilation of environmental conditions occurs in relation to the heredity of the organism whose “program” unfolds over the course of the lifetime and aspects of the environment are either selected or excluded which pass on to the next generation. Third, if the environment is normal then the heredity is maintained in the reproductive cells, but if conditions are altered then changes occur in the hereditary processes of the next generation. Fourth, specific factors such as vernalization, grafting and hybridization destabilize the hereditary program and allow it to be modified. Fifth, assimilation of nutrients and the external environment are dominated by heredity and during sexual reproduction, there is a mutual assimilation of different heredities which make it a vulnerable stage for modification. Sixth, speciation is not a product of populations but of individual developmental physiology (35-36).

While not exclusively comparably to Lamarckian conceptions of the inheritance of acquired characteristics, many features of Lysenkoist doctrine rely on those concepts. What is so crucial, particularly in regard to the state philosophy, is the possibility for humans to intervene in the material world in a
positive manner. Modification and intervention in the evolution of organisms for human purposes fit well with the normative conceptions of Marxism whose goal was understanding the world in order to change it. Rather than applying dialectical materialism to produce the tenets of Lysenkoism, however, the tenets were born from experience in field and promotion of false results. Lysenkoism was a Marxist science in name only.

Currents and work on genetics had begun and were accepted scientific practice in the Soviet Union for many years. Genetics under Lysenko became associated with the West and became labeled a “bourgeois” science. In the West, genetics were continually advanced throughout the 20th century and in the sense of true progress, by the end of the century, had achieved ultimate status as the mechanism for heredity. Mendelism or Neo-Mendelism was the main theoretical construct guiding investigations into heredity during Lysenko's time. Created from and expanding on the postulates of Abbe Mendel in the early 1900's, it is the general science of particulate heredity (Huxley 1949 3).

According to Huxley, Neo-Mendelism has four main tenets: First, the distribution of inheritance is based upon the behavior of the chromosomes and genes and serve as the heritable differences between individuals. Second, all changes in heredity are due to past mutation with either the addition, substitution or subtraction of genes or strings of genes leading to variation. Third, evolutionary change is based upon natural selection and the differential survival of genes with mutations serving as the quanta of change. Fourth, mutations produce effects which are small and these incremental changes appear as continuous variation at the species level and are important in evolution (121-22). The main difference between Neo-Mendelism and Lysenkoism, Huxley contends is that, Neo-Mendelism is organized around a central concept whose formulation was needed to explain observed facts, whereas, Lysenkoism was a central concept imposed on certain facts while excluding others to offer an alternative explanation (22-23).

With the discovery of DNA in 1953 by Watson and Crick, the geneticists were given a solid, materialist foundation for genetics on which they have never been refuted and is currently accepted fact (Gouyon et al 2002 135). In Lysenko's time, though, many aspects of genetics and the mechanisms and processes remained under-developed. On these “silences” in genetics Lysenkoists built their case to bolster their theories while ignoring both the Eastern and Western contemporary, and current research of the day that supported genetics. To solidify the movement, geneticists and other dissenters in the Soviet Union would pay a high price.

According to Graham (1983), the history of dialectical materialism as a pursuit of scholars can be broken into two phases: (1) “authentic” and (2) “calcified”. During the authentic period of the pre-1930s, natural science
ideology was not an intrusive affair and many scholars were freely interested in Marxist theories and methods (122). The application of dialectical materialism was done “authentically” as opposed to ideologically where Marxism was forced upon scientists as a state doctrine.

This situation intensified during the purges of the 1930s when the political atmosphere in the Soviet Union became even more oppressive and strained. The process of collectivization under Stalin was a traumatic experience involving the dislocation of millions of peasants and repression by police forces to ensure obedience to new rules. During this period universities and the main scientific establishment, the Academy of Sciences were purged and reorganized, “The intellectual tone of the academic discourse changed. The shifts were most dramatic in the social sciences, but they could be seen in the natural sciences as well. The historian who today leafs through Soviet journals of the late twenties can easily perceive a transformation around 1929, the year of 'the Great Break’” (Graham 1993 122).

Joravsky (1970) argues that political factors played an important role while placing responsibility on biologists that they themselves were unwitting contributors to the switch from genetics and biology to Lysenkoism. First, they endorsed a “Marxist” biology that was juxtaposed to a “bourgeois” science of any kind. Second, they endorsed the end of intellectual autonomy for scientists and scholars. Finally, they agreed with the program of political bosses that biologists duties were to serve the country's immediate practical needs rather than science for science sake (237). Given the context of the 1930s, however, it seems more than “unwittingly” that any scientist would support such radical shifts to an ideological science without coercion. The climate of fear and the reprisals against those individuals who challenged state authority or orthodoxy would be sufficient to induce many scientists to follow the official discourse. A striking comparison can be made of the US during “McCarthyism” when it became practically impossible for scholars sympathetic to Marxism or communism to hold those views in or outside of the classroom (Reisch 2005 19). Defiant scholars often lost their positions or were reprimanded under a climate of fear and repression.

Lecourt (1977) offers a more specified and historical approach which includes three distinct periods in which to examine the continuous political evolution of Lysenkoism. The first period can be considered his “technician phase” which lasted only a few short years from 1927 to 1929 and has already been discussed in some detail. This was the beginning of his career and had he not garnered governmental support, the outcome of his career would certainly have been different (40).

During the second period, roughly 1929-1934, Lysenko moved from technique to theory. What he called the “phasic development of plants” would become a key component of Lysenkoist doctrine (41); it was during this period
that a movement began to grow around the singular scientist. Lysenko also
did much to connect his new science to that of Ivan Michurin, a revered Leninist geneticist and agronomist who Lysenko mythologized after his death in 1935 (43-44). Developed contrary to Mendelism, which offered an internal “particulate” mechanism for the transmission of heredity, Lysenko posited, “By regulating external conditions, the conditions of life, of vegetable organisms, we can change strains in a definite direction and create strains with desirable heredity. Heredity is the effect of the concentration of the action of external conditions assimilated by the organism in a series of preceding generations” (Ryan 2002).

In the West, Mendelism had led to the discovery of the gene and chromosomes which were identified as the material “substance” of heredity in organisms, whereas in the East, this path was denied. Ironically, geneticists of the West had more closely satisfied the assumptions of dialectical materialism becoming more “Marxist” than had Lysenkoists in their distortions of Michurin, a founding father of Soviet genetics. Michurin had made important discoveries concerning predominance in genetics and his fruit gardens were recognized by the Council of People’s Commissars under Lenin’s insistence (MIA Michurin). Michurin himself never rejected Mendelism but the theories he formulated towards the end of the 18th and beginning of the 19th century had room for interpretation. These inconsistencies and unanswered avenues were seized upon under Lysenkoist conceptions.

That Michurin had laid foundations for a Soviet science of genetics was no concern for Lysenko who misrepresented his theories for his own political gain. Lysenko established his theories in opposition to genetics and Western “bourgeois” science in general. Sheehan (1978) gives an illustrative summary:

The science of genetics was denounced as reactionary, bourgeois, idealist and formalist. It was held to be contrary to the Marxist philosophy of dialectical materialism. Its stress on the relative stability of the gene was supposedly a denial of dialectical development as well as an assault on materialism. Its emphasis on internality was thought to be a rejection of the interconnectedness of every aspect of nature. Its notion of the randomness and indirectness of mutation was held to undercut both the determinism of natural processes and man's ability to shape nature in a purposeful way.

The disingenuity of Lysenko’s theories can be attributed to the fact that they were in no way deduced from the principles of dialectical materialism, but had a pragmatic character stemming from the experience of attempted agron-
onomics experiments (Lecourt 1977, 46). According to Soyfer (1994) Lysenko lacked the passions and intellectual curiosity of many of his peers (9). It is doubtful that Lysenko's intellectual accomplishments would lend credibility to the idea that he struggled to reconcile the dialectic and Marx's conceptions prior to or during his practical experiences in the field. Soyfer states, "Yet, having examined pages written in Lysenko's own hand, I can affirm that the inadequacies of his education remained obvious throughout his life... and he was unable to complete either a master's or a doctoral dissertation. Instead, he found a different way to the top..." (9-10).

Only later, after the fact of his success did Lysenko attempt to reconcile his theories into a coherent whole. The last phase extended from 1935 to 1948 and marked the most brutal and repressive consolidation of Lysenko's power and influence. During this time the doctrines, strands and inconsistencies in Lysenko's theories would be reorganized and unified into a theoretical system under the guise of dialectical materialism, the official philosophy of the Soviet state (Lecourt 1977 46).

The "new biology" that Lysenko and his followers established depended upon an ideological framework which made it possible to declare Mendelism as a "false" or "bourgeois" science compared to the "true Proletarian science" of Lysenkoism. This stance contributed to the repression and ultimate banning of genetics by Lysenko in his position as director of the Institute of Genetics of the Academy of Sciences. According to Lecourt, "From here it was only a step to treating geneticists as traitors and agents of imperialism infiltrated into the state apparatus" (47). In 1940, a crucial event in their campaign against the geneticists occurred: the attack on the most prestigious Soviet geneticist, Nikolai Vavilov. Director of the Moscow Institute of Genetics, Vavilov was publicly denounced by Lysenko and was subsequently arrested and died in deportation (49).

As Sheehan states, "Vavilov was not the only one. The growing ascendency of Lysenko coincided with the purges that reached into virtually every Soviet institution during 1936 to 1939. Already, before Vavilov's arrest, the losses among Soviet biologists had been staggering" (MIA). Many scientists, dissenters and oppositional bureaucrats found themselves in prison or dead. Regardless of these events, Lysenko found favor among Stalin and many other leaders of the Communist Party. Even after Stalin died, Lysenko remained in his position, yet, the apogee of the movement had passed and soon opposition both inside and outside of the Soviet Union would begin crack the edifice of Lysenkoism.

Farewell T.D. Lysenko and the Progress of Marxist Science

For most of the Lysenkoist period in the Soviet Union, the ideas and
practices of T.D. Lysenko were largely unknown to the outside world. Few of the techniques and results received the serious scrutiny that may have undermined the theories. Concerned with emerging American imperialism during the Cold War, the Soviet establishment convened a meeting to unite the widest possible spectrum of individuals into an ideological front to meet this challenge. The World Congress of Intellectuals for Peace was convened in Wroclaw, Poland in 1948, but to the surprise of many, the topic turned to Lysenko, which started an ideological battle, which was to have lasting consequences (Lecourt 1976, 17-18).

The article that began the battle was written by Jean Champenoix under the title, “A Great Scientific Event: Heredity is Not Governed by Mysterious Factors” and presented a report by the Soviet academy which was thoroughly denounced by the international community as based on metaphysics (18). The arguments made by the Lysenkoists in defense were largely based on ideological and political grounds rather than scientific ones. This stance only weakened their position as they claimed, as the rhetoric of Lysenko had consistently maintained, that it was a matter of “bourgeois” versus “proletarian” science (24).

At the conference, many Soviet geneticists spoke out against Lysenko’s theories and the experiences they had endured. By the end of the conference, however, Lysenko had drafted a report which effectively ended genetic study in the Soviet Union. Through the guise of “reorganization” of biology, the revisions extended throughout the scientific establishment down to the syllabi of individual professors in order to promote Michurin and Lysenkoist theories of heredity. Lecourt states, “These practical measures signaled no more nor less than the death sentence of genetics in the Soviet Union: all teaching of this discipline and all research were to be prohibited for more than fifteen years” (34). The reaction shocked the international community and set the USSR back for decades on research in genetics- a costly mistake from which was sown the seeds that ultimately led to the demise of Lysenkoism. The scientific “progress” that Lysenkoism had once offered had become a rigid, politically supported doctrine, amounting to a regression and distortion of science.

Lewontin and Levins (1976) point to five factors that contributed to the decline of Lysenkoism: First, it did not fulfill its promises to agriculture which had always remained a critical issue, but now after 30 years of practice it would no longer seem the “fix” that it once was perceived as. Second, administration and economic planning became depoliticized and more business-like; the domain of experts and technicians. Third, the prestige of academic authority was reconsolidated and the “revolutionary” peasant innovators and subsequent cultural revolution was aborted. Forth, the “two camps” (East vs. West) rhetoric that many politicians had favored lost sway and a more conciliatory approach was adopted; defiance of genetics that was once considered a pride
became an embarrassment. Fifth, the political police power began to weaken along with the need to settle past oppression and the return of many exiled geneticists created new demands for freedom of scientific research (56-57).

Finally in 1962, due to political pressure stemming from Khrushchev's exposure of the Stalinist "cult of personality" within the Soviet Union, Lysenko was dismissed from his position as director of the Institute of Genetics of the Academy of Sciences (Soyfer 1994, 272-73). An ardent Stalinist from the beginning, without the support of powerful leaders and amidst a climate of change in the scientific establishment and broader culture, Lysenko lost most of his positions and status bringing an end to the era of Lysenkoist domination.

Far from the simple tale of the misuse of science by a maniacal bureaucrat or from a genuine attempt to integrate Marxism and dialectical materialism into biology and agronomy, Lysenkoism represents a historical and political struggle in which many actors and factors contributed to a dynamic ascension of a particularly gifted rhetorician with the backing of a repressive, authoritarian state. Ultimately, Lysenkoism is the story of a failed revolution which effected the social and material relationships and conditions in Soviet Russia only to produce its own destruction through contradictions in practice and theory. Even though the case of Lysenkoism is unique to the historical circumstances in which it was situated, there are lessons to be drawn for science and the meaning of progress in the West and globally. It begs the question: as to what types of scientific dogmas and incorrect theories are politically supported in the American or international context? What contemporary theories cast as "progress" will not stand the test of time or be revealed as fraudulent?

Lysenkoism was based upon a vulgarization of Marxism; vulgarization in the sense that Marx's theories were not represented accurately or as an intellectual endeavor, but as ideology. The dangers of such vulgarization are well highlighted by the history of the movement. While the failure of Lysenkoist science helped to discredit a Marxist approach among many scientists globally, the negative example it provided allowed for new avenues in appropriate Marxist science to be considered. "Progress", in that sense, has given the approach value in the West as an alternative paradigm to traditional scientific method (Lewontin & Levins 1976, 63) as practitioners have had to reevaluate the assumptions of scientific theory given the context of recent politics and society. Studying the history of Lysenkoism has the potential to provide insight into the actual application of Marxist thought, especially in consideration of its pitfalls, methodological issues, its failures and possible successes. So long as scholars continue to find value in Marxist thought and dialectical materialism, it will have a critical place in the realms of science and society as a valuable, if not indispensable, innovative means for resolving fundamental
While "progress" as a universal, determinable goal is questionable, conceptions that science can and does change over time is certainly tenable. Particularly within the context of each discipline or scientific specialization, progress is possible; it is defining progress, however, which requires politics and is not a completely objective, empirical "Truth." As Rule (1994) contends, "...the expectation that theoretical work in our discipline should yield conclusions to puzzles or problems that just anyone might entertain is misguided and foredoomed. Instead, people may insist, different theoretical projects define their own ends-and their own standards for 'progress' in those directions" (254).

References

The Myth of Progress in Science


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Two traditions of social science research can be identified as ‘quantitative’ and ‘qualitative’ research, which are different from each other in style and technique. Supporters of these two traditions “sometimes seem to be at war” regarding the supremacy of their respective tradition in analyzing social phenomena (King, Keohane and Verba, 1994). In general, this war is quite visible in the field of social science and in public administration, which refers as federal, state and local government, as a discipline of social science. Transcending the boundaries of academia this debate has received considerable interest recently from people every corner of the society for several reasons. Any interested observer of current U.S. politics can notice these different views in the debates regarding U.S. government policies on the recent health care reform, bail out policies of financial institutions and auto industries. In general, liberals and Democrats in Congress supported these policies and, in contrast, conservatives and Republicans in Congress opposed the new reform policies.

Significant differences in policy choices in responding to critical socio-economic issues such as opposing health care reform and financial bailout in this economic downturn by a major political party may surprise general population, but from an epistemological point of view this is not a surprise at all. Differences of two major political parties are rooted in different epistemological views, which influence subject, goals and frame of the research question (Hessey-Biber & Leavy, 2004). Generally, in most cases views of the Republican Party on socio-economic issues are based on a positivist philosophy, which is designed by the model of natural science research, particularly a positivist approach (Bryman, 1992). Positivist approach is the idea that scientific knowledge should be originated from facts that must be based on observation rather than on opinion or speculation (Chalmers, 1999). It is important to note that, although, scholars in public administration use positive approach but they are mostly related to economics.

In analyzing public policy issues by positivist approach advocates of this approach emphasize that policy making and its outcomes might be improved if policy goals and implementation strategies of public organizations

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are based on quantitative, in other words scientific, data (Hughes, 1998). For example, in the context of recent health care reform a major argument of the Republican Party was that reform could increase the financial burden of federal and state government as the burden of paying for an increased number of beneficiaries who currently have no health insurance would be theirs. It is interesting that this argument ignored the fact that almost 47 million people in the U.S. had no health insurance due to high costs. In contrast, views of the Democratic Party on socio-economic issues are based mostly on a postpositivist philosophy, which is influenced by the epistemological view that rejects the appropriateness of use of natural science approach in understanding humans (Feyerabend, 1975). Postpositivist approach emphasizes qualitative research.

In analyzing social issues in public administration by quantitative tradition, two issues have received central attention recently due to the vast differences of two major political parties. First, the question of how ‘scientific’ statistically generated data is (the basis of quantitative research), and second, if public administration focuses only on quantitative research in formulating and implementing public policies. In examining these two central issues related to public administration research this paper uses quantitative data on the U.K. under the ‘people’ category presented in the CIA World Factbook as a metaphor. Main research question examined in this regard: can the statistical data of CIA World Factbook on the U.K. ‘people’ category, especially on ethnicity, religion, and languages, be considered as “scientific” upon which many quantitative research studies are based? This research question has been analyzed in relation to two central issues, as previously mentioned. This paper concludes that statistically generated quantitative data in the CIA World Factbook cannot be declared ‘scientific’ as portrayed by quantitative researchers and public administration research should not focus solely on quantitative research based on statistically generated data. It is important to note that this research is not about the authenticity or objectivity of the CIA World Factbook by any means as it uses statistical data generated by various governments, private, and international organizations. This research only focuses on some specific data provided in the CIA World Factbook and raises some issues as a metaphor to examine the claim of ‘scientific’ as a feature of quantitative data in general.

This research will contribute to the understanding of students of various social sciences as well as general readers about the recent debates over various social issues and positions of two major political parties through the lenses of quantitative and qualitative traditions of social science research. This research will also help students and general readers come to their own conclusions about criteria of public policy to address crucial social issues such as health care by public administration in federal, states and local level.
Methodology

To examine the current research question this paper employs a qualitative content analysis, which is a method of making valid inferences based on published texts such as documents, transcripts, news papers, and magazines by structures and procedures (Berelson, 1952) as its method to analyze the research question. In recent years this method also includes analysis of content of audio and video media (Stigler, Gonzales, Kawanaka, Knoll and Serrano, 1999) and documents available in Internet. The current content analysis includes analysis of both published and online texts from the CIA World Factbook of 1981-2010 periods. I believe that sample size of data within the periods of 1981-2010 (presented in the appendix) provide me legitimate scope to analyze the current research question regarding the claim of the “scientific” nature of data especially claimed by the quantitative researchers. Limit of the sample size of data about 30 years is a large enough to study a social phenomenon in terms of time. As Sandelowski (1995) argued that “(d)etermining an adequate sample size in qualitative research is ultimately a matter of judgment…” (p.183). Therefore, I believe that the analysis of data regarding the ‘people’ category of the U.K. provided in the CIA World Factbook from 1981-2010 is large enough in analyzing the current research question.

Methodological Controversies in Public Administration: A Background

Scholars of public administration have long been debating the issue of using research methodology in public administration (Wagle, 2000). Development of research methods and technologies in recent years have given social scientists the ability to use more precise, empirical models of scientific investigation and various mathematical and statistical tools to analyze social phenomena and thus provide strong arguments in favor of a quantitative approach to public administration research. Quantitative researchers argue that social reality can be ‘scientifically’ studied only based on quantitative information, in other words numerical or statistical data. ‘Scientific’, in this regard, is defined as systematically collected elements of information about a social phenomena related to a research (King, Keohane and Verba, 1994). Quantitative research uses numbers in analyzing social phenomenon and thus a major focus is put on numbers and statistical methods (Kvale, 1996); tending to develop causal relationships between two events based on numerical data and by using various statistical analysis (King et al.,1994).

In contrast, values like social equity and social justice have increasingly been emphasized in analyzing the role of public administration, evaluation of public policy, programs and performance of public agencies, which have provided strong arguments in favor of using a qualitative approach in public
administration research. Researchers of qualitative tradition argue that all social phenomena are not quantifiable and therefore public administration cannot rely only on quantitative research to respond to public demands. Quantitative research claims itself as “hard, objective, and strong” while it views qualitative research as “soft, subjective, and weak” (Hessey-Biber & Leavy, 2004).

In relation to methodological controversies in public administration research the current research aims to examine ‘scientific’ nature of UK demographic data in ‘people’ category provided in the CIA World Factbook as one of the premier sources of statistical data for quantitative research in social sciences (Buneman and Müller, 2009).

UK ‘People’ Category Data in the CIA World Factbook: A Discussion

In the following section the current research first discusses data presented in the UK ‘people’ category under the sub categories of ‘ethnicity’, ‘religion’, and ‘language’. Then it is analyzed as to whether these statistics can be considered ‘scientific’ based on the criteria of the ‘objective’ nature of scientific data as one of the major claims in favor of statistical data by quantitative researchers (Kvale, 1996). The characteristic ‘objective’ in quantitative research implies that the behaviors, for example demographic data such as age and gender, are easily classified or quantified by either participants or by the researchers (Gliner, Morgan and Leech, 2009) and findings should not be accepted or rejected by preference of researchers (Brady and Collier, 2004).

From 1981-1991 and 1995-2004, the ethnic identity of the U.K. population is measured as English, Scottish, Irish, Welsh, Ulster, West Indian, Indian, Pakistani, and Other. In 1981, the population with English ethnicity was 83%, from 1982-1991 and 1995-2004 the U.K. population of English ethnic background is shown as 81.5%. For the same year of 1981, the population of Scottish ethnicity in the U.K. is measured as 9%. From 1982-1991 and 1995-2004 people with Scottish ethnicity is measured at 9.6 %. In the same period of time, the population with Irish ethnicity is measured at 3% and 2.4 %, respectively. For the same period of time people with Welsh ethnicity in the U.K. were measured at 5% and 1.9%, respectively. The ethnicity of population as Ulster in the U.K. is measured at 1.8% for the periods of 1982-1991 and 1995-2004. The ethnicity of population labeled as West Indian, Indian, Pakistani, and other are measured at 2.8% from 1982-1991 and 1995-2004. From 1992-1994 for these three years no statistics are provided for any ethnic groups. In the period of 2005-2010, the subcategory of ethnicity in the CIA World Factbook includes new measurement units for the U.K. population such as White, Black, Indian, Pakistani, Mixed, and Other. In this period of 2005-2010, the ethnicity of population identified as ‘White’ is measured as 92.1%, 2% for ‘Black” in 2005 and 2007 and 2.1% for 2008-2010. For 2005-2010 the
population with Indian ethnicity is measured at 1.8%, Pakistani 1.3%, Mixed 1.3%, and Other 1.6%.

In the ‘Religion’ subcategory there is no data shown from 1981-2004, a consecutive 24 years, and from 2005-2010 the religion data is shown as Christian 71.6%, Muslim 2.7%, Hindu 1%, Other 1.6%, and Unspecified or None (in same category) at all, 23.1%. The language category does not record any statistical data, although, it records English, Welsh and Scottish as the three languages of the U.K.

Data in the U.K. ‘people’ category provided in the CIA World Factbook from 1981-2010 show an over simplification of statistical data recording. Starting the discussion with ‘ethnicity’ data; it is interesting that although ‘ethnicity’ data from 1981-2004 showed a consistent pattern including ethnicity of groups such as ‘English, Scottish, Irish, Welsh, Ulster, West Indian, Indian, Pakistani, and other’, from 2005-2010 it introduced total new categories in ‘ethnicity’ of ‘white, black, Indian, Pakistani, mixed and other’ instead of the previous categories. The question in this regard is how are these ‘ethnicity’ categories defined?

All black people do not necessarily belong to same ethnic group. Black people were first brought to the U.K. as slaves from all over the African continent. The current black population is made up of the successors of those African natives. “The peoples of Africa belong to several thousand different ethnic groups. Each ethnic group has its own distinct language, traditions, arts and crafts, history, way of life and religion” (Think Quest, 2010). Therefore, the generic brand of “Black” does not provide a reliable definition about the ethnicity of all people considered as black and thus these ethnic data cannot be objective. This generic categorization is surely influenced by the ideology of politics, value-ridden and positioned by traditional stereotyped views about black people. In this regard remark of Economic and Social Data Service (ESDS) is noteworthy: “Collecting data on ethnicity is a challenge because of the subjective, multi-faceted and changing nature of ethnic identification. In ethnic identity questions, we are unable to base ethnic identification upon objective, quantifiable information” (2010, p.5). In identifying ethnicity factors such as country of birth, nationality, parents’ country of birth, color, national/geographical origin, racial group, and religion although play important role but these factors cannot be meaningful if considered separately (ESDS, 2010). Another problem of generalizing ethnicity is “Different versions of the ethnicity question were asked in England and Wales, in Scotland and in Northern Ireland, to reflect local differences in the requirement for information. This again can make comparison difficult” (ESDS, 2010, p. 9). Similar to black, broad terms such as ‘Indian’ as an ethnicity does not make proper sense because of diverse ethnic groups of the country as acknowledged by ESDS (2010) that they fail to appropriately differentiate within the populations described. Thus,
one generic “Indian” brand cannot be an objective ethnic identity for all Indian immigrants living in the UK.

Even though it has only been in the last six years that the CIA World Factbook has been recording data on the religion of U.K. population, it also appears overly simplified. In 2005-2010, 71.6% of UK population is shown under the broad umbrella of ‘Christian’ faith when many other European countries and the U.S. categorize Christianity under several divisions because of distinct differences amongst Catholic, Protestant, Evangelical, Lutheran, Anglican and many other denominations. These are well established divisions within Christian religion and accepted by other countries. Therefore, statistical data of 71.6% of Christian without showing any subdivision does not portray the objective picture of religious affiliation of the U.K. population and thus cannot be claimed as ‘scientific’. Another reason that makes the claim of U.K. religion data as not scientific is: “It should be noted that, in terms of the statistics, of major religious groups, (italic added) the UK has to depend on sample surveys. It does not have the great advantage … in having the question of religion in the Census” (Christian Research Association, 2010). Similarly the Muslim religion has also many subdivisions with many crucial differences. In addition, for example, the “Kadiani”, a faith originated in India in early 1900s who believe many Muslim fundamentals while significantly contradict with many other fundamentals as well, although claimed themselves as Muslims but majority of mainstream Muslim community does not recognize them as Muslims. A number of “Kadiani” from India and Pakistan immigrated in the U.K. mainly on the issue of religious discrimination over the years yet all these groups of people are branded in one generic name of Muslim, which is surely misleading. This reality is acknowledged by ESDS as it states that religious affiliations of minorities are portrayed with various limitations due to small sample sizes of ethnic minorities. Due to this small sample it is difficult to portray a real picture of potential differences within specific categories, for example, among the settlers from different regions of India or different religious backgrounds (ESDS, 2010).

The CIA World Factbook does not provide any statistical data regarding language in the percentage of the U.K. population although three languages are listed as a U.K. language. This categorization of language conflicts with the ethnic category that shows more than 10 ethnic groups making up the U.K. population over the years. If these different populations have distinct ethnic identities then it is very likely that they have their own languages too, although there may be one or more major languages but there are no statistics reflecting about the languages of all ethnic groups showed in the ‘ethnicity’ sub category in the CIA World Factbook. Quantitative data as ‘objective’ implies that it provides clear explanation about any anomalies about data, which makes the ‘procedure is public’. This feature of scientific research as well as quantitative

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data is not followed regarding the projection of language data in the CIA World Factbook. Similarly, there are no notes provided for the change of names of categories in ethnicity, for example, from the old ethnicity categories of English, Irish, and Wales to recent categories of White, Black, and Others. Second, no definition is provided for categories such as White, Black or Christian, Muslims, and so on. As already discussed, all Africans do not belong to same ethnic group and neither all Christians have identical practices of their faith therefore, precise definitions should be provided in terms of ‘objective’ nature.

It is understandable that as the CIA World Factbook uses statistical data from various sources it is not unusual that subjective and value ridden character of primary sources of data may reflect in it, which is reported by ESDS’s comments on various ethnicity issues. Thus based on the analysis and the statistical data presented in the CIA World Factbook following findings can be reached:

It is not valid to claim that only statistically generated data are always ‘objective’ and thus ‘scientific’ because statistically generated data can be motivated by many factors and thus cannot be claimed always as scientific in terms of the criteria ‘objective’, which is the major characteristics of scientific data claimed by quantitative researchers.

Statistical data presented in the CIA World Factbook, especially on the U.K. ethnicity, religion, and language are subjective as different criteria are used in collecting these data especially ethnicity data (ESDS,2010) and religious and language data also appeared as value-ridden and positioned according to ESDS. Thus only statistically generated data cannot portrait the reality of social phenomenon, in this case, categorization of Black or Indian as an ethnic group cannot, or Christianity as religious affiliation can not portrait ‘objective’ picture of ethnic and religious differences among the U.K. population.

Conclusion

This research started with a specific research question: can the statistical data of the CIA World Factbook on the U.K. ‘people’ category, especially on ethnicity, religion, and languages, be considered scientific upon which many quantitative researches are based? One of the focuses of the current research, as mentioned earlier, was if public administration as a discipline focuses its research only on statistical data in formulating public policy. Using the CIA World Factbook as the metaphor of one of a source of statistical data, which is the basic element of quantitative research, the current content analysis reveals that the statistical data of a prime source of social science research may not be ‘objective’ and thus cannot be ‘scientific’.
Findings of the current research implies that although development of technology and computer software as research tools has made strong arguments in favor of using quantitative research in public administration but unfortunately, use of only quantitative research methods and statistical data cannot portray the reality of values of public administration research. Effectiveness of public policies, which refer as how successful a policy to achieve goals; as a core value of public administration cannot be measured by only quantitative criteria of cost benefit analysis or similar characteristics as used by the quantitative research. Qualitative methods, found that day to day government functions include many things rather than only decision making and policy process with quantifiable numbers and issues. Numbers are key ingredients in the policy process and the public administration decision process but “a high proportion of activities in which public managers engage are not amenable to the application of analytical techniques; a small proportion are” (Elmor, 1986, pp. 69-83). Public administration should respond to the demands of the public with constitutional guidelines, social equity, and social justice, values which cannot be measured quantitatively. For example, in the current economic downturn when millions of people in the U.S. have lost jobs, house and become unable even to take care of their health due to cost escalation only cost benefit analysis based on quantifiable data cannot be the basis of public policy regarding health care reform and its implementation. In formulating public policies in reforming health care government should respond to the needs of general people who are severely affected by economic downturns.

Therefore, my conclusion regarding the use of the quantitative method in public administration research, based on the findings of the current research, is that public administration should not focus only on quantitative research based on statistically generated data. Statistically generated data can also be less objective than portrayed by the quantitative researchers due to views and subjective judgment.

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The Cloister, An Augustinian Convent Translated to the Bahamas
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From Within the Abbey Church of Rievaulx, Yorkshire, England

Rievaulx Abbey was founded in 1132 AD by twelve monks from Clairvaux Abbey, as the first Cistercian monastery in North England. This picture was taken of the east inside façade of the Abbey Church. The church was originally a masterpiece of Romanesque architecture; however, this east end was rebuilt into one of England’s finest structures of Gothic architecture in 1225. Most monastic churches face the east where Christ is expected to rise again in Christian religion, yet Rievaulx abnormally faces the south since the monks had to fit the monastery into a narrow valley.

The Cloister, Paradise Island, Bahamas

This picture features a cloister belonged to the monastic enclosure of the 14th-century Greco-Gothic Augustinian Convent at Montréjeau, France. William Randolph Hearst bought parts of the convent and had it carefully deconstructed and shipped to America in the 1920s. It was left in shipping crates, until A&P heir, Huntington Ford bought the structure in 1962 and had it reassembled in the gardens of his new estate in the Bahamas. Historians and travel agents alike wrongly date the cloister to the 12th century, which was a Romanesque monastery that Hearst had bought. They also mistake it for a priory (for men), when in fact it was a convent, a place for women which would likely have had such a cloister.
VIKING AGE ARMS AND ARMOR ORIGINATING IN THE FRANKISH KINGDOM

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The export of Carolingian arms and armor to Northern regions outside the Frankish Empire from the 9th and early 10th century is a subject which has seen a gradual increase of interest among archaeologists and historians alike. Recent research has shown that the Vikings of this period bore Frankish arms, particularly swords, received either through trade or by spolia that is plunder. In the examination of material remains, illustrations, and capitularies, the reason why Carolingian arms and armor were prized amongst the Viking nations can be ascertained and evidence found as to how the Vikings came to possess such valued items.

The material remains come from a variety of archaeological sites, which have yielded arms and sometimes even well preserved armor. These artifacts are usually found in three types of sites. Bog deposits have the best-preserved weapons and armor because of the protective peat surrounding the object. Many solitary items, in various conditions, have been discovered in rivers. Most of the material remains, however, have been found in gravesites.

Literary records verify that swords and other weapons and arms passed to neighboring regions through gift-exchange. The Frankish Royal Annals show such gift giving relations between the Anglo-Saxons and the Franks. In the Annals, Charlemagne gave King Offa an Avar sword. Notice that the Franks gave away not their own prized swords, but foreign ones, which were acquired by Charlemagne’s son, Carloman, from the Avars. These exotic swords were depicted only as ceremonial or show pieces, hence they were not held in as high a regard by the Carolingians as were their own swords. The Gesta Karoli Magni mentions that Frankish arms and armor were exported widely. Evidence found in the Baltic region and beyond indicates such exports in the mid-ninth century. The monk of St Gall mentions the appearance

1 S. Blowney, “Petersen’s Type H-I Swords, a Gazetteer of Sources” (paper presented at the Medieval Congress, Kalamazoo, Michigan, Session 461 on Saturday May 7, 2005).
2 The Royal Frankish Annals' in Charlemagne, trans. P.D. King (Kendal, 1987).
5 Ibid.
of Vikings intending to purchase superior swords at the court of Louis the German,\(^5\) which denotes a peaceful trade system.

Restrictions on trade became authorized in many Frankish capitularies.\(^6\) Carolingian rulers fashioned these laws to stem the flow of arms, especially swords, to outside regions by condemning their export. The situation had not improved; therefore, in 864 A.D, Charles the Bald threatened death to anyone caught supplying Vikings with arms.\(^8\) A passage in the *Annales Bertiniani* in 869 A.D. asserts that the Saracens demanded one hundred and fifty Carolingian swords as part of the ransom for Archbishop Rotland of Arles\(^9\); apparently, the Saracens recognized the quality of these swords and could not obtain them as a consequence of the increasingly enforced Frankish laws.

Certain types of armor were also forbidden to be exported from the Frankish Kingdom, the *brunia*, which are chainmaille shirts, in particular. Charlemagne prohibited the sale of *bruniae* and *baugae*, or armguards, outside of his realm in 803 A.D, knowing that this was the only way to protect his men from facing an opponent equally armored.\(^10\) Also written in the *Capitulary of Boulogne*, in October 811 A.D, article 10:

> It has been decreed that no bishop or abbot or abbess or any rector or custodian of a church is to presume to give or to sell a *brunia* or a sword to any outsider without our permission; he may bestow these only on his own vassals. And should it happen that there are more *bruniae* in a particular church or holy place than are needed for the people of the said church's rector, then let the said rector of the church inquire of the prince what ought to be done concerning them.\(^11\)

Given that the Carolingians mandated these laws, the practice of selling these items to foreigners must have been prevalent. The replicated laws in the capitularies over the years also suggest a need to reinforce them. These laws were enforced by increasingly severe repercussions, which made Carolingian swords and armor hard to come by for foreigners. After which the Vikings had grown discontented with limited trading with the Frankish Empire

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\(^7\) [Capitulare Bononiense, Karoli Magni capitularia c. 10, in ed. A. Boretius, *Capitularia regum Francorum* (MGH, Cap. 1.167, 1883).


\(^10\) [Capitulare Bononiense.](#)
and resorted to raiding the coastlines. Changes in trade patterns, as Hodges and Whitehouse theorized,\textsuperscript{12} may also have initiated the outward movement of peoples and traders from Norse lands. New trade routes and emporia presented the Viking people with wealth and crafted materials from foreign regions and revealed the benefits of raiding outside their own homeland. In the late 8th to early 9th centuries, Norse merchants traded eagerly at Frankish emporia. By the mid to late 9th century, at the same time Charles the Bald was reinforcing the old laws on exports with stricter consequences, the Vikings began raiding the Frankish Kingdom. Between 834-839 A.D., Viking raiders frequently besieged emporia in Frisia, particularly Dorestad.\textsuperscript{13} Raids increased as more restrictions were placed on exports.

Weapons were taken from smithies as well as from opposing fighters. Ewart Oakeshott mentions that swords, in particular, were sought after and taken as a symbol of power after vanquishing an esteemed enemy.\textsuperscript{14} Occasionally, however, the Franks won a battle against the raiders.\textsuperscript{15} Since the Vikings attacked by the shore, leaving their ships at anchor, the victorious Carolingians could then profit from any spolia held on the ships, and many times redistributed Frankish weapons and trophies.\textsuperscript{16} The Annales Fuldenses, in 885 A.D., describes a clan of Frisians having defeated Viking raiders in order to commandeer the riches that the Vikings stole from their previous raids.\textsuperscript{17}

Carolingian armor, like swords, were purchased in trade or taken as spolia by Viking merchants and raiders respectively. The most common pieces of armor sought after were the Frankish brunia and helms.\textsuperscript{18} The brunia was a coat of maille similar in design to a modern t-shirt. In St. Olaf’s Saga, a chief-tain returning to the North “has on his ship one hundred men, and they had on coats of maille and foreign helmets”.\textsuperscript{19} More affluent royal vassals were obligated to own a brunia.\textsuperscript{20} The Capitulary of Aachen "made it obligatory for counts to have brumae and helmets in reserve in order to equip horsemen.

\textsuperscript{12} R. Hughes and D. Whitehouse, Mohammed, Charlemagne and the Origins of Europe, (Cornell, 1983).
\textsuperscript{13} Coupland.
\textsuperscript{14} R. E. Oakeshott, Records of the medieval sword (Suffolk; Rochester, 1991).
\textsuperscript{15} The Royal Frankish Annals' in Charlemagne.
\textsuperscript{18} Coupland.
destined to be armored knights”. However, infantry and cavalry men were not required to possess body armor. Churches and monasteries owned reserve armor to equip their milites.

Frankish shields are also found outside the Carolingian borders. The shields in 9th century manuscript illustrations depict a round shield with a distinct rim, firmly fixed by rivets. Some images reveal latticework mounts fastened to the shield inside the rim. Mounts of this type have been excavated in the Swedish ship burials of Valsgarde.

In the Danish Vimose bog deposit sixty-seven swords were found, along with one thousand spears, five with ash shafts as described in sagas. Fine maille was also found in this site. The Nydam bog, famous for the excavation of four Viking ships, held one hundred and six double-edged swords (ninety-three of them pattern welded) and five hundred and fifty-two spears. The spear and lance was the most common weapon of the Carolingians. A shield and lance bought together cost only two solidi, as listed in the Lex Riburara. In 792/93 A.D, the Capitulare missorum required cavalry to possess a shield and lance. By 802/3 A.D, the Capitulary of Aachen made infantry equipped with lance. A letter Charlemagne sent to Abbot Fulrad in 806 A.D, added a sword to the requirements.

Knives and daggers were also common weapons. There were three hundred daggers found in Coppergate, Jorvik, England alone. The large numbers of daggers found in the graves of women and children in addition to men indicate that these were commonplace. The relatively cheap manufacture of daggers and knives and their common usage would indicate that they were made locally and not as widely exported as the sought after swords.

There have been fewer Frankish swords found in Viking excavated

22 Coupland.
23 Coupland.
25 Oakeshott.
27 Oakeshott.
28 Lex Riburaria 40.11, ed. R. Sohm, Leges nationum Germanicarum, (MGH, 3.2.94, 1883).
29 Capitulare missorum c. 4, in ed. A. Boretius, Capitularia regum Francorum (MGH, 1.67, 1883).
30 Capitulare Aquisgranense c. 9, in ed. A. Boretius, Capitularia regum Francorum (MGH, Cap. 1. 171, 1883).
31 Karoli ad Fulradum abbatum epistola, in ed. A. Boretius, Capitularia regum Francorum (MGH, Cap. 1.168, 1883).
sites then there have been of other arms and armor. This was due not to the lack of Carolingian swords in the area, but to the practice of keeping swords to be used even after the death of the owner. The price of a sword during the reign of Charlemagne was three solidi; with a scabbard it sold as seven solidi,\textsuperscript{32} or whereas later, during Charles the Bald’s reign, the sword was valued at five solidi.\textsuperscript{33} The \textit{Laxdæla Saga} mentions that a sword was the price of half a crown, equal to the value of sixteen milk cows.\textsuperscript{34} Swords were expensive and even through plunder these elite weapons would have been hard to come by.

Frankish swords were sought after for their superior quality and may have been used by multiple owners. The fact that few swords have been found in graves does not necessarily imply that they were not used. Conversely, this probably meant that they were considered too valuable to be buried. These swords were doubtlessly passed down for generations as inheritances.\textsuperscript{35}

In order to be worn, the sword would have been attached to a sword-belt by mounts and clasps. There are no complete finds where the sword is preserved in situ with the cinguli, sword belt; the straps and mounts have usually been found separate, sometimes with the sword but not attached to the sword. Nevertheless, the arrangement has been reconstructed with the aid of illustrations in such sources as the \textit{Stuttgart Psalter},\textsuperscript{36} which depicts accurate pictures from the same time period as the archaeological finds. Thus, the use of cinguli to hold the sword is a contemporary portrayal. In the pictures, the sword is suspended from the belt by two converging straps. The purpose of the trefoil mounts is not discernible; they were likely used to attach the two straps to the sword belt. The \textit{Saint Emmeram Gospels}\textsuperscript{37} has an illustration showing a buckle and a long strapend, which held the belt’s ends together. The illustrations in these two manuscripts, taken together, account for the full set of fixtures: straps, mounts, strapends, and buckles. Similar mounts are also found in Scandinavian silver hoards.\textsuperscript{38} In Ladby, a ship-grave revealed a burial of a man with personal belongings that included a large Carolingian gilt silver belt-buckle which would have been used as a sword-clasp.\textsuperscript{39} In the exhibit \textit{Viking Age Arms and Armor Originating in the Frankish Kingdom}
A trefoil brooch of Scandinavian origin imitates the Carolingian-style trefoil-shaped mounts. A similar brooch is in the British Museum, discovered at Roskilde, Denmark, and made of a copper alloy decorated in a Borre style animal motif. Modern scholars theorize that the brooch would have been developed to symbolize the “Viking prowess of the man who presented the gift.” The plethora of mounts and clasps, and the fact that replica brooches were made from the designs of Carolingian clasps, leads one to believe that the swords were simply too valuable to be buried. The numerous finds in Scandinavia suggest again that the Vikings managed to obtain Frankish swords in relatively large numbers either through trade or through plunder.

A Manuscript of St. Gall, from the early tenth century, and an illustration of a battle scene from the Book of Maccabees in the Codex Periconi 17, both show the Frankish swords to be of the same type as have been found in many Viking graves. Ibn Fadlan, an early tenth century Arab, stated that the Rus Vikings carried swords of Carolingian type in his writing, Risala. “§ 81. Each man has an axe, a sword, and a knife and keeps each by him at all times. The swords are broad and grooved, of Frankish sort.”

The wide distribution of Frankish weapons in the Viking Northern lands demonstrates that the Vikings valued Frankish swords in particular. The difference between a Viking sword and a Frankish sword must have been significant enough to warrant extreme measures of obtaining them, such as raiding Frankish coast lines. The main difference must have been in the type and quality of the metal itself and how the smith worked the metal to form the blade.

New iron mines were opened in the Carolingian Age, making the

42 Milek.
43 St. Gall, Stiftsbibliothek MS 22.
44 *Book of Maccabees* in Leiden, Bibliotheca der Rijksuniversiteit MS Perizoni 17.
46 D. Edge and J. Paddock, *Arms and Armor of the Medieval Knight* (New York, 1988); Petersen, op. cit. in note xlix.
metal cheap and more available than it had been. While iron was used frequently on the continent, the Vikings had little metal to work with in their own lands. Most early weapons were forged from bog iron and, when opportunity arose, from meteorite iron. These two forms of metal were the best available because of their high nickel content; however, pieces of these metals large enough to make a sword were difficult to find. When possible, Carolingian alloys were pattern welded to form the blade of a Viking weapon. The earliest high-quality blades were created using pattern welding, a special method, which allowed the smith to use both low and high-quality iron. Pattern welding used steel blanks, welding two or more blanks together.

Shortly before the tenth century, a new technique of blade forging was developed in the Rhineland. With this new innovation, Frankish smiths improved the strength of the blade while also enhancing its maneuverability. The new Frankish sword became highly sought after by the Northmen as well as by the Saracens to the south. This new technique created hard-elastic steel, which were entirely steel. Differing from the pattern-welded iron, mentioned above, they did not need to be hardened with iron and strengthened by woven steel into an iron base. This sword was the paramount Viking Age sword. The first swords of this model bear the inscription ULFBERHT inlaid into the steel with iron, with crosses etched before and after the name. Since this name is produced on many swords from a long time span, it is thought that Ulfberht was the name of a family that owned the smithy which produced the swords. Foreigners discerned that these swords were superior to the pattern-welded ones they were accustomed to using. Although the new method was better than previous techniques, pattern-welding was not discontinued. An examination of the carbon differences in pattern-welded compared to ULFBERHT swords shows that the pattern-welded swords contained 0.4-0.52% carbon while the ULFBERHT swords contained 0.75%. In this case, modern science has provided evidence for why the Northmen desired Frankish swords.

The wide distribution of ULFBERHT blades reveals the huge impact this sword type had on the trading and pillaging of Frankish arms. Two blades have been discovered in Ireland at Kilmainham and Ballinderry Crannog. Shifford and London, England also held important finds of ULFBERHT swords. These sword types have been discovered from as far away as Iceland.

50 Modin, Hansson, Thalin, Tomtlund.
51 Ibid.
52 Oakeshott.
53 Oakeshott and Peirce.
54 Oakeshott.
55 Ibid.
56 Ibid.

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and modern day Russia.\textsuperscript{57}

In 1919, Jan Petersen classified Viking Age swords into twenty-six types on the basis of their sword hilts. Petersen displayed a chronological arrangement of the swords, labeling them A to X.\textsuperscript{58} Petersen’s type K swords are considered to be among the earliest of the Viking Age types and also as being native to the Frankish Kingdom. They are distributed across most of Europe, with many finds in Scandinavia, particularly Norway.

Another early style, Type H was well distributed across the Scandinavia and the northern regions on the continent. These swords have mostly been discovered in coastal areas of north Europe, indicating that they were imported. Many have been found in Sweden, Finland, and Russia.\textsuperscript{59} Many of these swords are pattern-welded; yet two of them are high-quality ULFBERT swords. Petersen holds that H-type swords were derived from type B swords, the transitional early model from the Frankish Kingdom. The blade of the ULFBERT sword may have been made in the Frankish Kingdom, and then possibly refitted with the Viking style of hilt and pommel.\textsuperscript{60}

Using Petersen’s classification, Sir Mortimer Wheeler condensed Petersen’s twenty-six types into seven similar styles and Oakeshott added two more styles to Wheeler’s seven.\textsuperscript{61} Wheeler divided the swords according to the styles of pommel and upper guard.\textsuperscript{62} The first two types, according to Oakeshott’s classification, are clearly Scandinavian in origin and thought to be developed from continental prototypes, as are the fifth, sixth, and ninth types. Type III has a three lobed pommel, its central lobe larger than the side two. Sometimes this sword features zoomorphic ends and straight guards. These swords come from Northwest Europe around the 9\textsuperscript{th} to 10\textsuperscript{th} centuries.\textsuperscript{63} Type III swords are rarely found in the British Isles outside of Scotland and Dublin. A full-page illustration of the king’s enthronement in the \textit{Codex Aureus of St Emmeran 870 A.D.} shows the royal armor-bearer for Charles the Bald holding a type III sword.\textsuperscript{64} The type IV sword is also generally held by Wheeler and Oakeshott to be Frankish in origin. With a wide distribution to Norway, Ireland, London, and throughout Gaul, this is the most popular of the Frankish swords.\textsuperscript{65} This sword has a nearly flat pommel with five lobes of the same size
and straight guards. These blades are double-edged, with remarkable ornamentation on hilts and pommels, and a few of the swords are pattern-welded. It is safe to surmise that the blades of type IV swords also were of Frankish origin since many of the swords bare the name ULFBERT inlaid into the sword, they are double-edged, and few are pattern welded. Type VII swords have an “almost semi-circular, flattish pommel”. The pommel is divided into three parts with grooves or beaded lines. This type of sword is distributed throughout Scandinavia and in the western regions of Gaul. These three categories demonstrate which types of swords likely originated on the continent and can then be used to identify the distribution areas and flow of export.

Frankish swords and armor were superior to anything the Vikings could produce. Spears and axes were not commonly exported from the Rhine-land because they used little iron and were affordable for the Northmen to manufacture. Armor such as the Frankish burnia and bauga were much sought after by the Northmen, because they did not make these items themselves. Even though the burnia and bauga were prized items, the Carolingian sword was the most sought commodity of arms and armor as indicated by the stress placed on swords in capitularies. Frankish swords from the 9th century were considerably stronger and more maneuverable than their antecedents. These weapons were probably first brought to the attention of the Vikings by means of trade, and later, when trade was prohibited, through plunder. Throughout the era of Viking expansion, these weapons were most centralized in Scandinavia and distributed through the Hebrides, to Iceland, and the Rus. This wide distribution shows the great importance the Frankish swords were to the Northmen.

Trefoil brooches are one example of how adept the Vikings were at recreating metal objects into designs, which suited them better. They did the same with Carolingian swords, sometimes even re-fitting a Frankish all steel blade which could not be found in their own lands with a pommel and hilt. The irony is that these high-quality Frankish swords are today called Viking swords.

66 Ibid.
67 Oakeshott.
68 Ibid.
69 The Royal Frankish Annals; Notker Balbulus; Capitulare missorum; Capitulare Bononiense; Edictum Pistense; Annales Bertiniani; Capitulare missorum.
70 Notker Balbulus.
71 Capitulare missorum; Capitulare Bononiense; Edictum Pistense.
72 Oakeshott.
MODELING OF A PHOTONIC CRYSTAL WAVEGUIDE
MODES WITH THE FDTD METHOD

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The electromagnetic modes are investigated using a simple 1D imple-
mentation of the FDTD numerical algorithm to a model of 1D photonic crys-
tal. The fields $E_z$ and $H_y$ are simulated along the $\hat{x}$-axis, the propagation
direction. Source implementation and the effects of various boundary condi-
tions such as ABC, Mur on TF-SF fields are investigated. Of particular focus
in this paper is, for example, on investigating the guided and/or radiation
modes at a stop band frequency of the photonic crystal formed of linear and
Kerr nonlinear media. Such structures exhibit interesting transmission and re-
fection properties that make them suitable for optical devices with frequency/
wavelength tunable characteristics.

I. INTRODUCTION

The simulation studies of electromagnetic modes in a photonic crystal
have attracted a great deal of interest both practically and scientifically not on-
ly because of their potential applications in the field of photonics but also from
the point of view of fundamental understanding [1–10]. One focus of particu-
lar recent interest has been on the modeling of a waveguide mode arising from
nonlinear photonic crystal [11–16]. These types of systems have potential ap-
lications in switching and multiplexing designs which may be of importance
in routing, uploading, and downloading information carried in optical net-
works. In this paper our interest will be in guided modes in the simplest case
of 1D photonic crystal (layered structure) with a nonlinearity, which is treated
and compared with results of the scattering of the modes in the linear limit of
the media. The arbitrary layered media, also known as 1D photonic crystal,
denotes the structure represented by a number of dielectric layers with arbi-
trary values of thickness and permittivity [10]. This structure is periodic in one
direction and uniform in other two directions.

A wide range of simulation techniques including the plane wave ex-
ansion (PWE) and finite-difference time-domain (FDTD) have been devel-
oped and utilized for investigating of the scattering and guidance properties of
electromagnetic modes in complex photonic crystal structure [12–19]. Howev-
er, the FDTD method will be considered in details in this paper due to its flexi-
bility to treat almost any types of structures. The conventional PWE method,
although very intuitive and popularly employed in photonic crystal research, suffers from poor convergence and inapplicable to find field distribution in complicated structure or investigate dynamic characteristics. The transfer matrix, finite element, and beam propagation also have been utilized recently. The transfer matrix method can be applied to any periodic structures and many excellent calculations have been performed.

Our particular interest in FDTD method derives from recent research in photonic crystal devices modeling. This method is one of the most advanced methods today particularly for computing the field distribution inside the photonic crystal structures with non-uniform dielectric constant distribution. This is a computationally efficient and stable approach to modeling electromagnetic interactions with arbitrary structures of photonic crystal consisting of various material properties of interest and has been extensively used for predicting behavior of electromagnetic wave scattering and radiation for a variety of practical problems. Some of these works have been conducted by John D. Joannopoulos, J.B. Pendry, Y. Kivshar including others [17–20].

The FDTD technique is based on the numerical time-integration of Maxwell’s curl equations. In this technique the computational space is replaced by a discrete set of nodes where finite differences to the spatial and temporal derivatives of the electromagnetic fields of the problem are used as approximations. The numerical approximations allow to setting a system of algebraic equations which are solved sequentially starting from initial and boundary conditions [21, 22]. In this paper, a FDTD code added with the Mur and TF-SF boundary has been developed and validated by performing the initial test on a slab waveguide. The nonlinear media considered in all the simulations reported here are composed of Kerr-type dielectric material with an instantaneous nonlinear response. The nonlinear part of the FDTD code presented in this paper has been developed in the spirit of the work published in [17, 18, 20, 23], and is used to investigate nonlinear periodic media comprising the 1D photonic crystal.

II. FORMULATION

For simplicity, a 1D problem with electric and magnetic field components $E_z$ and $H_y$ propagating in the $\hat{x}$ direction in a homogeneous medium is considered. The propagation has no variations in the $\hat{y}$ and $\hat{z}$ directions, i.e. \( \partial/\partial y = \partial/\partial z = 0, \ \partial/\partial x \neq 0 \). Using Fig. 1 as a guide for discretization in space (Yee lattice) and time (leapfrog algorithm, detailed in [21, 22]), Maxwell’s curl equations to be implemented in the FDTD form are
\[ \nabla \times \vec{H} = \frac{\partial \vec{D}}{\partial t} \Rightarrow E_x^{n+1} (i) = E_x^n (i) + \frac{\Delta t}{\varepsilon} \nabla \times \vec{H}_y^{n+\frac{1}{2}} \]  
\hspace{1cm} (II.1a) 

\[ \nabla \times \vec{E} = \frac{\partial \vec{B}}{\partial t} \Rightarrow H_y^{n+\frac{1}{2}} (i + \frac{1}{2}) = H_y^{n+\frac{1}{2}} (i - \frac{1}{2}) + \frac{\Delta t}{\mu} \nabla \times \vec{E}_z^n \]  
and  
\hspace{1cm} (II.1b) 

which propagate in time steps. The integer \( i \) represents the spatial index with \( x = \Delta x \cdot i \), and the \( n \) represents the time step with \( t = n \Delta t \) in the FDTD. The \( \vec{D} = \varepsilon_0 \varepsilon_r \vec{E} \) and \( \vec{B} = \mu_0 \mu_r \vec{H} \), where \( \varepsilon_r \) and \( \mu_r \), respectively, are relative permittivity and permeability of the medium with \( \mu_r = 1 \) unless stated a different value. The \( \varepsilon_0 \) and \( \mu_0 \) are permittivity and permeability of the free space. The \( \frac{\partial}{\partial x} \) operates on the fields at the rate of spatial offset \( \Delta x \) on each temporal offset \( \Delta t \).

Fig. 1: A typical 1D FDTD space chart of the Yee algorithm showing spatial offset between the electric and magnetic fields, \( E_z \) components symbolized as closed circles and \( H_y \) components as open circles on the \( x \)-axis (line of computational domain). The direction of Poynting vector is along the positive \( x \)-axis.

In order to consider Kerr-type nonlinearity in the medium the permittivity (dielectric constant) shown in the relation \( \vec{D} = \varepsilon_0 \varepsilon_r^* \vec{E} \) is simply modeled analytically in terms of electric field intensity described by

\[ \varepsilon_r^* = \varepsilon_r + \alpha \chi^{(3)} \left| E \right|^2 \]

\( \text{Kerr} \)  
\hspace{1cm} (II.2)
where $\varepsilon_r$ is the linear part of the nonlinear dielectric constant of the nonlinear medium, $\alpha$ is a constant which dictates the strength of the Kerr nonlinearity, $\chi^{(3)} \approx \chi_0^{(3)}$ (assuming the instantaneous response-model) is the third-order nonlinear dielectric constant of the medium and in this relationship $\chi_0^{(3)}$ has units of $m^2/V^2$, where $E$ is the electric field. The nonlinear dielectric gives rise to a polarization current term in the formulation [23–25]. At that, evaluating each term of Eq. (II.1a), including the Kerr polarization current, and solving for $E_z^{n+1}(i)$, we get the electric field update equation,

$$E_z^{n+1} = \gamma \left( 1 - 5\beta(E_z^{n+1})^2 - 2\beta E_z^{n-1} E_z^n \right) E_z^n - 2\beta \gamma \left( E_z^{n-1} \right)^3 + \gamma \frac{\Delta t}{\varepsilon} \nabla \times \mathbf{H}_z^{n+1}$$

(II.3)

where $\varepsilon = \varepsilon_0 \varepsilon_r$, $\beta = 3\alpha \chi_0^{(3)} / \varepsilon$, and $\gamma = \left( 1 + \beta (E_z^{n-1})^2 \right)^{-1}$. Notice that for zero nonlinear constant, $\chi_0^{(3)} = 0$, the Eq. (II.3) reduces to Eq. (II.1a) which is expected in our treatment.

The updating process starts with the calculation of the new values of the magnetic field component on all the grid points of the computational domain using Eq. (II.1b). By means of the values obtained, the new values of the electric field component are computed in the same way using Eq. (II.3). This approach avoids the necessity of updating the values of the dielectric material of the simulated device, arising due to the nonlinear effects caused by the applied electromagnetic field, because the nonlinear effects are directly applied in the electric field component, $E_z$, through the computation of Eq. (II.3). Here, the value of $E_z$ from the previous time step is used to calculate the value of $E_z$ in the subsequent time step.

III. NUMERICAL RESULTS

To validate the numerical method developed for the purpose of this paper, a simple case, for example, a slab waveguide, shown in Fig. 2, is considered. This waveguide is composed of a lossless linear dielectric material with dielectric constant $\varepsilon_r = 9$, but this slab is also treated as a nonlinear waveguide comprising the linear dielectric material core with the same linear...
dielectric constant, followed by a Kerr dielectric material with nonlinear part of the nonlinear dielectric constant as shown in Eq. (II.2), which is the field intensity dependent in Kerr-type nonlinearity. The structure was excited using a modulated Gaussian pulse (continuous wave) with the shape of the fundamental $TE_0$ mode profile:

$$E_{z0}(x_0,t) = E_0(x_0) \exp\left(-(t-t_c)^2/t_w^2\right) \cos\left(2\pi f_0 t\right)$$  \hspace{1cm} (III.1)

where $f_0 = 1 \times 10^{10} \text{Hz}$ is the modulation frequency, and $E_0(x_0)$ is the fundamental $TE_0$ mode profile. The excitation only propagates in one direction (positive $\hat{x}$-axis) due to the implementation of TF-SF boundary condition [22].

![Figure 2: Schematic diagram of a slab waveguide.](image)

In addition, a differential equation based absorbing boundary condition (ABC), e.g. Mur second order ABC, is implemented to terminate the grid at the boundary ends [22, 26]. Although the Mur ABC is not considered state-of-the-art, it provides a relatively simple way to terminate the grid that is more than adequate in our treatment.

We considered two cases to make sure the FDTD code written for computing the field distribution inside and outside of the layered structure. An example of such a computed field inside the structure containing one layer with dielectric constant $\varepsilon_r = 9$ surrounded by air ($\varepsilon_r = 1$) is shown in Fig. 3 where the inset shows a sequence of the incident pulse with time in free-space alone. In the first case, assuming there is no slab present in Fig. 2, the entire computational space is filled with free space. In this the Gaussian pulse propagates in space...
(from left to right) and time (leapfrog method) as shown in the inset. Here, a great deal of utility of waterfall plot is used to display the first 18 snapshots of the electric field in a single image where each snapshot is offset slightly from the next, which is a typical way to ascertain what is happening in the FDTD simulation. In the second case, the dielectric slab is present as described in Fig. 2 above. The slab region is assigned starting at constant, \( \varepsilon_r = 9 \). The inset shows the electric field distribution when the entire computational domain is filled with free space.

Fig. 3: Waterfall plot of the electric field distribution in a computational domain which has a slab waveguide region (starting at node 150 and ending at node 175) with linear dielectric

Once the field encounters the first interface at node 150, a reflected field (as can be seen just above the frame number 7) is created which is negative and appears to have about half the magnitude of incident pulse. Notice that the peak of the incident field spans a vertical space corresponding to nearly two frames while the peak of the reflected field spans about one frame. Another reflection (with smaller field intensity than the previous) occurs due to second interface at node 175, which is noticeable above the frame number 12. The transmitted pulse is positive and appears to have half the magnitude of the in-
cident field, which can be seen above the frame number 11 on the right of the slab region.

The transmission and reflection coefficients for the slab computed by using the FDTD time response data (spectrum of the output normalized by the spectrum of the input) are presented in Fig. 4. The fields are observed at the ports in front and behind of the slab. The field recorded in front of the slab contains the reflected field as well as the incident field. Therefore, the incident field is subtracted from this data in order to obtain just the reflected field. As seen in the plot, the exact solution agrees with the FDTD result for the slab with linear dielectric material. There is an increase of nonlinear transmittance from its linear counterpart, which will be explained in the next.

![Fig. 4: Transmission and reflection spectra for the slab waveguide.](image)

The transmission and reflection spectra for five lattice layers forming a 1D photonic crystal computed by the time response FDTD method are shown in Fig. 5. The spectra reflect the band structure of the crystal, and they are often used for the design and characterization of real specimens. As is seen in the figure, the transmittance/reflectance is quite different at different frequencies, and because of the periodic lattices, a typical stop band of minimum/
maximum transmittance/reflectance falls at the frequency range 3 to 5 GHz. The magnitude of transmission/reflection coefficient for nonlinear case increases/decreases due to the self-phase modulation (SPM) like effect. The physical system and computation process shown for this result are fairly simple. However, it may have a wide range of applications. Using the FDTD method it is possible to design different passive optical devices high-efficiency reflectors, and anti reflection films, distributed Bragg reflectors for vertical-cavity surface-emitting lasers (VCSEL), wavelength division mux/demux on the basis of fiber Bragg gratings, mirrors of tunable lasers, etc.

Fig. 5: Transmission and reflection spectra for 1D photonic crystal formed with 5 periods.
IV. CONCLUSIONS

The one dimensional transmission and reflection spectra of linear/nonlinear periodic media have been successfully simulated with the FDTD method. Using the FDTD code developed to model the slab waveguide, the Kerr-type material with an instantaneous nonlinearity, Bragg reflectors type systems have been investigated. The preliminary results demonstrate the usefulness of the technique presented in this paper, and thus set the foundation for future computation and design for optical nonlinear devices. The SPM like effect may be applied to switching operations with all-optical components.

References

LESSONS LEARNED AS A NOVICE RESEARCHER: A PILOT STUDY IN MATHEMATICS EDUCATION

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The lessons we learn in life are often catalyzed by events or happenings that we experience and that subsequently change us in some way. Life as a graduate student is replete with diverse experiences that mold and shape one’s outlook on teaching, learning, and disciplined inquiry. As a doctoral candidate, my role as a novice researcher is increasingly budding with growth and my responsibilities to design and conduct research have engendered some important lessons. Often confined to private or classroom conversations with graduate students and faculty members, the lessons I have learned as a novice researcher seem worth sharing to a larger audience.

To set the context for this discussion, in Fall 2010 I carried out an individual research project that served as a pilot study for my dissertation. This research involved high school students’ use of computer algebra systems (CAS)—mathematics technology that affords the creation and manipulation of graphical, numeric, and symbolic representations. Through task-based interviews with pairs of students, I investigated the nature of the translations and connections students made between representations, important components of representational fluency and students’ conceptual understanding of mathematics.

The lessons I discuss below include: developing relationships and refining my role as a participant observer, the utility of writing an HSIRB protocol, and the contention that daily writing and reading are importance research practices. I also discuss the importance of being involved in a community of well-intentioned critics, and communicating research as a chain of reasoning.

Developing Relationships and Refining My Role as a Participant Observer

Some forms of research, such as a textbook analysis for example, do not require developing relationships with other people. On the other hand, my research involved interviewing high school students and thus required not only selecting an appropriate school site to conduct the research, but a principal, teacher, and students, who were interested in participating. Several semesters prior to conducting the pilot study of focus, I communicated my research interests to colleagues who had connections with teachers at local schools. I was fortunate to become acquainted with and to begin developing a professional
relationship with a particular teacher who supported my inquiry into students’ thinking about mathematics in technology-rich settings.

**What is the goal of observing?** During scheduled observations of the classroom, I learned that it was important to both have a goal before observing and to reflect on the experience afterwards. For instance, for some of the first classroom visits, I was interested in observing how CAS technology was positioned in the classroom. How were students using the technology? Did the teacher, textbook, or lesson content seem to influence students’ experiences in learning mathematics with CAS technology? Were symbolic, graphical, or numeric representations more prominent? Were students encouraged to reflect on the use of CAS technology with multiple representations? By asking questions and reflecting on what I observed unfold during instruction, some of the complexities of classroom became more clear.

**How should observations be documented?** As an artifact of these practices over time, I realized the importance of developing refined methods of taking field notes and also gained a better sense of students’ experiences that seemed significant in a technology-enriched mathematics classroom. Before conducting the pilot research, I had informal research questions in mind, and developed and tested various protocols to be used during observations, which helped me to focus on what I was really interested in—students’ representational fluency in CAS environments. In addition to documenting my experiences in personal field notes, I had regular conversations about my experiences with the classroom teacher, and also with an advisor. These conversations pushed my thinking, sometimes confirming and sometimes challenging my interpretations of classroom practice.

**What is an appropriate role to assume in the classroom?** Many of my observations occurred prior to conducting the pilot research so it allowed time to reflect on my role in the classroom. I found it useful to ask myself questions that had various trade offs. For instance, what are the advantages to walking around the room and asking students questions as opposed to sitting silently in the back of the classroom? Should I observe one student or group of students who seem to be more active in using their CAS technology during class time or should I observe several students or groups of students to capture a more diverse picture of students’ activity? With the permission of the teacher, I found it more engaging and was able to have richer experiences by asking select students questions about how they were using their CAS. I usually focused on a few students who were more active in using their CAS technology because it gave me more to observe and to reflect on with respect to my evolving research questions.

**How are relationships formed with key players?** Finally, it was important for me to kindle a professional relationship with the teacher so as to
develop a sense of trust and comfort with her and her students. Through my experiences in observing the classroom, I not only developed relationships with the teacher, but I became a familiar face to the students. In particular, the students became accustomed to me being in the classroom, and were comfortable answering questions, and letting me watch how they were using their CAS technology. The principal was also a key player in conducting research at this school site because schools and districts have their own regulations about the conduct of research, not too dissimilar to the regulations set out by HSIRB at Western (discussed in the next section). Thus, a necessary first step in conducting research with human subjects was clear communication with the principal and teacher at the select school site. Without it, my research would not have been possible.

**HSIRB Protocol is a Worthwhile “Hurdle”**

My research involved interviewing students, so it was necessary to complete an HSIRB protocol. This is somewhat of a lengthy process and thus was one of the first tasks I was charged with early on in my project. Embarking on writing an HSIRB proposal for the first time seemed like a daunting task. I had previously attended a training session supported by the Graduate College, but at that time I was not conducting my own research so it was hard to engage in the presentation. However, I should mention that I did enjoy the opportunity to meet Vicki Janson, a former research compliance coordinator at WMU. I had also completed the necessary training, but again, it was not “real” to me at the time because I had yet to conduct research with human subjects.

*How do you work under strict timelines?* I had a strict timeline in completing the HSIRB for my pilot research, and needed to have a clear conceptualization of my study in the first weeks of the semester. I created a separate “HSIRB” folder that contained drafts of my own protocol, and other accepted protocols (including an example of one that had been rejected and subsequently revised and accepted). Having access to exemplar protocols was paramount in crafting my own successful protocol.

In crafting my protocol, I needed to keep in mind both what my own restrictions and needs were, but also the restrictions and needs of the participating teacher and her students. Due to the nature of the school site, I conducted the interviews during class time so it was necessary to coordinate schedules. The teacher and I communicated via email and phone for more general planning purpose, and in person regarding the intricate details of recruiting participants and scheduling the interviews.

*How do you refine your research ideas?* My advisor explained that one should complete an HSIRB when a research study that involves human subjects is mostly (or totally) conceptualized—this proved to be easier said than
done. In particular, I found it most difficult to refine my ideas into something that was researchable in the timeline of a semester. I was simultaneously trying to manage and toggle between the pressure of both short-term goals of the semester’s pilot study, and future research that would eventually inform my dissertation research. The HSIRB requirement to clearly articulate the design and plan for my research study forced me to put into words the study that I had conceptualized. For example, I needed to articulate select research questions, but also to provide justifications for the design I had chosen. Why fewer participants in a qualitative design rather than a greater number of participants in a quantitative or mixed methods design? Why interview students in pairs rather than individually? What tasks would I use during the interviews and what questioning techniques would I employ?

I decided to interview three pairs of students for an hour each with researcher designed tasks and probing questions that were modeled after related research studies on students’ use of technology and multiple representations. Following Huntley, Marcus, Kahan, and Miller (2007), it was my contention that interviewing students in pairs would generate richer data and promote student-student and student-technology interactions, allowing the researcher to be less invasive in students’ experiences with the specifically designed tasks. I also decided to design the tasks and probing questions so that students would make use of multiple representations. For example, they might start out by solving a task in a given symbolic representation, then need to draw on a graph or a written context to make sense of that result. As the goal of my research was to uncover the nature of students understanding of the connections between representations I decided it was fitting to encourage students to use multiple representations if they didn’t consider this option on their own.

How do you craft a protocol that is specific but allows for some flexibility? After submitting my protocol, but before conducting the study, I decided that I needed to make changes to the tasks and questions that I had designed. In email conversations with the compliance coordinator, I was able to get the changes approved in a timely manner, but it was also suggested that I use different wording in future HSIRB protocols. For example, instead of saying “these tasks will be used” and “these questions will be asked” I could have used language such as “tasks similar to the ones included here will be used” and “questions like the ones included here will be asked” so as to safeguard against needing to make changes between the time the protocol is submitted and the study is conducted.

In the end, my HSIRB protocol served as a well-organized record of my plan for research which ultimately facilitated carrying out the pilot study. I had hands on experiences in keeping efficient and realistic timelines, and cannot stress enough the importance of clearly communicating these plans with all involved (in this case, the school principal, teacher, and students).
Reading and Writing are Central Practices of Research

In advice to aspiring researchers, Boaler, Ball and Even (2003) contend that reading and writing are two central practices of research. In the midst of classroom visits and completing the HSIRB protocol in the first weeks of my pilot research, I found the practices of reading and writing to be extremely beneficial to my growth as a researcher.

Reading is an important practice of research. Throughout the course of the semester, my readings included both those geared toward the research process in general, and those more specific to my own research interests. For example, Alan Schoenfeld (2007, 2010) offers accounts of method and theory that are both significant aspects of research in mathematics education (and to other fields as well). These readings helped me understand some of the important decisions that a researcher needs to make in designing quality research. On that note, I found Marti Simon’s (2004) description of quality research in mathematics education to be helpful in crafting my pilot study because it gave me some criteria to latch on to in conducting and communicating about my research. In particular, Simon stresses the importance of justifying the design and conduct of a study, and portraying the research as a logical and coherent chain of reasoning.

With a clear focus on research design, my consumption of literature had a new and lively purpose. I learned to recognize and incorporate important jargon and constructs specific to the field of mathematics education, how to identify and include a clearly delineated research framework, and the importance of stating clear research questions as a major part of a chain of reasoning.

Writing is an important practice of doing research. While occupied with reading, I was engaged in regular writing. The assignments of the research course I was taking included a research interests paper, a literature review, a research design and methods paper, and a final report that included my results and a discussion of implications. In addition to these papers, I kept updated entries in an EndNote library of all the readings I was doing and included helpful key words to make searching the database more efficient. I also wrote in both electronic and paper journals, and kept organized records of all research experiences such as field notes from classroom observations and notes and memos of coding processes. By keeping myself in the regular habit of writing, I found it easier to organize my thoughts and to keep track of the things I was learning throughout the research process.

Reading and writing are creative processes. By engaging in the process of reading and writing on a daily basis, I also came to understand how creative energy is needed before, during, and after designing and conducting research. Becoming a specialist in a particular domain or field requires that
one has mastered the literature and is an expert in that area. In this light, I
found it particularly beneficial to use previously established criteria to set
goals for my own research. For instance, Boote and Beile (2005) provide a
clearly delineated framework with criteria that can be used in judging the qual-
ity of a literature review. In my experience I was better equipped to craft quality
research by regularly engaging in the practices of reading and writing, while
attending to quality criteria established by experts.

On a final note for this learning experience, I remember asking a former doctoral candidate in mathematics education what advice she had or what
she might do differently throughout the research process. She remarked that
she regretted not spending more time reading throughout the research process
because reading helps to exemplify well crafted and communicated research.
In looking ahead to the writing my dissertation, I will keep in mind the im-
portant practice of reading, for it will not only keep me abreast of contempo-
rary research, but will also inform my communication of research.

Surrounded by a Cadre of Well-Intentioned Skeptics

Learning can be perceived as a practice of transforming one’s participa-
tion in a community of practice from peripheral membership to core mem-
bership (Wenger, 1998). In a research community, this participation includes
consuming and engaging in critiques of others’ research. While designing and
designing my pilot research, I participated in a capstone course with several
other doctoral students and a faculty member. Each week, individuals would
be asked to give progress reports, instituting a level of accountability for for-
ward progress. We were also encouraged to bring our emerging research ideas
or concerns to class meetings. As a class we soon built a strong, trusting rap-
port in which constructive criticism was the norm for discussion. The feedback
from peers was extremely beneficial in crafting a better research project.

Beyond pushing each other to do quality research, we supported each
other to overcome what seemed like insurmountable obstacles in the design
and conduct of our respective studies. Participating in a class or seminar com-
nunity of colleagues who are also engaged in research is a practice that I will
continue to engage in because I learned that my own research could be im-
proved both directly through discussion of my own agenda and indirectly
through critique of others’ research.

Communicating Research as a Clear Chain of Reasoning

Near the close of my research project I found myself asking questions
that did not have easy answers, and that my advisor could not help me with.
When do I stop analyzing my data? When do I know that I’ve spent enough
time interpreting my results? I needed to take a step back and think hard about whether or not I had answered my research questions, but also to think about the chain of reasoning that I was building. Inspired by Lesh, Lovitts and Kelly (2000), I have learned that the main links in a chain of reasoning for a research study include: (a) rationale for why the research is being conducted (b) identification of and justification of an appropriate lens or research framework that is used to determine relevant information and assumptions and (c) a clear articulation of what results are intended to be produced and for what purposes.

To answer my own questions, I needed to revisit the purpose of my study, the theoretical lenses I was using, and the results that I was analyzing. Specifically, I spent considerable time thinking hard about the research questions I set out to answer and the means by which I collected and analyzed my data. One mechanism that I found helpful to sort out these ideas was the preparation of a formal presentation and final paper. These outcomes of my pilot research forced me to be clear in communicating my chain of reasoning so that it made sense and could be followed by others. Giving a presentation to the department and writing a final paper for this course was not the end of my research, but instead, marked a healthy jumping off point that gave me a sense of accomplishment in looking to the future. Thus, a final lesson learned was the importance of taking time to carefully reflect on and clearly communicate research as a chain of reasoning.

Closing Comments

In closing, conducting an individual research project has provided a plethora of learning opportunities, more than I would have anticipated at the onset of the project. Some of the lessons I’ve learned involved working with the technicalities of the research system (including HSIRB), while other lessons were specific to developing good habits and practices as a researcher (including daily reading and writing).

Research can be both arduous and rewarding. The results of an individual research project will have a single author’s name attached to them, but as a process, the design and conduct of research is never a solo endeavor. Acknowledgements are extended to the research participants, and those in my community—especially the well-intentioned skeptics and critics that continue to support and challenge me in new ways.
References


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The deadline for submission is September 12, 2011. There are many options for suitable paper topics for submission to this Review. Graduate students can analyze and discuss major topics or issues in the field. How have particular issues or topics been addressed over time? How have issues like race and gender been incorporated? How has culture and history been discussed? How have issues of empire and geopolitical realities been addressed in your profession? In what ways and by what causal mechanisms have issues or topics come to define different approaches or theories in your discipline? Another fruitful sight for critical engagement might be to discuss your chosen profession based on your experiences at Western Michigan University. Where has your discipline been and where do you see it going? What are the leading edges of your profession and how might your work contribute to the transformation of conventional wisdom. In short, the Review invites you to reflect on the meaning of “discipline” in your field of study. How does your own work contribute to understanding or resolving any controversies between leading practitioners and paradigms? These thematic options are offered as suggestions to encourage graduate students to look over their built-up work and then create an original paper that is as critical as it is constructive. Any papers discussing these issues and topics are welcome as are any other papers that are representative of graduate work at WMU. In all cases, papers that manage to cross disciplinary lines or speak directly to neighboring areas of study are strongly encouraged. The specific guidelines for submission and the editorial statement can be accessed at the Review’s website: http://www.wmich.edu/gSac/publications.html

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The deadline for submission is September 12, 2011. The Hilltop Review is also soliciting contributions of artwork and digital photography. One submission will be selected for the color or black and white cover of the journal. Two or three others will be selected as black and white or color inserts. The Review encourages groundbreaking and iconoclastic artwork that builds on previous work while going beyond it in some significant way. Any artwork and digital photography from any graduate students at WMU will be considered for publication. The specific guidelines for submission and the editorial statement can be accessed at the Review’s website: http://www.wmich.edu/gSac/publications.html
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The Hilltop Review, Spring 2011